ENERGY FUELS RESOURCES (USA) INC.

RESPONSES TO

REVIEW OF AUGUST 15, 2012 (AND MAY 31, 2012) ENERGY FUELS RESOURCES (USA) INC. RESPONSES TO ROUND 1 INTERROGATORIES ON REVISION 5 RECLAMATION PLAN REVIEW, WHITE MESA MILL SITE, BLANDING, UTAH, REPORT DATED SEPTEMBER 2011

AUGUST 31, 2015

TABLE OF CONTENTS

ATTACHMENTS

DIVISION'S ASSESSMENT OF EFR RESPONSES TO RD 1 INTERROGATORY WHITE MESA REC PLAN 5.0; R313-24-4; 10 CFR40.31(H); INT 01/1; RESPONSES TO RECLAMATION PLAN REV. 4.0 INTERROGATORIES

The Division requests that EFR include the additional costs for removing the identified ACM in the estimate of costs to decontaminate and decommission the mill. The Division will review the revised reclamation cost estimates, when available, to verify that these costs have been included in the reclamation cost estimates.

Response:

Energy Fuels Resources (USA) Inc. (EFRI) submitted asbestos inspection reports as Attachment A to EFRI (2012) for the following facilities:

- Administration Building
- Mill Building, Boiler Plant, Scale House, and the Sample Plant
- Maintenance-Warehouse Facility
- SX Building

The asbestos inspection report for the Mill Building, Boiler Plant, Scale House, and the Sample Plant erroneously included inspection information for the Maintenance-Warehouse Facility. The asbestos inspection report for the Mill Building, Boiler Plant, Scale House, and Sample Plant has been revised and the report is provided as Attachment A to this response document.

Costs for removing asbestos containing material (ACM) identified in the asbestos inspection reports are currently incorporated in the annual surety estimates. These costs will also be included in the reclamation cost estimate in the next version of the Reclamation Plan.

Reference for Response:

Energy Fuels Resources (USA) Inc. (EFRI), 2012. Responses to Interrogatories – Round 1 for Reclamation Plan, Revision 5.0, March 2012. August 15.

DIVISION'S ASSESSMENT OF EFR RESPONSES TO RD 1 INTERROGATORY WHITE MESA RECPLAN REV 5.0 R313-24-4; 10CFR40 APPENDIX A, CRITERION 4; INT 02/1; ENGINEERING DRAWINGS

Based on review of the above Response, the Division finds that although EFR provided narrative descriptions of the changes it intends to make to engineering drawings, revised drawings were not submitted with interrogatory responses. Rather, EFR committed to provide revised engineering drawings with the "next revision of the Reclamation Plan". The Division will review the revised engineering drawings, when available, to verify that these changes to the drawings have been made. Because EFR submitted neither revised engineering drawings nor the revised Reclamation Plan in its interrogatory response, this interrogatory will remain open.

Response:

Revised engineering design drawings are provided as Attachment B and incorporate (1) the applicable proposed changes listed in EFRI (2012) for this interrogatory, (2) the revised cover design based on technical analyses presented in EFRI (2012) and included as attachments to this response document, and (3) recent topography provided by EFRI.

Reference for Response:

Energy Fuels Resources (USA) Inc. (EFRI), 2012. Responses to Interrogatories – Round 1 for Reclamation Plan, Revision 5.0, March 2012. August 15.

DIVISION'S ASSESSMENT OF EFR RESPONSES TO RD 1 INTERROGATORY WHITE MESA REVISED RECPLAN 5.0; R313-24-4; 10CFR40 APPENDIX A, CRITERION 4; INT 03/1; CQA/CQC PLAN, COVER CONSTRUCTABILITY, AND FILTER AND ROCK RIPRAP LAYER CRITERIA AND PLACEMENT

The Division finds EFRs' Response to the first item of this interrogatory pertaining to materials to be placed into Cell 1 – i.e., EFR's commitment to revise all sections of the CQA/CQC Plan, Technical Specifications, and the text of the Reclamation Plan itself to preclude placement of tailings into the Cell 1 Disposal Area, and to identify the Cell 1 area as the "Cell 1 Disposal Area" in all documents – to be acceptable. These revised documents will need to be reviewed, when available, to verify that these changes have been made. Because these revised documents were not submitted in its interrogatory response, this interrogatory will remain open.

Based on its review of the section of EFR's response pertaining to the constructability of the currently proposed cover system having such extremely flat topslope inclinations, the Division is unable to concur with EFR's contention that such flat inclinations can be constructed uniformly and reliably over the entire required topslope area, as insufficient supporting information and justification have been submitted to satisfactorily support the contention. This issue needs to be addressed before appropriate conclusions can be reached.

In addition to the Division's uncertainties related to the constructability of the currently proposed cover, insufficient information has been provided in Attachment A (Technical Specifications, Section 8) and Attachment B (CQA/CQC Plan, Section 6) to the Rev 5.0 Reclamation Plan or in EFR's response regarding the means and procedures that would be implemented for controlling, verifying, and documenting layer thicknesses and final grades across the top portions of the cover. Examples of information missing that should be provided are discussions regarding the need for use of Global Positioning System (GPS) and computer terrain modeling technology and how these might be combined to provide for a Computer Aided Earthmoving System (CAES) for verification of soil compaction and thicknesses of layers as they are being installed and undergoing compacted during each pass of the compaction equipment over placed loose lifts (e.g., Caterpillar 2003). The advantage of this methodology is that it provides a continuous record in a continuous manner across the entire cover area footprint, rather than acquiring data at a series of isolated points. Discussions of soil density tests and independent land surveys for demonstrating the effectiveness of the CAES method, and procedures that may be used for visual monitoring of the CAES-verified compaction process and review of CAES-generated computer records for each layer of soil placed by on-site QC personnel, should also be provided. A more detailed discussion should also be provided of companion sand cone tests and moisture tests to be performed along with nuclear tests until a sufficient number of have been performed to demonstrate a clear correlation between results obtained using these test methods. Similar procedures to those described here have been accepted and are in use at the Crescent Junction, Utah uranium tailings repository (e.g., see U.S. DOE-EM/GJ1547 [DOE 2012]).

The Division finds the filter layer gradation and permeability criteria and proposed construction quality assurance testing procedures and frequencies to be acceptable. The revised CQA/CQC Plan will need to be reviewed, when available, to verify that these changes have been made. Because the revised CQA/CQC document was not submitted in its interrogatory response, this interrogatory will remain open.

The Division also finds EFR's commitment to revise Section 5.7.1 of the CQA/CQC Plan and Section 8.2.4 of the Technical Specifications to include a required minimum thickness of the rock riprap layer equal to 1.5 times the D50 rock riprap diameter of 7.4 inches, or the D100 of the rock riprap materials, whichever is greater, to be acceptable. The revised CQA/CQC Plan and revised Technical Specifications *will need to be reviewed, when available, to verify that these commitments will be faithfully implemented. Because these revised documents were not submitted in its interrogatory response, this interrogatory will remain open.*

Based on review of the information provided in the Response with respect to rock riprap placement and construction quality assurance testing, the Division notes that EFR did not address certain additional specific recommendations included in Appendix F (Rock Placement Procedures for Erosion Protection) of NUREG-1623 (NRC 2002) in their response to this interrogatory, but which should be addressed. Additional NUREG-1623 recommendations that should also be addressed/ implemented include the following:

- *Initial testing should be conducted to determine the gradation and the rock weight/unit volume that will be achieved in future rock placement activities.*
- *No individual rock piece should exceed 90% of the riprap layer thickness*
- *Dumped riprap should be placed to its full course thickness in one operation and in such a manner as to avoid displacing any underlying bedding material*
- *It should be declared that rearranging of individual stones by mechanical equipment or by hand may be required to the extent necessary to obtain a well-keyed and reasonably well-graded distribution of stone sizes and that larger pieces of riprap may require individual placement by equipment.*
- *Any stones that are not firmly wedged should be adjusted and additional selected stones inserted or existing stones replaced, so as to achieve a solid interlock.*

Based on its review of the section of EFR's response pertaining to settlement and of the referenced revised settlement analyses, the Division is unable to assess the correctness of EFR's conclusion regarding cover performance with respect to settlement due to errors, omissions, discrepancies, and insufficient information in the materials submitted. These issues need to be addressed before appropriate and reliable conclusions can be reached. These issues are more fully discussed in Sections 7.0 and 9.0 below relative to the response to Interrogatory 07/01, Technical Analysis - Settlement and Potential for Cover Slope Reversal and/or Cover Layer Cracking and 09/01, Technical Analysis - Liquefaction. Evidence should also be provided that the eight UMTRCA repository sites (which EFR claims have slopes similar to the 0.5 to 1% slopes proposed for the subject site) have performed adequately and that demonstrates that future differential settlement of those repositories during the 200- 1,000 –year performance period of those facilities will not occur to a degree that flattening/slope reversal of the topslope portions of those covers would result. Such information should include currently observed differential settlements and predictions of future settlements calibrated to the observed performance.

Response:

The Division states that they accept EFRI's commitment to revise all sections of the CQA/CQC Plan, Technical Specifications, and the text of the Reclamation Plan to denote the Cell 1 area as the "Cell 1 Disposal Area" and to note that this area will not include disposal of tailings. This information has been added to the revised Technical Specifications and CQA/CQC Plan provided as Attachments C.1 and C.2, respectively to this response document, for Division review. The designation of "Cell 1 Tailings Area" to "Cell 1 Disposal Area" will be revised in Section 3.2 of the main text in the next version of the Reclamation Plan.

The Division expressed concern regarding constructability of the proposed cover slopes ranging from 0.5 to 1 percent. Cover with similar slopes have been permitted and constructed for Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I and II sites including:

- Falls City Title I site in Texas (less than 1% cover slopes)
- Bluewater Title II site in New Mexico (0.5 – 4% cover slopes)
- Conquista Title II site in Texas (0.5 – 1% cover slopes)
- Highland Title II site in Wyoming (0.5 – 2% cover slopes)
- Panna Maria Title II site in Texas (0.5% cover slopes)
- Ray Point Title II site in Texas (0.5 – 1% cover slopes)
- Sherwood Title II site in Washington (0.25% cover slopes)
- L-Bar Title II site in New Mexico (0.1% cover slopes)

EFRI proposes to place the final cover in two phases for each cell. The first phase would consist of placement of the majority of the cover, without the erosion protection layer and possibly a portion of the water storage/frost protection/radon protection layer. For Cell 2, this first phase of cover placement would take place after approval of the Reclamation Plan and completion of the License renewal. The second phase of final cover placement would occur after sufficient settlement has occurred from dewatering of tailings and placement of the first phase of final cover. Between the first and second phase of cover placement, additional interim cover would be placed in any low areas to maintain positive drainage of the interim cover surface. Results of settlement analyses (see Attachment E) indicate that potential differential settlement after active maintenance will be sufficiently low that ponding and slope reversal is not expected to occur on a cover slope of 0.5 to 1.0 percent. Work completed on the final reclamation cover, as described above, will be credited against the annual reclamation cost update submitted to the State of Utah on March 4th of each year.

Settlement monuments, as well as water levels within the tailings, will be monitored on a regular basis. Settlement monuments are currently surveyed monthly with a quality control check done annually by a certified Surveyor. A detailed standard operating procedure (SOP) is used for the settlement monitoring. Results are reported to the Division annually in the Annual Technical Evaluation Report (ATER). Mini-piezometers will be installed across the each cell prior to the first phase of cover placement. This data will provide information on settlement and dewatering of the cells to confirm the final phase of cover can be placed and when active maintenance is no longer required.

Grading control for construction of the reclamation cover shall be achieved with Global Positioning System (GPS) guided equipment. This requirement has been added to the Technical Specifications as requested by the Division. The Computer Aided Earthmoving System (CAES) is a type of GPS-guided grading control method.

Text has been added to Sections 5.2, 5.3.6, 5.4.5, and 5.6.3 of the CQA/CQC Plan to note that a sufficient number of sand cone and moisture content tests will be performed to provide a correlation between the sand cone and nuclear density tests.

The Division states that they accept the filter layer gradation and proposed construction quality assurance testing procedures and frequencies. Sections 8.2.5 and 8.4.7 of the Technical Specifications (Attachment C.1) and Section 5.7.1.2 of the CQA/CQC Plan (Attachment C.2) have been revised to include the updated testing frequency and filter material gradation requirements.

The Division states that they accept the proposed revisions to Section 5.7.1 of the CQA/CQC Plan and Section 8.2.4 of the Technical Specifications to include a required minimum thickness of the rock riprap layer equal to 1.5 times the D_{50} rock riprap diameter, or the D_{100} of the rock riprap materials, whichever is greater. This information has been added to the Technical Specifications (Attachment C.1) and CQA/CQC Plan (Attachment C.2).

The Division requests additional information be added to the CQA/CQC Plan for riprap placement based on recommendations in NUREG-1623 (NRC, 2002). The following text has been added to Section 5.7.2 of the CQA/CQC Plan (Attachment C.2).

- Initial testing should be conducted to determine the gradation and the rock weight/unit volume that will be achieved in future rock placement activities.
- Individual stones shall not be greater than 90 percent of the riprap layer thickness.
- Dumped riprap shall be placed to its full course thickness in one operation and in such a manner as to avoid displacing bedding material.
- Hand placement or rearrangement of individual stones will be required only to the extent necessary to secure the results specified above. Larger stones may require individual placement by equipment.
- Any stones that are not firmly wedged shall be adjusted and additional selected stones inserted or existing stones replaced, so as to achieve a solid interlock.

The Division did not comment on EFRI's proposed revisions to Sections 5.7.1.1, 5.7.2 and 5.7.4 of the CQA/CQC Plan for riprap placement provided in EFRI's Response 5 to Interrogatory 03/1 (EFRI, 2012). It is assumed that the Division is in agreement with these proposed revisions and EFRI has included the revisions in the revised CQA/CQC Plan (Attachment C.2).

The settlement analysis and liquefaction analyses have been revised to incorporate the site-specific tailings data collected in October 2013 (MWH, 2015) and address the Division's comments provided in DRC (2013). The responses to the Divisions review comments on these analyses and a summary of the revised results are provided in the responses to Interrogatories 07/1 and 09/1.

References for Response:

Energy Fuels Resources (USA) Inc. (EFRI), 2012. Responses to Interrogatories – Round 1 for Reclamation Plan, Revision 5.0, March 2012. August 15.

MWH Americas, Inc. (MWH), 2015. White Mesa Mill Tailings Data Analysis Report. Prepared for Energy Fuels Resources (USA) Inc. April.

U.S. Nuclear Regulatory Commission (NRC), 2002. Design of Erosion Protection for Long-Term Stability, NUREG-1623, September.

Utah Department of Environmental Quality, Division of Radiation Control (DRC), 2013. Review of August 15, 2012 (and May 31, 2012) Energy Fuels Resources (USA), Inc. Responses to Round 1 Interrogatories on Revision 5 Reclamation Plan Review, White Mesa Mill, Blanding, Utah, report dated September 2011. February 13.

DIVISION'S ASSESSMENT OF EFR RESPONSES TO RD 1 INTERROGATORY WHITE MESA RECPLAN REV 5.0 R313-24-4; 10CFR40, APPENDIX A, CRITERION 4; INT 04/1; VOID SPACE CRITERIA FOR DEBRIS, RUBBLE PLACEMENT, AND SOIL/BACKFILL REQUIREMENTS

The Division's assessments of these responses are summarized below.

a. *Maximum Void Space Percentage: EFR does not state a maximum allowable void space due to the lack of practical means of quantifying residual void space following placement and backfilling. In lieu of stating a void space limit, EFR incorporates practices and requirements that were developed for the UMTRAP/UMTRCA and FUSRAP projects and that have been demonstrated effective in limiting settlement. EFR has developed and will implement method specifications that reflect best management practices, as documented in Attachment A "Plans and Technical Specifications for Reclamation of White Mesa Mill Facility; Blanding, Utah".*

   The practices call for compressible materials to be crushed or covered with soils (thus reducing residual void space), while voids in and around incompressible materials will be filled with soils or, if needed, grout.

The Division judges these specifications to be acceptable.

b. *Construction Practices: Processing, placement, backfilling, and compacting of debris and organic material are discussed in Sections 7.3 and 7.4 of Attachment A "Plans and Technical Specifications for Reclamation of White Mesa Mill Facility; Blanding, Utah". According to these specifications:*

   - *Some larger items and items with internal voids will be size reduced to expose voids so they can be filled.*
   - *Debris items will be placed to minimize nesting that could lead to residual voids after backfilling.*
   - *Compressible debris will be flattened or crushed.*
   - *Voids will be backfilled with soil, sand, or grout as judged appropriate by CQA Manager.*

These specifications constitute current best management practices and we judge them to be acceptable given current state of knowledge.

c. *Controlling Residual Voids: EFR's QA staff will observe construction practices to ensure that specifications for reducing void space within debris are met. The interrogatory response includes a statement that "The QA staff will make a recommendation to the Contractor for the implementation of a grouting program in instances when voids, either within a debris mass, or within a vessel, cannot be properly filled with soil using conventional equipment".*

No reference to a "grouting program" exists in Attachment A "Plans and Technical Specifications for Reclamation of White Mesa Mill Facility; Blanding, Utah". Attachment A should be revised to formalize this commitment.

d. *Effects of Void Space on Settlement Analyses: EFR's response is given in its response to INT 07/1. EFR's response notes that the cover system will not be constructed ". . . until settlement monitoring of the subsurface shows the anticipated settlement has taken place."*

An additional criterion should be added requiring that observed settlement has stabilized according to some reasonable criterion.

e. *Percentage of Organic Materials: EFR's response makes several statements that, as far as we are able to determine, are not supported or documented:*

- *"The percentage of organic materials to be disposed of is anticipated to be a small percentage of the total material being disposed."*
- *". . . the biodegradation of these materials is not anticipated to compromise the integrity of the cover system."*

EFR should provide additional information to support these statements and provide confidence that the integrity of the cover system will not be compromised.

1. *Segmenting and Placing Metallic Waste Materials: Section 7.3 of Attachment A "Plans and Technical Specifications for Reclamation of White Mesa Mill Facility; Blanding, Utah" requires that larger debris items be size reduced, that larger pieces are not stacked on top of each other, that large structural shape either be placed edge to edge or spaced far enough that voids can be filled and equipment can operate between them, that the maximum dimension be 20 feet, that the maximum volume of any piece of debris be 30 cubic feet, and that long structural members be placed horizontally, and that any piece not satisfying these requirements be reworked.*

These provisions are considered acceptable.

1. *Types of Materials and Placement Practices: Section 7.3 of Attachment A "Plans and Technical Specifications for Reclamation of White Mesa Mill Facility; Blanding, Utah" places limits of 20 feet in length and 30 cubic feet in volume.*

Although the interrogatory response mentions a maximum pipe length of 10 feet, this limit is not stated in the Attachment A. EFR should revise Attachment A to state the maximum pipe length if it is less than 20 feet.

f. *Relative Quantities of Debris, Rubble, and Contaminated Soil: EFR should revise Attachment A to address the possibilities mentioned in the interrogatory response, should relative quantities of debris, rubble, and contaminated soil not allow Cell 1 to be closed as planned.*

g. *Backfilling Voids Inside Debris Objects: EFR proposes to revise Attachment A to incorporate the statement "The voids on the inside of the item shall be filled with contaminated soil, clean fill soil, or grout (controlled low-strength material, flowable fill, etc...). Contaminated soil (Section 7.3.3) or clean fill will be placed outside of the items and compacted with standard compaction equipment (where possible) or hand-operated equipment to the compaction requirements in Specification Section 7.4." EFR also describes measures that could be taken to ensure that voids inside debris items are filled. These include:*

- *Filling the voids with soil through an existing opening*
- *Filling the voids with soil by cutting the item open*
- *Crushing the item flat (so no voids remain within*
- *Cutting pipes short, standing them on end, and filling them with soil*
- *Pumping controlled low-strength material (CLSM or grout) into a region to form a monolithic grouted mass*

These proposed revisions are acceptable and should be incorporated into Attachment A as proposed and other documents as appropriate.

h. CLSM Compressive Strength Requirements: EFR states that grout, if required, will be formulated to "mimic, as closely as possible, the strength and hydraulic properties of the contaminated soil that will also be used for filling voids within the debris."

EFR should state more specifically how these properties will be achieved and what formulation is likely to produce the desired outcome.

Response:

The following text has been added to Section 7.4.1 of the Technical Specifications (Attachment C.1) to reference recommendation of a grouting program, where needed. In addition, discussion of a grouting program has been added to Section 7.3.6.

> "The CQA technicians will make a recommendation to the Contractor for the implementation of a grouting program in instances when voids, either within a debris mass, or within a vessel, cannot be properly filled with soil using conventional equipment."

Organic debris will be size-reduced by crushing, chipping or shredding prior to placement. As described in the Technical Specifications, organic material will only be placed in lifts less than 12 inches thick and mixed with the soil and other incompressible debris during placement to prevent pockets of organic material from being created. Organics mixed with soil for spreading will be limited to 30 percent by volume of the mixture. This limit has been added to the Technical Specifications (Attachment C.2).

Additional interim cover will be placed during active maintenance in any low areas on the cover to maintain positive drainage of the cover surface due settlement including due to debris void spaces and/or organics.

The Division requests that a maximum pipe length of 10 feet be added in the Technical Specifications. A limit of 10 feet or less is already listed for cut pipe pieces from demolition debris in Section 7.3.7 of the Technical Specifications, therefore this text addition is not required.

Section 3.3 of the Technical Specifications (Attachment C.2) has been revised to include the following text.

> "If sufficient debris, rubble and contaminated soil are not available to fill Cell 1 as designed, the footprint of Cell 1 can be reduced in size so that the horizontal dimension extending out from Cell 2 is reduced and the lateral extent of the disposed materials is reduced to be closer to the base of the Cell 2 impoundment. If a design modification is required for Cell 1, it will be submitted to the Division for review and approval and these Technical Specifications will be revised accordingly."

Section 7.3.6 of the Technical Specifications (Attachment C.2) has been modified to as proposed in EFRI (2012) to provide revised and additional information on backfilling of voids inside debris objects. Text has also been added to this section to provide additional discussion on grout strength requirements.

Reference for Response:

Energy Fuels Resources (USA) Inc. (EFRI), 2012. Responses to Interrogatories – Round 1 for Reclamation Plan, Revision 5.0, March 2012. August 15.

DIVISION'S ASSESSMENT OF EFR RESPONSES TO RD 1 INTERROGATORY WHITE MESA RECPLAN 5.0 R313-24-4; 10CFR40, APPENDIX A; INT 05/1; SEISMIC HAZARD EVALUATION

Results of the Division's review of EFR's Response to each individual interrogatory statement in this Round 1 interrogatory are summarized below.

As stated in the Basis for the Interrogatory and Round 1 Interrogatory statement #5, "The USGS National Hazard Maps should not be used for developing site-specific seismic design parameters (personal communication between Dr. Mark Petersen, Chief, National Seismic Hazard Mapping Project and Ivan Wong of URS Corporation, 2010) for critical and important facilities. For such types of facilities, a site-specific probabilistic seismic hazard analysis (PSHA) is recommended." However, contrary to this recommendation, Denison's consultant MWH in response used the USGS National Hazard Maps (specifically the interactive deaggregation tool) to recommend design ground motions for the facility. EFR did not perform a site-specific PSHA as requested. Use of the National Hazard Maps does not constitute a site-specific PSHA. The maps are four years old and are in the process of being updated. PSHA computer software such as EZFRISK® are readily available to perform a site-specific PSHA. Below are specific comments on EFR's responses to the interrogatory statements:

1. *Please further clarify the rationale for selecting the annual probability of exceedance of hazard for the facility.*

EFR has adequately responded to this statement.

2. *Adjust the cited USGS National Hazard Map PGA value of 0.15 g for the site Vs30 as appropriate.*

EFR states that the site-specific Vs30 (time-averaged shear-wave velocity in the top 30 m) as determined by Tetra Tech (2010) was 586 m/sec corresponding to a NEHRP site class E or soft soil. This is an erroneous statement. A Vs30 of 586 m/sec actually corresponds to a NEHRP site class C, very dense soil or soft rock. MWH also estimated the Vs30 for the site and concluded that the Vs30 ranged from 620 to 700 m/sec corresponding to a NEHRP site class D or stiff soil. This is also incorrect. This range in Vs30 also corresponds to a NEHRP site class C. Aside from these errors, the shear-wave velocity (Vs) estimate for the 10 m of soil appears reasonable although SPT does not measure Vs directly and so the uncertainties in the inferred Vs can be significant. However the technical basis for the Vs for the remaining 20 m of interbedded sandstone needs to be provided.

As stated above and in Statement 5, a request had been made not to use the National Hazard Maps but to perform a site-specific seismic hazard evaluation. The assumption that a site Vs30 of 760 m/sec is appropriate for the site allowing use of the maps is problematic.

More importantly, the characterization of the site as a thin soil site where there is 10 m of soil over firm (?) rock (Tetra Tech, 2010) indicates that a site response analysis is now required to address site effects on ground motions. The sharp Vs contrast between the lower velocity soil and the higher velocity rock will amplify short-period ground motions like PGA by as much as a factor of 2 for low rock ground motion inputs. The use of Vs30 in a site-specific hazard analysis will not capture these site amplification effects (Abrahamson, 2011). A site response analysis with a Vs profile into the rock should be performed. Using an equivalent-linear or fully non-linear computer code would be acceptable. It is recommended that direct measurements of Vs be made for input into the site response analysis.

3. *Explain why the calculated hazard for the background earthquake PGA of 0.24 g was estimated but ignored in the recommendation provided in Appendix E.*

EFR did not respond to this statement. However that question is now irrelevant because of the following actions. As recommended and agreed to by Denison in Response 3, a site-specific PSHA is the best approach for quantifying the hazard at the site particularly from background earthquakes. Denison states that was done as in discussed in Response 5 and as contained in Attachment A. A site-specific PSHA was in fact not performed but the National Hazard Maps were used as stated above and below.

4. *Provide information to justify the use of 15 km distance for a background earthquake Mw 6.3 event.*

EFR's response referred back to Response 3. EFR stated that the 15 km distance was selected because it would provide a conservative PGA at the site. This response fails to answer the question. A distance of 10 km would also provide a "conservative PGA at the site". However, this is now an irrelevant question because a deterministic seismic hazard analysis is to be replaced by a site-specific PSHA although such an analysis has yet to be performed.

5. *Perform and report results of a site-specific PSHA in lieu of using the USGS National Hazard Maps for developing site-specific seismic design parameters.*

As commented above, a site-specific PSHA was not done and the 2008 USGS National Hazard Maps were used. The USGS National Hazard Maps consider the Colorado Plateau in which the site is located as part of the central and eastern U.S. with respect to ground motion prediction models. Denison's Attachment 5 shows those ground motion models. Recent research by the USGS (McNamara et al. 2012) and studies for the proposed Blue Castle nuclear power plant site near Green River (Jennie Watson, personal communication, Dec 2012) indicate that is an erroneous assumption and that the use of western U.S. ground motion prediction models is more appropriate. Early site-specific PSHAs including an analysis for the NRC-regulated Atlas Moab tailings site (Wong et al. 1996) and the U.S. Bureau of Reclamation's Glen Canyon Dam (URS 1999) used western U.S. ground motion models. This is another reason why the National Hazard Maps should not be used for developing site-specific design parameters. It is strongly recommended that the Next Generation of Attenuation (NGA) ground motion prediction models be used in the site-specific PSHA for White Mesa. It is expected that the USGS will use the NGA models for the Colorado Plateau in the 2013 National Hazard Maps.

Response:

EFRI conducted a site-specific probabilistic seismic hazard analysis (PSHA) for the White Mesa Mill site to address the Division's comments for this interrogatory. Three versions of the report were submitted to the Division, with the final version submitted in April 2015 (MWH, 2015). The Division provided a final technical review of the report on May 28, 2015 (DRC, 2015) which stated the remaining review items were adequately addressed. The results from this report were used to update technical analyses for the Reclamation Plan. The updated analyses are discussed in other responses and will be included in the next version of the Reclamation Plan.

Reference for Response:

MWH Americas, Inc. (MWH), 2015. White Mesa Mill Probabilistic Seismic Hazard Analysis Report. Prepared for Energy Fuels Resources (USA) Inc. April.

Utah Department of Environmental Quality, Division of Radiation Control (DRC), 2015. Geotechnical Final Review of Energy Fuels Resources (USA) Inc., White Mesa Mill, Tailings Data Analysis Report dated April 2015, and Probabilistic Seismic

Hazard Analysis Report dated April 2015, RML#UT1900479, San Juan County, Utah. May 28.

DIVISION'S ASSESSMENT OF EFR RESPONSES TO RD 1 INTERROGATORY WHITE MESA RECPLAN REV 5.0 R313-24-4; 10CFR40, APPENDIX A, CRITERION 1; INT 06/1; SLOPE STABILITY

The Division finds that the revised slope stability analysis provided in the revised Attachment D to the EFR response did not adequately address several considerations and criteria that may be important to the analysis of the stability of the closed tailings embankment, including the following:

- *No details were provided regarding shear strength data for the liner and LCRS components in Cells 4A and 4B*
- *No information was provided as how the bottom liner component(s) was (were) simulated in the global stability analysis completed for cross Section A through Cell 4B*
- *No details were provided regarding shear strength data for the liner and LCRS components in Cell 2*
- *No information was provided as how the bottom liner component(s) was (were) simulated in the global stability analysis completed for cross Section B through Cells 2 and 1*
- *Insufficient information was provided regarding:*
    1) *the estimated in-place dry density, in-place most density, and in-place saturated density (unit weight values) of the tailings;*
    2) *rationale for selecting the tailings condition and tailings properties assumed in the analysis (e.g., drained vs. undrained conditions and for selection of in-place moist tailings density vs. in-place saturated tailings density for long-term static conditions or long-term seismic conditions); and*
    3) *the location of the assumed water table, e.g., if drained condition assumed;*
- *The discussion and Table E.1 in Attachment D of table of the material properties used in the model did not distinguish between different material strength parameters assumed for long-term static conditions vs. long-term seismic conditions, e.g., no discussion of percentage reduction in strength properties for the seismic (pseudostatic) stability analysis was provided;*
- *No discussion of or rationale was provided for whether it may be appropriate and reasonably conservative to assume that the tailings dewatering system might be clogged, possibly leading to ineffective drainage at the base of the tailings cell in area including the lowest point in the tailings bottom surface and therefore possibly result in an undrained condition within the tailings. For such a case, undrained tailings strength relationships might suggest strength values for the tailings that may be different than those assumed by EFR; and*
- *No discussion or rationale was provided for whether it may be appropriate and reasonably conservative to assume that the strength parameters for the clay liner in the Cell 1 area might be estimated based on the PI that would lead to the weakest strength, or estimated using some other method that would generate the weakest estimated shear strength value for the clay liner.*

The Division requests that EFR, in Attachment D, further define how the tailings total unit weight value stated in Table E.1 (90 pcf) and used in the revised slope stability analysis was derived (or how representative a value that value is of the tailings). For example, tailings sample results (see Appendix F, Settlement and Liquefaction Analyses of Updated Tailings Cover Design Report, Denison 2011) indicate that the tailings have an average specific gravity of 2.73; if a dry unit weight of 90 pcf were assumed (Section E.3 of Attachment D of this Response,) an average tailings void ratio of about 0.89 would result.

Based on this void ratio, the tailings bulk density would be approximately 119.4 pcf, compared to the total unit weight of the tailings listed in Table E.1 of Attachment D of this Response of 95 pcf. Alternatively, if an average tailings dry unit weight of 86.3 pcf were assumed (as was done in Appendix F, Settlement and Liquefaction Analyses of the Updated Tailings Cover Design Report, Denison 2011), then an average tailings void ratio of about 0.97 would result. Based on this void ratio, the tailings bulk density would be approximately 117.2 pcf. EFR should reevaluate and verify that their assumed tailings properties, calculation methodologies, and assumptions are representative, reasonably conservative, and bounding.

Response:

The slope stability analysis has been updated to incorporate the revised cover grading and additional site-specific tailings data collected in October 2013 (MWH, 2015). The revised analysis is provided in Attachment D as part of the revised Appendix E, Slope Stability Analysis, which will be included in the next version of the Updated Tailings Cover Design Report (Appendix D to the Reclamation Plan).

The liner and LCRS components of Cells 2, 4A and 4B were not included in the slope stability analysis because the strength parameters of these components do not affect the reclaimed stability analysis. Failure surfaces representing the lowest calculated factors of safety do not intersect the liner and LCRS components, even for conservatively low shear strength conditions within the cells.

Tailings density values used in the slope stability analysis have been updated to incorporate the results of tailings testing conducted in October 2013 (MWH, 2015). The rationale for selecting the tailings condition and properties are provided in Attachment D.

A liquefaction analysis was conducted for the tailings and is presented in Attachment G. The results indicate the tailings are not susceptible to earthquake-induced liquefaction for reclaimed conditions. For materials that do not liquefy or lose shear strength with seismic shaking, seismic slope stability is analyzed by a pseudo-static approach. The unsaturated parameters used for the pseudo-static slope stability analyses are conservative representations of constant volume shear strength, and no further reduction is warranted.

The tailings are planned to be dewatered prior to placement of the final portion of cover. The phreatic surface was estimated to be five feet above the liner system for the analyses. Sensitivity analyses indicated that increasing the phreatic surface does not impact the location of the critical failure surface for the slope stability analyses.

The shear strength parameters for the clay liner for Cell 1 were estimated using the average measured PI (60) for samples meeting the placement specifications for minimum PI and percent passing the No. 200 sieve, and the generalized relationship between PI and effective angle of internal friction presented in Holtz and Kovacs (1981). The relationship in Holtz and Kovacs (1981) was based on normally consolidated clays. The stability analyses did not include cohesion, and the clay liner material will be compacted. Therefore the shear strength parameters used in the stability analyses are conservative values.

References for Response

Holtz, R.D. and W.D. Kovacs, 1981. An Introduction to Geotechnical Engineering. New York: Prentice-Hall.

MWH Americas, Inc. (MWH), 2015. White Mesa Mill Tailings Data Analysis Report. Prepared for Energy Fuels Resources (USA) Inc. April.

DIVISION'S ASSESSMENT OF EFR RESPONSES TO RD 1 INTERROGATORY WHITE MESA RECPLAN REV. 5.0; R313-24-4; 10CFR40, APPENDIX A, CRITERION 4; INT 07/1; TECHNICAL ANALYSIS - SETTLEMENT AND POTENTIAL FOR COVER SLOPE REVERSAL AND/OR COVER LAYER CRACKING

As discussed in the Response to Interrogatory No. 3 in Section 3.0 above, EFR did not provide settlement performance data or settlement prediction analyses for any of the other facilities referenced by EFR as having been constructed with a similar range of topslope inclinations. Similarly, EFR did not provide any information demonstrating a correlation between observed settlement at these repositories and the future settlement predictions developed for those facilities that might allow the performance of these facilities to be evaluated with respect to their observed or predicted post-construction behavior.

The revised settlement analysis included one-dimensional analyses of both primary consolidation and estimates of settlement due to creep associated with secondary consolidation occurring during (i) interim soil cover placement/loading; (ii) tailings dewatering; and (iii) final cover loading. EFR also provided estimates of seismically-induced settlement due to earthquake loading.

In its settlement analyses, EFR relies of data from settlement monuments in Cell 2 to estimate settlement parameters (e.g., compression indices and coefficients of consolidation) for the tailings. Each monument or monitoring point is treated independently, and the range of data and corresponding analytical results are reported in terms of maximum, minimum and average values. Examination of the data indicates that the 5 westernmost monuments or monitoring locations (2W12W2, 2W3, 2W3-S, and 2W4) behave very differently than the others, with an average observed settlement of about 0.77 feet from July 1991 (on average) to the start of dewatering in 2009, whereas the other data set only averages about 0.1 feet during a period most typically from July 2005 to January 2009. Given the grossly different amounts of settlement between the two sets of settlement data (and the issue not simply being a matter of greater tailings thickness), the use of a simple average across the two sets of data seems inappropriate. More importantly, given the relatively short time of settlement observation for the eastern monuments and the flat shape of the settlement curves, it seems likely that significant settlement occurred prior to monitoring, thus making this approach to settlement estimation problematic as was discussed in the first Interrogatory. If significant portions of the settlement time histories were not captured in the eastern monitoring data, the use of "average" values derived from the data (as apparently is the case currently) will not represent the behavior a majority of tailings under newly added load. On the other hand, if the range of settlement data as measured is representative of true settlement behavior, then a significant range of possible behavior should be expected (reflective of directive in the first round of interrogatories to consider a range of tailings ranging from fine grained slimes to coarse sands and their spatial distribution within the impoundment cells).

EFR has attempted estimate both compression indices and coefficients of consolidation for the tailing by curve fitting settlement data from five of the monitoring points (those possessing enough curvature to which a curve can be fit) with theoretical settlement curves. From the plots provided in Attachment E, it appears that something is amiss in the curve-fitting analyses since primary and secondary consolidation appears to be happening at the same time, rather than secondary occurring after completion of primary. Such an error would make the "back-calculated" indices and coefficients incorrect. This issue should be examined further. Again, as stated in the first round of Interrogatories, this back-calculation or curve-fitting approach is problematic at since the start of the settlement time history prior to monitoring is missing and a third variable (the effective drainage length) is not precisely known. Because of this, variance from calculated values should be expected and must be considered when evaluating subsequent cover performance. To better address the shortcomings inherent in using this curve-fitting/back-calculation approach, it was stated in the previous Interrogatory to "use consolidation parameters *obtained from site-specific testing of the tailings materials, reflecting both spatial and temporal variations in the tailings."*

The settlement analyses performed by EFR focused on evaluating settlement in the Cell 2 area only. No discussion or analyses were provided regarding any tailings management/disposal process-related differences such as different tailings placement methods/modes that may have occurred/might exist with regard to the various tailings disposal cells or of the effects that such differences might have on tailings consolidation and settlement behavior in each disposal cell area. Additionally, no discussion or analyses were provided for differences in dewatering system designs, differences in the expected dewatering efficiencies likely to occur between different cells (with resulting differences in statured tailings thicknesses at the different stages in time evaluated in the settlement analyses), or differences in thicknesses of tailings in the different cells (e.g., tailings thickness in Cell 4A varies from about 26 to 42 ft, with an average thickness of about 34 ft, vs. tailings thickness ranging from about 14.5 ft to 28.50 ft in Cell 2).

In the Response to Item 2. of this Rd 1 interrogatory, EFR indicated that a final water level in the tailings in Cell 2 at the end of dewatering was estimated based on dewatering analyses presented in the Revised ICTM Report. However, the Reclamation does not contain a schedule for, a detailed description of, measures that EFR will undertake to ensure that dewatering of Cells 2 and 3 will be completed within the 7-year time period specified in the latest Financial Surety submitted to the Division by EFR, or a shorter time period. This is important since recent data suggests that the current rate of dewatering in Cell 2 may be on the order of 1 inch per year. As part of the additional settlement analyses that are needed to further address differential settlement and evaluate impacts of differential settlement on cover slope integrity/slope reversal, EFR needs to address additional requirements related to dewatering analyses, measures, costs, and schedule for dewatering of Cells 2 and 3 as described in Section 15.3 below.

In calculating the settlement of the tailings in Cell 2, it appears that tailings above elevation 5604.95 (a datum which seems to correspond to the average 2009 first quarter water levels plus an assumed 3-foot perched zone thickness) have been omitted from consideration during future dewatering and placement of the final cover (from time t1 to t2, and from t2 to t3). Even above the water table, these materials will respond to the added stresses from cover construction and their contribution to total settlement should be included.

Neither the response nor Attachment E presents a rationale for selecting tailings properties (e.g., specific gravity of tailings of 2.75, moist unit weight of 100.29 pcf above the capillary fringe, long-term moisture content of 16.2%, void ratio of 0.99 assumed for the Phase 1 analysis) to be used in the revised settlement analyses. Further, while unit weights for the various components of the cover system have been provided, their thickness have not all be provided, thus preventing a check of the stresses resulting from cover placement. The thickness of each component of the cover system needs to be indicated in the calculation spreadsheet.

Without a narrative and sample calculations for all of the spreadsheet results presented in Attachment E, it is difficult to assess the adequacy of the analysis presented. For example, it is unclear how the bottom elevation of the "upper zone" was determined, and then how the thicknesses of the upper and lower zones correspond to the drainage path used to determine the time for 90% consolidation. Such clarification need to be provided in order to assess the adequacy of the settlement calculations. General references to calculation methodology such as "Terzaghi et al. 1996, pages 223-240" are too general to satisfy this need for additional information.

It is unclear what time for primary consolidation was used in calculating the secondary settlement, and the reviewer is otherwise unable to assess the results calculated by EFR. Again, a narrative and/or sample calculations (or at least illustrative equations and a description of how specific values were determined) should be provided for all spreadsheet calculations in order to assess their correctness.

With respect to the calculated seismically induced settlement, there appears to be errors in the calculation process (for example, the vertical strain should be twice the resultant of the vertical strain for 15 cycles of shaking multiplied by the variable Cn [doubling is to account for the multi-directional application of strain as described in the referenced Stewart and Whang (2003) paper]). Also, the calculations incorrectly treat the tailings as a single layer subject to a constant amount of cyclic strain. The tailings should be discretized into smaller, discrete layers and the stress and strain calculations redone. Another apparent inaccuracy in EFR's calculation is an apparent capping of shear strain amplitude to 1.0%. In Stewart and Whang's cyclic strain charts (Fig 3 in their paper), cyclic shear strain values are shown up to 1%, which is a reasonable limit for compacted soils (noting that "compacted soils" is part of the title of Stewart and Whang's paper). However, the soils in question are uncompacted tailings in which cyclic strains could exceed 1%. Hence, extrapolation or another calculation methodology should be used to determine seismically induced settlement. Also, the Stewart and Whang procedure is not well established (vetted) within the geotechnical earthquake engineering community. Consequently, EFR should compare the results obtained using this procedure with those of a more-well established procedure such as Tokimatsu and Seed (1987) or Ishihara and Yoshimine (1992).

In reviewing Table 2 'Summary of Settlement Results', it is unclear how the values shown for "Total Settlement five years after placement of Final Cover due to Final Cover Placement, Creep, and a Seismic Event" in row 5 (minimum and maximum values of 0.52 to 0.83) were determined. While calculations supporting the preceding four rows of settlement results in the table are readily identified within the spreadsheet calculations presented in Attachment E, no explicit calculations justifying the fifth row of values are presented. Additional information is needed.

In its assessment of differential settlement and cover cracking analysis, ERF estimates that the "maximum potential differential settlement that could be expected between adjacent movement monitoring locations would be on the order of 0.3 feet." With typical spacings between monitoring locations of about 250 feet (scaled from the figure by the reviewer, and an explicit statement of such should be provided by EFR), this equates to an average deflection ratio (differential settlement) of about 0.12%, which is less than the proposed minimum cover slope of 0.5%, and hence on this basis, ponding is not expected. However, the value of 0.3 feet needs to be reassessed due to the issues just previously presented.

In assessing the potential cracking of the cover, EFR has relied upon the most critical combination of projected settlement of a monitoring point (0.9 ft at 2W4-S) and it associated distance away from the edge of the tailings cell (being for this monument 100 ft) to determine the greatest strain demand on the cover based on the approach of Lee and Shen (1969). This value is then compared to the cracking resistance based on an empirical relationship using soil index properties (Claire et al. of Morrison-Knudsen, 1993). While this approach is reasonable, the input for Lee and Shen's horizontal movement formula has been incorrectly selected. In the analysis, EFR has used the average slope of the settlement profile (0.9/100) rather than a local maximum which would include the effects of bending. This point is illustrated in the test data and illustrative example provided in Lee and Shen's paper: the vertical displacement between the two ends of their 93-inch long soil beam is 1 inch, yielding an average slope of about 1%; however, the maximum slope in their beam which includes bending is 2%, located near the middle of the beam. In Lee and Shen's paper, the maximum reported tensile horizontal strain is about 0.6%, derived from the 2% maximum (not 1% average overall) slope. To be consistent with Lee and Shen, EFR should use the expected peak slope between points, not the average between the two points. Assuming that the peak is twice the average as in Lee and Shen's test case (although ERF will need to provide a reasoned and defensible value specific to this project; representative published relationships depicting cover deformation shapes and tensile strain/distortion relationships include those included in Gourc et al. (2010) and Rajesh and Viswanadham (2010), the maximum horizontal strain appears to be twice that of the 0.028% previously reported, exceeding the reported maximum allowable strain of 0.05%, meaning that the layer is expected crack. The analysis must be redone to include the effects of localized bending as *was indicated in the first round of Interrogatories, and the performance of the cover reassessed accordingly.*

Also relating to the cracking analysis, a thickness of 4.7 ft is used for the soil layer. However, the actual thickness of the sandy clayey silt soils in the tailings cover design, which collectively serve for radon attenuation is 8.8 ft per Figure 2-2 of the Revised ICTM Report (Denison Mines 2010). The analysis should either be revised to reflect this value or a justification provided for the value used.

As part of the previous Interrogatory, EFR was asked to "demonstrate that the results of settlement analyses are consistent with results of drainage/dewatering analyses, and ensure that drainage/dewatering analyses reflect the tailings and drainage conditions (including slime drain system) existing in each cell. In EFR's Response, the following statement is made:

"It should be noted the assumptions made in the one-dimensional consolidation analyses of Phase 2 (i.e. complete coverage of the tailings impoundment by an infinitely-permeable underdrain system, and instantaneous drawdown to final water level) do not exist within the impoundment, and will result in an underestimation of the time required to achieve 90% consolidation. The results of the tailings dewatering analysis, which includes the 3-dimensional aspects of flow toward the underdrain strips, and a finite underdrain permeability, are considered to provide a more reliable estimate of the duration Phase 2 consolidation."

Unfortunately, no further reference or discussion is presented regarding the dewatering analyses, and hence the question of time needed to reach 90% consolidation remains unresolved. Based on its consolidation settlement analysis, EFR reports that the time to reach 90 percent of primary consolidation due to dewatering of the tailings in Cell 2 ranges from 0.14 to 0.63 years. However, in the dewatering analysis (see Appendix J of Revised Infiltration and Contaminant Transport Modeling Report, White Mesa Mill Site, Blanding, Utah, by MWA 2010)), EFR reports that "the MODFLOW dewatering model predicts that the tailings would drain down nonlinearly through time reaching an average saturated thickness of 3.5 feet (1.07 m) after 10 years of dewatering." These two conclusions are not compatible. As part of this Response to Interrogatory, the results of the dewatering analyses need to be considered in conjunction with the settlement analyses and the subsequent assessment of cover settlement.

As stated previously, no explicit discussion or analyses were provided regarding any tailings management/disposal process-related differences such as different tailings placement methods/modes that may have occurred/might exist with regard to the various tailings disposal cells or of the effects that such differences might have on tailings consolidation and settlement behavior in each disposal cell area. Additionally, no discussion or analyses were provided for differences in dewatering system designs, differences in the expected dewatering efficiencies likely to occur between different cells (with resulting differences in statured tailings thicknesses at the different stages in time evaluated in the settlement analyses), or differences in thicknesses of tailings in the different cells.

In summary, based on review of all of the above, the Division concludes that the analyses provided by EFR are, in general, overly simplistic and do not adequately account for the full range of different conditions that may occur with the tailings management cells area. Extrapolating assumed tailings parameters and properties from published data on tailings at other facilities creates additional uncertainties in the consolidation, settlement, stability, and liquefaction analyses. Assumed data must be supplemented by site-specific data; alternatively, the most reasonably conservative values might be used if adequate assessment and justification is provided. Justifications for some parameter values are lacking in EFR's response. EFR should provide additional analyses that specifically address the different factors and conditions and their effects referenced in the preceding paragraphs. Also, there appears to be several errors, omissions, discrepancies, and insufficient information in the analyses conducted and provided by EFR which need to be to be addressed before appropriate and reliable conclusions can be reached.

Response:

EFRI conducted a tailings investigation of Cells 2 and 3 at the White Mesa Mill site in October 2013 to address the Division's comment for this interrogatory and Interrogatory 09/1 requesting collection of site-specific tailings data to supplement existing tailings data used settlement analyses. Results are presented in MWH (2015b). Settlement analyses have been updated to incorporate the additional site-specific tailings data, as well as the revised cover grading design, results of the recent site-specific probabilistic hazard analysis (presented in MWH, 2015a), and revised procedures for the seismic settlement analysis. The revised analyses are provided in Attachment E, Settlement and Liquefaction Analyses, and will be included in the next version of the Updated Tailing Cover Design Report (Appendix D to the Reclamation Plan).

These revisions address the Division's comments which include requests for (1) collection of site-specific tailings data to supplement exiting tailings data, (2) use of site-specific tailings data to evaluate settlement, (3) inclusion of all layers into the settlement analyses, (4) revisions to seismic settlement calculations, and (5) revisions to differential settlement calculations. To evaluate changes in settlement and water levels due to dewatering and placement of final cover prior to and after final cover placement, EFRI will conduct settlement monitoring and install mini-piezometers across the cells prior to the first phase of cover placement. This data will provide information on the rate and extent of dewatering of the cells and settlement to confirm when the final phase of cover can be placed and when active maintenance is no longer required.

Evaluation of total settlement due to final cover placement and dewatering indicates potential future settlement during active maintenance of approximately 0.9 to 1.6 feet for Cells 2 and 3. During this time, additional fill can be placed in any low areas in order to maintain positive drainage of the cover surface. The total estimated settlement that could occur (due to creep and seismic settlement) after the maintenance time period is estimated to range from 0.3 to 0.7 feet. This estimated differential settlement is sufficiently low that ponding or slope reversal is not expected to occur on a cover slope of 0.5 to 1.0 percent. The results of the settlement analyses also indicate that cover cracking of the highly compacted radon barrier is not expected.

Similar results are expected for Cells 4A and 4B. Although Cells 4A and 4B have higher tailings thicknesses, these cells have a more effective dewatering systems and a low water level requirement for dewatering. These cells also have a slightly steeper average cover slope (approximately 0.8 percent) than Cells 2 and 3.

References for Response

MWH Americas, Inc. (MWH), 2015a. White Mesa Mill Probabilistic Seismic Hazard Analysis Report. Prepared for Energy Fuels Resources (USA) Inc. April.

MWH Americas, Inc. (MWH), 2015b. White Mesa Mill Tailings Data Analysis Report. Prepared for Energy Fuels Resources (USA) Inc. April.

DIVISION'S ASSESSMENT OF EFR RESPONSES TO RD 1 INTERROGATORY WHITE MESA RECPLAN REV. 5.0; R313-24-4; 10CFR40, APPENDIX A, CRITERION 4; INT 08/1: TECHNICAL ANALYSIS – EROSION STABILITY ANALYSIS

The revised calculated 1-hr and 6-hr duration PMP values are equal to or smaller in magnitude than the respective PMP values previously determined (8.3 inches and 10.0 inches, respectively) using the method of Hansen et al. 1984. The existing design is, thus, oversized relative to precipitation projected to occur at the site. Therefore, the previous analyses are considered acceptable and bounding.

Review of the topslope erosional stability calculations indicates that these analyses are not complete and that the validity of certain assumptions used in these calculations has not been adequately demonstrated. Missing from these analyses, for example, are a sensitivity analysis case of bare soil conditions occurring on soil-only topslope surfaces (e.g., "uniform weathered earth" or bare soil condition) to simulate a lack of vegetation on these topslope areas, and a full analysis and justification for the estimated Manning's "n" values appropriate for the soil-only surfaces, and gravel/soil admixture surfaces. For example, the response did not distinguish between an appropriate "n" value for uniform weathered earth conditions and "n" values for vegetated conditions; e.g., $n = (n_R^2 + n_S^2 + n_\Psi^2 – [0.0156])^{½}$ *(Temple et al. 1987, p. 5).*

Additionally, in the erosion analyses, EFR assumed a default flow concentration factor of 3, in accordance with recommendations in NUREG-1623 (NRC 2002). However, this assumption is valid only if uniform grading will be done during construction and differential settlement has been shown to be insignificant. As discussed in Section 3.3 above regarding the Response to Rd 1 Interrogatory 03/1 and in Section 7.0 regarding the Response to Rd 1 Interrogatory 07/1, neither the ability to construct the proposed flat topslope areas to a uniform slope nor the potential for differential settlement to occur in the tailings management area embankment after closure have been adequately demonstrated.

The EFR response and calculations and methodologies relating to sizing of angular and rounded riprap on the different sideslopes of the tailings cells area are considered acceptable.

The EFR response, calculations, and methodologies relating to evaluation of the filter gradation criteria are considered acceptable.

EFR committed to, but did not provide revised Drawings, revised CQA/CQC Plan, and revised Technical Specifications showing the filter and rock riprap layers. These revised documents will need to be reviewed, when available, to verify that these changes have been made. Because these revised documents were not submitted in its interrogatory response, this interrogatory will remain open.

EFR committed to, but did not provide revised Drawings showing the changes indicated for the rock riprap layer minimum thickness and cross sections . The revised drawings will need to be reviewed, when available, to verify that these changes have been made. Because these revised documents were not submitted in its interrogatory response, this interrogatory will remain open.

Response:

The erosional stability analysis has been updated to incorporate the revised cover grading. The revised analysis is provided in Attachment F as part of the revised Appendix G, Erosional Stability Evaluation, which will be included in the next version of the Updated Tailings Cover Design Report (Appendix D to the Reclamation Plan).

Based on the results of the plant survey conducted by EFRI in 2012 and evaluation of the plant cover performance at the Monticello site (which has similar environmental conditions), a plant cover estimate of 30 percent was determined to be a reasonable value for reduced performance (drought) conditions, rather than bare soil conditions. See Attachment G for further discussion. This value was used for the erosional stability analyses to represent long-term, lower-bound vegetation conditions.

NRC (2002) states that a concentration factor is used in the erosional stability calculations to account for imperfections in the slope (NRC, 2002). As noted in NRC (2002), the addition of a concentration factor is based on studies performed by Abt and Johnson (1991) which recommend a factor of 2 to 3. NRC (2002) recommends a default value of 3 for the concentration factor. Review of the Abt and Johnson (1991) study and follow up discussion with Steve Abt (Abt, 2012) confirm that the concentration factor included in the erosional stability calculations in NRC (2002) is intended to account for imperfections in the slope, and concentration and channelization of flow on the surface. Steve Abt (2012) also confirmed the recommendation of a concentration factor of 2 to 3 for cover slopes on uranium disposal facilities based on the Abt and Johnson (1991) study. The concentration factor of 3 presented in NRC (2002) was used in the analyses, and is applicable to the planned sequence of tailings settlement, monitoring, and cover placement.

The revised Drawings, Technical Specifications, and CQA/CQC Plan incorporated the results of the revised erosional stability analysis and the documents are provided in Attachments B, C.1, and C.2, respectively, for Division review.

References for Response

Abt, S. R. and T.L. Johnson, 1991. "Riprap Design for Overtopping Flow." J. of Hydr. Engr., ASCE,117(8), pp. 959-972, August.

Abt, S., 2012. Personal communication from Steven Abt, Colorado State University, to Melanie Davis, MWH Americas, Inc. May 18.

U.S. Nuclear Regulatory Commission (NRC), 2002. “Design of Erosion Protection for Long-Term Stability”, NUREG-1623, September.

DIVISION'S ASSESSMENT OF EFR RESPONSES TO RD 1 INTERROGATORY WHITE MESA RECPLAN REV. 5.0; R313-24-4; 10CFR40, APPENDIX A, CRITERION 1; INT 09/1; LIQUEFACTION

In the Rd 1 interrogatory, EFR was requested to "provide revised liquefaction analyses that rely upon actual site-specific data for the tailings materials, rather than assumed parameters." EFR's response to this Interrogatory states that "a constant Standard Penetration Test (SPT) blow count (n-value) of 2 blows in 12 inches (uncorrected) is assumed for the tailings zones that will remain saturated under long-term steady state conditions." While this assumption of 2 blows in 12 inches (uncorrected) is a conservative reinterpretation of the previously assumed value of 4 blows in 12 inches, it is still only an assumption; it is not based on data. It is again requested that site-specific data for the materials be used in analyses, not assumed data. Alternatively, EFR should use, and provide adequate justification for demonstrating that the most reasonably conservative parameter values possible (are used) in all calculations.

The assumed SPT blowcounts are subsequently corrected using a fines content of 30, said to be based on an average of laboratory test values. Sands with this large of fines content are typically quite resistant to liquefaction (hence the much greater blow counts after the fines correction). Since the fines content value used to characterize the tailings is based on an average value (and given that the effect of fines content on liquefaction resistance is not linear), it is more appropriate to use a lower bound estimate of fines content rather than average value; otherwise, a false factor of safety may result for some of the coarser-grained materials. Again, as stated in the previous interrogatory, consideration should be given to the potential variation of properties of the tailings.

The liquefaction analyses presented in Attachment F use a peak ground acceleration of 0.15 g and a moment magnitude of 6.0. These values are consistent with those of revised probabilistic seismic hazard analyses. However, as part of the earlier deterministic analysis, Tetra Tech (2010) estimated a magnitude 6.3 for a random background event, said to be consistent with that used in previous seismic evaluations performed for sites in the Colorado plateau. Please clearly identify and justify the more appropriate value to use in the analyses, and revise analyses as needed.

The liquefaction analyses presented in Attachment F uses a dry unit weight of tailings of 90 pcf. Page C-4 of the REC plan (Denison Mines 2011) indicates that the dry unit weight of the tailings is 91.4 pcf, rather than 90 pcf. The dry unit weight of tailings used in the settlement analyses in Attachment E appears be 86.3 pcf. In the previous Interrogatory, it was stated that "consistent characterization of the tailings throughout the report seems to be needed." This issue remains unaddressed.

In the simplified liquefaction analysis procedure, the parameter K_σ which accounts for effects of confining stress is not used. At the base of the tailings, the currently computed effective vertical overburden stress is nearly two tons per square foot. At this value, Figure 14 of Youd et al. (2001) shows the value of K_σ for sands to be about 0.81, which would tend to reduce the as-calculated factor of safety. The factors of safety should be recalculated including the correction factor K_σ, or alternatively exclusion of this factor from analysis should be justified.

In the liquefaction analysis presented in the revised Attachment F, there appears to be multiple inconsistencies regarding the thicknesses of the various components of the cover system for each of the cells (and hence the stresses used in the analysis may be incorrect). Normal stresses calculated in the liquefaction analysis sheet are associated with assumed cover-system soil thicknesses, which appear in some instances to be too high, as well as with assumed relative compactions, some of which are too high. For example, the thickness of random fill material at 95% of Standard Proctor dry density in the cover is stated in the liquefaction analysis to be 4.7 feet for Cell 2. This appears to be too thick. Therefore, the *results of the liquefaction analysis itself, which depend on the "compacted cover" thickness, apparently are in error. The entire design cover system in the liquefaction analysis, from top to bottom, is claimed in the liquefaction sheet to be as follows:*

Topsoil rock mulch: 0.5 feet thick.

Random fill at 85% of Standard Proctor dry density: 3.5 feet

Random fill at 95% of Standard Proctor dry density: 4.7 feet

Grading fill at 80% of Standard Proctor dry density: 2.5 feet

The assertion that the value of 4.7 feet appears to be too high for the random fill at 95% of Standard Proctor dry density can be demonstrated from a number of sources. Figure 2.2 in the Revised ICTM Report (Denison Mines 2010) provides a "generalized" cross-sectional view of the cover system for the site and gives the purported general cover design is as follows:

Topsoil rock mulch: 0.5 feet thick.

Random fill at 85% of Standard Proctor dry density: 3.5 feet

Random fill at 95% of Standard Proctor dry density: 2.8 feet

Grading fill at 80% of Standard Proctor dry density: 2.5 feet

The random fill at 95% of Standard Proctor dry density has a thickness listed above of only 2.8 feet, not 4.7 feet. The REC plan (Denison Mines 2011) offers similar information, but with the thickness of random fill at 95% of Standard Proctor dry density being said to be only 2.5 feet. However, this generalized cross-sectional view of the cover system also is considerably different compared to plans for actual constructed thicknesses in Cells 2 and 3. To obtain a more accurate value for planned thickness of random fill at 95% of Standard Proctor dry density, it is necessary to turn to the engineering drawings. A check can be made of the value used in the liquefaction analysis by comparing it against "compacted cover" values shown for Cell 2 in Sheet TRC-7 of the REC Plan, Revision 5.0 (Denison Mines 2011). Sheet TRC-7 is titled, "Cover over Cell 2 Cross Sections." These cross sections of the planned Cell 2 cover system show a maximum thickness for the "compacted cover", representing the random fill at 95% of Standard Proctor dry density, of about two feet. However, that exists only in a few places. Cross Section A shows only about 40% of the cell along that cross-sectional line having any "compacted cover" whatsoever, with an average thickness of only about one foot where that "compacted cover" does exist. About 60% of the cell along Cross Section A has no cover of 95% of Standard Proctor dry density at all.

Cross Section B shows only about 25% of the cell along that cross-sectional line having any "compacted cover" of 95% of Standard Proctor dry density whatsoever, with an average thickness of about one foot where the compacted soil does exist. 75% of the cell along that cross section has no "compacted cover" of 95% of Standard Proctor dry density at all. Cross Section C shows only about 25% of the cell along that cross-sectional line having any "compacted cover" of 95% of Standard Proctor dry density whatsoever, with an average thickness of one foot or less where the "compacted cover" exists. Sheet TRC-2 also confirms this, but in plan view. Cross Section C shows about 75% of the cell along that cross-sectional line with no cover having 95% of Standard Proctor dry density at all.

Assuming that the cross-sections provide a representative cross-sectional view of the cover system in Cell 2, it appears that, on average, to a rough approximation (assuming that each cross-section represents one-third of the cover), coverage of the cell by any 95%-of-Standard-Proctor "compacted cover" at all exists on only a little more than [(0.333)(0.40) + (0.333)(0.25) + (0.333)(0.25)] = 0.3, or three-tenths (3/10), of the cell. The average thickness of "compacted cover" at the cell, averaged over the cell's entire area, is thus only about (0.3)(1 ft) = 0.3 ft.

The liquefaction analysis sheet uses a value for the thickness of "compacted cover" having 95% of Standard Proctor dry density that happens to be [(4.7 – 0.3)/0.3] x 100% = 1470% in excess of the actual *value. In other words, the thickness of the random fill at 95% of Standard Proctor dry density assumed in liquefaction analysis is 15.7 times that value. Please address these inconsistencies in the liquefaction analysis spreadsheet calculations and provide correct values for the thickness of the random fill at 95% of Standard Proctor dry density.*

Apart from issues associated with characterization of the cover system components, the liquefaction analysis spreadsheet calculations presented in Attachment F indicated a tailings surface elevation for Cell 2 of 5613.5 feet. 5613.5 feet is the approximate surface elevation for much of the tailings in Cell 2. However, tailings in the vicinity of Cross Section C in Cell 2 have much higher elevations in the northern half of the cell. There, the elevations reach to 5623 feet. Also, the liquefaction analysis spreadsheet calculation shows that the water surface elevation for Cell 2 is 5593.03 ft amsl. For of the second quarter of 2012, on May 29th, the reported depth to water in the tailings slimes in Cell 2 was measured as 21.10 ft (EFR 2012). The top of slimes drain pipe is at an elevation of 5618.73 ft amsl (personal communication with Russ Topham of the Division on October 5, 2012, who reported receiving it from Garrin Palmer of EFR on October 5, 2012). So, the calculated head of water in the tailings is estimated to be 5618.73 ft amsl minus 21.10 ft, or 5597.63 ft amsl. This is 4.6 feet higher than what is shown in the liquefaction analysis sheet. These values should be corrected.

As is the case for Cell 2, so it is for Cell 3 that actual planned thicknesses of various layers at different percentages of Standard Proctor dry densities, or at different compactions, greatly vary from what the liquefaction sheet shows. Sheet TRC-6 in the REC Plan (Denison Mines 2011) demonstrates this. Please fix the stated thickness values. Also, since the errors in thicknesses translate to errors in calculated normal stresses induced by cover systems in the various cells, and other calculations on the liquefaction analysis sheet, please be sure that these are fixed as well.

The liquefaction analysis spreadsheet calculations identify the tailings thickness for Cell 2 as 32.5 feet, that for Cell 3 as 38.5 feet, and that for Cells 4A/B as 40.5 feet. Table F.1 of Denison Mines 2011 is cited. Table F.1 and the Attachment F-2, Settlement Analysis spreadsheets in Denison Mines 2011 likewise provide figures of 32.5, 38.5 and 40.5 feet for the tailings thicknesses for Cells 2, 3, and 4A/B, respectively. These figures, however, appear to conflict with the tailings thickness for Cells 2 and 3 given on Page C-2 of the Response text of "approximately 30 feet" and "the tailings thickness for Cells 4A/B of approximately 42 feet" (Denison Mines, 2011). These inconsistencies should be fixed.

It can be seen, based on 1980 as-built drawing information from Energy Fuels Nuclear, Inc., as shown on Sheet TRC-7 of Denison Mines (2011) that, for most of the Cell 2, the elevation of the tailings surface is 5613 ft amsl. This knowledge, coupled with some additional information, can lead to a better understanding of maximum saturated thickness in the tailings of Cell 2. Assuming for the moment that the Denison Mines (2011) Table F.1 32.5 feet value is correct, this means that the nominal base of the tailings must be, on average, at about 5613 ft amsl minus 32.5 feet, or 5580.5 ft amsl. Since, as calculated above, the head of water in the tailings is 5597.63 ft amsl, it follows that the average saturated thickness of the tailings in Cell 2 is 5597.63 ft amsl minus 5580.5 ft amsl, or 17.1 feet. This compares with a value of 12.03 feet claimed for maximum saturated thickness in the liquefaction sheet. The latter number appears to be off by 5.07 feet, which would be a 30% error. This may substantively change a number of liquefaction calculations. Please correct the saturated thickness in the liquefaction sheet.

From the previous calculations for Cell 2, it is observed that the saturated thickness is about 30% greater than claimed in the liquefaction analysis. This has effects on calculations for effective overburden stress and other consequent calculations. These effects can be accounted for to some extent. The saturated zone starts about 4.5 feet higher than shown on the liquefaction analysis sheet, at approximately 5597.63 ft amsl, not at 5593.03 ft amsl. This means that 4.6 feet of tailings must be accounted for with a 120.3 pcf saturated specific weight compared to old approach of (if that 4.6 feet of tailings is assumed to have a moist specific weight of 95.40 pcf). Secondly, it changes the values of effective stress at each deeper depth analyzed, since it also shifts the elevation vs. water pressure curve *up. The Division request that EFR please make appropriate changes to the effective overburden stress calculations, or justify not doing so, not only for Cell 2, but for other cells, as needed.*

In summary, based on a review of the information provided and in consideration of the issues previously discussed, the Division finds that several of the issues identified in the Interrogatory remain unaddressed, and consequently, the Division is unable to assess the correctness of EFR's conclusions regarding performance of the tailings impoundment cells relative to liquefaction. In particular, no explicit discussion relating the results of the tailings dewatering analysis to the water levels used in the liquefaction analyses was presented. Also, parameters regarding the tailings characterization continue to be assumed (although now some are more conservatively selected) rather than being based on site-specific data. If assumed data are used, it should reflect the most reasonably conservative values possible. While adverse performance seems unlikely based on the relatively high factors of safety with respect to liquefaction potential currently calculated, there are enough inconsistencies in the analyses that further evaluation is merited.

Response:

EFRI conducted a tailings investigation of Cells 2 and 3 in October 2013 at the White Mesa Mill site to address the Division's comment for this interrogatory and Interrogatory 07/1 requesting collection of site-specific tailings data to supplement existing tailings data used settlement analyses. The results are presented in MWH (2015b). Liquefaction analyses have been revised to incorporate the additional site-specific tailings data, as well as the revised cover grading design, results of the recent site-specific probabilistic hazard analysis (presented in MWH, 2015a), and revised procedures for the liquefaction analysis. The revised analyses are provided in Attachment E, Settlement and Liquefaction Analyses, and will be included in the next version of the Updated Tailing Cover Design Report (Appendix D to the Reclamation Plan).

These revisions address the Divisions comments which include requests for (1) collection of site-specific tailings data to supplement exiting tailings data, (2) use of site-specific tailings data to evaluate liquefaction, (3) include use of results for most recent PSHA completed for the site (MWH, 2015a), and (4) revisions to liquefaction calculations and assumptions.

The results of the liquefaction analyses indicate the tailings are not susceptible to earthquake-induced liquefaction for reclaimed conditions.

References for Response

MWH Americas, Inc. (MWH), 2015a. White Mesa Mill Probabilistic Seismic Hazard Analysis Report. Prepared for Energy Fuels Resources (USA) Inc. April.

MWH Americas, Inc. (MWH), 2015b. White Mesa Mill Tailings Data Analysis Report. Prepared for Energy Fuels Resources (USA) Inc. April.

DIVISION'S ASSESSMENT OF EFR RESPONSES TO RD 1 INTERROGATORY WHITE MESA RECPLAN REV. 5.0; R313-24-4; 10CFR40, APPENDIX A, CRITERION 6; INT 10/1; TECHNICAL ANALYSES – FROST PENETRATION ANALYSIS

The May 31, 2012 EFR response and calculations and methodologies used for completing the revised frost depth analysis are considered acceptable, with the one exception described in the following paragraph.

The Division notes that in the revised infiltration and revised radon emanation modeling most recently completed by EFR, use of NRC-recommended adjusted porosity and bulk density values was not considered. The Division requests that EFR conduct a revised radon emanation modeling sensitivity analysis (as well as conduct a revised infiltration sensitivity analysis) for the approved final cover for a scenario that incorporates adjusted bulk density and porosity values (or adjusted appropriate other soil parameters in the infiltration analysis) for soils in the upper zone of the cover system potentially impacted by the predicted maximum frost penetration. Adjusted soil property values used in the simulations should either consist of adjusted values derived in a manner consistent with NRC recommendations for adjusting such properties in frost-impacted soils for radon flux emanation calculations (NRC 2003a, Section 5.1.3), or adjusted values derived/assigned in manner consistent with recommendations provided in Benson et al. 2011, whichever is more conservative for the respective simulations. (See also discussion in Section 1.3 of the Technical Memorandum, White Mesa Mill Site – Revised ICTM Report Review addressing EFR's Response to Rd 1 Interrogatory 01/1 on the Revised Infiltration and Contaminant Transport Modeling Report).

The final revised Appendix B to Appendix D will need to be reviewed, when available, to verify that the revised frost depth information has been incorporated. The final revised frost depth analysis completed once the final cover design has been approved Drawings will need to be reviewed, when available, to verify that the revised frost depth calculation has addressed elements included in this request and has appropriately addressed any changes in the cover design, as applicable. Because these revised documents were not submitted with the response, this interrogatory will remain open.

Response:

A workshop on April 30, 2013 with representatives from the DRC, DRC's contractor (URS), EFRI, MWH, and Dr. Craig Benson facilitated discussion on DRC's February 2013 review comments on the Reclamation Plan, Revision 5.0 (DRC, 2013b) and the revised Infiltration and Contaminant Transport (ICTM) Report (DRC, 2013a). During this meeting, Dr. Benson presented material properties for the proposed cover materials for White Mesa and compared this data to the range of design recommendations provided in NUREG/CR-7028 (Benson et al., 2011) and the database of pedogenic-altered values at the Alternative Cover Assessment Program (ACAP) sites. Discussion from this meeting is provided in the August 2015 EFRI response document to DRC's 2013 review comments on the ICTM (see response to Interrogatory 01/1 - Inconsistencies Between Revised ICTM Report and Reclamation Plan Rev 5.0). The hydraulic test results for the soils stockpiled at White Mesa are within the range of parameter values anticipated to occur long-term as noted by Benson et al. (2011). Based on this comparison, adjusting soil characteristics due to frost penetration or other potential pedogenic processes are not warranted. The physical and hydraulic properties of the relatively permeable cover soils at the emplaced conditions are close to long-term properties from pedogenic processes, are such that post-construction changes should be minimal.

The frost penetration analysis will be updated after approval of the conceptual final cover design is obtained from the Division. The frost penetration analysis requires revision to incorporate additional data collected from a site investigation conducted on April 19, 2012 to further evaluate cover borrow materials. It is anticipated that the results of the updated analyses will be similar to the analyses presented in Denison (2012), with a frost penetration depth on the order of 81 cm (32 in).

Reference for Response:

Benson, C.H. W.H. Albright, D.O. Fratta, J.M. Tinjum, E. Kucukkirca, S.H. Lee, J. Scalia, P.D. Schlicht, and X. Wang, 2011. Engineered Covers for Waste Containment: Changes in Engineering Properties and Implications for Long-Term Performance Assessment (in 4 volumes). NUREG/CR-7028, Prepared for the U.S. Nuclear Regulatory Commission, Washington, D.C., December.

Denison Mines (USA) Corp. 2012. Responses to Interrogatories – Round 1 for Reclamation Plan, Revision 5.0, March 12. May 31.

Utah Department of Environmental Quality, Division of Radiation Control (DRC), 2013a. Radioactive Material License (RML) Number UT 1900479: Review of September 10, 2012 Energy Fuels Resources (USA), Inc. Responses to Round 1 Interrogatories on Revised Infiltration and Contaminant Transport Modeling (ICTM) Report, White Mesa Mill Site, Blanding, Utah, report dated March 2010. February 7.

Utah Department of Environmental Quality, Division of Radiation Control (DRC), 2013b. Review of August 15, 2012 (and May 31, 2012) Energy Fuels Resources (USA), Inc. Responses to Round 1 Interrogatories on Revision 5 Reclamation Plan Review, White Mesa Mill, Blanding, Utah, report dated September 2011. February 13.

DIVISION'S ASSESSMENT OF EFR RESPONSES TO RD 1 INTERROGATORY WHITE MESA RECPLAN REV. 5.0; R313-24-4; 10CFR40, APPENDIX A; INT 11/1; VEGETATION AND BIOINTRUSION EVALUATION AND REVEGETATION PLAN

The Division finds that EFR has addressed, in part, the items included in the interrogatory and considerable useful new information has been provided. However, some additional information is still needed to complete the responses, as described in the following paragraphs.

EFR presented results of the vegetation survey in summary fashion and provided few details. Are there survey reports describing methods and results in greater detail? Is there data available for each transect location? Is there information on other plant species observed but that did not have cover recorded at the transect points? The vegetation survey results did not include an updated vegetation map or information on the current vegetation in the reclamation cells. The map in the September 2011 Reclamation Plan (Revision 5.0) is clearly inconsistent with the results of the vegetation sampling reported in the August 15, 2012 Responses to Interrogatories, in that 19.1% big sagebrush cover was found at sample sites that are located in areas shown in Figure 17-1 as reseeded grassland and controlled big sagebrush. Information should have been provided on the current vegetation of the reclamation cells. The information provided does not provide an adequate account of current vegetation or an explanation of the successional processes that have occurred following previous disturbances and reclamation efforts.

Attachment G provides an updated seed mix, which now includes galleta. The total seeding rate in Table D.1 needs to be corrected to be 22.5 lbs PLS/acre. A column of PLS/square foot should be added to this table (this information was previously provided for most species in the September 2011 Appendix J Reclamation Plan). This mix is now correctly characterized as containing both native and introduced species.

Information was provided on the ecological characteristics of each of the species in the seed mix. However, no information was provided regarding past success or failure with these species at the site during interim reclamation. Previous revegetation experience at the site and changes in composition and cover over time, if available, need to be presented in order to support the predicted cover percentages.

Table D.4. Please provide more explanation as to how the values in this table were derived.

Table D.9 provides levels of soil properties for stockpiled soils compared to sustainable levels reported in the literature. These "sustainable levels" may or may not be achievable or sustainable over a long term within the study area, depending on its environment. To help determine realistic long-term expectations, soil properties should also be measured at reference areas. To what extent will establishment of grassland vegetation contribute to developing soil properties supporting sustainable vegetation?

The description of organic matter and nutrient amendments lacks sufficient detail. Provide more information regarding quantities, potential sources, and suitability for sustained growth?

How will institutional control be used to exclude grazing by livestock for the performance period?

Weeds and weed management should be addressed. It is noted that a significant portion of the vegetation over in the sagebrush areas surrounding the White Mesa Mill Site comes from cheatgrass and Russian thistle, and that cheatgrass and jointed goat grass initially dominated revegetation areas at Monticello.. What other weeds occur in the area or may occur in the future? Use of a mix of hay and manure to provide soil organic matter could introduce weeds.

Section D.4.5. of Attachment G , Supporting Documentation for (Rd 1) Interrogatory 11/1 (Revised Appendix D to the Updated Tailings Cover Design Report), first sentence indicates that "monitoring of an alternative cover at the Monticello Mill Tailings Disposal Site showed that the plant cover performed well over a seven year period." The last phrase "plant cover performed well over a seven year period" *should be reworded because although cover goals for grasses were met later in the 7-year period, cover goals established for the Monticello cover for shrubs species were not achieved despite significant shrub planting efforts in in 2000 and in 2007 (e.g., see Sheader and Kastens [undated] circa 2007). Please provide a reference for the statement that eight species provided 70% of the plant cover at Monticello. The text in Revised Appendix D does not provide an indication of the percentage vegetative cover comprised by weedy species including weedy cheatgrass and Russian Thistle over that time period at Monticello and does not discuss how these species may affect cover revegetation goals (evapotranspiration capabilities) established for the Monticello or White Mesa cover systems.*

Section D.7.2 addresses succession, including increase in sagebrush cover. The discussion should acknowledge the establishment of big sagebrush and other shrubs on former seeded grassland and controlled sagebrush areas north of the Mill Site in the 35 years since the original vegetation study, and discuss its relevance to the revegetation plan. The discussion indicates that warm season grasses are expected to increase over time. Is there an existing vegetation community in the region similar to that which is expected to develop? The discussion also mentions pulse-dominated precipitation – are there expected changes in seasonality of precipitation? An explanation should be provided as to why shrub species that occur just south of, and at lower elevations than the tailings management areas location, , such as four-wing saltbush, shadscale, blackbrush, and Mormon tea, would not increase under potentially warmer and dryer future climate conditions at the site.

The Reclamation Plan (or revised Infiltration and Contaminant Transport Report) needs to provide: (1) definition of clear, concise, and measurable revegetation acceptance goals/criteria for the vegetation establishment on the tailings cell cover system, (2) a description of how EFR will conduct periodic post-closure monitoring and reporting to the Division of the vegetation community health, viability, success, and sustainability, (3) a description of proposed action plans, schedules and deadlines for remedial actions if/when needed to effectuate plant community success, and (4) similar follow-up monitoring of the plant community/cover system to ensure successful performance before release of the facility's surety bond and/or transfer of title to DOE. EFR should describe specific, quantitative goals for shrub establishment (including rooting depths and minimum acceptable shrub cover percentages) that consider the need for deeper rooted plants to remove water that may accumulate lower in the cover profile in response to an exceptionally wet year or successive wet years, especially given the lack of a capillary break layer in the currently proposed cover design. In developing these descriptions, plans, and goals, EFR should consider and address lessons learned from the post-closure monitoring and maintenance activities and/or corrective revegetation measures required at the Monticello, Utah tailings repository and other similar facilities in this regard (e.g., Waugh 2008; Sheader and Kastens undated, circa 2007; U.S. DOE 2007; Sheader and Kastens [undated, circa 2007). EFR should assess the potential applicability and benefits of using vegetation health monitoring tools/metrics such as the Cover Vegetation Index recently implemented at the Monticello Repository (U.S. DOE 2009).

The Reclamation Plan should describe corrective measures that may be needed to address/correct issues related to: (1) establishment of undesirable species, e.g., colonization by certain undesired grass/weedy species that may have more limited water stress tolerance than initially seeded grass species and/or that may outcompete planted grass species unless controlled (e.g., Smesrud et al. 2012; Sheader and Kastens [undated, circa 2007]); (2) Seed predation following seeding/reseeding efforts; (3)Possible low success rates resulting from for shrub establishment efforts, etc…. Estimated costs for conducting these post-closure activities, corrective actions, and reporting, once approved by the Division, will need to be incorporated in the financial surety estimate.

The Revised Attachment G provided by EFR as part of its Response presents the results of a June 1012 burrowing animal survey (Section D.5.3). However, as described above, the results are presented in summary fashion and few of the necessary details are provided. Are there survey reports describing methods and results in greater detail? Is there data available for each transect location? Does badger *burrow density include feeding areas (dug-out prey burrows)? The reported burrow density for badger appears very low. Additional information about potential burrow densities should be provided based on a review of the literature. The analysis should consider both burrows dug by badgers for their own use and digging while hunting.*

Little information is presented on burrow densities, other than Gunnison prairie dog. Results for Gunnison prairie dog are based on the June 2012 survey and do not consider literature values. Information on burrow densities for Gunnison prairie dog should be summarized by transect and the locations of prairie dog towns marked on a map. The results need to be put in context by reference to literature, for example Lupis et al. 2007, considering both regional densities, predicted range and habitat suitability. The statement in Attachment D that prairie dogs are unlikely to occur because they prefer low plant cover and short vegetation is not consistent with the description of habitats where they occur in southeastern Utah in Lupis et al. 2007. Most of the grass species included in the seed mix are reported to occur in grassland habitat occupied by this species in southeastern Utah. They also occupy desert shrub habitats.

Table D.8. Ranges of depths for burrowing mammals mostly not provided, just maximum depth, and based on a single citation per species. The "maximum" depth for Gunnison's prairie dog of 122 cm from Verdolin et al 2008 should be correctly characterized as an average depth reported from several studies. The actual maximum (mean plus 1 SD) reported by Verdolin et al. 2008 appears to be 1.85 m. All of the numbers in this table should be revisited to provide a range of maximum values reported in the literature and to determine whether the maximum has been accurately stated.

Table D.6 and discussion. There is literature indicating that big sagebrush can root to depths considerably below 180 cm. Please address and further explain this finding/statement. Rooting depths of other shrubs that may occur should also be considered.

Additional information needs to be presented to justify that the highly compacted zone will minimize biointrusion by plant roots. Consider moisture conditions, potential degradation when dry, behavior of roots related to soil moisture and gas exchange, and other factors. Cite previous studies or observations of root growth relative to compacted soils.

Response:

Vegetation on previously revegetated areas at the Mill site has not been evaluated. This information would have limited value in evaluating the proposed reclamation plan or in determining if future reclamation will produce a sustainable plant community on the tailings cells. The proposed reclamation plan is substantially different than previous reclamation efforts in terms of soil cover, soil amendments and species to be planted, such that any comparisons would not provide any predictive value. The only reclamation that has occurred at the Mill site was seeding of Cell 2 in 2011. Seeding only included crested wheatgrass (*Agropyron desertorum*) and no evaluations have been conducted since seeding occurred.

Further details of the 2012 vegetation survey are provided in a revision of Appendix D (Vegetation and Biointrusion Evaluation) to the Updated Tailings Cover Design Report (Appendix D of the Reclamation Plan, Revision 5.0). The revised Vegetation and Bionintrusion Evaluation appendix is provided as Attachment G.1 to this response document.

A map of current vegetation at the Mill site does not exist. The most recent mapping of vegetation at the Mill site was conducted by Dames and Moore in 1977 (Dames and

Moore, 1978) as part of the Environmental Report for the White Mesa Uranium Project. Further discussion of mapping units from 1977 and the 2012 survey is presented in Attachment G.1.

An updated seed mixture that includes number of seeds/square foot and the addition of shrub species is presented in Attachment C.1, Attachment G.1, and Attachment G.2. Attachment C.1 is revised Technical Specifications to the Reclamation Plan, Revision 5.0. Attachment G.1 is as described previously. Attachment G.2 is a revised Appendix J (Revegetation Plan) to the Updated Cover Design Report (Appendix D of the Reclamation Plan, Revision 5.0).

The species in the proposed seed mixture have not been used on site, so there is no information available regarding success or failure with these species at the site during interim reclamation efforts. However, there are decades of revegetation research using these species in semiarid regions of the western U.S. along with tens of thousands of acres that have been successfully reclaimed with these species. The plethora of information that exist on the use of these species for disturbed land reclamation provides ample evidence that these species are adapted to the environmental conditions of the Mill site and are highly likely to lead to successful reclamation. As stated above, the only reclamation that has occurred at the Mill site was seeding of Cell 2 in 2011 with crested wheatgrass, and no evaluations have been conducted since seeding occurred.

Further explanation of LAI values and how numbers were derived are presented in Attachment G.1.

No reference areas have been previously established to provide information on soil properties to document that sustainable levels are achievable. However, soil that will be used as cover material on the tailings cells has been evaluated, and was included in Attachment G of EFRI (2012) as Table D.9 (EFRI, 2012). An update of this table is included as Table D.38 in Attachment G.1 to this response document. This table includes physical and chemical properties of the soil and also levels reported in the literature that would be considered sustainable. Soil properties that appear deficient and would need improvement to achieve sustainability include: percent organic matter, total nitrogen, and extractable potassium. Amendments would be applied during reclamation to address these deficiencies and this application is discussed Attachment G.1. Over time, the soil-forming process of pedogenesis will continue as climate and on-site organisms (primarily plants and the soil microbial community) modify the soil over time. This process would include the addition of organic matter in the form of composted biosolids which will improve soil structure, water holding capacity, cation exchange capacity, buffering capacity, and overall soil fertility. All of the benefits will lead to a more productive soil and greater sustainability.

Further details on the use of an organic amendment including type, rates of application, source of material, and potential benefits are presented in Attachment G.1. Revised specifications for soil amendments are provided in Attachment C.1.

Existing restricted fencing of the site will be used as an institutional control to exclude grazing by livestock for the performance period.

A weed management plan is presented in Attachment C.1 and Attachment G.1.

Cover goals for shrub species have not been met at the Monticello Mill Tailings Disposal site because of establishment issues related to big sagebrush and seedling damage caused by montane voles (*Microtus montanus*) (DOE, 2007). Attachment G.1 reflects this finding.

The statement that eight of the seeded species at the Monticello Mill Tailings Disposal site provided 70 percent of the plant cover was based on a progress report from Stoller. This finding has been modified and discussed further in Attachment G.1 using results from the 2007 vegetation monitoring report (DOE, 2008).

In the 2007 revegetation monitoring report at Monticello (DOE, 2008) the following was reported:

> "Seed germination requirements for sagebrush and rabbitbrush are potentially pertinent in determining why these species did not establish well on the repository cover. Although the seeds of many species (e.g., most grasses) persist for years in the soil, rabbitbrush and sagebrush seeds persist for only one season. In addition, sagebrush seed may require cold stratification to germinate. It is unlikely that the seed was stratified by the supplier prior to shipment, and seeding was done in April 2000, after natural stratification would have occurred."

In addition: "In 2000, the 3-month period immediately following seeding was exceptionally dry, and this may be the major cause of poor sagebrush and rabbitbrush seed germination. Grass and forb seeds, which persist longer in the soil, would have emerged later, when conditions were more favorable, and the presence of these seeded species indicates that this occurred."

Low precipitation during a critical time of the year following seeding, competition from more mature vegetation, and damage caused by vole herbivory have been presented as reasons for low shrub density at Monticello (DOE, 2008; DOE, 2007).

Changes in the relative cover of common weed species at the Monticello site are summarized from previous monitoring reports (DOE, 2003, DOE, 2004, DOE, 2005a, DOE, 2005b, , and DOE, 2008) and presented in Table 1. These results demonstrate that weed species at the site remain well controlled.

Table 1. Changes in Weedy Species Over Time (Relative Cover Percentages, Zones A1 and B Combined from Monticello Disposal Cell Cover Revegetation (Taken from DOE 2008)

Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	Trend
Aegilops cylindrical	---	---	---	0.8	---	1.9	---	---	0.1	Not abundant; not increasing
Amaranthus bitoides	8.1	1.7	0.8	---	---	---	0.5	---	---	Nearly eliminated after two growing seasons
Bromus tectorum	1.9	18.3	4.5	18.2	35.6	56.3	15.5	21.0	12.8	Abundant weed peak in 2005
Chenopodium album	4.6	2.9	4.2 1	2.4	0.2	---	0.5	---	---	Nearly eliminated after four growing seasons
Convolvulus arvensis	---	---	---	---	0.2	0.2	0.5	0.5	---	Not abundant; not increasing
Lactuca serriola	---	---	0.1	1.9	1.9	1.6	1.0	---	1.4	Not abundant; not increasing
Salsola tragus	36.0	69.9	48.2	33.3	8.2	0.1	6.5	---	---	Once abundant; nearly eliminated in 2007/2008
Sisymbrium altissimum	---	3.8	---	1.7	3.1	2.8	6.5	0.5	0.2	Not abundant; not increasing; peak in 2006

The following is taken from DOE (2008): “In Utah, weed law has recently been revised to reflect categories of weeds targeted for control. The main management goal for Category C weeds is not to eradicate the weed but to prevent its spread. Small quantities of *Convolvulus arvensis* (field bindweed), a Category C noxious weed, have been observed on the site since 2002, but this species has not spread. One San Juan County listed noxious weed, *Aegilops cylindrica* (jointed goatgrass) has been observed on the site since 2003 in small quantities and also has not spread. Another Category C noxious weed species, *Cirsium arvense* (Canada thistle), was observed and treated in 2006, and it has subsequently not been observed. One Category A noxious species, *Centaurea stoebe ssp. micranthos* (spotted knapweed) was discovered near the site’s entrance gate and treated in 2008. Populations of *Acroptilon repens* (Russian knapweed), a Category B species, were treated near the office building in 2008. Neither of these noxious species has spread into the revegetated areas, and they will continue to be monitored and treated for eradication from the site. DOE will continue to monitor and manage the entire site, including portions of the site where vegetative success criteria have been met, for all noxious weed species.”

Based on the success achieved at Monticello in controlling weeds, it is unlikely that the presence of weeds at the Mill site will negatively affect revegetation goals, and the proposed weed management plan will help ensure revegetation success.

Attachment G.1 includes modifications to acknowledge the establishment of big sagebrush and other shrubs on previously seeded grassland and controlled sagebrush areas north of the Mill site over the last 35 or more years, and a discussion has been included as to the relevance of this shrub response to the revegetation plan.

There are grassland steppe communities south of Bluff, Utah which is directly south the Mill site (CARTOKO, 2010). These semiarid grasslands are dominated by a variety of grama grasses, galleta, three awn (*Aristida spp.*), ring muhly (*Muhlenbergia torreyi*), and pungent muhly (*Muhlenbergia pungens*) (Banner 1992); all warm-season species.

The discussion of a potential climate shift to a pulse-dominated hydrology has been deleted (see Attachment G.1). However, in response to the question if there are expected changes in seasonality of precipitation with a shift to a pulse-dominated hydrology, we believe there may be a decrease in winter precipitation. Additional discussion is provided in Attachment G.1.

Regionally common shrub species from areas that are characterized by lower elevation and having climatic conditions that are warmer and drier than the Mill site would include fourwing saltbush (*Atriplex canescens*), shadscale saltbush (*Atriplex confertifolia*), blackbrush (*Coleogyne ramosissima*), and Morman tea (*Ephedra viridis*).

Fourwing saltbush is one of the most widely distributed and important native shrubs on rangelands in the western United States including the Intermountain, Great Basin, and Great Plains regions (Welsh et al., 2003). Fourwing saltbush occurs most commonly in salt-desert scrub communities in the Great Basin, Mojave and Sonora Desert areas of western North America (Kearney et al., 1960; Welsh et al., 2003). In the Great Basin region it is often associated with black greasewood (*Sarcobatus vermiculatus*), black brush (*Coleogyne ramosissima*), big sagebrush (*Artemisia tridentata*), creosote bush (*Larrea tridentata*), rabbitbrush (*Chrysothamnus spp.*) and shadscale (*Atriplex confertifolia*) (Welsh et al., 2003).

Fourwing saltbush is adapted to most soils but is best suited to deep, well-drained; loamy to sandy to gravely soils. It is very tolerant of saline soil conditions and somewhat tolerant of sodic soil conditions (Ogle and St. John, 2008).

Shadscale saltbush occurs throughout western North America from California and Oregon east to North Dakota and south to Arizona and Texas. The greatest concentrations of shadscale saltbush are found in the Great Basin and Colorado Plateau (Simonin, 2001). Shadscale saltbush can be found in warm desert shrub-steppe environments. Populations occur in low valleys, foothills and mesas from 2,500 to 7,500 feet elevation (Simonin, 2001). It often grows in association with other halophytes including mat-atriplex, and greasewood, but can also be found in sagebrush and pinyon-juniper communities (McArthur and Monsen, 2004; Welsh et al., 2003). Shadscale saltbush is highly drought tolerant and is adapted to sites receiving 6 to 12 inches of annual precipitation. This species is tolerant of high saline conditions (pH 7.5-9.0) and is classified as a facultative halophyte (Branson et al., 1976). It prefers well-drained soils but may inhabit a wide range of soil textures from fine to gravelly.

Blackbrush occurs primarily in the transition zones in Great Basin deserts. It is found at elevations from 2,500 to 7,000 feet in areas where the annual temperature fluctuation can range from -11 degrees to 116 degrees Fahrenheit. It is drought-deciduous, meaning that it avoids water stress by becoming temporarily dormant and then shedding its older leaves as stress intensifies during the dry season. Spiny stems, coupled with chemical compounds in current year's growth, protect blackbrush from heavy browsing. It is adapted to dry and well-drained soils and is most abundant in sandy, gravelly, and rocky soils.

Green ephedra occurs on rocky or sandy slopes and plains in such plant communities as the juniper-pinyon woodland, the sagebrush desert, creosotebush deserts, and the desert grassland from 3,000 to 7,000 feet elevation (Benson and Darrow, 1981). Common associates include creosotebush (*Larrea tridentata*), shadscale saltbush, fourwing saltbush, big sagebrush, galleta, and sand dropseed (*Sporobolus cryptandrus*). Green ephedra is tolerant of calcareous, weakly saline, and slightly saline-alkaline (sodic) sites. It thrives in dry, well-drained sites and it is intolerant of wet sites and poor drainage. The plant is drought-resistant.

Based on this discussion of ecological characteristics of common shrub species from sites of lower elevation than the Mill site it is certainly possible that any one of these shrubs could occur at the Mill site if the future climate was warmer and drier than the present.

Attachment C.1 and Attachment G.1 include information on revegetation acceptance goals/criteria that include shrub establishment goals. Lessons learned from post-closure monitoring at Monticello have been incorporated (see Attachment G.1).

A post-closure monitoring plan has been added and is included in Attachments C.1 and G.1.

Quantitative goals for sustained shrub establishment are described in Attachment C.1 and Attachment G.1 and include the establishment of a minimum of 500 stems per acre. Two shrub species, fourwing saltbush and rubber rabbitbrush (*Ericameria nauseosa*), have been added to the proposed seed mixture. Both species have the potential for deep root penetration (e.g. six meters) when soil conditions allow (Kearney et al., 1960) but are not expected to root into the compacted radon attenuation layer because the targeted bulk density of the compacted zone of 1.8 g/cm^2 will inhibit root penetration (Mimore et al. 1969; Heilmen, 1981; and Zisa et al., 1980).

There is no further detail on the burrow animal survey that was conducted at the Mill Site in 2012. Estimates of burrow densities for both badgers and prairie dogs have been placed in context of literature values in Attachment G.1.

Burrowing depths have been revised and are presented in Attachment G.1.

Rooting depths have been revised and include shrub species and are presented in Attachment G.1.

Further discussion is presented in Attachment G.1 on soil compaction and root growth.

References for Response

Banner, R.E., 1992. Vegetation types of Utah. Rangelands 14:109-114.

Benson, L. D. and R. A. Darrow, 1981. Trees and shrubs of the southwestern deserts. The University of Arizona Press, Tucson, Arizona.

Branson, F.A., R.F. Miller, and I.S. McQueen, 1976. Moisture relationships in twelve northern desert shrub communities near Grand Junction, Colorado. Ecology. 57(6): 1104-1124.

CARTOKO, 2010. Vegetation Cover Types in Utah. www.cartoko.com/2010/07/state-of-utah-vegetation-cover-types/

Dames and Moore, 1978. Environmental Report—White Mesa Uranium Project, San Juan County, Utah. Prepared for Energy Fuels Nuclear, Inc.

U.S. Department of Energy (DOE), 2003. Long-Term Surveillance and Maintenance Program 2002. Revegetation Monitoring of the Monticello, Utah, Repository Cover, U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado, September.

U.S. Department of Energy (DOE), 2004. Office of Legacy Management 2003 Revegetation Monitoring of the Monticello, Utah, Repository Cover, U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado, February.

U.S. Department of Energy (DOE), 2005a. Office of Legacy Management 2004 Revegetation Monitoring of the Monticello, Utah, Repository Cover, U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado, January.

U.S. Department of Energy (DOE), 2005b. Office of Legacy Management 2005 Revegetation Monitoring of the Monticello, Utah, Repository Cover, U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado, December.

U.S. Department of Energy (DOE), 2007. Study of Factors Affecting Shrub Establishment on the Monticello, Utah, Disposal Cell Cover," DOE-LM/1387-2007, Office of Legacy Management, Grand Junction, Colorado.

U.S. Department of Energy (DOE), 2008. 2007 Revegetation Monitoring of the Monticello, Utah, Repository Cover, U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado, March.

Energy Fuels Resources (USA) Inc. (EFRI), 2012. Responses to Interrogatories – Round 1 for Reclamation Plan, Revision 5.0, March 2012. August 15.

Heilman, P., 1981. Root penetration of Douglas-fir seedlings into compacted soil. Forest Science 27:660-666.

Kearney, T.H., R.H. Peebles, J.T. Howell, and E. McClintock, 1960. Arizona flora. 2nd ed. University of California Press. Berkeley, CA. 1085p.

McArthur, E.D. and S.B. Monsen, 2004. Chenopod Shrubs. In: S.B. Monsen, R. Stevens, and N.L.

Mimore, D., D. Smith, and F. Woollard, 1969. Effects of high soil density on seedling root growth of seven northwestern tree species. USDA Forest Service Research Note PNW-112. Pacific Northwest Forest and Range Experiment Station, Portland, OR.

Paschke, M., K. Topper, R. Brobst, and E. Redente, 2005. Long-term effects of biosolids on revegetation of disturbed sagebrush steppe in northwestern Colorado. Restoration Ecology 13:545-551.

Ogle, D. and L. St. John, 2008. Plants for saline to sodic soil conditions. Plant Materials Technical Note No. 9. USDA-NRCS. Boise, Idaho. 12p.

Simonin, K.A., 2001. Atriplex confertifolia. In: Fire Effects Information System, [Online]. US Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory.

Welsh, S.L., N.D. Atwood, S. Goodrich, and L.C. Higgins, 2003. A Utah Flora. Brigham Young University. Provo, UT. 912p.

Zisa, R., H. Halverson, and B. Stout, 1980. Establishment and early growth of conifers on compact soils in urban areas. USDA Forest Service Research Paper NE-451. Northeastern Forest Experiment Station, Broomall, PA.

DIVISION'S ASSESSMENT OF EFR RESPONSES TO RD 1 INTERROGATORY WHITE MESA RECPLAN REV. 5.0; R313-24-4; 10CFR40, APPENDIX A, CRITERION 6(4); INT 12/1; REPORT RADON BARRIER EFFECTIVENESS

The Division's assessment of the Response follows below:

As with a number other responses, EFR has deferred final resolution of issues to its submission of the next revision of the Reclamation Plan. The Division requests that EFR please submit the next revision of the Reclamation Plan that incorporates all changes proposed in the license amendment request.

EFR's responses leave unresolved the following issues regarding radon flux modeling:

1. *The dependence of Radon emanation and diffusion coefficient on long-term moisture content (raised in Item d of INT 12/1) is not but should be addressed. Please address this dependence. [Note: The Division notes that the radon diffusion coefficient used in the revised radon emanation analysis for the tailings is higher (by about a factor of 3) than the diffusion coefficient value assumed in radon emanation analyses competed for a similar tailings disposal facility (Monticello Tailings Repository) in Utah (e.g., NRC 2008). The value used in the Monticello analysis was derived using a different procedure (Rogers and Nielson 1991) than was used by EFR. Using a higher radon diffusion coefficient in the radon emanation analysis represents a more conservative assumption.]*
2. *The summary of values used for long-term moisture content does not adequately explain the work presented in Attachment H, Attachment C.2. This lack of supporting interpretation basis leaves unresolved the conclusion that the values used in Radon modeling are conservative. Please complete the discussion of values of long-term moisture content used in Radon modeling.*
3. *Values summarized in Table C-4 for diffusion coefficients are inconsistent with those appearing in Attachment H, Attachment C.3. Please resolve this inconsistency*
4. *All calculated Radon fluxes from the surface of the cover system (Layer 5) exceed 20 pCi/cm^2-s, albeit by very slight amounts. Please address the apparent failure of the proposed cover system design to satisfy the regulatory constraint for Radon flux.*

Response:

The radon emanation modeling has been revised to incorporate updated radon diffusion coefficients and additional site-specific tailings data collected in October 2013 (MWH, 2015). The revised analysis is provided in Attachment H as part of the revised Appendix C, Radon Emanation Modeling, which will be included in the next version of the Updated Tailings Cover Design Report (Appendix D to the Reclamation Plan).

The radon emanation coefficients used in the radon emanation analysis were selected using procedures recommended in NUREG-1620 (NRC, 2003). The radon emanation coefficient was selected as 0.20 for the tailings based on recommendations in NUREG-1620 (NRC, 2003) that states a "value of 0.20 may be estimated for the tailings based on the literature, if supported by limited site-specific measurements." The radon emanation coefficient for the cover layers was selected as the conservative default value used in the RADON model of 0.35.

The diffusion coefficients for the tailings and cover layers for the radon emanation modeling results provided in EFRI (2012) were calculated based on the empirical relationship by Rogers and Nielson presented in NRC (1989). This relationship is dependent upon porosity and the degree of saturation and was based on approximately 100 radon diffusion coefficient measurements. The diffusion coefficients for the tailings and cover layers have been revised to be calculated using the empirical relationship presented in Rogers and Nielson (1991). This relationship is an update to the one presented in NRC (1989) and was developed from over 1,000 radon diffusion coefficient measurements. The porosity and degree of saturation were calculated based on the long-term densities and long-term moisture contents presented in Attachment D.

MWH collected representative samples from the on-site random fill and topsoil stockpiles for use in estimating the long-term moisture contents for the cover layers. The laboratory results for the 15 bar water contents for these samples were used to estimate long-term water contents for the random fill and erosion protection layers. NRC (2003) recommends use of 15 bar water contents to estimate long-term water contents for use in radon emanation modeling.

The long-term water content of the topsoil was estimated as 5.2 percent based on the measured 15 bar gravimetric water content for a topsoil sample (E1-A) which represents the average index properties for the topsoil stockpiles (UWM, 2012). The long-term water content of the rock mulch was estimated as 4 percent based on the addition of 25 percent gravel by weight to the topsoil.

Based on the cover material gradations, the cover soils were bracketed into three groups, finer grained soils, uniform graded soils, and broadly graded soils. A weighted average procedure that accounted for the relative volumes of each soil type (based on the stockpile volumes) was incorporated to determine the average long-term gravimetric water content for the random fill using the measured 15 bar water contents. Data used for estimation of the long-term water content value for the cover material is provided in Attachment D.

All calculated rates of radon emanation from the surface of the cover system are below the limit of 20 pCi/m2-sec.

Reference for Response:

Energy Fuels Resources (USA) Inc. (EFRI), 2012. Responses to Interrogatories – Round 1 for Reclamation Plan, Revision 5.0, March 2012. August 15.

MWH Americas, Inc. (MWH), 2015. White Mesa Mill Tailings Data Analysis Report. Prepared for Energy Fuels Resources (USA) Inc. April.

Rogers, V.C., and K.K. Nielson. 1991. Correlations for Predicting Air Permeabilities and Rn- 222 Diffusion Coefficients of Soils, Health Physics (61) 2

U.S. Nuclear Regulatory Commission (NRC), 1989. Calculation of Radon Flux Attenuation by Earthen Uranium Mill Tailings Covers, Regulatory Guide 3.64. June.

U.S. Nuclear Regulatory Commission (NRC), 2003. Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites under Title II of the Uranium Mill Tailings Radiation Control Act of 978. NUREG-1620, Revision 1, June.

University of Wisconsin-Madison (UWM), Wisconsin Geotechnics Laboratory, 2012. Compaction and Hydraulic Properties of Soils from Banding, Utah. Geotechnics Report NO. 12-41 by C.H. Benson and X. Wang. July 24.

DIVISION'S ASSESSMENT OF EFR RESPONSES TO RD 1 INTERROGATORY WHITE MESA RECPLAN REV. 5.0; R313-24-4; 10CFR40, APPENDIX A, CRITERION 6(6); INT 13/1; CONCENTRATIONS OF RADIONUCLIDES OTHER THAN RADIUM

To further resolve remaining issues pertaining to concentrations of radionuclides other than radium in soil, the Division requests that EFR please do the following:

1) *Provide justification (either data or references to data) to support EFR's determination of U-nat and Th-230 background concentrations.*

2) *Incorporate a description of how EFR's site-specific sampling program will be used to determine background concentrations for radionuclides other than Ra-226 into EFR's documentation of how MARSSIM will be implemented and submit for the Division's review.*

3) *Incorporate a description of how EFR will use the "sum rules" for surface and subsurface soils into EFR's documentation of how MARSSIM will be implemented and submit for the Division's review.*

4) *Incorporate a description of EFR's plan for using radiation measurement instrumentation for soil background analyses, radium-gamma correlations, verification data, and sensitivity analyses into EFR's documentation of how MARSSIM will be implemented and submit for the Division's review.*

5) *As suggested in Item 4 of INT 13/1, please incorporate into documentation relating to how MARSSIM will be implemented, descriptions of the following:*

- ✓ *Calibration procedures*
- ✓ *Instrument testing*
- ✓ *Detection limits of sample analyses*
- ✓ *Extent of expected contamination*
- ✓ *Limits of gamma survey*
- ✓ *Verification of the soil-radium gamma correlation*

Response:

1) The U-nat and Th-230 background concentrations submitted in earlier interrogatories (EFRI Round 1 response to 13.2) are solely interim background values, and will not be used to guide the remediation process.

The mean background data over 24 years of annual sampling from the mill background sampling station, BHV-3, is 0.78 pCi/g for U-238 and 0.93 pCi/g for Ra-226. These results are comparable to other background sampling locations off site. Ra-226 concentrations have been reported as 1.1 pCi/g near the airport entrance south of Blanding, and 0.83 pCi/g southeast of Crescent Junction (Myrick et al., 1981). U-238 values have been reported as 0.94 pCi/g near the airport entrance south of Blanding, and 0.78 pCi/g U-238 southeast of Crescent Junction (Myrick et al, 1981). These values are shown in Table 1 below. No comparable Th-230 background data has been found from the mill's data or from reference documents.

Table 1. Reported Background Concentrations

Location	Ra-226 (pCi/gram)	U-238 (pCi/gram)
BHV-3	0.93	0.78
Airport Entrance	1.1	0.94
SE Crescent Junction	0.83	0.78

Background values provided in the earlier interrogatories (1.9 pCi/g U-nat and 0.93 pCi/g Th-230 based on equilibrium with the Ra-226 value of 0.93 pCi/g) are interim values. No further investigation is necessary for remediation purposes until background reference areas are established during the remediation process. A systematic soil sampling program will be conducted in an area within 3 miles of the site, similar to the areas to be remediated, to determine the average background radionuclide concentrations to ultimately be used for the cleanup. Similarity or representativeness will be determined based on geology, geomorphology, soil type and soil chemistry. The background will be determined at the beginning of reclamation.

According to MARSSIM 4.5 (NRC, 2000), a site background reference area should have similar physical, chemical, geological, radiological, and biological characteristics as the survey unit being evaluated. Background reference areas are normally selected from non-impacted areas, but are not limited to natural areas undisturbed by human activities. In some situations, a reference area may be associated with the survey unit being evaluated, but cannot be potentially contaminated by site activities. For example, background measurements may be taken from core samples of a building or structure surface, pavement, or asphalt. The Division will be consulted during selection of proposed background sample locations.

2) A description of how EFRI's site-specific sampling program will determine background concentrations for radionuclides other than Ra-226 has been incorporated into revised sections of the Reclamation Plan which discuss the implementation of MARSSIM guidance. Please refer to Section 6.3, and Section 6.3.2 of the revised Technical Specifications (provided as Attachment C.1 to this document).

3) A description of how EFRI will use the "sum rules" for surface and subsurface soils has been incorporated into revised sections in the Reclamation Plan which discuss the implementation of MARSSIM guidance. Please refer to Section 6.6.3.3 of the revised Technical Specifications (provided as Attachment C.1 to this document).

4) A description of EFRI's plan for using radiation measurement instruments for soil background analyses, radium gamma correlations, verification data and sensitivity analyses has been incorporated into revised sections in the Reclamation Plan which discuss the implementation of MARSSIM guidance. Please refer to Section 6.3.2 of the revised Technical Specifications (provided as Attachment C.1 to this document).

5) The Technical Specifications in Attachment A of the Reclamation Plan have been revised to incorporate how MARSSIM guidance will be implemented during reclamation. The revised Technical Specifications are provided as Attachment C.1. Specific subsections of the Technical Specifications, Section 6 have been modified as follows:

- *Calibration procedures*
  - See Section 6.5.1 of the revised Technical Specifications.
- *Instrument testing*

  - o Instruments will be QC's using Exhibit A-1 incorporated into the revised Technical Specifications.
- *Detection limits of sample analyses*
  - o See Section 6.7.1 of the revised Technical Specifications.
- *Extent of expected contamination*
  - o See Section 6.6.3.1 of the revised Technical Specifications.
- *Limits of gamma survey*

The gamma radiation survey will be limited by the minimum detectable concentration (MDC) for the 2-inch x 2-inch sodium iodide (NaI) scintillometer, which is approximately 104 Bq/Kg (2.8 pCi/gram) for Ra-226, according to MARSSIM Table 6.7. This MDC depends on the background, which may raise or lower the MDC. Remediation will be primarily driven by Ra-226, which is the contaminant with the most restrictive cleanup standard as determined in the SENES Consultants, Inc. letter to EFRI dated August 15, 2012. This letter was provided as Attachment I to EFRI's Supporting Documentation for Response to Utah DRC Interrogatory 13/1 (SENES, 2012).

Table 2. Reported MDC's from MARSSIM Table 6.7

Nuclide	MDC (Bq/kg)	MDC (pCi/gram)
U-Nat	2960	80
Th-230	78,400	2100
Ra-226 (with decay products in equilibrium)	104	2.8

- *Verification of the soil-radium gamma correlation*
  - o See Section 6.6.3.6 and Section 6.6.3.7 of the revised Technical Specifications.

References for Response

Myrick, T.E., B.A. Berven and F.F. Haywood, 1981. State Background Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343.

SENES, 2012. Letter to J.A. Tischler, Energy Fuels Resources, Inc. Radium Benchmark Dose Approach. August 15, 2012, as provided in EFRI Responses to Utah DRC Interrogatories Round 1. August 2012.

United States Nuclear Regulatory Commission (NRC), 2000. Multi-Agency Radiation Survey and Site Investigation Manual. NUREG-1575. August.

DIVISION'S ASSESSMENT OF EFR RESPONSES TO RD 1 INTERROGATORY WHITE MESA RECPLAN REV. 5.0; R313-24-4; 10CFR40, APPENDIX A; INT 14/1; COVER TEST SECTION AND TEST PAD MONITORING PROGRAMS

The Division has a concern that comparing the performance of the proposed ET cover at the White Mesa Mill Site to the performance of the Monticello tailings repository cover system is inappropriate, for several reasons. For example, the cover system at Monticello is a composite system (having several types of highly-specialized layers designed to accomplish various physical objectives). More specifically, the cover system at Monticello differs significantly in design and operation from the currently selected monolithic cover system proposed for White Mesa in that (1) the Monticello cover system includes an animal intrusion barrier (consisting of cobbles at about 1 m (~ 3 feet) of depth), and (2) a capillary barrier (at ~ 1.6 to 2 m, located below the animal intrusion barrier, below another layer of soil, and just above the radon barrier). Each of these cover system components provide important functions not accomplished in the currently-proposed monolithic soil ET cover design for White Mesa.

In addition to differences in design between the Monticello repository cover and the proposed ET cover for the White Mesa Site, there are fundamental differences in the properties of the soils used to construct the Monticello cover compared to the soils currently proposed for use in constructing the ET cover at White Mesa. For instance, soils proposed by EFR for use in constructing the ET cover are extremely low in natural organic matter (OM) content, e.g., compared to soils that were used for constructing the Monticello Tailings Repository cover system e.g., zero to about 0.4 % according to Table D-5 in Appendix D of the Revised ICTM Report, compared to a recommended minimum OM content of from approximately 1.5 to 3.0%). These factors indicate that, given the natural climate conditions at the site (which could include possible prolonged (e.g., decadal to multi-decadal) future drought periods likely to create conditions unfavorable for sustaining plant growth in the cover), and without substantial and extensive OM enhancements incorporated into the soils prior to cover construction and possible periodic active post-closure intervention/maintenance measures such as reseeding, possible irrigation of the cover, etc…, the on-site soils tested to date appear to be unfavorable for use in constructing the ET cover (see also discussion in Section 2.3.1 of the Technical Memorandum, White Mesa Mill Site – Revised ICTM Report Review addressing EFR's Response to Rd 1 Interrogatory 02/1 on the Revised Infiltration and Contaminant Transport Modeling Report).

The Division also notes the following statements made by EFR in in the Revised ICTM Report (Denison Mines 2010):

- *On Page 4-2 in the Revised ICTM Report (Denison 2010), EFR states "Furthermore, results from nearby uranium mill tailings lysimeter at Monticello (Waugh et al., 2008) also agree with model predictions for the proposed cover system at White Mesa." The Revised ICTM Report proceeds to compare modeled infiltration rates at the proposed cover at White Mesa with measured infiltration rates associated with the Monticello cover.*
- *On Page 4-2 in the Revised ICTM Report (Denison 2010), EFR also states " The model-predicted infiltration rates for monolithic ET cover are consistent with data reported from lysimeter and infiltration modeling studies of other vegetated ET covers (e.g., Albright et al. 2004; Bolen et al. 2001; Fayer and Gee 2006; Gee et al., 1994; Scanlon et al. 2005).*

After referring to studies by Bolen et al. (2001), Albright et al. (2004), and others mentioned, the Revised ICTM Report states, "In summary, a monolithic ET cover is the preferred design to minimize infiltration necessary to meet the Permit (Part I.D.8) and meet the radon attenuation standard." However, the cover systems described in several of these cited references contain different design components, such as a capillary break, that are not included in the currently proposed ET cover. For example, Bolen et al. 2001 *review ET cover systems at 12 sites. Unlike the proposed White Mesa cover system, a number of the 12 cover systems reviewed by Bolen et al. (2001) are reported to contain either a sand layer or a gravel layer of appreciable thickness, which may act as a capillary barrier/ capillary break. Albright et al. 2004, who discuss the same 12 sites, state that six of them have a capillary barrier/break layer. Also unlike the proposed cover system at White Mesa, however, nearly all (i.e., 10 of 12) of these sites have geosynthetic root barriers consisting of nonwoven geotextile containing lumps of slow-release trifluralin (herbicide-like plant root inhibitor) (see also Albright et al., 2004). Each barrier is installed between interim cover and the overlying final cover system. Trifluralin acts to prevent plant biointrusion into waste by interfering with root mitosis so that its use at a site can modify impacts of rooting, biointrusion and drainage through a cover system.*

The other studies mentioned by EFR also refer to sites with cover systems having substantial differences from the proposed White Mesa site cover system. Fayer and Gee (2006), for example, describe performance of four types ET cover systems at the Hanford Lysimeter Test Facility at a semi-arid site in Hanford, Washington for periods of up to 17 years. Of interest here is that each type of cover system described incorporates a capillary barrier/break layer, as part of the "Hanford Barrier", in some form.

The cover design for the Crescent Junction, Utah tailings repository (relocation repository facility for the Moab tailings) also contains a combination "Infiltration and Biointrusion" Barrier" underlying the frost protection component of the cover and overlying the radon barrier layer in the cover (see, e.g., DOE 2012, Addendum E, p. 14).

Several published studies demonstrate that incorporating a capillary barrier (with an adjacent granular filter layer) can substantially reduce cover infiltration rates. For example, a comparison of two otherwise similar cover systems (one monolithic with a thick soil cover, and one non-monolithic, with a capillary barrier) in terms of their ability to restrict drainage shows that the cover system with a thick soil cover was outperformed by the cover system having a capillary barrier by up to a ten-to-one ratio or greater (Porro 2001). Similar results were obtained in forced irrigation testing of alternative cover systems by Martian et al. 2001. Infiltration reduction depends on cover-system materials and environmental conditions. Hydraulic performance is evaluated as the probability that ET from the water-storage soil layer overlying the capillary break layer is sufficient to prevent water accumulation in the soil sponge layer from exceeding its storage capacity in any given year. The potential benefits in cover system infiltration performance with a capillary barrier are well documented.

For reasons described above, the Division also finds that the technical adequacy of a monolithic ET cover at the White Mesa site is not adequately supported by the comparisons EFR provides to other cover systems as described in technical references cited by EFR.

With respect to a Test Pad/Test Section, the Division believes that there is value in, and a need for, constructing and monitoring a pilot test pad or pilot test section prior to full-scale cover construction, and in a location off of the tailings. Information and benefits that can be gained from such pilot testing include:

- *Helps establish/verify a performance standard for the cover;*
- *Validates the cover design and construction;*
- *Could result in suggestions for improved design features and construction methods when implementing the full-scale cover construction; and*
- *Helps to identify and resolve problems that may be encountered during full-scale cover construction, e.g., allow engineers to evaluate, plan for, and/or mitigate factors such as vegetation establishment (in)effectiveness and address issues such as loss of one or more planted species following seeding/vegetation placement, desiccation cracking during or following cover layer placement and compaction; etc…, and*

- *Provides monitoring data (e.g., from field-scale pan lysimeters) to help evaluate the future infiltration performance of a full-scale cover constructed to a similar set of standards and using the same construction equipment and construction methods, as well as reduces risks associated with potential failure of, or disruption of in-situ cover conditions resulting from emplacement of, one or more monitoring devices installed within the full-scale cover system.*

Advance construction and testing of such a Test Pad or Cover Test Section would allow engineers to obtain data on key characteristics of the constructed cover soils that are important for vegetation establishment such as soil nutrients, propagules, and microorganisms (e.g., mycorrhizae) needed to establish a sustainable plant community. Data collected on concentrations of soil macronutrients (e.g., nitrogen, phosphorus, and potassium) and micronutrients (e.g., sulfate, zinc, iron, manganese, copper, calcium, magnesium, sodium, and boron) in the constructed test cover could be used to assess whether they are similar to and within typical ranges for soils around the site which have been selected for use as a natural analog or analogs for predicting the final cover vegetation characteristics and performance.

The sustainability of the ET cover may rely, in part, on the establishment and resilience of a diverse plant community; however, the dynamics of such a plant community are complicated and effects are difficult to predict (e.g., Waugh et al. 2008). Link et al. 1994 indicate that, even in the absence of large-scale disturbances, seasonal and yearly variability in precipitation and temperature will cause changes in species abundance, diversity, biomass production, and soil water extraction rates on covers. Poor shrub establishment, for example, could result in poor water extraction, causing water accumulation in the lower portions of the cover profile during exceptionally wet precipitation periods (percolation exceeding the total storage capacity or drained upper limit of the soils). Data on soil structure development observed to occur over time within a constructed test cover profile following its construction could also be acquired and compared to that observed in natural soils at the selected analog site(s) to assess conditions that could be expected to develop in the future full-scale cover with respect to whether they may be suitable for promoting future development and sustainability of such shrubs, if desired based on the cover infiltration modeling results.

On the basis of the considerations discussed above, the Division requests the following:

- *EFR will need to provide a detailed Technical Work Plan for Division review and approval, no later than 90 days after approval of the revised Infiltration and Contaminant Transport Modeling (ICTM) Report by the Division, for constructing, monitoring and testing a Cover Test Pad//Test Section representative of the intended full-scale cover system. The Work Plan shall: (1) provide a construction schedule; (2) provide details of the proposed Test Pad/Section's design and construction; (3) describe the proposed monitoring/testing program duration; (4) define parameters to be monitored/tested in the Test Pad/Test Section; (5) provide a schedule and details regarding reporting of monitoring and testing results; (6) describe objectives of the Test Pad/Test Section construction, monitoring, and testing program; and (7) propose and justify criteria for demonstrating that those objectives have been achieved.*
- *The Test Pad/Test Section Work Plan will need to address acquisition of data for parameters (e.g., percolation data, weather data, fertilization and nutrient content data and other soil testing, botanical data,...) to validate assumptions and predictions made by EFR with regard to the projected site-specific and cover-specific performance of the full-scale cover, including future emergence rates and characteristics of vegetation on the cover.*
- *The Reclamation Plan should be revised to incorporate the information and requirements described herein with regard to this Test Pad/Test Section.*

EFR's proposal to maintain a rough surface on all but the uppermost lift in the cover is acceptable and EFR should incorporate this commitment into Attachment A of the next revision of the Reclamation Plan.

Response:

The response to the suitability of the White Mesa cover soils relative to vegetative growth and sustainability is addressed in the response to Interrogatory 11/1.

EFRI has added the requirements to maintain a rough surface on all but the uppermost lift of the cover system in the Technical Specifications. The revised Technical Specifications are provided in Attachment C.1.

A workshop was conducted on April 30, 2013 with representatives from the Division, the Division's contractor (URS), EFRI, MWH, and Dr. Craig Benson to discuss Division's February 2013 review comments on the Reclamation Plan, Revision 5.0 (DRC, 2013b) and the revised ICTM Report (DRC, 2013a). During this workshop, Dr. Benson presented a comparison of the White Mesa cover design to the Monticello cover design, as well as information on construction of of cover test pads and test monitoring sections. Discussion from this workshop on these topics is summarized in the paragraphs below for this response and was prepared by Dr. Benson. Dr. Benson is the lead author for NUREG/CR-7028 (Benson et al., 2011) and was a lead inspector for the US EPA's Alternative Cover Assessment Program (ACAP), as described in Benson et al. (1999, 2001) and Malusis and Benson (2006). EFRI has engaged Dr. Benson in the cover design for the White Mesa tailings cells with regards to selection of and evaluation of laboratory testing of the cover materials, comparison of the EFRI cover design with the Monticello cover system, development of a plan for the cover test section, and with evaluation of the long-term properties for the cover soils.

EFRI acknowledges that soil layering in the cover profile at the Monticello Uranium Mill Tailings Disposal Facility differs from layering in the monolithic cover proposed for the White Mesa facility. The Monticello cover includes an animal intrusion layer as well as a sand layer at the base, the latter intended to create a capillary break (Figure 1). The cover at Monticello also includes a geomembrane overlying a clay radon barrier at the base. However, the hydrological monitoring conducted at Monticello pertains only to that portion of the cover above the geomembrane, i.e., that portion of the cover functioning as a water balance cover (aka an evapotranspirative cover).

Although the Monticello cover has different elements than the monolithic cover proposed for White Mesa, the cover at Monticello functions as a monolithic cover, as illustrated by the water content record shown in Figure 2.

In all but the wettest years, nearly all of the infiltrating water is managed in the upper 900-mm-thick storage layer, making the impact of the underlying layers unimportant. During those years the cover functions like at 1100-mm thick monolithic cover (surface layer + upper storage layer) (Figure 2). In very wet years, variations in water content occur more deeply, including in the intrusion layer, the underlying 300-mm-thick storage layer, and the sand layer at the base. The variations in water content follow the same pattern as water contents in the upper storage layer, exhibiting the continuity and smooth variation in water content with time and depth that occurs in a monolithic cover.

For example, water contents in each layer are shown in Figure 3 for winter 2004 - 2005, the wettest and snowiest on record. The water content in each layer varies steadily and continuously over months rather than exhibiting an abrupt and sudden change that would occur if a capillary break existed at the intrusion layer or at the sand layer. In fact, the water content of the sand layer increases appreciably before the overlying lower storage layer approaches saturation, indicating that a capillary break effect is not occurring at the interface between the lower storage layer and the sand layer.

Another example is shown in Figure 4, which depicts the water content in each layer from mid-winter to late summer 2010, which included an exceptionally wet spring during which water penetrated the entire cover profile (Figure 2). The water content records in Figure 4 show a steady downward movement of the wetting front in the profile. There is no “hold up” of the wetting front at the intrusion layer or the sand layer. Moreover, water migrates into the animal intrusion layer and the sand layer without the overlying layers (upper storage layer and lower storage layer, respectively) approaching saturation, indicating that a capillary break was not forming at either interface.

There are reasons why the Monticello cover functions like a monolithic cover, even though the layering may suggest that different behavior should occur in response to contrasts in soil texture. First, the intrusion layer consists of cobble particles embedded in a fine-textured soil matrix. This matrix is comprised of the same fine-textured soil used for the upper and lower storage layers, and provides capillary connectivity between the upper and lower storage layers. Cobble in the intrusion layer does reduce the pore space available for soil water storage, but does not alter the hydrologic dynamics or inhibit the flow of water up or down in the profile. The reason for the absence of a capillary break at the interface between the lower storage layer and the sand is not clear, but the deep location of this interface is a likely cause. The interface may also have been invaded by fines from the overlying lower storage layer during construction, which would provide a capillary conduit between the lower storage layer and the sand layer. Regardless of the mechanism, however, the water content data do indicate that the interface between the lower storage layer and the sand does not create a capillary break.

Thus, while the layering in the cover at Monticello may differ from that at White Mesa, both covers function as monolithic covers, and both are in similar climates (Monticello being slightly wetter and snowier than White Mesa) and are comprised of similar materials. For these reasons, Monticello is an appropriate analog for White Mesa, and probably is the most suitable analog available. Over the past 15 years (2000-2015), the annual percolation rate for Monticello has ranged from 0.0 to 3.8 mm/yr, and has averaged 0.5 mm/yr. During this period, annual precipitation has ranged from 232 to 535 mm and averaged 351 mm, including the wettest and snowiest winter on record (2004-2005). Given these similarities, the cover proposed for White Mesa should provide similar or better hydrologic isolation.

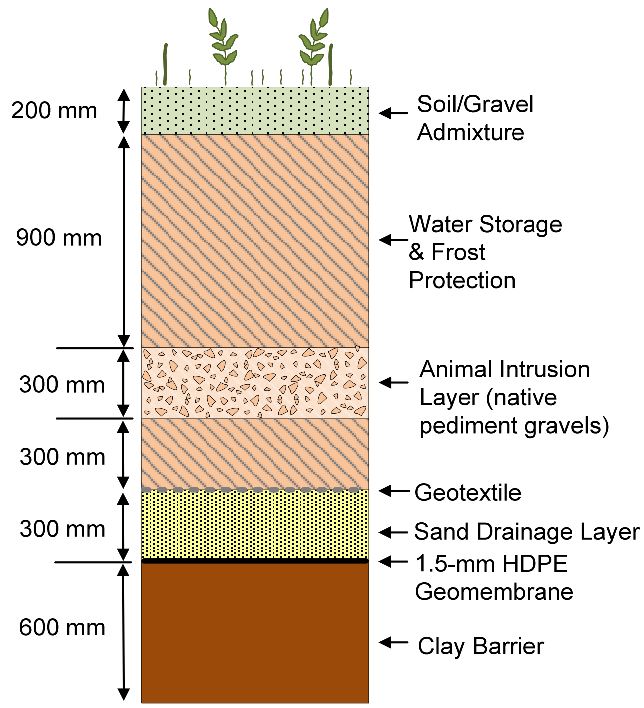


Figure 1. Profile of final cover used for the Monticello disposal facility. Only that portion of the cover above the geomembrane is instrumented for hydrological monitoring.

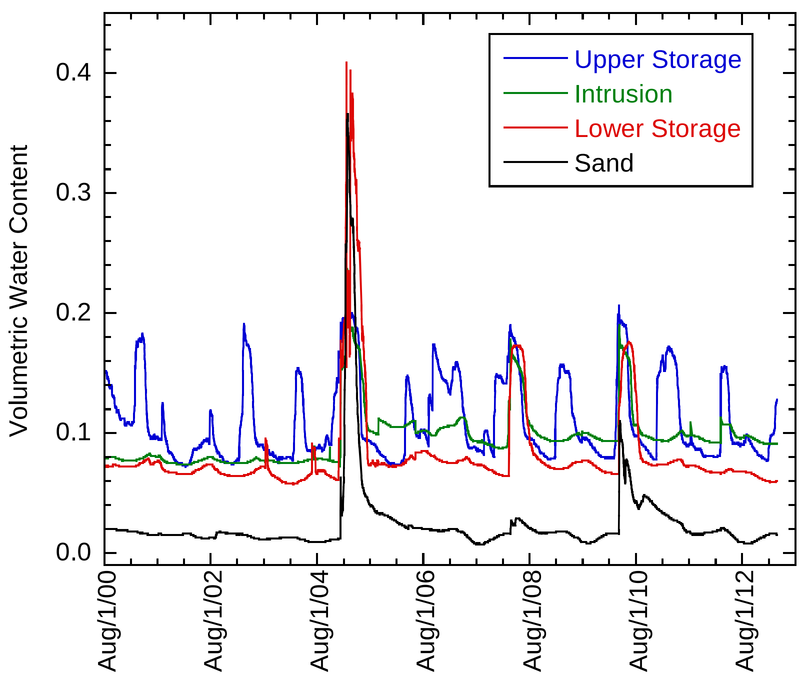


Figure 2. Water content record in Monticello cover in the upper storage layer, animal intrusion layer, lower storage layer, and underlying sand layer.

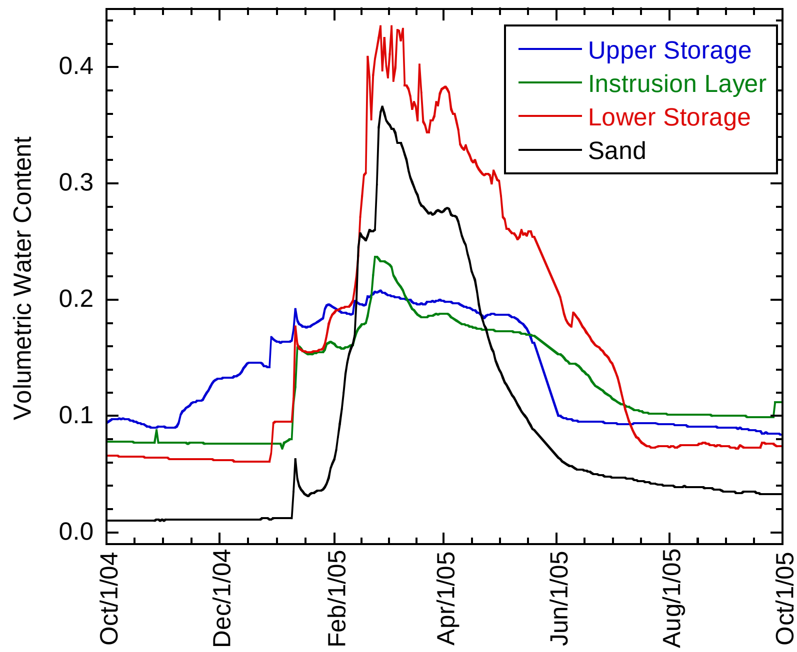


Figure 3. Water content record in Monticello cover in the upper storage layer, intrusion layer, lower storage layer, and underlying sand layer during Winter 04-05, the wettest and snowiest on record.

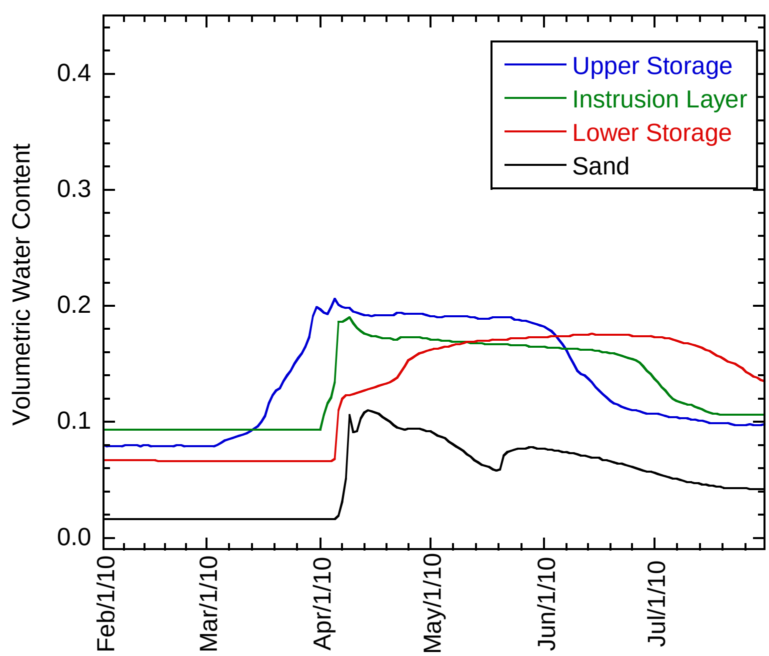


Figure 4. Water content record in Monticello cover in the upper storage layer, animal intrusion layer, lower storage layer, and underlying sand layer during 2010, a very wet spring with moisture penetrating the entire cover.

EFRI understands the Division's position regarding construction of a test section adjacent to the disposal facility that might lead to lessons learned that could be used to improve on, or optimize the cover design. EFRI will be placing the majority of the final cover on Cell 2 after approval of the Reclamation Plan and License Renewal, and will construct a test section within the actual cover (for the full cover profile). This test section, which will be constructed over actual tailings using the same full-scale methods employed for the actual cover, will provide a more realistic representation of cover performance than a test section adjacent to the facility. Moreover, because only a portion of the cover will have been constructed at this point, less learned from the test section can be applied to other areas of the facility as additional final cover is constructed.

EFRI is proposing that the test section be designed, constructed, and monitored using principles developed during US EPA's Alternative Cover Assessment Program (ACAP), as described in Benson et al. (1999, 2001) and Malusis and Benson (2006). The ACAP methodology has been employed to evaluate nearly 50 final cover designs, and has been adopted as the de facto standard for final cover monitoring in the US and abroad. The ACAP methodology is currently being used to monitor the final cover at DOE's Monticello Uranium Mill Tailings Disposal Facility and to evaluate the performance of the cover design employed at DOE's Grand Junction Disposal Facility near Cheney, Colorado. The US Nuclear Regulatory Commission also recommends the ACAP methodology for monitoring the performance of final covers in NUREG/CR-7028 (Benson et al. 2011).

EFRI will engage ACAP investigators (i.e. Dr. Craig Benson) when developing, constructing, and monitoring the test section, and defining the program details mentioned in the interrogatory. The monitoring system will include instruments to measure all components of the water balance, including percolation from the base of the cover, and on-site meteorological conditions. A complementary surveillance program will also be developed to monitor the vegetative community, edaphic properties of the cover soils, and pedogenic evolution of the cover profile, as suggested in NUREG/CR-7028. Comparisons will be made between the monitoring data and predictions and assumptions made when developing the proposed cover design.

References

Benson, C., T. Abichou, W. Albright, C. Gee, and A. Roesler, 2001. Field Evaluation of Alternative Earthen Final Covers, International J. Phytoremediation, 3(1), 1-21.

Benson, C., T. Abichou, X. Wang, G. Gee, and W. Albright, 1999. Test Section Installation Instructions – Alternative Cover Assessment Program, Environmental Geotechnics Report 99-3, Dept. of Civil & Environmental Engineering, University of Wisconsin-Madison.

Benson, C., W. Albright, D. Fratta, J. Tinjum, E. Kucukkirca, S. Lee, J. Scalia, P. Schlicht, and X. Wang, 2011. Engineered Covers for Waste Containment: Changes in Engineering Properties & Implications for Long-Term Performance Assessment, NUREG/CR-7028, Office of Research, U.S. Nuclear Regulatory Commission, Washington.

Malusis, M. and C. Benson, 2006. Lysimeters versus Water-Content Sensors for Performance Monitoring of Alternative Earthen Final Covers, Unsaturated Soils 2006, ASCE Geotechnical Special Publication No. 147, 1, 741-752.

Utah Department of Environmental Quality, Division of Radiation Control (DRC), 2013a. Radioactive Material License (RML) Number UT 1900479: Review of September 10, 2012 Energy Fuels Resources (USA), Inc. Responses to Round 1 Interrogatories on Revised Infiltration and Contaminant Transport Modeling (ICTM) Report, White Mesa Mill Site, Blanding, Utah, report dated March 2010. February 7.

Utah Department of Environmental Quality, Division of Radiation Control (DRC), 2013b. Review of August 15, 2012 (and May 31, 2012) Energy Fuels Resources (USA), Inc. Responses to Round 1 Interrogatories on Revision 5 Reclamation Plan Review, White Mesa Mill, Blanding, Utah, report dated September 2011. February 13.

DIVISION'S ASSESSMENT OF EFR RESPONSES TO RD 1 INTERROGATORY WHITE MESA RECPLAN REV. 5.0; R313-24-4; 10CFR40, APPENDIX A, CRITERION 9; INT 15/1; <u>FINANCIAL SURETY ARRANGEMENTS</u>

EFR must submit and receive approval of its revised cost estimates before the Division will approve EFR's proposed and revised cover system design.

EFR has inadequately addressed the time required to dewater Cell 2 and Cell 3 prior to final cover construction, EFR should submit technically supported quantitative projections of the times required to achieve moisture contents for these cells upon which the final covers can be constructed with expectation that the dewatered tailings will not likely contribute to instabilities in the covers. These quantitative analyses should consider all mechanisms that affect water content of the tailings, including (but not limited to) precipitation, runoff, infiltration, lateral drainage, transpiration, evaporation, percolation, groundwater migration, and active removal. Quantitative analyses should also include uncertainty and sensitivity analyses to account for known and likely uncertainties in input parameter values and their effects on dewatering. The Reclamation Plan must include a detailed description of dewatering measures that EFR will use to accomplish dewatering of Cells 2 and 3 within the 7 year-time period specified in the latest Financial Surety submitted to the Division by EFR (See also Section 7.3 above). The current Surety submittal of March 14, 2012 (including the revised submittal dated September 14, 2012) does not list the time to dewater Cell 2. However, all other cells show a 62,400 hour dewatering time). Costs of the specific dewatering measures need to be included in the Financial Surety. Because this revised evaluation and the revised reclamation cost estimates described above were not submitted with EFR's response to the Rd 1 interrogatories, this issue will remain open.

Response:

EFRI conducted a tailings investigation of Cells 2 and 3 in October 2013 at the White Mesa Mill site to address the Division's comment for Interrogatories 07/1 and 09/1 requesting collection of site-specific tailings data to supplement existing tailings data used for settlement analyses. The results are presented in MWH (2015). Results of the investigation indicated migration of water towards the sump in Cell 2. This is expected since water has been pumped from the Cell 2 sump since 2008. Quantatative projections of time to achieve acceptable tailings moisture contents for cover placement cannot be made without additional information on the rate of drainage from the tailings due to Cell 2 dewatering. To further evaluate the change in water levels due to dewatering in Cell 2 prior to and after final cover placement, EFRI plans to install mini-piezometers across the cells prior to the first phase of cover placement. This data will provide information on the rate and extent of dewatering of the cells to confirm when the final phase of cover can be placed and when active maintenance is no longer required.

Costs associated with dewatering were provided in the most recent surety submitted to the Division in 2014. These costs will also be included in the surety to be provided in the next version of the Reclamation Plan.

Reference for Response:

MWH Americas, Inc. (MWH), 2015. White Mesa Mill Tailings Data Analysis Report. Prepared for Energy Fuels Resources (USA) Inc. April.

DIVISION'S ASSESSMENT OF EFR RESPONSES TO RD 1 INTERROGATORY WHITE MESA RECPLAN REV. 5.0; R313-15-501; INT 16/1; RADIATION PROTECTION MANUAL

The Division requests that EFR revise the RPM to specify how the program will be modified to address the unique decommissioning requirements, or the process through which the manual and program will be revised in the future. EFR should also include procedures for gamma radiation surveys in the revised RPM that are discussed in the response document. Because this revised information was not submitted with the response, this interrogatory will remain open.

Response:

The Radiation Protection Manual (RPM) will be modified during the decommissioning process as needed. During the decommissioning process if it is determined that the current RPM does not take into account specific items, then the SERP process will be utilized to amend the RPM in order to address those situations. The SERP summary report will continue to be submitted to the State of Utah, Division of Waste Management and Radiation Control (DWMRC) on an annual basis and will be available upon request at the White Mesa Mill.

Section 2.7 of the RPM now states that the gamma survey for the decommissioning of the site will be conducted in accordance with the most current approved Reclamation Plan, Section 6 of the Technical Specifications. The updated RPM is provided as Attachment I.

DIVISION'S ASSESSMENT OF EFR RESPONSES TO RD 1 INTERROGATORY WHITE MESA RECPLAN REV. 5.0 R313-15-1002; INT 17/1; RELEASE SURVEYS

EFR should yet either (1) cite previously submitted documents where these topics were addressed or (2) develop and submit for the Division's review and approval the following:

- *Decontamination procedures for buildings and equipment.*
- *Disposal of building components and equipment either on-site or off-site, depending on results of release surveys.*

Response:

The Reclamation Plan states that buildings and equipment will be disposed of on-site. If it is determined that some materials are not contaminated and may be free released from the site, then the existing procedure and free release criteria will be used as stated in the RPM Section 2.6 and in accordance with the NRC guidance for "Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use" (dated April 1993) Additional guidance documents referenced in the Technical Specifications, Section 6, will be used as appropriate and applicable to the items being released for unrestricted use.

Decontamination procedures for items to be released for unrestricted use will be developed during reclamation and will be based on the type of equipment and the construction of the equipment (i.e. what the item is constructed of such as metal, glass, plastic etc.). Current Mill procedures will be the basis for the decontamination procedures used at the time of reclamation. If decontamination to the unrestricted release criteria specified in the RPM Section 2.6 is not attainable, the item will be disposed of on site.

DIVISION'S ASSESSMENT OF EFR RESPONSES TO RD 1 INTERROGATORY WHITE MESA RECPLAN REV. 5.0 5.0 R313-12; INT 18/1; INSPECTION AND QUALITY ASSURANCE

EFR has inadequately defined the responsibilities and duties of the Radiation Safety Officer in its revision of the Radiation Protection Manual for Reclamation.

EFR has committed to, but must yet revise Section 1.8b of the Technical Specifications to indicate that the Division must review and approve all reclamation plan design modifications.

Response:

Section 1 of the RPM, which delineates the RSO responsibilities and duties, has been modified to include the following "The RSO will have the responsibility of overseeing all aspects of this procedure and all total releases of any materials from the facility." The updated RPM is provided as Attachment I.

Section 1.8b of the Technical Specifications has been revised to indicate that the Division must review and approve all design modifications to the Reclamation Plan. The revised Technical Specifications are provided in Attachment C.

DIVISION'S ASSESSMENT OF EFR RESPONSES TO RD 1 INTERROGATORY WHITE MESA RECPLAN REV. 5.0 R313-24; 10CFR 40.42(J); INT 19/1; REGULATORY GUIDANCE

Beyond EFR's commitment to revise the Reclamation Plan to reference and incorporate guidance, EFR must yet actually revise the document and submit it for the Division's review and approval.

Response:

The Technical Specifications in Attachment A of the Reclamation Plan have been revised to incorporate and reference NUREG-1575 (NRC, 2000), NUREG-1575 Supplement 1 (NRC, 2009) and NUREG-1757 (NRC, 2006) guidance. The revised Technical Specifications are provided as Attachment C.1.

Reference for Response

United States Nuclear Regulatory Commission (NRC), 2000. Multi-Agency Radiation Survey and Site Investigation Manual. NUREG-1575. August.

United States Nuclear Regulatory Commission (NRC), 2006 NUREG 1757 Volume 2, Consolidated Decommissioning Guidance, Characterization, Survey, and Determination of Radiological Criteria. Revision 1.

United States Nuclear Regulatory Commission (NRC), 2009 NUREG 1575 Supplement 1, Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual.

DIVISION'S ASSESSMENT OF EFR RESPONSES TO RD 1 INTERROGATORY WHITE MESA RECPLAN REV. 5.0 R313-24; 10CFR40 APPENDIX A CRITERION 6(6); INT 20/1; SCOPING, CHARACTERIZATION, AND FINAL SURVEYS

EFR reasonably addresses the nine topics contained in Items 1 through 9 of the interrogatory. The response provides procedures for how gamma surveys may be conducted and indicate instruments that may be used. These procedures and instruments are not included in the RPM. Additionally, a discrepancy exists between the RPM and the response document regarding the frequency of instrument calibrations. Section 3.1.4.2 of the RPM state "All beta-gamma survey instruments are sent out annually for calibration" whereas the response states "As indicated in the Mill's Radiation Protection Reclamation Manual each existing instrument (Ludlum 19) used will be calibrated by an offsite –third party every 6 months.

The Division requests that EFR incorporate the substance of these responses into the further revised Technical Specifications or other documentation pertinent to the Reclamation Plan. EFR must also resolve the discrepancy stated above. Because this revised information was not submitted with the response, this interrogatory will remain open.

Response:

Section 2.7 of the RPM now states that the gamma survey for the decommissioning of the site will be conducted in accordance with the most current approved Reclamation Plan, Section 6 of the Technical Specifications.

The calibration frequency for beta-gamma survey instruments is every 6 months. The RPM has been corrected. The updated RPM is provided as Attachment I.

ATTACHMENT A

SUPPORTING DOCUMENTATION FOR INTERROGATORY 01/1:

MILL BUILDING, BOILER PLANT, SCALE HOUSE, AND THE SAMPLE PLANT

ASBESTOS INSPECTION REPORT

IHI
ENVIRONMENTAL

ASBESTOS INSPECTION REPORT

Mill-Boiler Plant-Scale House-Sample Plant
White Mesa Mill-Denison Mines Corp
6425 S. Highway 191
Blanding, Utah 84511

August 1, 2012

Prepared for:

Ms. Jo Ann Tischler, Corporate Director of Compliance & Permitting
Denison Mines
1050 17th Street, Suite 950
Denver, Colorado 80265

Prepared by:

Lono Folau
Asbestos Inspector #ASB-0537

Reviewed by:

Jon H. Self
Asbestos Program Manager

IHI Project 12U-A1081

640 East Wilmington Ave | Salt Lake City UT 84106 | Telephone: 801-466-2223 | Fax: 801-466-9616 | E-mail: ihi@ihi-env.com

Salt Lake City | San Francisco | Phoenix | Denver | Seattle

TABLE OF CONTENTS

APPENDICES

EXECUTIVE SUMMARY

On May 31, 2012, IHI Environmental conducted an asbestos inspection of the Mill Building, Boiler Plant, Scale House and the Sample Plant at the Denison Mines White Mesa Mill in Blanding, Utah. Ms. Jo Ann Tischler, Corporate Director of Compliance and Permitting, requested this inspection to identify asbestos-containing materials (ACM) that exist in the building.

- **No asbestos-containing material was identified in these buildings.**

The suspect asbestos materials identified in these buildings included wall systems on the second level of the Mill Building, floor tiles on the second floor of the Mill Building and the Scale House, and gasketing on the boiler in the Boiler Plant. No suspect asbestos material was identified in the Sample Plant.

The report that follows this Executive Summary should be read in its entirety because it includes important information, such as material descriptions and locations, regulatory requirements, and building-specific recommended response actions.

ASBESTOS INSPECTION

Mill-Boiler Plant-Scale House
White Mesa Mill-Denison Mines Corp
6425 S. Highway 191
Blanding, Utah

1.0 INTRODUCTION

On May 30, 2012, IHI Environmental conducted an asbestos inspection of the Mill Building, Boiler Plant, Scale House and the Sample Plant of the White Mesa Mill in Blanding, Utah. Ms. Jo Ann Tischler, of Denison Mines, requested this inspection to identify asbestos-containing materials (ACM) that exist in the facility.

2.0 BUILDINGS DESCRIPTION

- Buildings Identification

  Buildings Name ....Mill Building, Boiler Plant, Scale House, and Sample Plant

  Buildings Address ....6425 South Highway 191, Blanding, Utah 84511

- Building Construction

  Buildings Construction Date........circa 1978

  Renovations.................................Not known

  Building Type ....Plant, offices, boiler

  Buildings Total Sq. Ft.................33,330 square feet (Mill Building), 2,500 square feet (Boiler Plant), 400 square feet (Scale House), 1,250 square feet (Sample Plant)

  Structural System ....Concrete foundation with steel (Mill Building and Boiler Plant), wood (Scale House), and concrete with brick (Sample Plant)

  Exterior Wall Construction ....Metal (Mill Building and Boiler Plant), wood (Scale House), and brick (Sample Plant)

  Floor Deck Construction ....Concrete (Mill Building, Boiler and Sample Plants), wood (Scale House)

  Roof Deck Construction ....Metal (Mill Building, Boiler Plant, and Sample Plant), wood (Scale House)

Roof Construction ....Metal (all buildings)

- Floors

  Floors Above Grade .... One (except Mill Building-offices on second level)

  Floors Below Grade .... None

- Interior Finishes

  Floors ....Concrete (Mill Building, Boiler and Sample Plant), vinyl floor tile (Scale House and Mill Building second level)

  Walls .... Metal (Mill Building and Boiler Plant), brick (Sample Plant), wood (Scale House), and wall system (Mill Building second level)

  Ceilings .... Metal (Mill Building and Boiler Plant), brick (Sample Plant), wood (Scale House), and wall system (Mill Building second level)

  Attic .... None

  Basement .... None

- Building Mechanical

  Heating Plant .... Not known

  Cooling Plant .... Roof units

3.0 INSPECTION PROCEDURES

3.1 Asbestos-Containing Material (ACM)

IHI visually inspected all accessible areas of the building to identify suspect ACM. To assess the condition and determine friability of the suspect materials, IHI visually examined and touched all accessible surfaces, structures, and mechanical systems within the building.

Suspect ACM was identified and assessed by homogeneous areas. A homogeneous area is defined as a single material, uniform in texture and appearance, installed at one time, and unlikely to consist of more than one type, or formulation, of material. In cases where joint compound and/or tape has been applied to wallboard (gypsum board) and cannot be visually distinguished from the wallboard, it is considered an integral part of the wallboard and in effect becomes one material forming a wall or ceiling "system."

Each homogeneous area was given a unique material identification (ID) number. Each ID number begins with a letter: "S" for surfacing materials, "T" for thermal system insulation, or "M" for miscellaneous materials. This letter is followed by a three-digit number, assigned in consecutive order. This number is used to identify that specific homogeneous area throughout the inspection report.

3.2 Bulk Sampling

To determine the asbestos content of materials, IHI collected bulk samples from all accessible homogeneous areas of suspect ACM and submitted the samples to an accredited laboratory for analysis.

The number of samples collected from each homogeneous area generally followed the U. S. Environmental Protection Agency (EPA) Asbestos Hazard Emergency Response Act (AHERA) regulations (40 CFR §763.86). Friable surfacing materials were sampled using the random sampling scheme given in the EPA publication 560/5-85-030a, titled "Asbestos in Buildings: Simplified Sampling Scheme for Friable Surfacing Materials." Bulk sample IDs collected during the inspection were entered on chain-of-custody forms for submittal to the analytical laboratory.

3.3 Bulk Sample Analysis

Bulk samples were analyzed using polarized light microscopy (PLM) and visual estimation according to the EPA Interim Method for the Determination of Asbestos in Bulk Insulation Samples, EPA-600/M4-82-020. Samples were analyzed by Dixon Information Inc. in Salt Lake City, Utah. Dixon Information is accredited under the National Institute of Standards and Technology, National Voluntary Laboratory Accreditation Program (NIST-NVLAP) for bulk asbestos sample analysis, and is also accredited by the American Industrial Hygiene Association (AIHA).

EPA's National Emissions Standards for Hazardous Air Pollutants (NESHAP) and AHERA regulations define ACM as material containing greater than 1% asbestos by weight; materials containing 1% or less asbestos are not considered regulated ACM by the EPA. Further, the NESHAP regulations state that any sample found to contain less than 10% asbestos but greater than "none detected," by the visual estimation method used during PLM analysis, must be assumed to contain greater than 1% asbestos unless confirmed by NESHAP point counting analysis.[1]

Despite EPA (and Utah Division of Air Quality) rules exempting building materials containing 1% or less asbestos from stringent regulation, Occupational Safety and Health Administration (OSHA) regulations outline specific precautionary work practices when employees work with materials containing even trace amounts of asbestos.[2]

The laboratory reports can be found in Appendix D of this report.

4.0 INSPECTION RESULTS

4.1 Asbestos-Containing Materials

The Executive Summary and Table 1 in Appendix A list all homogeneous areas that contain asbestos. Each material is described by type of material, friability and visual appearance.

Friability is defined in accordance with EPA's NESHAP regulations.

- "Friable ACM" is any material containing more than 1% asbestos (as determined by PLM) that, when dry, may be crumbled, pulverized, or reduced to powder by hand pressure and also includes non-friable ACM that may become friable during building demolition.
- "Non-friable ACM" is any material containing more than 1% asbestos (as determined by PLM) that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.
- "Category I non-friable ACM" are asbestos-containing resilient floor coverings (commonly known as vinyl asbestos tile (VAT)), asphalt roofing products, packings, and gaskets.
- "Category II non-friable ACM" encompasses all other non-friable ACM.

[1] NESHAP point counting includes examining materials under a polarizing microscope using an eyepiece reticule that superimposes a grid of points over the field of view. 400 points are examined.
[2] OSHA regulations pertaining to asbestos in buildings include 29 CFR 1926.1101 and 29 CFR 1910.1001. OSHA has also issued interpretive letters that provide clarification about how materials containing less than 1% asbestos should be handled. (see www.osha.gov)

- "Non-friable RACM" is used to denote thermal system insulation that is in good condition but would become friable during renovation or demolition and therefore is "regulated asbestos containing material" (RACM).

4.2 Non-Asbestos-Containing Materials

Homogeneous areas of suspect ACM are identified as non-ACM if material contains no detectable asbestos. Table 2, located in Appendix A of this report, lists all homogeneous areas that were found to be non-ACM.

4.3 Bulk Sample Analytical Results

Table 3, located in Appendix A of this report, lists all the bulk samples (chronologically by sample number) collected from homogeneous areas of suspect ACM, and the laboratory analytical results. Each sample was given a unique sample number. There may be more than one sample number for the same homogeneous area of suspect ACM indicating multiple samples were collected from that homogeneous material. The homogeneous areas of suspect ACM are identified on this table by their material identification numbers. The sample location listed on this table provides a brief, but specific, description of the location where the sample was collected. This is different from the homogeneous area location provided on Tables 1 and 2. Table 4 is the same as Table 3, except that the entries have been sorted by homogeneous area number.

4.4 Damage and Hazard Assessment

Each homogeneous area of ACM was assessed for existing damage, accessibility, and potential for future damage, this information is presented in Table 5, located in Appendix A of this report. This table also lists the substrate beneath each homogeneous area of ACM.

Damage and hazard assessment categories are included in the tables in Appendix A.

4.5 Materials Requiring Special Considerations

The inside of the metal boiler and metal boiler flue could not be accessed during the inspection.

4.6 Assumed Asbestos-Containing Materials

None

4.7 Inaccessible Areas

Suspect materials that were hidden or inaccessible may not have been characterized by this inspection. Therefore, any material not identified in this report as having been tested should be treated as suspect ACM until it has been sampled by a Utah-certified inspector and analyzed by an accredited laboratory applying EPA methods.

In addition, some building structures may have been constructed after the application of ACM, and therefore may have obscured these materials from visual examination during this inspection. Typical scenarios include thermal system insulation inside hardened mechanical chases, floor tile and mastic under walls, and sprayed-on texturing and fireproofing behind structural supports or architectural features.

4.8 Materials Assumed >1% Asbestos (no NESHAP point count)

None

5.0 RESPONSE ACTIONS

5.1 Applicable Rules and Regulations

In Utah, EPA asbestos regulations are administered by the Utah Division of Air Quality (DAQ).[3] The Utah Occupational Safety and Health Administration (UOSH) has adopted the Federal OSHA regulations.[4] In addition, the Salt Lake Valley Health Department (SLVHD) regulates demolition activities in Salt Lake County.[5] The SLVHD regulations for pre-demolition building inspections require an asbestos inspection, but also require building owners to inspect the building for other hazardous materials such as universal wastes, hazardous and toxic wastes, and lead-based paint. Like asbestos, these wastes, if present, must be removed prior to building demolition.

---

[3] R307-801. Asbestos, Utah Division of Air Quality Rules, Implementation of Toxic Substances Control Act Title II, Asbestos Certification, Asbestos Training, notifications and Asbestos Work Practices for Renovations and Demolitions (See www.airquality.utah.gov).

[4] Asbestos, Tremolite, Anthophyllite, and Actinolite Standards, Chapter D (Construction), Section 58; and Chapter Z (General Industry), Section 1001, Utah Occupational Safety and Health Rules and Regulations (Administered by Utah Occupational Safety and Health Division) (See www.uosh.utah.gov).

[5] Salt Lake City – County Health Department, Health Regulation #1 Section 12 (See www.slvhealth.org).

Regulatory factors relevant to asbestos abatement decision-making are included in Appendix E.

5.2 Renovation and Demolition (EPA and OSHA)

A listing of ACM found during this inspection is presented in the Executive Summary at the front of this report, and in Appendix A, Table 1.

NESHAP regulations require the removal of friable ACM and non-friable ACM that could become friable during demolition or renovation activities. Therefore, we recommend that all of the ACM in this building be removed and properly disposed of by a licensed asbestos abatement contractor if total demolition of the facility is planned, or those materials that will be impacted by renovation plans be removed prior to the commencement of renovation work. Despite EPA (and Utah Division of Air Quality) rules exempting building materials containing 1% or less asbestos from stringent regulation, Occupational Safety and Health Administration (OSHA) regulations outline specific precautionary work practices when employees work with materials containing even trace amounts of asbestos.[6] Strict compliance by building owners with the OSHA asbestos regulations may result in response actions not required by the EPA and Utah DAQ for certain unregulated materials.

6.0 COST ESTIMATES

Details of the estimated removal costs by homogeneous area can be found in Table 6, Appendix A, and in the Executive Summary table. These estimates are provided for budgeting and planning only, and do not have a level of accuracy sufficient to be used as a construction design cost estimate. The actual cost of asbestos removal is dependent on factors such as the size of the job, the required time frame for removal, the time of year the job is conducted, and economic factors. These estimates do not include replacement costs, or the cost for asbestos abatement design and management consulting services.

---

[6] OSHA regulations pertaining to asbestos in buildings include 29 CFR 1926.1101 and 29 CFR 1910.1001. OSHA has also issued interpretive letters that provide clarification about how materials containing less than 1% asbestos should be handled. (see www.osha.gov)

Appendix A

Data Tables

Table 2

Homogeneous Areas That Do Not Contain Asbestos

Mill Building
White Mesa Mill-Denison Mines Corp

Homogeneous Area Number	Material Description/Location	Amount
M001	**Wall System** White joint compound paper tape and white gypsum plaster Throughout walls of Lab, Office, Lunch Room and Restrooms on Second Level	3,450 sq. ft.
M002	**Floor Tile and Mastic on Cement** 12" x 12" Tan vinyl floor tile and black mastic Throughout walls of Lab, Office, Lunch Room and Restrooms on Second Level	920 sq. ft.

Table 3
Bulk Sample Analytical Results by Sample Number
Mill Building
White Mesa Mill-Denison Mines Corp

Sample Number	Homogeneous Area Number	Material Sampled	Sample Location	Analytical Results
A1081M-1	M001	Wall System	NE. corner wall of Office, Second Level	ND
A1081M-2	M001	Wall System	Center of wall of Lunch Room, Second Level	ND
A1081M-3	M002	Floor Tile and Mastic on Cement	Lunch Room, Second level	ND: floor tile ND: black mastic
A1081M-4	M002	Floor Tile and Mastic on Cement	Office, Second Level	ND: floor tile ND: black mastic

Note: ND =No Asbestos Detected, NA= Not Analyzed, TR = <1% Asbestos, PC = Point Count

Table 4

Bulk Sample Analytical Results by Homogeneous Area Number

Mill Building

White Mesa Mill-Denison Mines Corp

Sample Number	Homogeneous Area Number	Material Sampled	Sample Location	Analytical Results
A1081M-1	M001	Wall System	NE. corner wall of Office, Second Level	ND
A1081M-2	M001	Wall System	Center of wall of Lunch Room, Second Level	ND
A1081M-3	M002	Floor Tile and Mastic on Cement	Lunch Room, Second level	ND: floor tile ND: black mastic
A1081M-4	M002	Floor Tile and Mastic on Cement	Office, Second Level	ND: floor tile ND: black mastic

Note: ND =No Asbestos Detected, NA= Not Analyzed, TR = <1% Asbestos, PC = Point Count

Table 2

Homogeneous Areas That Do Not Contain Asbestos

Boiler Room

White Mesa Mill-Denison Mines Corp

Homogeneous Area Number	Material Description/Location	Amount
M001	**Gasket** Light tan fiberglass gasket Boiler Building	1 unit

Table 3

Bulk Sample Analytical Results by Sample Number

Boiler Room

White Mesa Mill-Denison Mines Corp

Sample Number	Homogeneous Area Number	Material Sampled	Sample Location	Analytical Results
A1081B-1	M001	Gasket	Boiler Building	ND

Note: ND =No Asbestos Detected, NA= Not Analyzed, TR = <1% Asbestos, PC = Point Count

Table 4

Bulk Sample Analytical Results by Homogeneous Area Number

Boiler Room

White Mesa Mill-Denison Mines Corp

Sample Number	Homogeneous Area Number	Material Sampled	Sample Location	Analytical Results
A1081B-1	M001	Gasket	Boiler Building	ND

Note: ND =No Asbestos Detected, NA= Not Analyzed, TR = <1% Asbestos, PC = Point Count

Table 2

Homogeneous Areas That Do Not Contain Asbestos

Scale House

White Mesa Mill-Denison Mines Corp

Homogeneous Area Number	Material Description/Location	Amount
M001	**Floor Tile and Mastic on Wood** 12" x 12" Gray vinyl floor tile and yellow adhesive Scale House	390 sq. ft.
M002	**Floor Tile and Mastic on Wood** 12" x 12" Tan vinyl floor tile and yellow adhesive (patches) Scale House	10 sq. ft.

Table 3
Bulk Sample Analytical Results by Sample Number
Scale House
White Mesa Mill-Denison Mines Corp

Sample Number	Homogeneous Area Number	Material Sampled	Sample Location	Analytical Results
A1081SH-01	M001	Floor Tile and Mastic on Wood	Scale House	ND
A1081SH-02	M002	Floor Tile and Mastic on Wood	Scale House	ND

Note: ND =No Asbestos Detected, NA= Not Analyzed, TR = <1% Asbestos, PC = Point Count

Table 4

Bulk Sample Analytical Results by Homogeneous Area Number

Scale House

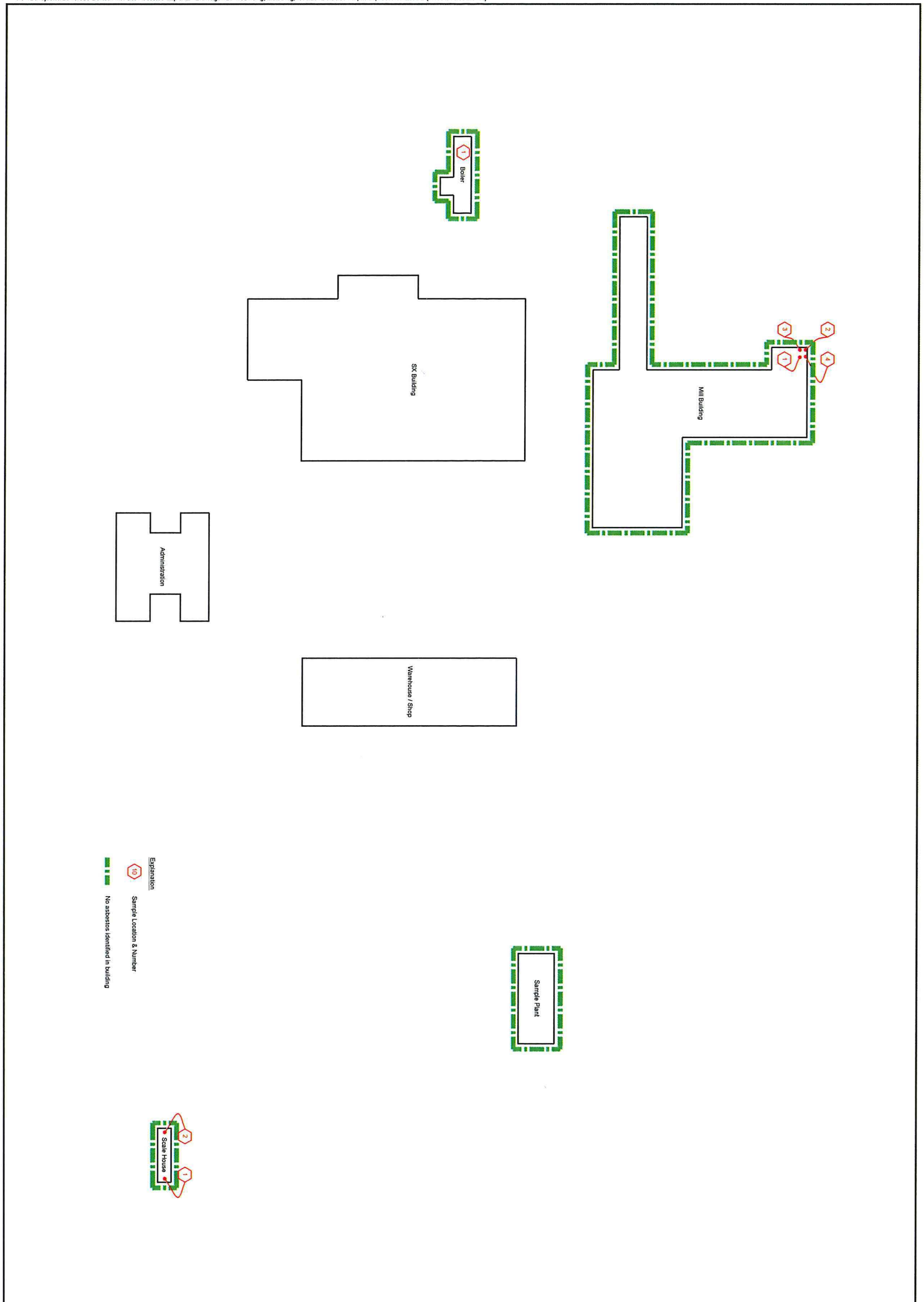
White Mesa Mill-Denison Mines Corp

Sample Number	Homogeneous Area Number	Material Sampled	Sample Location	Analytical Results
A1081SH-01	M001	Floor Tile and Mastic on Wood	Scale House	ND
A1081SH-02	M002	Floor Tile and Mastic on Wood	Scale House	ND

Note: ND =No Asbestos Detected, NA= Not Analyzed, TR = <1% Asbestos, PC = Point Count

Appendix B

Building Floor Plans



PROJECT No:	12U-A1081
SHEET:	1 of 1
DRAWN BY:	Keith
DATE:	07-11-2012
REVISED BY:	
DATE:	
REVIEWED BY:	
DATE:	

N

0 50' 100'

Denison Mines Corp.
White Mesa Mill
6425 South Highway 191
Blanding,UT

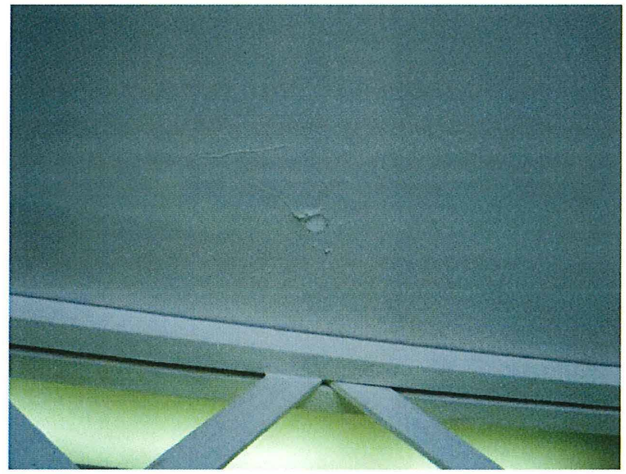
Asbestos & Hazardous Materials Sample Location Map

IHI ENVIRONMENTAL
640 E. Wilmington Ave.
Salt Lake City, UT 84106
801.466.2223
ihi@ihi-env.com

Appendix C

Photographs

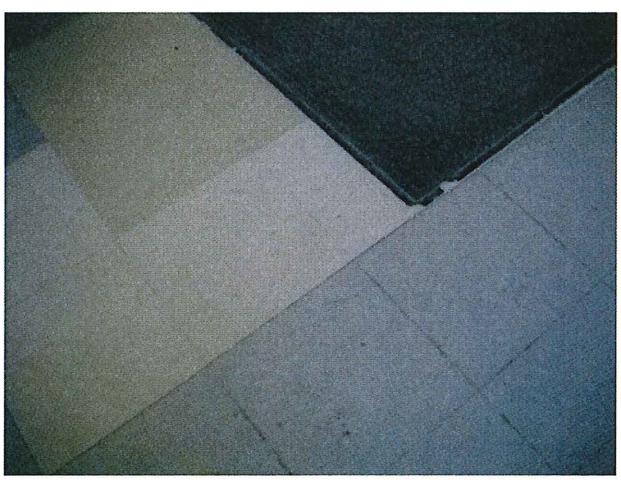
Photograph 1
The floor tile and adhesive on the second level of the Mill Building did not contain asbestos.



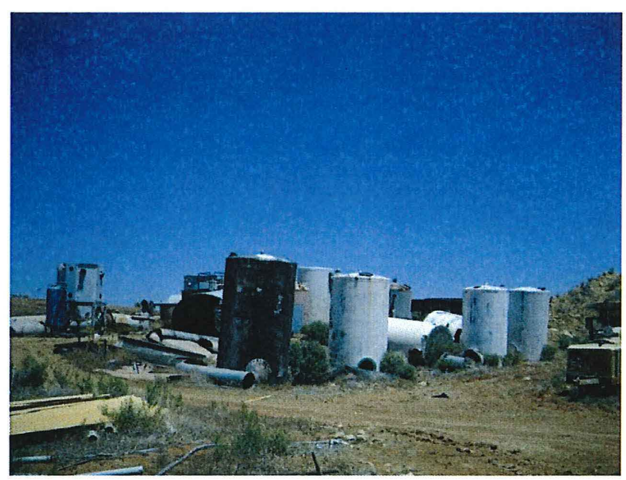
Photograph 2
The wall system on the second level of the Mill Building was reported as none detected for asbestos.

Photograph 3
The gasket on the boiler of the Boiler Plant did not contain asbestos.

Photograph 4
The metal boiler flue could not be accessed to inspect for suspect asbestos materials.



Photograph 5
The floor tiles in the Scale House were reported as none detected for asbestos.



Photograph 6
No suspect asbestos material was identified at the dump yard.

Appendix D

Laboratory Results

DIXON INFORMATION INC.
MICROSCOPY, ASBESTOS ANALYSIS & CONSULTING
A.I.H.A. ACCREDITED LABORATORY # 101579
NVLAP LAB CODE 101012-0

June 13, 2012

Mr. Lono Folau
IHI Environmental
640 East Wilmington Ave
Salt Lake City, UT 84106

Ref: Batch # 104908, Lab # H19744 - H19750
Received June 6, 2012
Test report Page 1 of 3
Denison Mines-White Mesa Mill
Mill Building\Boiler\Scale House
6425 S Highway 191, Blanding UT
Proj# 12U-A1081
Sampled by Lono Folau

Dear Mr. Folau:

Samples H19744 through H19750 have been analyzed by visual estimation based on EPA-600/M4-82-020 December 1982 optical microscopy test method, with guidance from the EPA/600/R-93/116 July 1993 and OSHA ID 191 methods. Appendix "A" contains statements which an accredited laboratory must make to meet the requirements of accrediting agencies. It also contains additional information about the method of analysis. This analysis is accredited by NVLAP. Appendix "A" must be included as an essential part of this test report. The data for this report is accredited by NVLAP for laboratory number 101012-0. It does not contain data or calibrations for tests performed under the AIHA program under lab code 101579.

This report may be reproduced but all reproduction must be in full unless written approval is received from the laboratory for partial reproduction. The results of analysis are as follows:

Lab H19744, Field A1081M-1 Wall system
This sample contains white paint, white gypsum plaster with mica, brown and off-white plant fiber paper, and white gypsum plaster with 1% fiberglass. This sample is non-homogeneous. **Asbestos is none detected.**

The paint is 1% of the sample. The plaster with mica is 4% of the sample. The plant fiber paper is 5% of the sample. The white gypsum plaster is 90% of the sample.

78 WEST 2400 SOUTH • SOUTH SALT LAKE, UTAH 84115-3013
PHONE 801-486-0800 • FAX 801-486-0849 • RES. 801-571-7695

<u>Lab H19745, Field A1081M-2</u> Wall system
This sample contains white paint, white gypsum plaster with mica, brown plant fiber paper, and white gypsum plaster with 1% fiberglass. This sample is non-homogeneous. **Asbestos is none detected.**

The paint is 1% of the sample. The plaster with mica is 1% of the sample. The plant fiber paper is 5% of the sample. The white gypsum plaster is 93% of the sample.

The analysis sensitivity is limited in the second material type due to the thin layer.

<u>Lab H19746, Field A1081M-3</u> Floor tile and mastic
This sample contains three types of material: The first type is tan plastic and limestone; the second type is yellow resin mastic; the third type is black tar mastic with 1% organic fiber in debris. This sample is non-homogeneous. **Asbestos is none detected.**

The first type is 97% of the sample. The second type is 1% of the sample. The third type is 2% of the sample.

<u>Lab H19747, Field A1081M-4</u> Floor tile and mastic
This sample contains two types of material: The first type is off-white plastic and limestone; the second type is black tar mastic with less than 1% organic fiber in debris. This sample is non-homogeneous. **Asbestos is none detected.**

The first type is 99% of the sample. The second type is 1% of the sample.

<u>Lab H19748, Field A1081B-1</u> Boiler gasket
This is 95% fiberglass in brown binder. **Asbestos is none detected.**

<u>Lab H19749, Field A1081SH-1</u> Floor tile and mastic
This sample contains two types of material: The first type is gray plastic and limestone; the second type is yellow resin mastic. This sample is non-homogeneous. **Asbestos is none detected.**

The first type is 99% of the sample. The second type is 1% of the sample.

Lab H19750, Field A1081SH-2 Floor tile and mastic
This sample contains three types of material: The first type is tan binder; the second type is tan plastic and limestone; the third type is yellow resin mastic. This sample is non-homogeneous. **Asbestos is none detected.**

The first type is 1% of the sample. The second type is 98% of the sample. The third type is 1% of the sample.

In order to be sure reagents and tools used for analysis are not contaminated with asbestos, blanks are tested. Asbestos was none detected in the blanks tested with this bulk sample set.

Very truly yours,

Steve H. Dixon, President

Analyst: Paul Crane ______________________ Date Analyzed: June 13, 2012

Dixon Information Inc.
78 West 2400 South
South Salt Lake, Utah 84115
Phone: 1-801-486-0800 Fax: 1-801-486-0849

BULK ANALYTICAL REQUEST FORM

Turnaround Time - Circle One **Batch Number** 104908

Rush (24 hours $25.00 per sample)

(X) **Non-rush** (5 Working days $17.00 per sample)

Name of location sample was taken at Denison Mines - White Mesa Mill Mill Building & Boiler & Scale House
Street address sample was taken at 6425 S. Highway 191, Blanding, UT
Sampled by: Lono Folau

Report to be sent to: Lono Folau
Company: IHI Environmental
Address: 640 E. Wilmington Ave
City: SLC State: UT
Zip Code: 84106
Telephone #: 801-466-2223
Fax #: 801-466-9616
E-mail: lfolau@ihi-env.com

Billing to be sent to:
Company: IHI Environmental
Address:
City: State:
Zip Code:
Telephone #:
Fax #:
PO #: 12U-A1081

Field #	Description of Sample	Samples Collected Date	Samples Collected Time	Lab #
A1081M				
1	Wall system	5/30/12		19744
2	" "			19745
3	Floor tile and mastic			19746
4	" " " "	5/30/12		19747
A1081B-				
1	Boiler gasket	5/30/12		19748
A1081SH-				
1	Floor tile and mastic	5/30/12		19749
2	" " " "	5/30/12		19750

Chain of Custody

Submission of asbestos samples for analysis and/or signing a chain of custody is the equivalent of submission of a purchase order and constitutes an agreement to pay for services provided at Dixon Information Incorporated standard schedule of fees for services.

Submitted by: [signature] Date: 6/6/12 Time:
Received by Lab: [signature] Date: 6-6-12 Time: 1320
Received by Analyst: [signature] Date: 6/8/12 Time: 1100
Returned by Lab: Date: Time:

Appendix "A"

"This report relates only to the items tested. This report must not be used to claim product endorsement by NVLAP or AIHA."

NVLAP and AIHA requires laboratories to state the condition of samples received for testing: These samples are in acceptable condition for analysis unless there is a statement in the report of analysis that a test item has some characteristics or condition that precludes analysis or requires a modification of standard analytical methodology. If a test item is not acceptable, the reasons for non-acceptability will be given under the laboratory number for that particular test item. The reported percentages of each material type are based on the sample received by the laboratory and may not be representative of the parent material. Orientation of top and bottom may not be specified due to uncertainty of orientation.

Methods of Analysis and Limit of Detection

In air count analysis, the results may be biased when interferences are noted.

The accuracy of asbestos analysis in bulk samples increases with increasing concentration of asbestos. Pigments, binders, small sample size, and multiple layers may affect the analysis sensitivity.

There are two methods for analysis of asbestos in a bulk test sample. Visual estimation is the most sensitive method. If an analyst makes a patient search, 0.1% or less asbestos can be detected in a bulk sample.

The second method of analysis is a statistical approach called point counting. EPA will not accept visual estimations if a laboratory detects a trace of asbestos in a sample i.e. anything less than 1% asbestos. Government agencies regulate asbestos containing materials (ACM) whenever the ACM is more than 1%. OSHA requirements apply on samples containing any amount of asbestos.

Due to the higher charge for a point count analysis, Dixon Information Inc. does not perform a point count unless authorized to do so by the client. If a sample is point counted, when possible, various chemical and/or physical means may be used to concentrate the asbestos in the sample. This is permitted by the EPA method and it increases the accuracy of the analysis.

Appendix E

Regulatory Factors

Several factors determine how asbestos in a building must be treated if it has the potential of being disturbed during a renovation or demolition. These factors include the following:

Factor	EPA Regulations for Asbestos Removal	OSHA Regulations for Asbestos Removal
Definition of asbestos in a building material	Defines ACM as a material containing 1% or greater asbestos.	Defines an ACM as one containing >1% asbestos.
Regulation of asbestos in building materials	Regulates only ACM. If the asbestos concentration in a material is shown to be "none detected" by initial analysis or 1% or less by point count analysis, EPA/DAQ does not regulate it.	Regulates not only ACM but all materials containing any amount of asbestos. Regulations are not as stringent for materials containing equal-to or less-than 1% asbestos but greater than a "none detected" concentration.
Determination of asbestos concentration in a gypsum board wall system	Allows compositing of all layers (joint compound, joint tape, and gypsum board) into one sample, which decreases the possibility that the sample will be evaluated as an ACM.	Requires that each layer of the wall system be analyzed and reported independently, which increases the possibility of a sample containing ACM or identifiable asbestos.
Defines regulated and non-regulated ACM	Yes – Regulated ACM include friable ACM and resilient flooring, asphalt roofing, gaskets and packing that have become friable and other ACM that have a high probability of becoming friable.	No – Requirements for asbestos work procedures and worker training are less stringent for resilient flooring, asphalt roofing materials, and materials containing greater than "none detected" but not greater than 1% asbestos.
Notification of asbestos abatement or building demolition required	Yes – Utah DAQ must be notified on the appropriate form 10 working-days prior to an asbestos abatement of regulated asbestos material greater than the NESHAP-established notifiable quantity with demolition, or demolition where abatement is not required.	No – Not required.
Provision for allowing ACM to remain in a building during a demolition.	Yes – Allows ACM resilient flooring, asphalt roofing, and certain other non-friable building materials in good condition to remain in a building during demolition as long as the demolition process will not render them friable.	No – If any asbestos is left in a building during a demolition, the demolition workers are expected to meet the same OSHA requirements that an abatement contractor would meet if an abatement contractor was conducting an abatement of those materials.

Appendix F

Project Limitations

PROJECT LIMITATIONS

This Project was performed using, as a minimum, practices consistent with standards acceptable within the industry at this time, and a level of diligence typically exercised by EH&S consultants performing similar services.

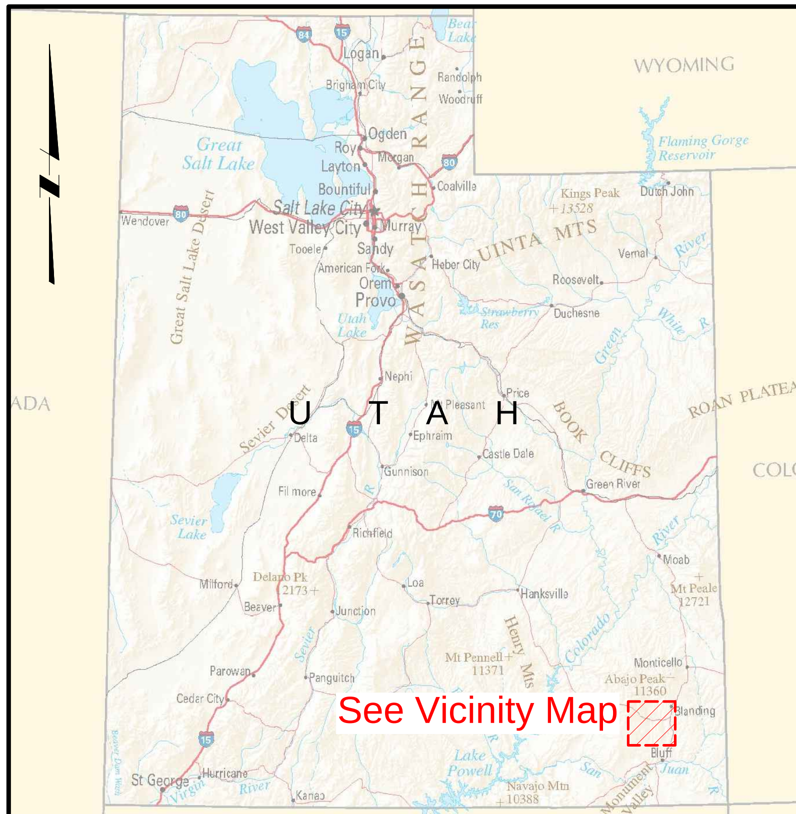
The procedures used attempt to establish a balance between the competing goals of limiting investigative and reporting costs and time, and reducing the uncertainty about unknown conditions. Therefore, because the findings of this report were derived from the scope, costs, time and other limitations, the conclusions should not be construed as a guarantee that all universal, toxic and/or hazardous wastes have been identified and fully evaluated. Furthermore, IHI assumes no responsibility for omissions or errors resulting from inaccurate information, or data, provided by sources outside of IHI or from omissions or errors in public records.

It is emphasized that the final decision on how much risk to accept always remains with the client since IHI is not in a position to fully understand all of the client's needs. Clients with a greater aversion to risk may want to take additional actions while others, with less aversion to risk, may want to take no further action.

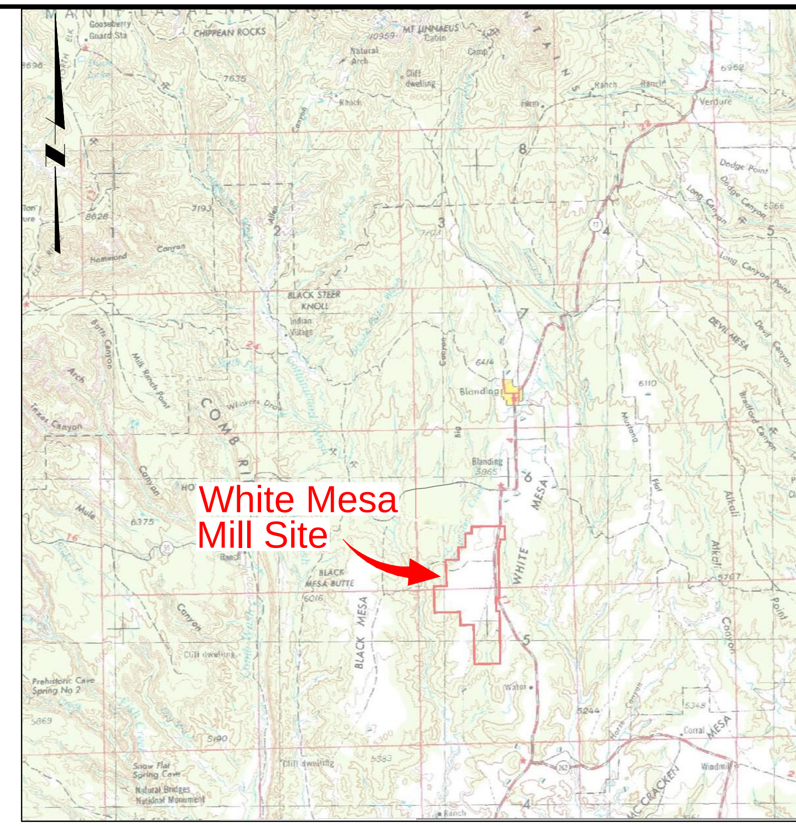
ATTACHMENT B

SUPPORTING DOCUMENTATION FOR INTERROGATORY 02/1:

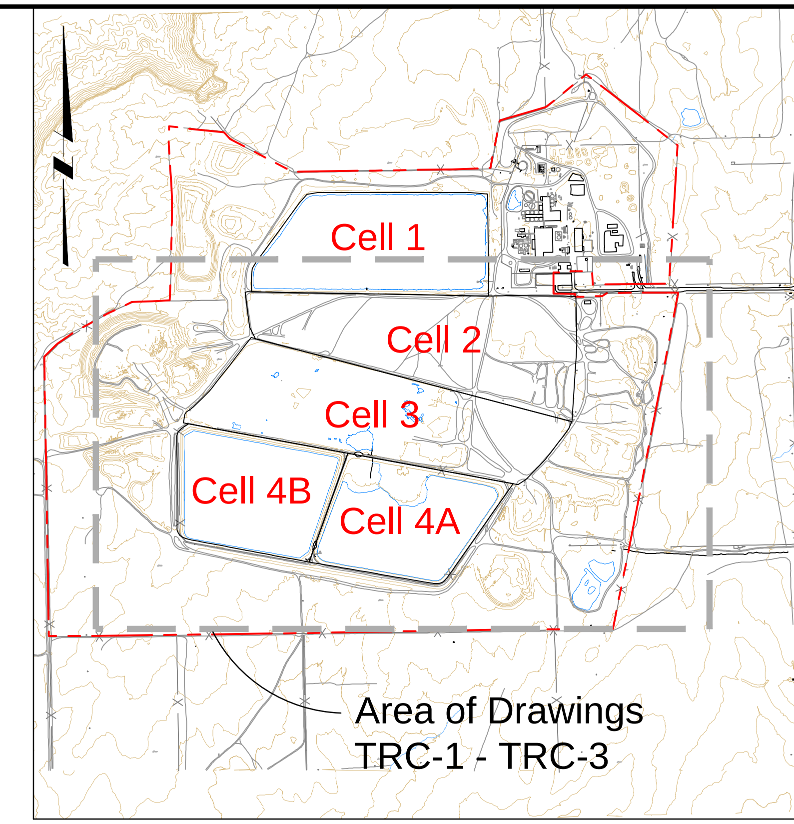
REVISED RECLAMATION PLAN DRAWINGS TO ATTACHMENT A OF RECLAMATION PLAN, REVISION 5.0



LOCATION MAP
NOT TO SCALE



VICINITY MAP
NOT TO SCALE



SITE MAP
NOT TO SCALE

INDEX OF DRAWINGS

WHITE MESA MILL TAILINGS RECLAMATION

prepared for

ENERGY FUELS RESOURCES (USA) INC.

SAN JUAN COUNTY, UTAH

ISSUE/REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED WITH EFRI 2015 RESPONSES TO FEB 2013 DRC REVIEW COMMENTS	DM	MD	08–15
A	ISSUED FOR RECLAMATION PLAN REVISION 5.0	DM	RS	08–11

DESIGNED BY	M DAVIS	08–15
DRAWN BY	D MIRANDA	08–15
CHECKED BY	C STRACHAN	08–15
APPROVED BY	M DAVIS	08–15
PROJECT MANAGER	M DAVIS	08–15
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

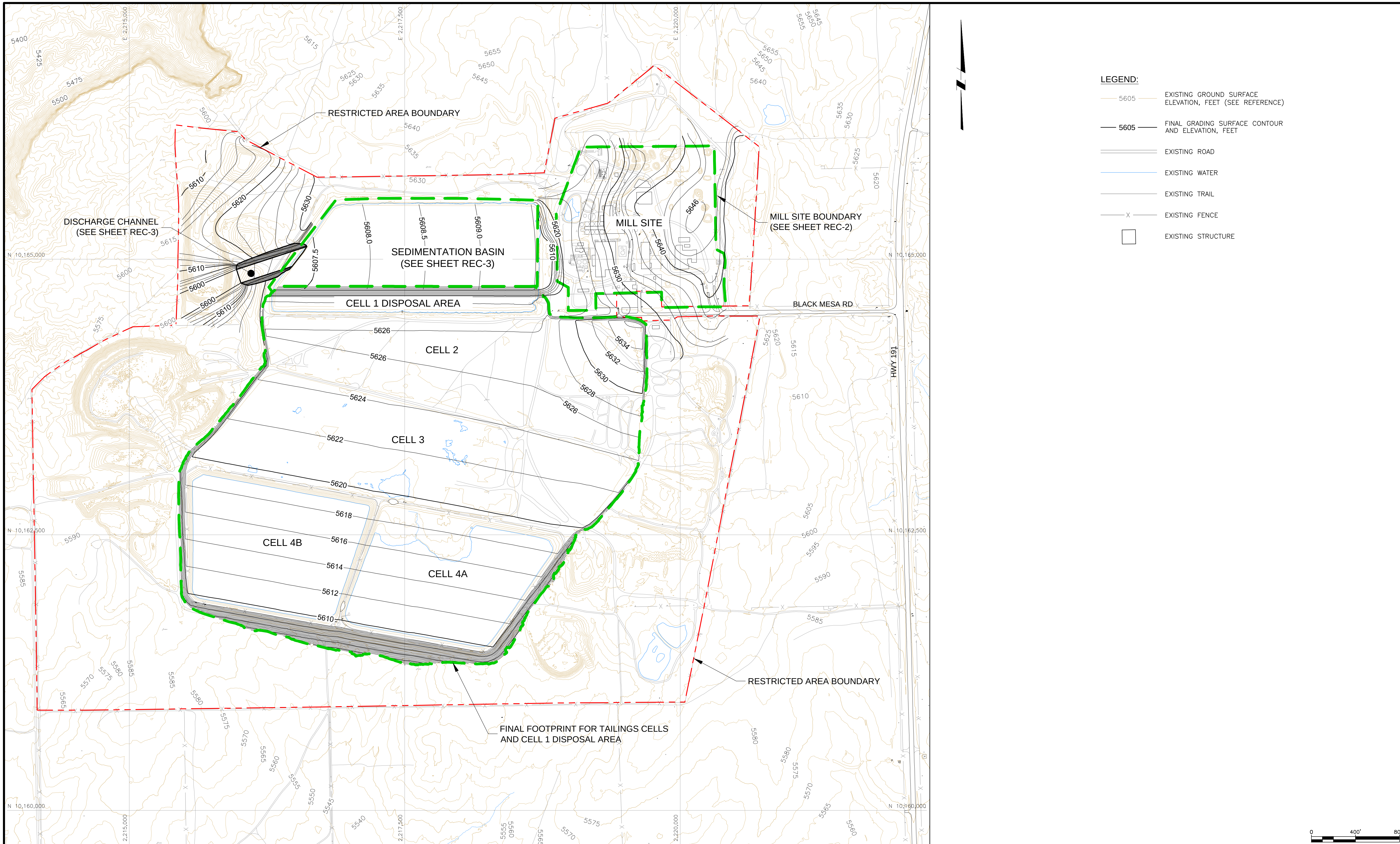
Energy Fuels Resources (USA) Inc.

PROJECT LOCATION: BLANDING, UTAH
PROJECT: WHITE MESA MILL TAILINGS RECLAMATION
TITLE: TITLE SHEET AND PROJECT LOCATION MAP

MWH

SHEET: REC-0
REVISION: B
FILE NAME: WMM COVER
DATE: AUG 2015

L:\Design-Drafting\Clients-A-H\ENERGY FUELS\013-Sheet Set\2015-08-31 COVER DSGN DWGS\WMM COVER



ISSUE	REV	DESCRIPTION	TECH	ENG	DATE
	B	ISSUED WITH EFRI 2015 RESPONSES TO FEB 2013 DRC REVIEW COMMENTS	DM	MD	08-15
	A	ISSUED FOR RECLAMATION PLAN REVISION 5.0	DM	RS	08-11

DRAWING REFERENCE(S):
- EXISTING TOPOGRAPHY BASED UPON FILE PROVIDED FROM ENERGY FUELS ON JULY 20, 2015. PER ENERGY FUELS, GROUND SURFACE CONTOURS ARE FROM 2012 AERIAL SURVEY CONDUCTED BY JONES & DeMILLE ENGINEERING INC., EXCEPT FOR CELLS 2 AND 3. CELL 2 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED OCTOBER 2013. CELL 3 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED ON JULY 8, 2014.

DESIGNED BY	M DAVIS	08-15
DRAWN BY	D MIRANDA	08-15
CHECKED BY	C STRACHAN	08-15
APPROVED BY	M DAVIS	08-15
PROJECT MANAGER	M DAVIS	08-15
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Energy Fuels Resources (USA) Inc.

PROJECT LOCATION: BLANDING, UTAH

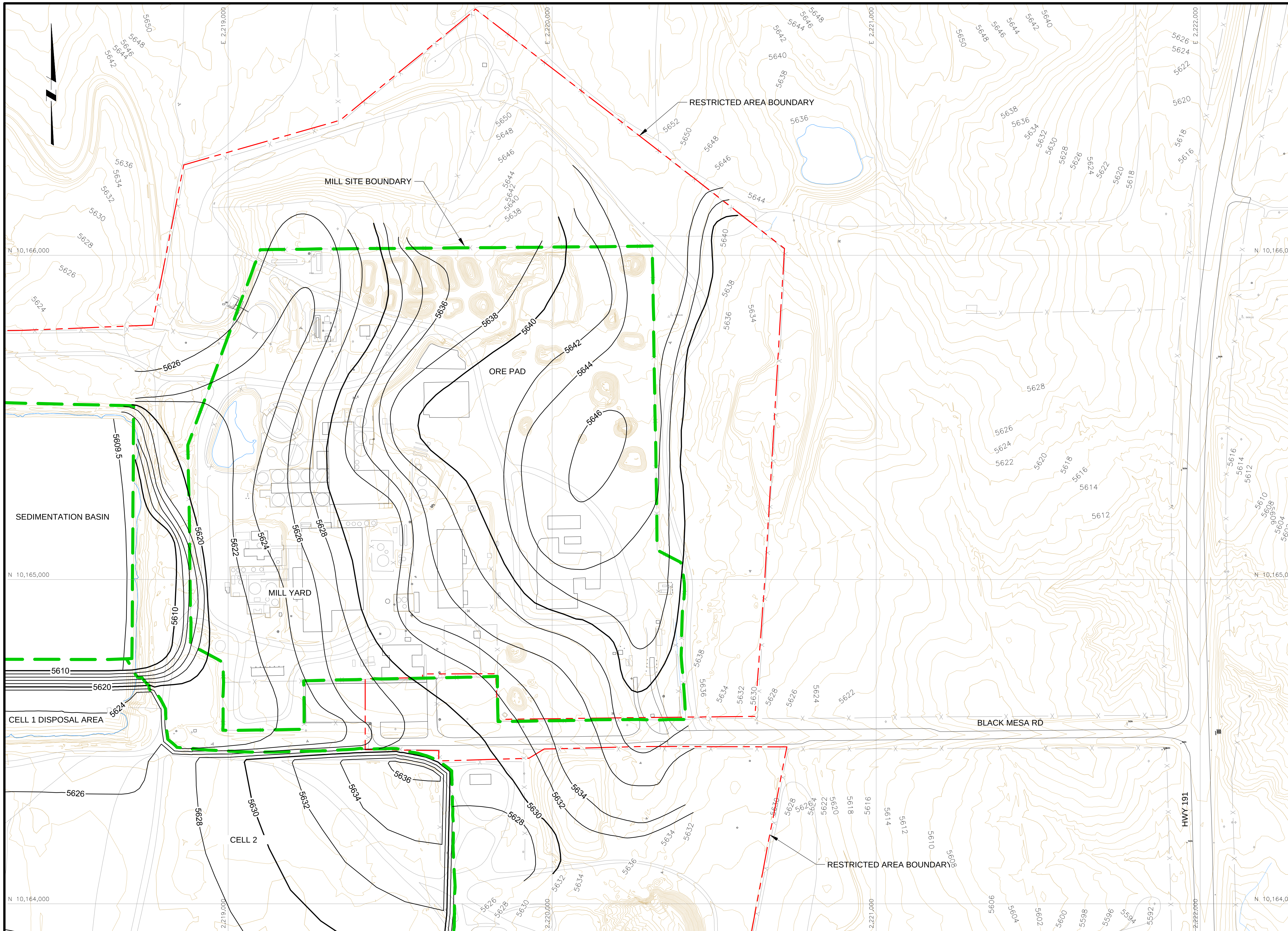
PROJECT: WHITE MESA MILL TAILINGS RECLAMATION

TITLE: PLAN VIEW OF RECLAMATION FEATURES

MWH

SHEET: REC-1 | REVISION: B
FILE NAME: WMM REC-1 | DATE: AUG 2015

L:\Design-Drafting\Clients-A-H\ENERGY FUELS\013-Sheet Set\2015-08-31 COVER DSGN DWGS\WMM REC-1



LEGEND:

5605	EXISTING GROUND SURFACE ELEVATION, FEET (SEE REFERENCE)
5605	FINAL GRADING SURFACE CONTOUR AND ELEVATION, FEET
	EXISTING ROAD
	EXISTING WATER
	EXISTING TRAIL
X	EXISTING FENCE
	EXISTING STRUCTURE

NOTES:

1. ADAPTED FROM DENISON MINES (USA) CORPORATION FIGURE A-3.2-1. TITLE: MILL SITE AND ORE PAD FINAL GRADING PLAN, DATED FEBRUARY, 1997.
2. ACTUAL FIELD CONDITIONS MAY VARY FROM FEATURES SHOWN.
3. ACTUAL FINAL CONTOURS WILL DEPEND ON EXTENT OF EXCAVATION DICTATED BY RESULTS OF FIELD RADIOMETRIC SURVEYS.

0 150' 300'

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED WITH EFRI 2015 RESPONSES TO FEB 2013 DRC REVIEW COMMENTS	DM	MD	08-15
A	ISSUED FOR RECLAMATION PLAN REVISION 5.0	DM	RS	08-11

DISCLAIMER:
THIS DRAWING WAS DEVELOPED THROUGH THE APPLICATION OF PROFESSIONAL ENGINEERING SKILL AND PROPRIETARY METHODOLOGIES, PROCESSES AND KNOW HOW OF MWH AS AUTHOR ALL PURSUANT TO THE TERMS OF A CONTRACTUAL SCOPE OF WORK GOVERNING ITS PREPARATION. THIS DRAWING MAY NOT BE USED OR MODIFIED OTHER THAN IN STRICT ACCORDANCE WITH THE TERMS OF THE GOVERNING CONTRACT AND SCOPE OF WORK OR OTHERWISE ABSENT THE INVOLVEMENT AND CONSENT OF THE AUTHOR. ANY ALTERATION OR ADAPTATION OF THIS DRAWING SHALL BE CONSISTENT WITH THE AUTHOR'S CONTRACTUAL AND PROPRIETARY RIGHTS AND BE AT USER'S SOLE RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY OF MWH.

DRAWING REFERENCE(S):
- EXISTING TOPOGRAPHY BASED UPON FILE PROVIDED FROM ENERGY FUELS ON JULY 20, 2015. PER ENERGY FUELS, GROUND SURFACE CONTOURS ARE FROM 2012 AERIAL SURVEY CONDUCTED BY JONES & DeMILLE ENGINEERING INC., EXCEPT FOR CELLS 2 AND 3. CELL 2 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED OCTOBER 2013. CELL 3 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED ON JULY 8, 2014.

DESIGNED BY	M DAVIS	08-15
DRAWN BY	D MIRANDA	08-15
CHECKED BY	C STRACHAN	08-15
APPROVED BY	M DAVIS	08-15
PROJECT MANAGER	M DAVIS	08-15
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Energy Fuels Resources (USA) Inc.

PROJECT LOCATION: BLANDING, UTAH

PROJECT: WHITE MESA MILL TAILINGS RECLAMATION

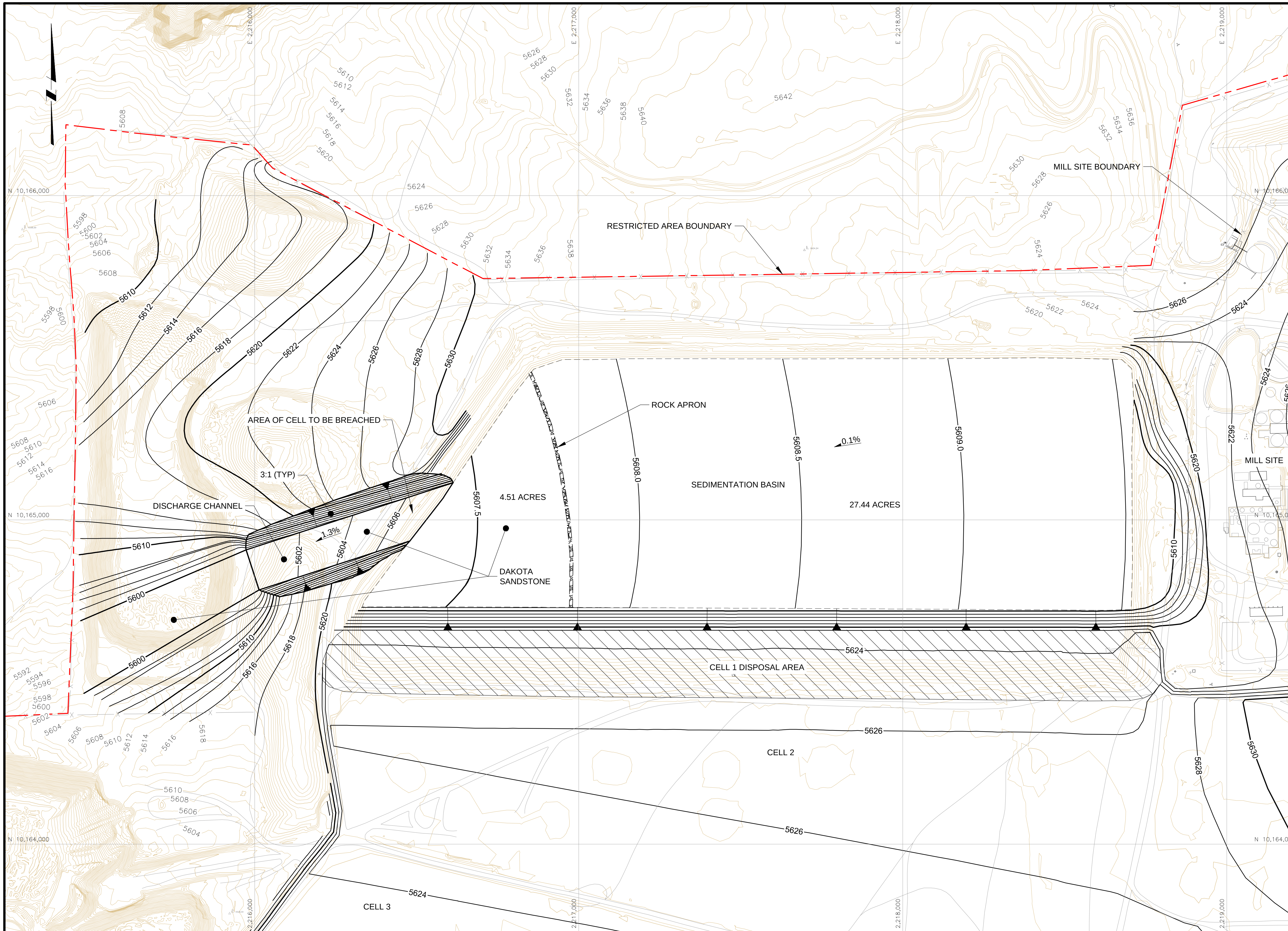
TITLE: MILL SITE AND ORE PAD AREA GRADING PLAN

MWH

SHEET: REC-2 | REVISION: B

FILE NAME: WMM REC-2 | DATE: AUG 2015

L:\Design-Drafting\Clients-A-H\ENERGY FUELS\013-Sheet Set\2015-08-31 COVER DSGN DWGS\WMM REC-2



LEGEND:

- 5605 — EXISTING GROUND SURFACE ELEVATION, FEET (SEE REFERENCE)
- 5605 — FINAL GRADING SURFACE CONTOUR AND ELEVATION, FEET
- EXISTING ROAD
- EXISTING WATER
- EXISTING TRAIL
- X — EXISTING FENCE
- EXISTING STRUCTURE

NOTES:

1. ADAPTED FROM DENISON MINES (USA) CORPORATION FIGURE A-3.2-1. TITLE: MILL SITE AND ORE PAD FINAL GRADING PLAN, DATED FEBRUARY, 1997.

0 150' 300'

ISSUE/REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED WITH EFRI 2015 RESPONSES TO FEB 2013 DRC REVIEW COMMENTS	DM	MD	08-15
A	ISSUED FOR RECLAMATION PLAN REVISION 5.0	DM	RS	08-11

DISCLAIMER:
THIS DRAWING WAS DEVELOPED THROUGH THE APPLICATION OF PROFESSIONAL ENGINEERING SKILL AND PROPRIETARY METHODOLOGIES, PROCESSES AND KNOW HOW OF MWH AS AUTHOR ALL PURSUANT TO THE TERMS OF A CONTRACTUAL SCOPE OF WORK GOVERNING ITS PREPARATION. THIS DRAWING MAY NOT BE USED OR MODIFIED OTHER THAN IN STRICT ACCORDANCE WITH THE TERMS OF THE GOVERNING CONTRACT AND SCOPE OF WORK OR OTHERWISE ABSENT THE INVOLVEMENT AND CONSENT OF THE AUTHOR. ANY ALTERATION OR ADAPTATION OF THIS DRAWING SHALL BE CONSISTENT WITH THE AUTHOR'S CONTRACTUAL AND PROPRIETARY RIGHTS AND BE AT USER'S SOLE RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY OF MWH.

DRAWING REFERENCE(S):
- EXISTING TOPOGRAPHY BASED UPON FILE PROVIDED FROM ENERGY FUELS ON JULY 20, 2015. PER ENERGY FUELS, GROUND SURFACE CONTOURS ARE FROM 2012 AERIAL SURVEY CONDUCTED BY JONES & DeMILLE ENGINEERING INC., EXCEPT FOR CELLS 2 AND 3. CELL 2 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED OCTOBER 2013. CELL 3 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED ON JULY 8, 2014.

DESIGNED BY	M DAVIS	08-15
DRAWN BY	D MIRANDA	08-15
CHECKED BY	C STRACHAN	08-15
APPROVED BY	M DAVIS	08-15
PROJECT MANAGER	M DAVIS	08-15
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Energy Fuels Resources (USA) Inc.

PROJECT LOCATION: BLANDING, UTAH

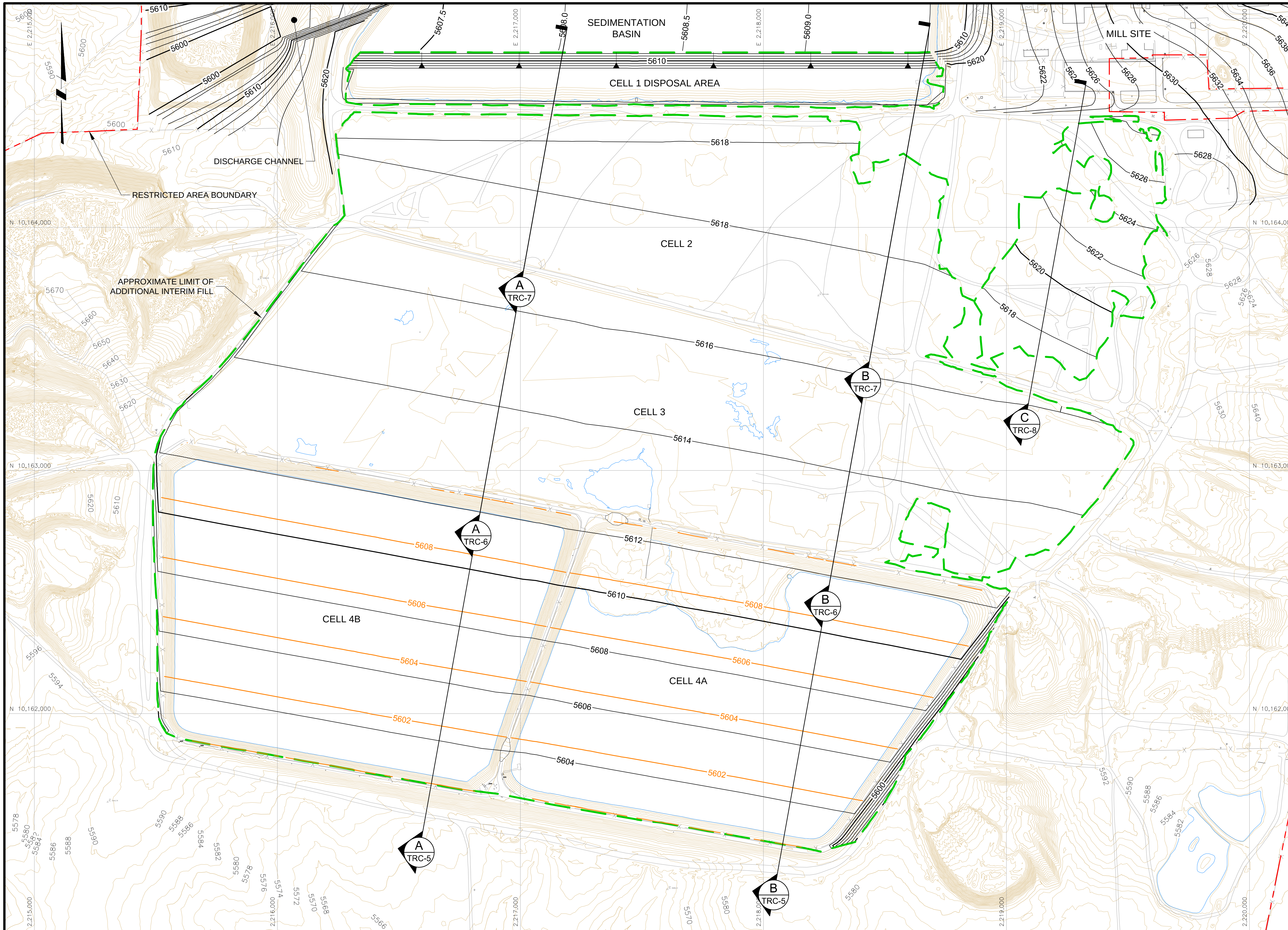
PROJECT: WHITE MESA MILL TAILINGS RECLAMATION

TITLE: SEDIMENTATION BASIN DETAIL

MWH

SHEET: REC-3
REVISION: B
FILE NAME: WMM REC-3
DATE: AUG 2015

L:\Design-Drafting\Clients-A-H\ENERGY FUELS\013-Sheet Set\2015-08-31 COVER DSGN DWGS\WMM REC-3



LEGEND:

5605	EXISTING GROUND SURFACE ELEVATION, FEET (SEE REFERENCE)
5605	TOP OF INTERIM FILL ELEVATION, FEET
5605	MAXIMUM PERMITTED TAILINGS SURFACE CONTOUR AND ELEVATION, FEET
	EXISTING ROAD
	EXISTING WATER
	EXISTING TRAIL
X	EXISTING FENCE
	EXISTING STRUCTURE

L:\Design-Drafting\Clients-A-H\ENERGY FUELS\013-Sheet Set\2015-08-31 COVER DSGN DWGS\WMM TRC-1

ISSUE/REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED WITH EFRI 2015 RESPONSES TO FEB 2013 DRC REVIEW COMMENTS	DM	MD	08-15
A	ISSUED FOR RECLAMATION PLAN REVISION 5.0	DM	RS	08-11

DISCLAIMER:
THIS DRAWING WAS DEVELOPED THROUGH THE APPLICATION OF PROFESSIONAL ENGINEERING SKILL AND PROPRIETARY METHODOLOGIES, PROCESSES AND KNOW HOW OF MWH AS AUTHOR ALL PURSUANT TO THE TERMS OF A CONTRACTUAL SCOPE OF WORK GOVERNING ITS PREPARATION. THIS DRAWING MAY NOT BE USED OR MODIFIED OTHER THAN IN STRICT ACCORDANCE WITH THE TERMS OF THE GOVERNING CONTRACT AND SCOPE OF WORK OR OTHERWISE ABSENT THE INVOLVEMENT AND CONSENT OF THE AUTHOR. ANY ALTERATION OR ADAPTATION OF THIS DRAWING SHALL BE CONSISTENT WITH THE AUTHOR'S CONTRACTUAL AND PROPRIETARY RIGHTS AND BE AT USER'S SOLE RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY OF MWH.

DRAWING REFERENCE(S):
- EXISTING TOPOGRAPHY BASED UPON FILE PROVIDED FROM ENERGY FUELS ON JULY 20, 2015. PER ENERGY FUELS, GROUND SURFACE CONTOURS ARE FROM 2012 AERIAL SURVEY CONDUCTED BY JONES & DeMILLE ENGINEERING INC., EXCEPT FOR CELLS 2 AND 3. CELL 2 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED OCTOBER 2013. CELL 3 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED ON JULY 8, 2014.

DESIGNED BY	M DAVIS	08-15
DRAWN BY	D MIRANDA	08-15
CHECKED BY	C STRACHAN	08-15
APPROVED BY	M DAVIS	08-15
PROJECT MANAGER	M DAVIS	08-15
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Energy Fuels Resources (USA) Inc.

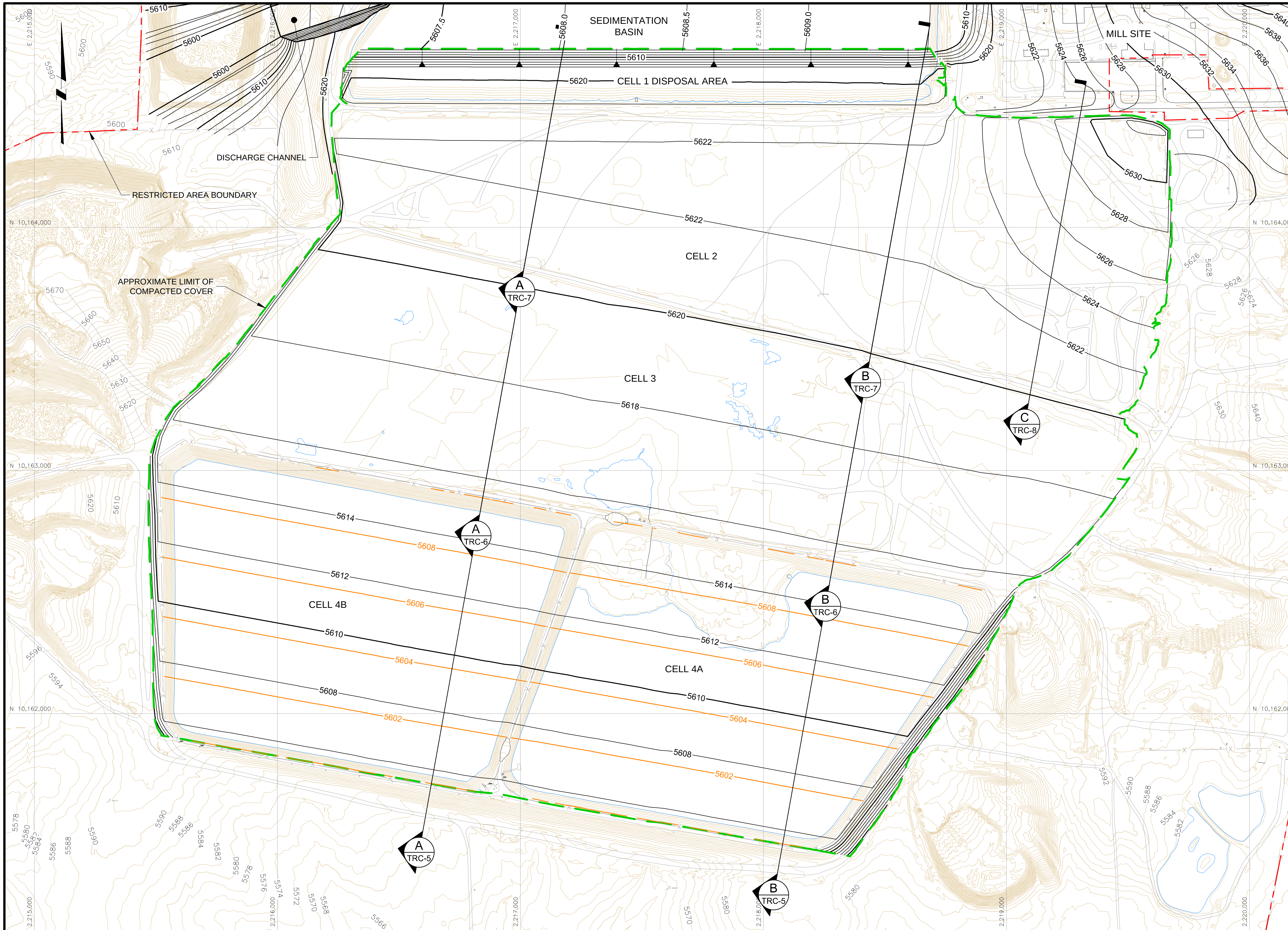
PROJECT LOCATION: BLANDING, UTAH

PROJECT: WHITE MESA MILL TAILINGS RECLAMATION

TITLE: INTERIM FILL GRADING PLAN

MWH

SHEET: TRC-1
REVISION: B
FILE NAME: WMM TRC-1
DATE: AUG 2015



LEGEND:

5605	EXISTING GROUND SURFACE ELEVATION, FEET (SEE REFERENCE)
5605	TOP OF COMPACTED COVER ELEVATION, FEET
5605	MAXIMUM PERMITTED TAILINGS SURFACE CONTOUR AND ELEVATION, FEET
	EXISTING ROAD
	EXISTING WATER
	EXISTING TRAIL
X	EXISTING FENCE
	EXISTING STRUCTURE

ISSUE/REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED WITH EFRI 2015 RESPONSES TO FEB 2013 DRC REVIEW COMMENTS	DM	MD	08-15
A	ISSUED FOR RECLAMATION PLAN REVISION 5.0	DM	RS	08-11

DISCLAIMER:
THIS DRAWING WAS DEVELOPED THROUGH THE APPLICATION OF PROFESSIONAL ENGINEERING SKILL AND PROPRIETARY METHODOLOGIES, PROCESSES AND KNOW HOW OF MWH AS AUTHOR ALL PURSUANT TO THE TERMS OF A CONTRACTUAL SCOPE OF WORK GOVERNING ITS PREPARATION. THIS DRAWING MAY NOT BE USED OR MODIFIED OTHER THAN IN STRICT ACCORDANCE WITH THE TERMS OF THE GOVERNING CONTRACT AND SCOPE OF WORK OR OTHERWISE ABSENT THE INVOLVEMENT AND CONSENT OF THE AUTHOR. ANY ALTERATION OR ADAPTATION OF THIS DRAWING SHALL BE CONSISTENT WITH THE AUTHOR'S CONTRACTUAL AND PROPRIETARY RIGHTS AND BE AT USER'S SOLE RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY OF MWH.

DRAWING REFERENCE(S):
- EXISTING TOPOGRAPHY BASED UPON FILE PROVIDED FROM ENERGY FUELS ON JULY 20, 2015. PER ENERGY FUELS, GROUND SURFACE CONTOURS ARE FROM 2012 AERIAL SURVEY CONDUCTED BY JONES & DeMILLE ENGINEERING INC., EXCEPT FOR CELLS 2 AND 3. CELL 2 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED OCTOBER 2013. CELL 3 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED ON JULY 8, 2014.

DESIGNED BY	M DAVIS	08-15
DRAWN BY	D MIRANDA	08-15
CHECKED BY	C STRACHAN	08-15
APPROVED BY	M DAVIS	08-15
PROJECT MANAGER	M DAVIS	08-15
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Energy Fuels Resources (USA) Inc.

PROJECT LOCATION: BLANDING, UTAH

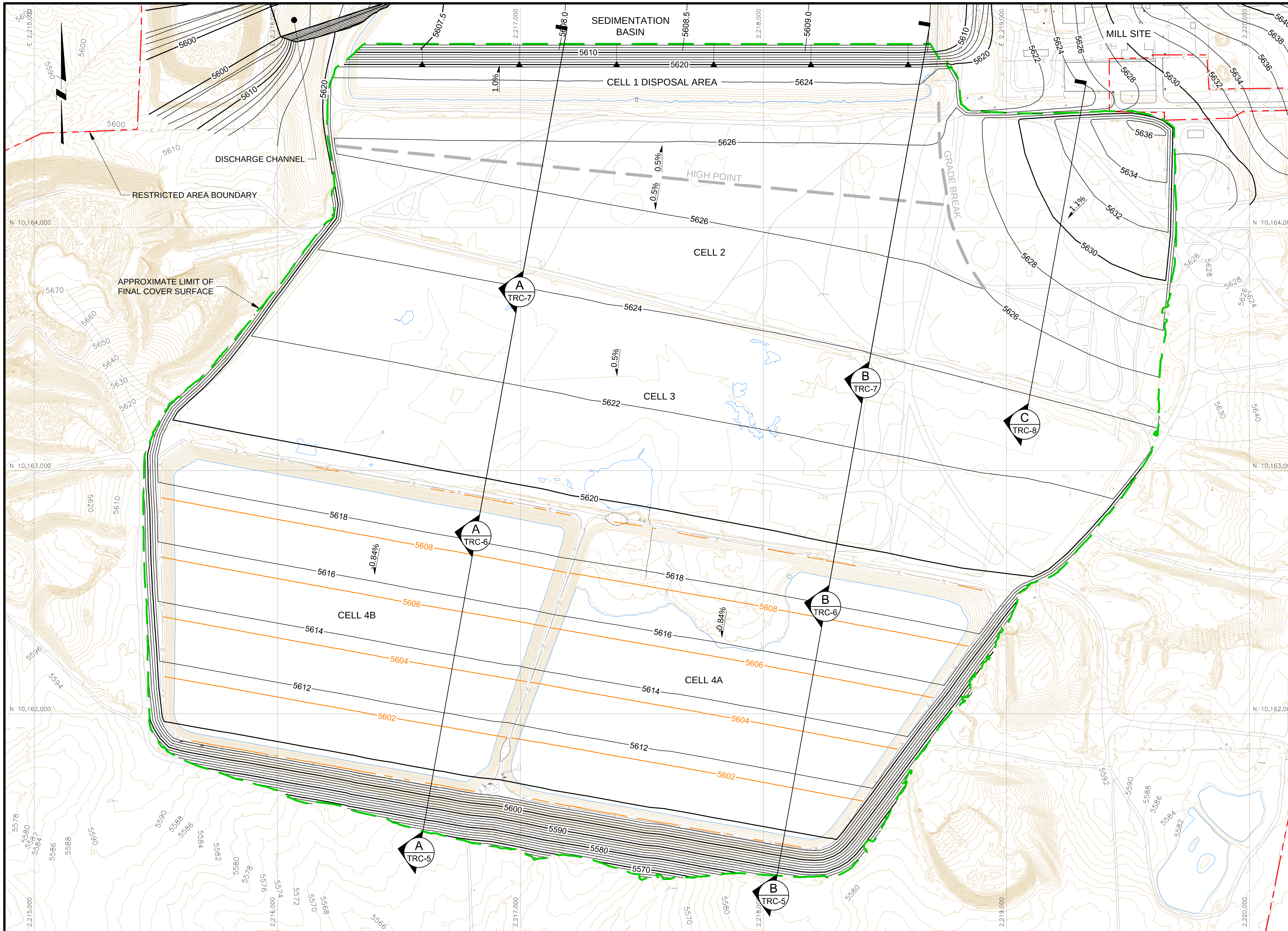
PROJECT: WHITE MESA MILL TAILINGS RECLAMATION

TITLE: COMPACTED COVER GRADING PLAN

MWH

SHEET: TRC-2 | REVISION: B
FILE NAME: WMM TRC-2 | DATE: AUG 2015

L:\Design-Drafting\Clients-A-H\ENERGY FUELS\013-Sheet Set\2015-08-31 COVER DSGN DWGS\WMM TRC-2



LEGEND:

5605	EXISTING GROUND SURFACE ELEVATION, FEET (SEE REFERENCE)
5605	TOP OF FINAL COVER ELEVATION, FEET
5605	MAXIMUM PERMITTED TAILINGS SURFACE CONTOUR AND ELEVATION, FEET
	EXISTING ROAD
	EXISTING WATER
	EXISTING TRAIL
X	EXISTING FENCE
	EXISTING STRUCTURE

ISSUE/REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED WITH EFRI 2015 RESPONSES TO FEB 2013 DRC REVIEW COMMENTS	DM	MD	08–15
A	ISSUED FOR RECLAMATION PLAN REVISION 5.0	DM	RS	08–11

DISCLAIMER:
THIS DRAWING WAS DEVELOPED THROUGH THE APPLICATION OF PROFESSIONAL ENGINEERING SKILL AND PROPRIETARY METHODOLOGIES, PROCESSES AND KNOW HOW OF MWH AS AUTHOR ALL PURSUANT TO THE TERMS OF A CONTRACTUAL SCOPE OF WORK GOVERNING ITS PREPARATION. THIS DRAWING MAY NOT BE USED OR MODIFIED OTHER THAN IN STRICT ACCORDANCE WITH THE TERMS OF THE GOVERNING CONTRACT AND SCOPE OF WORK OR OTHERWISE ABSENT THE INVOLVEMENT AND CONSENT OF THE AUTHOR. ANY ALTERATION OR ADAPTATION OF THIS DRAWING SHALL BE CONSISTENT WITH THE AUTHOR'S CONTRACTUAL AND PROPRIETARY RIGHTS AND BE AT USER'S SOLE RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY OF MWH.

DRAWING REFERENCE(S):
- EXISTING TOPOGRAPHY BASED UPON FILE PROVIDED FROM ENERGY FUELS ON JULY 20, 2015. PER ENERGY FUELS, GROUND SURFACE CONTOURS ARE FROM 2012 AERIAL SURVEY CONDUCTED BY JONES & DeMILLE ENGINEERING INC., EXCEPT FOR CELLS 2 AND 3. CELL 2 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED OCTOBER 2013. CELL 3 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED ON JULY 8, 2014.

DESIGNED BY	M DAVIS	08–15
DRAWN BY	D MIRANDA	08–15
CHECKED BY	C STRACHAN	08–15
APPROVED BY	M DAVIS	08–15
PROJECT MANAGER	M DAVIS	08–15
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Energy Fuels Resources (USA) Inc.

PROJECT LOCATION: BLANDING, UTAH

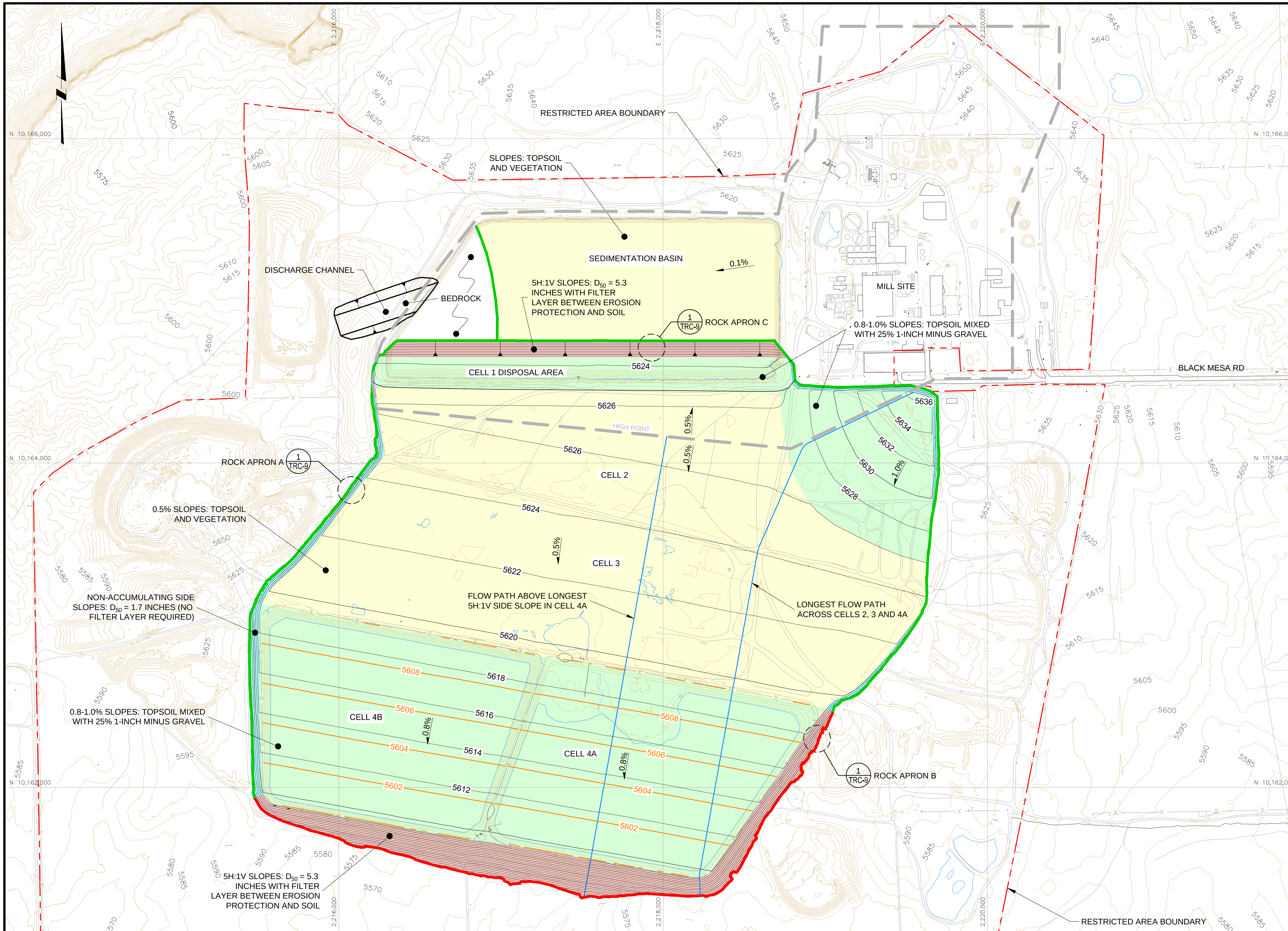
PROJECT: WHITE MESA MILL TAILINGS RECLAMATION

TITLE: FINAL COVER SURFACE LAYOUT

MWH

SHEET: TRC-3
REVISION: B
FILE NAME: WMM TRC-3
DATE: AUG 2015

L:\Design-Drafting\Clients-A-H\ENERGY FUELS\013-Sheet Set\2015-08-31 COVER DSGN DWGS\WMM TRC-3



LEGEND:

5605	EXISTING GROUND SURFACE ELEVATION, FEET (SEE REFERENCE)
5605	TOP ON INTERIM FILL ELEVATION, FEET
5605	MAXIMUM PERMITTED TAILINGS SURFACE CONTOUR AND ELEVATION, FEET
	EXISTING ROAD
	EXISTING WATER
	EXISTING TRAIL
—X—	EXISTING FENCE
☐	EXISTING STRUCTURE

0 300' 600'

ISSUE/REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED WITH EFRI 2015 RESPONSES TO FEB 2013 DRC REVIEW COMMENTS	DM	MD	08–15
A	ISSUED FOR RECLAMATION PLAN REVISION 5.0	DM	RS	08–11

DRAWING REFERENCE(S):
- EXISTING TOPOGRAPHY BASED UPON FILE PROVIDED FROM ENERGY FUELS ON JULY 20, 2015. PER ENERGY FUELS, GROUND SURFACE CONTOURS ARE FROM 2012 AERIAL SURVEY CONDUCTED BY JONES & DeMILLE ENGINEERING INC., EXCEPT FOR CELLS 2 AND 3. CELL 2 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED OCTOBER 2013. CELL 3 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED ON JULY 8, 2014.

DESIGNED BY	M DAVIS	08–15
DRAWN BY	D MIRANDA	08–15
CHECKED BY	C STRACHAN	08–15
APPROVED BY	M DAVIS	08–15
PROJECT MANAGER	M DAVIS	08–15
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Energy Fuels Resources (USA) Inc.

PROJECT LOCATION: BLANDING, UTAH

PROJECT: WHITE MESA MILL TAILINGS RECLAMATION

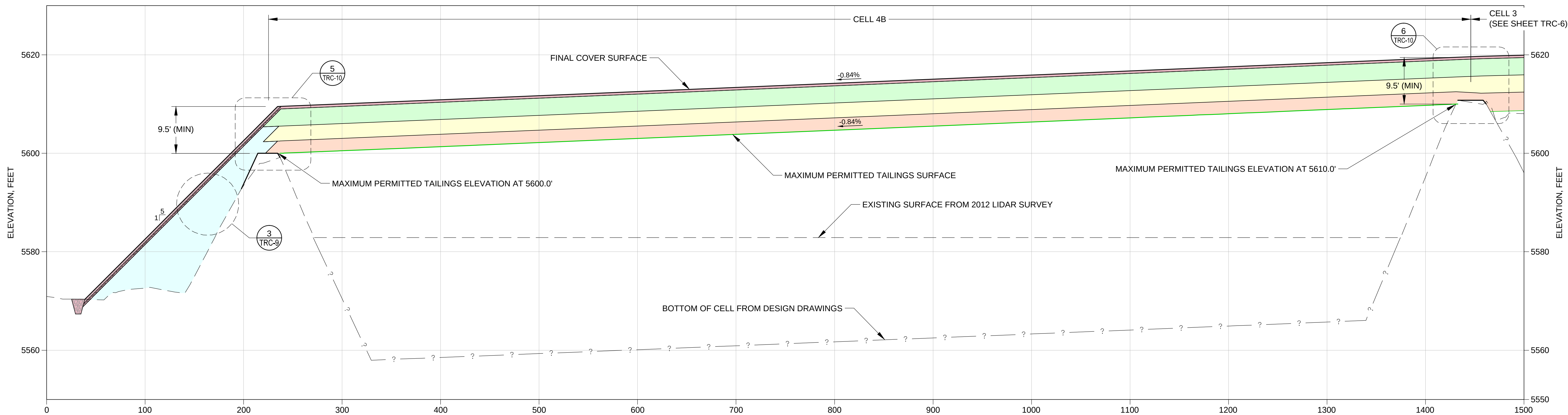
TITLE: RECLAMATION COVER EROSION PROTECTION

MWH

SHEET: TRC-4 REVISION: B

FILE NAME: WMM TRC-4 DATE: AUG 2015

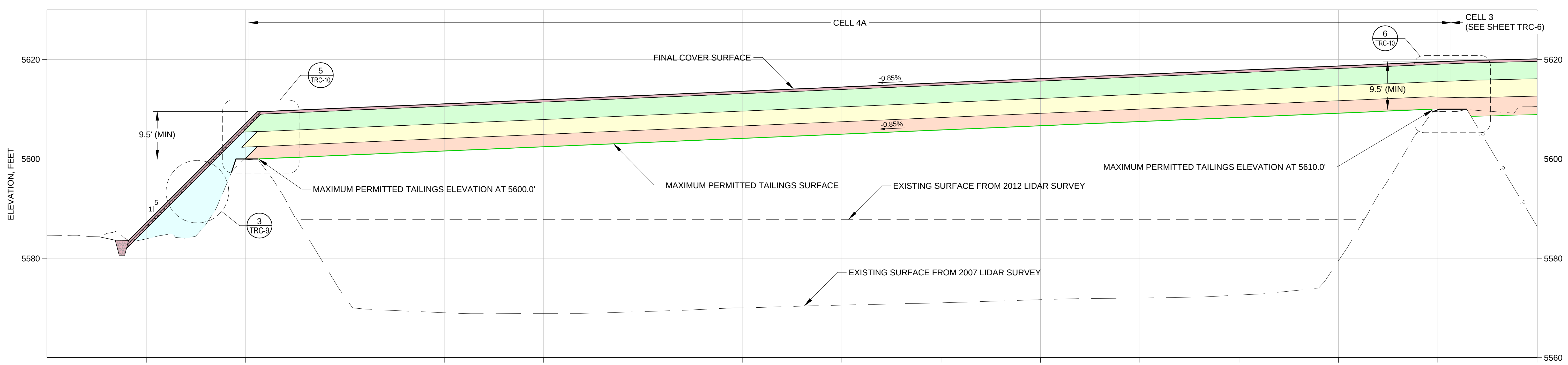
L:\Design–Drafting\Clients–A–H\ENERGY FUELS\013–Sheet Set\2015–08–31 COVER DSGN DWGS\WMM TRC-4



A
TRC-3

TAILINGS COVER

HORZ 0 50 100
VERT 0 10 20
SCALE IN FEET
VERTICAL EXAGGERATION = 5X



B
TRC-3

TAILINGS COVER

HORZ 0 50 100
VERT 0 10 20
SCALE IN FEET
VERTICAL EXAGGERATION = 5X

LEGEND:

- EROSION PROTECTION
- COMPACTED COVER
- RANDOM FILL
- GROWTH MEDIUM
- INTERIM FILL

ISSUE/REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED WITH EFRI 2015 RESPONSES TO FEB 2013 DRC REVIEW COMMENTS	DM	MD	08-15
A	ISSUED FOR RECLAMATION PLAN REVISION 5.0	DM	RS	08-11

DRAWING REFERENCE(S):
- EXISTING TOPOGRAPHY BASED UPON FILE PROVIDED FROM ENERGY FUELS ON JULY 20, 2015. PER ENERGY FUELS, GROUND SURFACE CONTOURS ARE FROM 2012 AERIAL SURVEY CONDUCTED BY JONES & DeMILLE ENGINEERING INC., EXCEPT FOR CELLS 2 AND 3. CELL 2 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED OCTOBER 2013. CELL 3 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED ON JULY 8, 2014.

DESIGNED BY	M DAVIS	08-15
DRAWN BY	D MIRANDA	08-15
CHECKED BY	C STRACHAN	08-15
APPROVED BY	M DAVIS	08-15
PROJECT MANAGER	M DAVIS	08-15
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Energy Fuels Resources (USA) Inc.

PROJECT LOCATION: BLANDING, UTAH

PROJECT: WHITE MESA MILL TAILINGS RECLAMATION

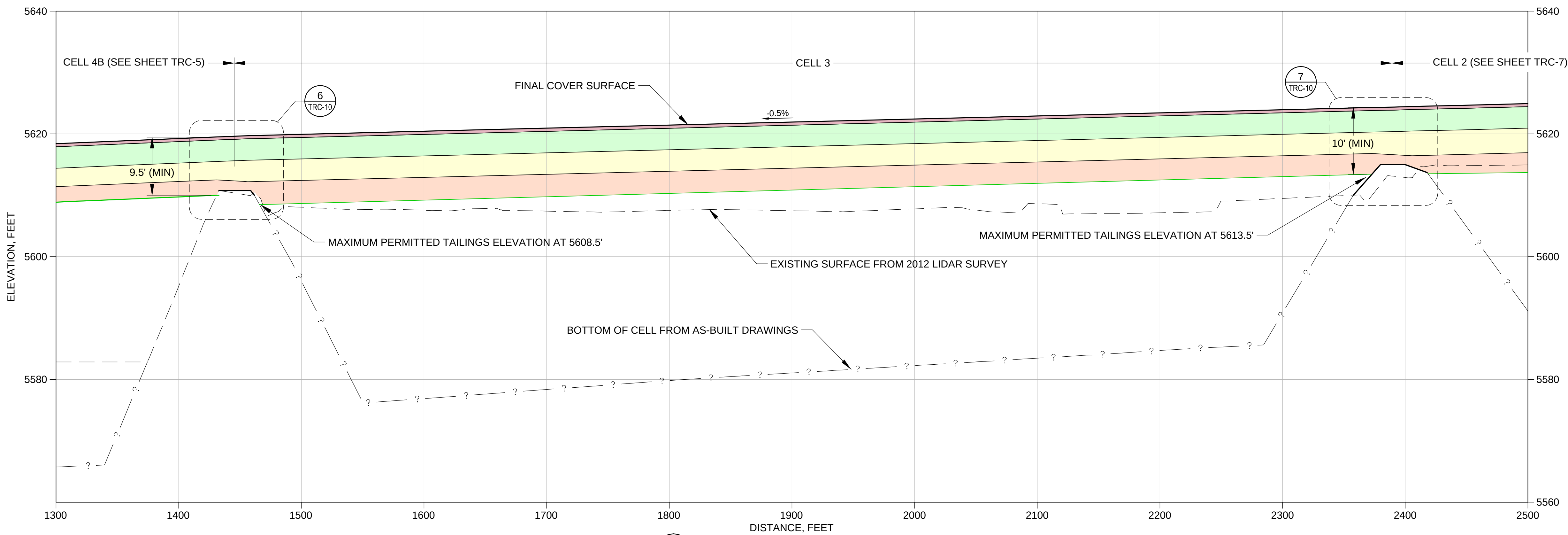
TITLE: COVER OVER CELL 4A & 4B CROSS SECTIONS

MWH

SHEET: TRC-5 | REVISION: B

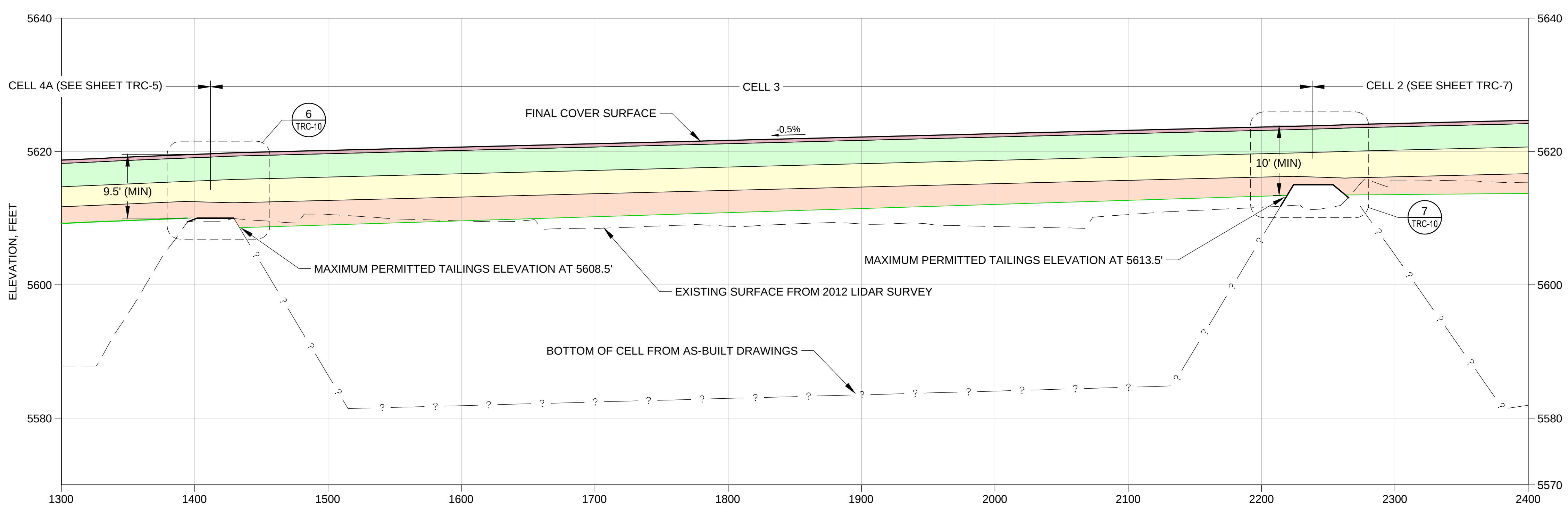
FILE NAME: WMM TRC-5 | DATE: AUG 2015

L:\Design-Drafting\Clients-A-H\ENERGY FUELS\013-Sheet Set\2015-08-31 COVER DSGN DWGS\WMM TRC-5



A TRC-3 TAILINGS COVER

HORZ 0 50 100
VERT 0 10 20
SCALE IN FEET
VERTICAL EXAGGERATION = 5X



B TRC-3 TAILINGS COVER

HORZ 0 50 100
VERT 0 10 20
SCALE IN FEET
VERTICAL EXAGGERATION = 5X

LEGEND:

- EROSION PROTECTION
- GROWTH MEDIUM
- COMPACTED COVER
- INTERIM FILL

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED WITH EFRI 2015 RESPONSES TO FEB 2013 DRC REVIEW COMMENTS	DM	MD	08-15
A	ISSUED FOR RECLAMATION PLAN REVISION 5.0	DM	RS	08-11

DISCLAIMER:
THIS DRAWING WAS DEVELOPED THROUGH THE APPLICATION OF PROFESSIONAL ENGINEERING SKILL AND PROPRIETARY METHODOLOGIES, PROCESSES AND KNOW HOW OF MWH AS AUTHOR ALL PURSUANT TO THE TERMS OF A CONTRACTUAL SCOPE OF WORK GOVERNING ITS PREPARATION. THIS DRAWING MAY NOT BE USED OR MODIFIED OTHER THAN IN STRICT ACCORDANCE WITH THE TERMS OF THE GOVERNING CONTRACT AND SCOPE OF WORK OR OTHERWISE ABSENT THE INVOLVEMENT AND CONSENT OF THE AUTHOR. ANY ALTERATION OR ADAPTATION OF THIS DRAWING SHALL BE CONSISTENT WITH THE AUTHOR'S CONTRACTUAL AND PROPRIETARY RIGHTS AND BE AT USER'S SOLE RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY OF MWH.

DRAWING REFERENCE(S):
- EXISTING TOPOGRAPHY BASED UPON FILE PROVIDED FROM ENERGY FUELS ON JULY 20, 2015. PER ENERGY FUELS, GROUND SURFACE CONTOURS ARE FROM 2012 AERIAL SURVEY CONDUCTED BY JONES & DeMILLE ENGINEERING INC., EXCEPT FOR CELLS 2 AND 3. CELL 2 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED OCTOBER 2013. CELL 3 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED ON JULY 8, 2014.

DESIGNED BY	M DAVIS	08-15
DRAWN BY	D MIRANDA	08-15
CHECKED BY	C STRACHAN	08-15
APPROVED BY	M DAVIS	08-15
PROJECT MANAGER	M DAVIS	08-15
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Energy Fuels Resources (USA) Inc.

PROJECT LOCATION: BLANDING, UTAH

PROJECT: WHITE MESA MILL TAILINGS RECLAMATION

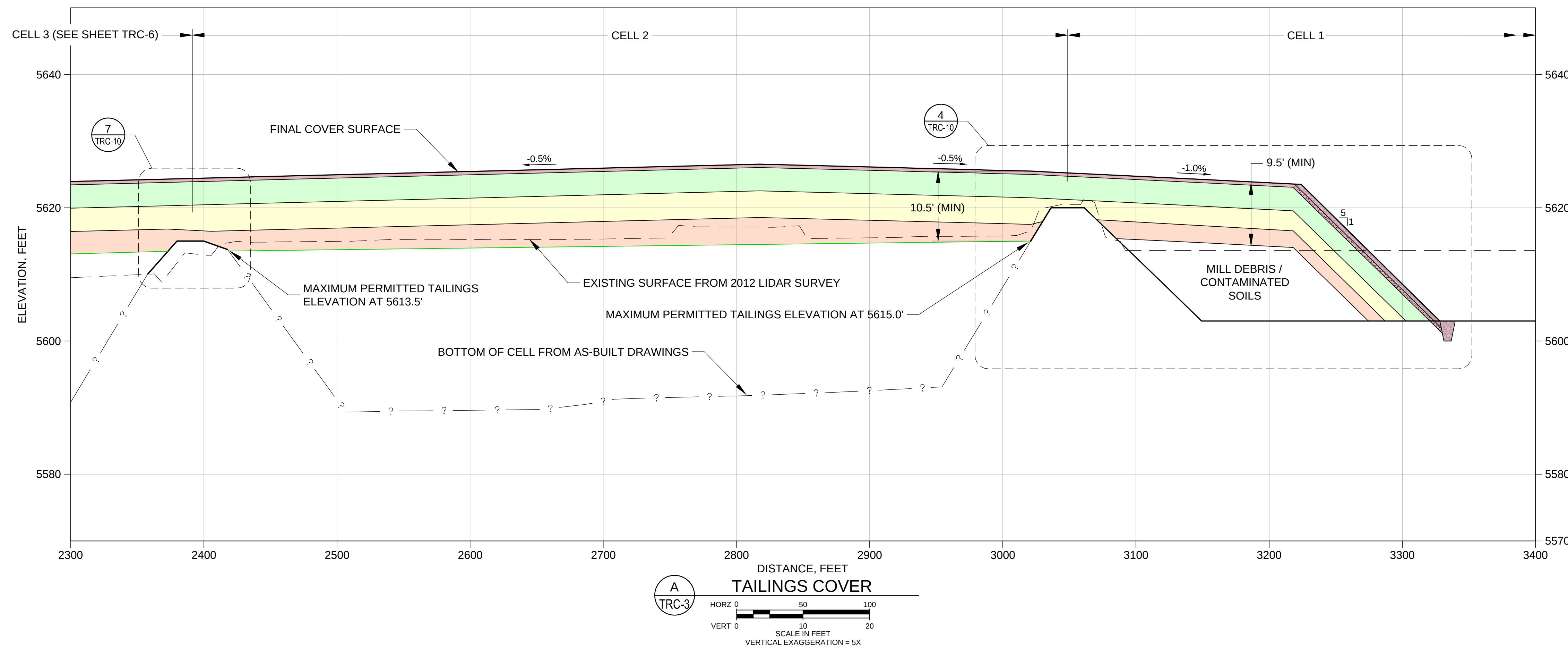
TITLE: COVER OVER CELL 3 CROSS SECTIONS

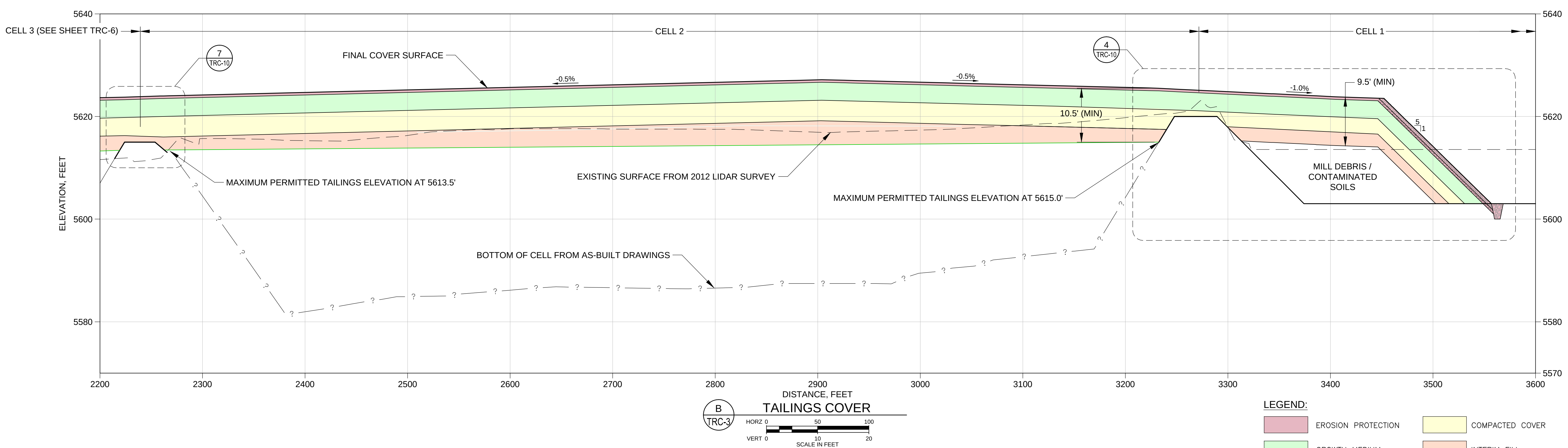
MWH

SHEET: TRC-6 | REVISION: B

FILE NAME: WMM TRC-5 | DATE: AUG 2015

L:\Design-Drafting\Clients-A-H\ENERGY FUELS\013-Sheet Set\2015-08-31 COVER DSGN DWGS\WMM TRC-5





LEGEND:
- EROSION PROTECTION
- GROWTH MEDIUM
- COMPACTED COVER
- INTERIM FILL

ISSUE/REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED WITH EFRI 2015 RESPONSES TO FEB 2013 DRC REVIEW COMMENTS	DM	MD	08-15
A	ISSUED FOR RECLAMATION PLAN REVISION 5.0	DM	RS	08-11

DISCLAIMER:
THIS DRAWING WAS DEVELOPED THROUGH THE APPLICATION OF PROFESSIONAL ENGINEERING SKILL AND PROPRIETARY METHODOLOGIES, PROCESSES AND KNOW HOW OF MWH AS AUTHOR ALL PURSUANT TO THE TERMS OF A CONTRACTUAL SCOPE OF WORK GOVERNING ITS PREPARATION. THIS DRAWING MAY NOT BE USED OR MODIFIED OTHER THAN IN STRICT ACCORDANCE WITH THE TERMS OF THE GOVERNING CONTRACT AND SCOPE OF WORK OR OTHERWISE ABSENT THE INVOLVEMENT AND CONSENT OF THE AUTHOR. ANY ALTERATION OR ADAPTATION OF THIS DRAWING SHALL BE CONSISTENT WITH THE AUTHOR'S CONTRACTUAL AND PROPRIETARY RIGHTS AND BE AT USER'S SOLE RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY OF MWH.

DRAWING REFERENCE(S):
- EXISTING TOPOGRAPHY BASED UPON FILE PROVIDED FROM ENERGY FUELS ON JULY 20, 2015. PER ENERGY FUELS, GROUND SURFACE CONTOURS ARE FROM 2012 AERIAL SURVEY CONDUCTED BY JONES & DeMILLE ENGINEERING INC., EXCEPT FOR CELLS 2 AND 3. CELL 2 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED OCTOBER 2013. CELL 3 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED ON JULY 8, 2014.

DESIGNED BY	M DAVIS	08-15
DRAWN BY	D MIRANDA	08-15
CHECKED BY	C STRACHAN	08-15
APPROVED BY	M DAVIS	08-15
PROJECT MANAGER	M DAVIS	08-15
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Energy Fuels Resources (USA) Inc.

PROJECT LOCATION: BLANDING, UTAH

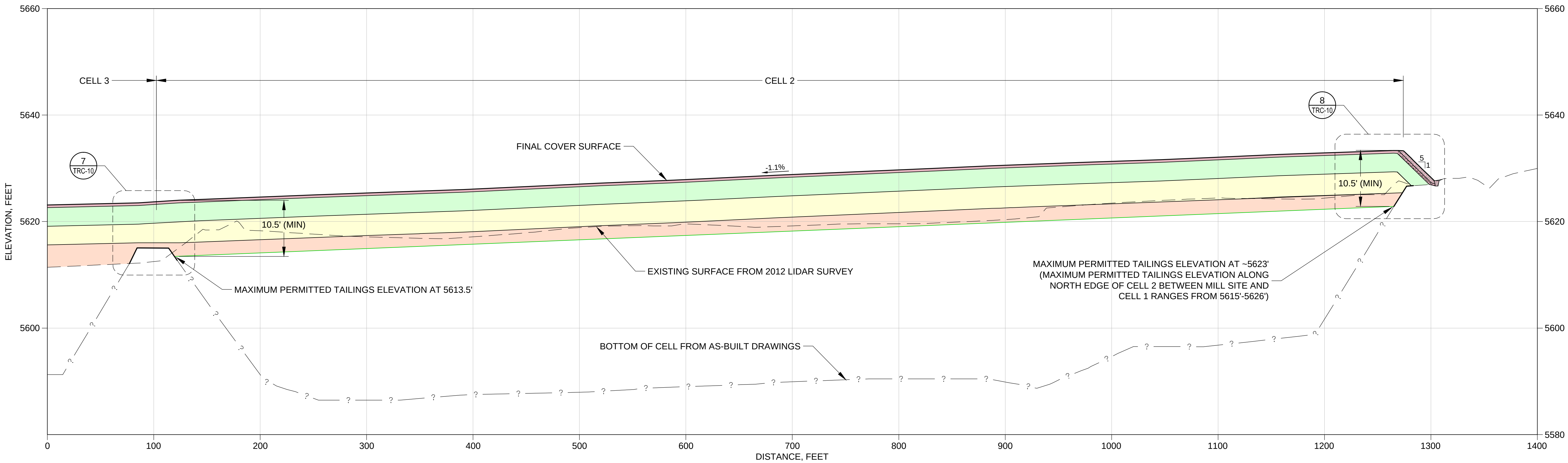
PROJECT: WHITE MESA MILL TAILINGS RECLAMATION

TITLE: COVER OVER CELL 2 CROSS SECTIONS

MWH

SHEET: TRC-7
REVISION: B
FILE NAME: WMM TRC-5
DATE: AUG 2015

L:\Design-Drafting\Clients-A-H\ENERGY FUELS\013-Sheet Set\2015-08-31 COVER DSGN DWGS\WMM TRC-5



C
TRC-3

TAILINGS COVER

HORZ 0 50 100
VERT 0 10 20
SCALE IN FEET
VERTICAL EXAGGERATION = 5X

LEGEND:

- EROSION PROTECTION
- GROWTH MEDIUM
- COMPACTED COVER
- INTERIM FILL

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED WITH EFRI 2015 RESPONSES TO FEB 2013 DRC REVIEW COMMENTS	DM	MD	08–15
A	ISSUED FOR RECLAMATION PLAN REVISION 5.0	DM	RS	08–11

DISCLAIMER:
THIS DRAWING WAS DEVELOPED THROUGH THE APPLICATION OF PROFESSIONAL ENGINEERING SKILL AND PROPRIETARY METHODOLOGIES, PROCESSES AND KNOW HOW OF MWH AS AUTHOR ALL PURSUANT TO THE TERMS OF A CONTRACTUAL SCOPE OF WORK GOVERNING ITS PREPARATION. THIS DRAWING MAY NOT BE USED OR MODIFIED OTHER THAN IN STRICT ACCORDANCE WITH THE TERMS OF THE GOVERNING CONTRACT AND SCOPE OF WORK OR OTHERWISE ABSENT THE INVOLVEMENT AND CONSENT OF THE AUTHOR. ANY ALTERATION OR ADAPTATION OF THIS DRAWING SHALL BE CONSISTENT WITH THE AUTHOR'S CONTRACTUAL AND PROPRIETARY RIGHTS AND BE AT USER'S SOLE RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY OF MWH.

DRAWING REFERENCE(S):
- EXISTING TOPOGRAPHY BASED UPON FILE PROVIDED FROM ENERGY FUELS ON JULY 20, 2015. PER ENERGY FUELS, GROUND SURFACE CONTOURS ARE FROM 2012 AERIAL SURVEY CONDUCTED BY JONES & DeMILLE ENGINEERING INC., EXCEPT FOR CELLS 2 AND 3. CELL 2 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED OCTOBER 2013. CELL 3 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED ON JULY 8, 2014.

DESIGNED BY	M DAVIS	08–15
DRAWN BY	D MIRANDA	08–15
CHECKED BY	C STRACHAN	08–15
APPROVED BY	M DAVIS	08–15
PROJECT MANAGER	M DAVIS	08–15
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

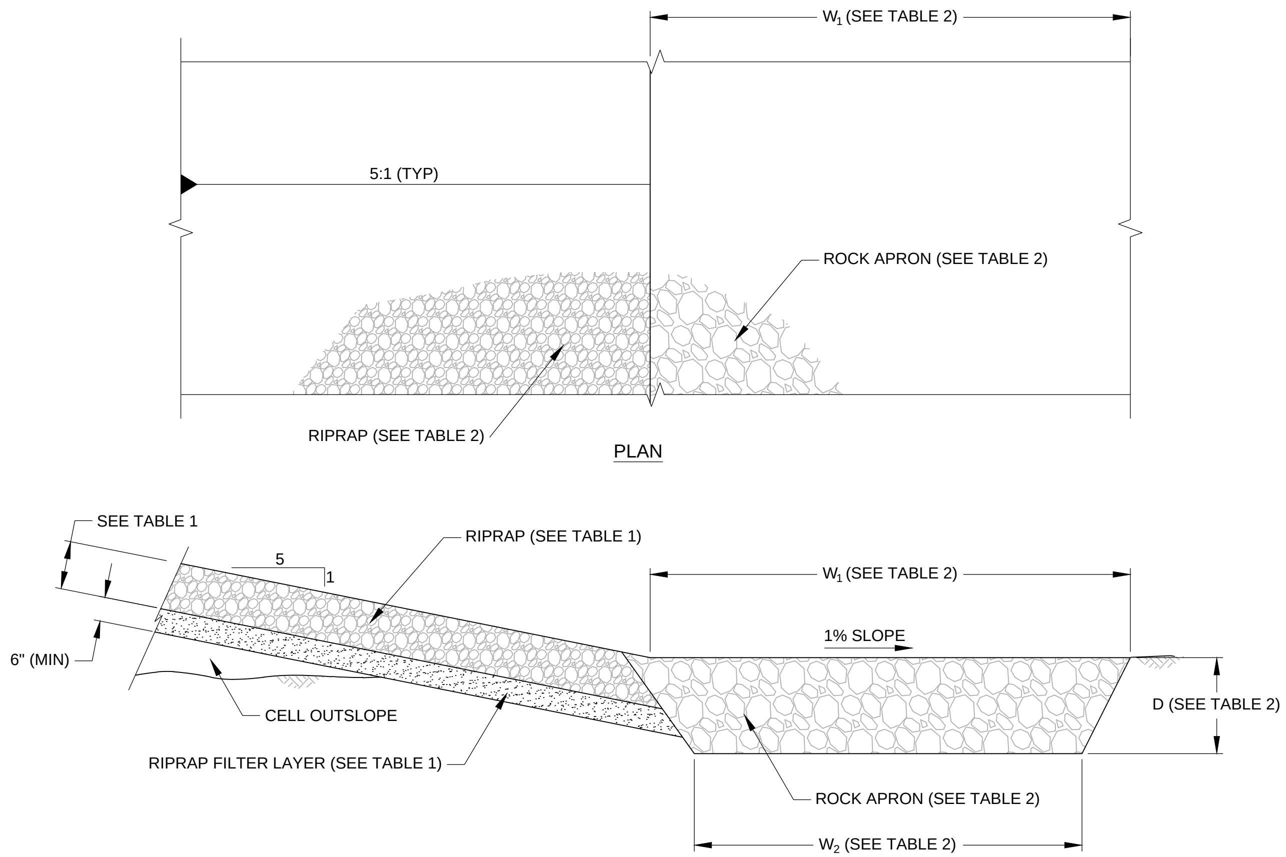
Energy Fuels Resources (USA) Inc.

PROJECT LOCATION: BLANDING, UTAH
PROJECT: WHITE MESA MILL TAILINGS RECLAMATION
TITLE: COVER OVER CELL 2 CROSS SECTION

MWH

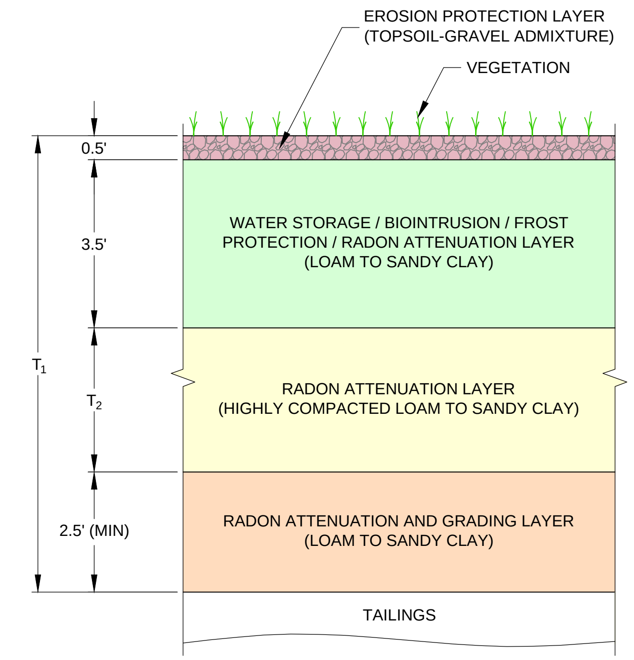
SHEET: TRC-8
REVISION: B
FILE NAME: WMM TRC-5
DATE: AUG 2015

L:\Design-Drafting\Clients-A-H\ENERGY FUELS\013-Sheet Set\2015-08-31 COVER DSGN DWGS\WMM TRC-5



1 TRC-4 ROCK APRON AT BASE OF TOE CELL OUTSLOPES

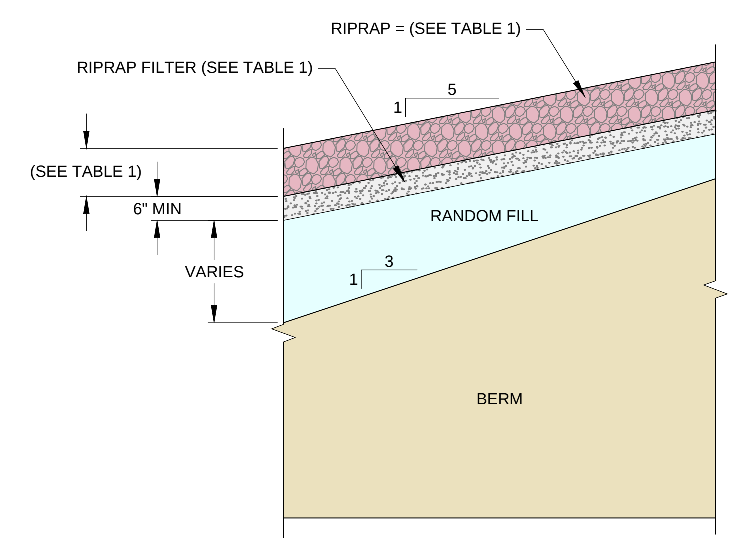
0 2 4 SCALE IN FEET



2 - COVER DETAIL FOR TOP SURFACE OF TAILINGS CELLS AND CELL 1 DISPOSAL AREA

NOT TO SCALE

COVER THICKNESS TABLE		
CELL	COVER (T_1)	RADON ATTENUATION LAYER (T_2)
1	9.5'	3.0'
2	10.5'	4.0'
3	10.0'	3.5'
4A & 4B	9.5'	3.0'



3 - COVER DETAIL FOR SIDE SLOPES

NOT TO SCALE

LEGEND:
- EROSION PROTECTION
- GROWTH MEDIUM
- COMPACTED COVER
- INTERIM FILL
- RANDOM FILL

TABLE 1 - RIPRAP ON SIDE SLOPES				
SIDE SLOPE AREA	RIPRAP D_{50}		FILTER	
	D_{50}	THICKNESS	D_{100}	THICKNESS
EAST & WEST SIDES	1.7"	6"	(NOT NEEDED)	-
CELL 4A & 4B SOUTHERN	5.3"	8"	3"	6"
CELL 1 DISPOSAL AREA	5.3"	8"	3"	6"

TABLE 2 - ROCK APRON SCHEDULE				
ROCK APRON TYPE	APRON RIPRAP D_{50}	(MINIMUM)		
		W_1	W_2	DEPTH (D)
A	3.4"	4.5'	2.5'	1'
B	10.6"	13.5'	7.5'	3'
C	9.0"	11.5'	5.5'	3'

ISSUE/REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED WITH EFRI 2015 RESPONSES TO FEB 2013 DRC REVIEW COMMENTS	DM	MD	08-15
A	ISSUED FOR RECLAMATION PLAN REVISION 5.0	DM	RS	08-11

DESIGNED BY	M DAVIS	08-15
DRAWN BY	D MIRANDA	08-15
CHECKED BY	C STRACHAN	08-15
APPROVED BY	M DAVIS	08-15
PROJECT MANAGER	M DAVIS	08-15
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

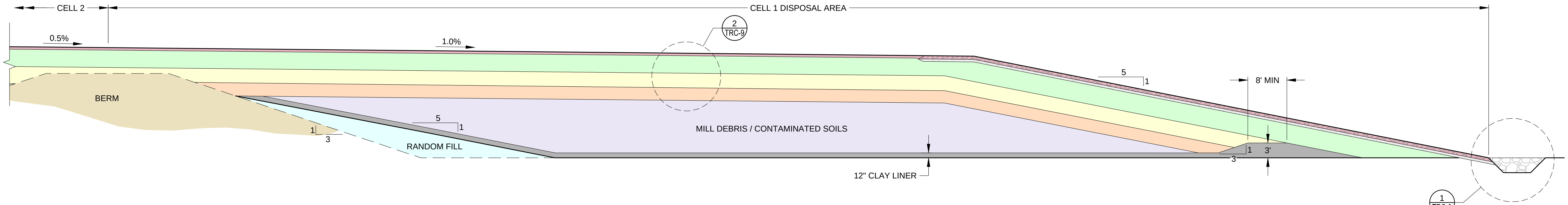
Energy Fuels Resources (USA) Inc.

PROJECT LOCATION: BLANDING, UTAH
PROJECT: WHITE MESA MILL TAILINGS RECLAMATION
TITLE: RECLAMATION COVER DETAILS (SHEET 1 OF 2)

MWH

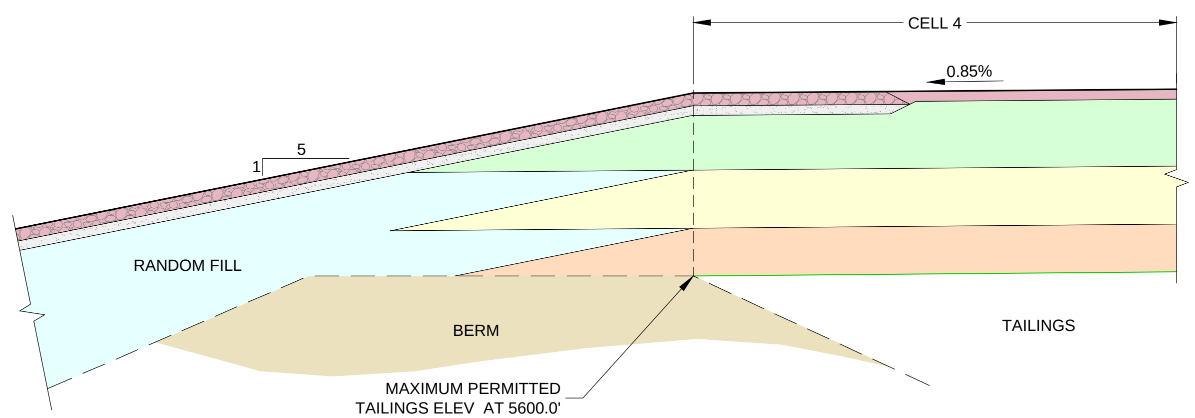
SHEET: TRC-9 | REVISION: B
FILE NAME: WMM TRC-9 | DATE: AUG 2015

L:\Design-Drafting\Clients-A-H\ENERGY FUELS\013-Sheet Set\2015-08-31 COVER DSGN DWGS\WMM TRC-9



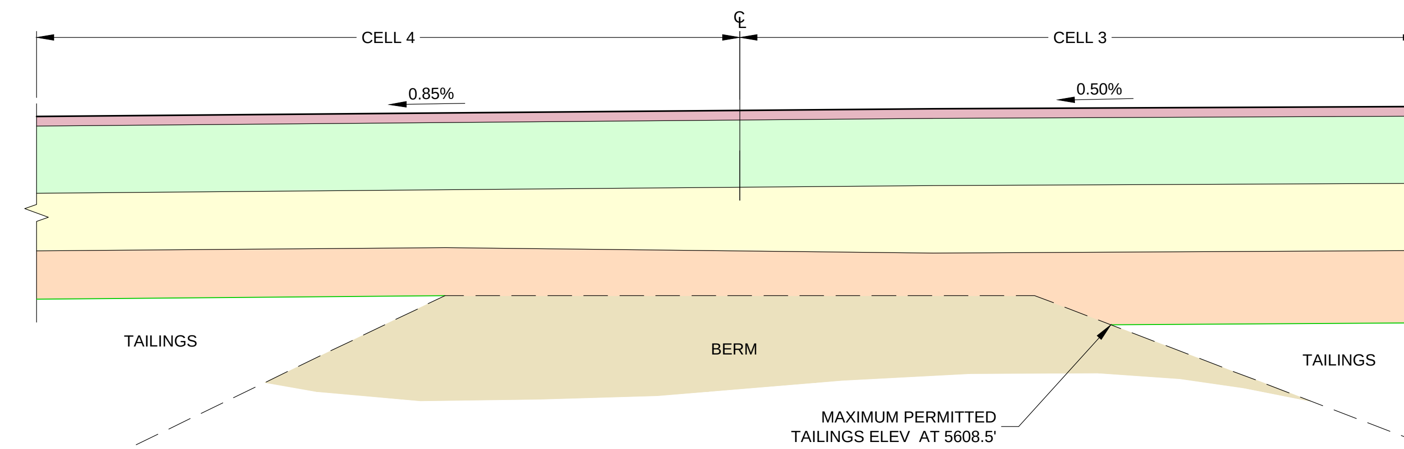
4 / TRC-7 COVER DETAIL FOR CELL 1 DISPOSAL AREA

0 10 20



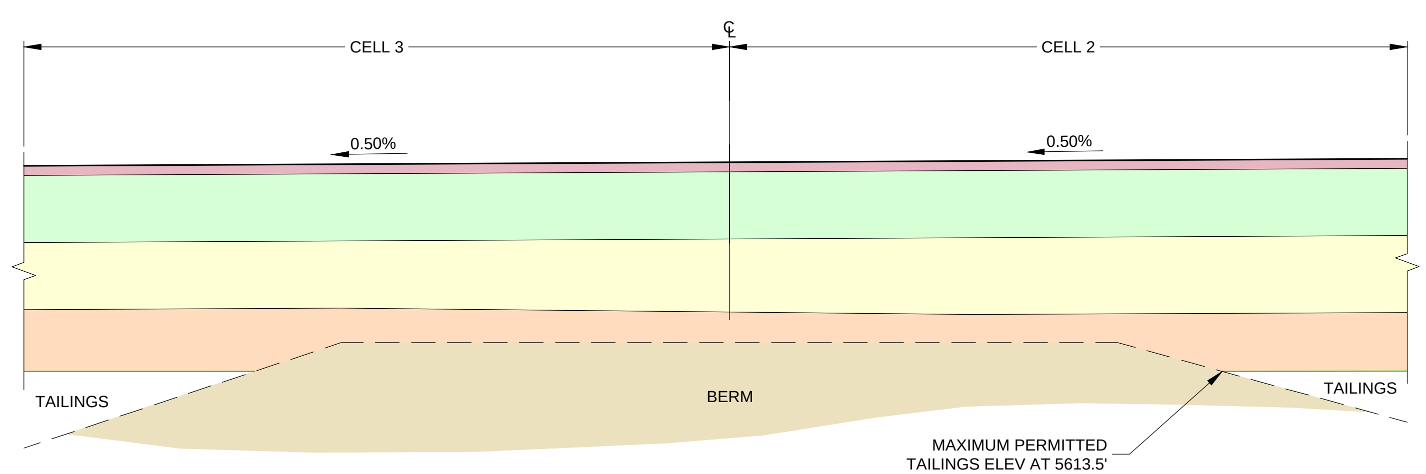
5 / TRC-5 COVER DETAIL OVER BERM - SOUTHERN EDGE CELL 4

0 5 10



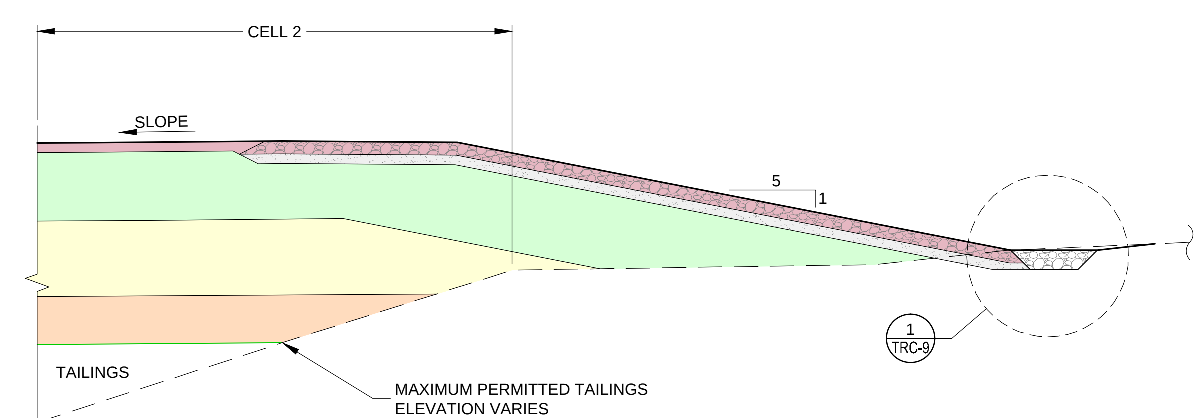
6 / TRC-5 6 / TRC-6 COVER DETAIL OVER BERM - BETWEEN CELL 4 AND CELL 3

0 5 10



7 / TRC-6 7 / TRC-7 7 / TRC-8 COVER DETAIL OVER BERM - BETWEEN CELL 3 AND CELL 2

0 5 10



8 / TRC-8 COVER DETAIL OVER BERM - NORTHEASTERN EDGE OF CELL 2

0 5 10

LEGEND:

- EROSION PROTECTION
- GROWTH MEDIUM
- COMPACTED COVER
- INTERIM FILL
- RANDOM FILL

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED WITH EFRI 2015 RESPONSES TO FEB 2013 DRC REVIEW COMMENTS	DM	MD	08–15
A	ISSUED FOR RECLAMATION PLAN REVISION 5.0	DM	RS	08–11

DESIGNED BY	M DAVIS	08–15
DRAWN BY	D MIRANDA	08–15
CHECKED BY	C STRACHAN	08–15
APPROVED BY	M DAVIS	08–15
PROJECT MANAGER	M DAVIS	08–15
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Energy Fuels Resources (USA) Inc.

PROJECT LOCATION: BLANDING, UTAH

PROJECT: WHITE MESA MILL TAILINGS RECLAMATION

TITLE: RECLAMATION COVER DETAILS (SHEET 2 OF 2)

MWH

SHEET: TRC-10 | REVISION: B

FILE NAME: WMM TRC-10 | DATE: AUG 2015

L:\Design-Drafting\Clients-A-H\ENERGY FUELS\013-Sheet Set\2015-08-31 COVER DSGN DWGS\WMM TRC-10

ATTACHMENT C

SUPPORTING DOCUMENTATION FOR INTERROGATORY 03/1, 04/1, AND 13/1:

REVISED TECHNICAL SPECIFICATIONS AND CONSTRUCTION QUALITY ASSURANCE/ QUALITY CONTROL PLAN TO ATTACHMENT A AND B OF RECLAMATION PLAN, REVISION 5.0

ATTACHMENT C.1

REVISED TECHNICAL SPECIFICATIONS AND CONSTRUCTION QUALITY ASSURANCE/ QUALITY CONTROL PLAN TO ATTACHMENT A OF RECLAMATION PLAN, REVISION 5.0

PLANS AND TECHNICAL SPECIFICATIONS FOR

RECLAMATION OF WHITE MESA MILL FACILITY

BLANDING, UTAH

TABLE OF CONTENTS

1.0 SPECIAL PROVISIONS

1.1 Scope of Document

The following technical specifications have been prepared for reclamation and decommissioning of the Energy Fuels Resources (USA) Inc. (”EFRI”), White Mesa Uranium Mill Facility (“Mill”) in Blanding, Utah. These technical specifications have been prepared for review and approval by the Utah Department of Environment Quality (“DEQ”), Division of Waste Management and Radiation Control (“DWMRC”) and are submitted as an attachment to the Reclamation Plan. The design drawings for reclamation are included in this attachment and are designated as the “Drawings”. The Construction Quality Assurance/Quality Control Plan (“CQA/QC Plan”) referenced in this document is provided as Attachment B to the Reclamation Plan.

These technical specifications have been written assuming (a) a contractor will conduct tailings impoundment reclamation under contract with EFRI and under EFRI’s direction, and (b) the work quality will be checked with independent (third-party) construction quality assurance.

1.2 Definitions and Roles

Construction Quality Assurance (CQA) – A planned and systematic pattern of means and actions designed to assure adequate confidence that the materials or services meet contractual and regulatory requirements and will perform satisfactorily in service. CQA refers to means and actions employed by the involved parties to assure conformity of the project work with the CQA/QC Plan, the Drawings, and the Technical Specifications.

Construction Quality Control (CQC) – Actions which provide a means to measure and regulate the characteristics of an item or service in relation to contractual and regulatory requirements. CQC refers to those actions taken by the Contractor, technicians, or other involved parties to verify that the materials and the workmanship meet the requirements of the CQA/QC Plan, the Drawings, and the Technical Specifications.

Technical Specifications – The document that prescribes the requirements and standards for the specific elements of the reclamation. The Technical Specifications will be prepared in final form prior to commencement of reclamation activities.

Drawings – The detailed project drawings to be used in conjunction with the Technical Specifications. The Drawings will be prepared in final form as construction drawings prior to reclamation.

Construction Project – The total authorized/approved reclamation project that requires several construction segments to complete.

Construction Segment – A portion of the total construction project involving a specific area or type of work. Several construction segments will likely take place simultaneously during reclamation.

Construction Task – A basic construction feature of a construction segment involving a specific construction activity.

ASTM Standards – The latest versions of the American Society for Testing and Materials specifications, procedures and methods.

For these Technical Specifications, EFRI is referred to as the **Owner**, with overall responsibility for closure, as well as site reclamation.

The on-site **Construction Manager** is responsible for the conduct, direction and supervision of all reclamation activities as detailed in the Drawings and Technical Specifications.

The **Design Engineer** is responsible for the design of the various elements of the reclamation project and for preparing the Drawings and Technical Specifications.

The **Contractor** is defined as the group (or groups) selected by EFRI and responsible for conducting the work tasks outlined in Section 1.3 under the direction of, and under contract with EFRI.

The **Surveyor** is a party, independent from the Owner or Contractor, who is responsible for surveying, documenting, and verifying the location of all significant components of the work.

The **CQA/QC Consultant** is a party, independent from the Owner or Contractor, who is responsible for observing, testing, and documenting the various activities comprising the Reclamation Project in accordance with the CQA/QC Plan, the Technical Specifications and the Drawings.

The **CQA Officer** will be responsible for overall implementation and management of the CQA/QC Plan for the reclamation project.

The **CQA Site Manager** will be appointed by the CQA Consultant to provide day-to-day, on-site oversight of the CQA/CQC activities. The CQA Manager could be an EFRI employee or a third-party consultant.

The CQA Consultant will utilize various **QC Technicians** to assist the on-site CQA Site Manager to perform specific tasks through the project to verify the adequacy of construction materials and procedures.

The **Document Control Officer** will be appointed by the Construction Manager to assist with managing the various documents that will be produced throughout the project.

The **CQA Laboratory** is a party, independent from the Owner and Contractor, responsible for conducting tests of soils and other project materials in accordance with ASTM and other applicable standards in either an on-site or off-site laboratory.

The **DWMRC Project Manager** will represent the DWMRC's interests in the reclamation project.

The CQA/QC Plan (Attachment B of the 2011 Reclamation Plan) contains more detailed descriptions of the project roles.

1.3 Scope of Work

The work outlined in these Technical Specifications consists of execution of the following tasks associated with reclamation of the disposal cells and associated site reclamation.

a. Preparation of borrow areas for material excavation by removal of vegetation; and stripping, salvaging, and stockpiling of topsoil;

b. Preparation of material staging and stockpile areas by removal of vegetation; stripping, salvaging, and stockpiling of topsoil; and providing for storm water diversion and internal water collection;

c. Removal of raffinates and PVC liner materials from Cell 1 and placement within the last active tailings cell;

d. Construction of a clay-lined disposal cell along the Cell 1 containment dike for disposal of mill demolition debris and contaminated soils;

e. Construction of a sedimentation basin in the location of Cell 1;

f. Excavation of process area structure foundations, paved areas, concrete pads and roadways, and placement of these materials in the disposal cell;

g. Excavation of contaminated subsoils from the process area, and placement in the last active tailings cell or the Cell 1 Disposal Area.

h. Construction of the cover system over the tailings cells, with placement of rock mulch and/or topsoil over the disposal cell cover surface.

i. Regrading and placement of topsoil over excavated areas, stockpile and staging areas, and other disturbed areas of the site.

j. Establishment of vegetation on the disposal cell surface and surrounding reclaimed areas on site.

Work not included in these Technical Specifications consists of salvage of facility equipment, demolition of facility structures, groundwater monitoring and remediation, and post-reclamation performance monitoring.

1.4 Applicable Regulations and Standards

The work shall conform to applicable Federal, State, and County environmental and safety regulations. The work shall conform to applicable conditions in the Owner's radioactive materials license. Geotechnical testing procedures shall conform to applicable ASTM standards, as documented in the most current edition of standards in force at the start of work. Personnel safety procedures and monitoring shall be conducted in accordance with the Owner's Radiation Protection Manual for Reclamation and as directed by the Radiation Safety Officer (RSO).

1.5 Permits

The work will be conducted under the Owner's existing radioactive materials license and State of Utah Air Quality Approval Order (DAQE-AN0112050018-11, issue date March 3, 2011). The Contractor will be responsible for applying for, and obtaining (permit fees included), all other necessary permits required to complete the work outlined in these Technical Specifications.

1.6 Inspection and Quality Assurance

In general, the QA/QC Plan details the Owner's organizational structure and responsibilities, qualifications of personnel, operating procedures and instructions, record keeping and document control, and quality control in the sampling procedure and outside laboratory. The Plan will adopt the existing quality assurance/quality control procedures utilized in compliance with the existing license.

The RSO (and approved assistants as needed) will conduct on-site training, and full-time personnel monitoring, and inspection of construction activities while the site reclamation work is in progress. The RSO (and assistants) will be independent representatives of and appointed by the Owner. The responsibilities and duties of the RSO shall be as outlined in the Owner's Protection Manual for Reclamation.

The CQA Manager (and approved assistants as needed) will provide full-time, on-site inspection of all construction activities and quality assurance testing outlined in these Technical Specifications and the CQA/QC Plan while the construction work is in progress. The CQA Manager and assistants will be independent representatives of and appointed by the Owner. The inspection and CQA testing conducted by the CQA Manager shall be under the supervision of the Reclamation Project Manager. Inspection and CQA testing shall include the tasks described in the CQA/QC Plan and listed below.

a. Observation of construction practices and procedures for conformance with the Technical Specifications.
b. Testing material characteristics to ensure that earthen materials used in the construction conform to the requirements in the Technical Specifications.
c. Documentation of construction activities, test locations, samples, and test results.
d. Notification of results from quality assurance testing to the Owner and the Contractor.
e. Documentation of field design modifications or approved construction work that deviates from the Technical Specifications.

The CQA Manager shall record the documentation outlined above on a daily basis. The Reclamation Project Manager shall approve deviations from the Technical Specifications (if necessary), with notification to the Owner and DWMRC or other appropriate Utah state regulatory agency personnel. Quality control procedures have been developed for reclamation and presented in Attachment B of this Reclamation Plan. Procedures will be used for testing, sampling, and inspection functions.

1.7 Construction Documentation

During construction, the CQA Manager will record documentation of construction inspection work on a daily basis. Documentation will include the following items.

a. Work performed by the Contractor.
b. CQA testing and surveying work conducted.
c. Discussions with the Owner and the Contractor.
d. Key decisions, important communications, or design modifications.
e. General comments including: weather conditions, work area surface conditions, and visitors to the site.

All earthwork test results will be documented on a daily basis, with a copy of the results given to the CQA Manager by the end of the following working day after the testing.

The CQA Manager or his representative will take photographs of key construction activities and critical items for documentation.

A final construction completion report, documenting the as-built conditions of the tailings impoundment reclamation components will be submitted to DWMRC at the end of construction. This report will include the following items.

a. All design modifications or changes to the Technical Specifications that were made during construction.
b. An as-built layout of the facility prior to, and at the completion of reclamation construction.
c. An as-built layout of other reclaimed areas of the site.
d. Documentation of soil cleanup verification work (soil radiation survey and soil sampling and analyses) in areas of contaminated soil excavation.
e. Documentation of the revegetation work (soil amendments, seed mix, and vegetation establishment).

1.8 Design Modifications

Design modifications (due to unanticipated site conditions or field improvements to the design) will be made following the protocol outlined below.

a. Communication of modification with the Reclamation Project Manager.
b. Submittal to, and review by, DWMRC for approval.
c. Documentation of modification(s) in the construction completion report.

1.9 Environmental Requirements

The Contractor shall store materials, confine equipment, and maintain construction operations according to applicable laws, ordinances, or permits for the project site. Fuel, lubricating oils, and chemicals shall be stored and dispensed in such a manner as to prevent or contain spills and prevent said liquids from reaching local streams or groundwater. If quantities of fuel, lubricating oils or chemicals exceed the threshold quantities specified in Utah regulations, the Contractor shall prepare and follow a Spill Prevention Control and Countermeasures Plan (SPCCP), as prescribed in applicable Utah regulations. The Owner shall approve said plan. Used lubricating oils shall be disposed of or recycled at an appropriate facility. Disposal of all waste associated with the project work will be the responsibility of the Contractor.

1.10 Water Management

The Contractor shall construct and maintain all temporary diversion and protective works required to divert storm water from around work areas. The Contractor shall furnish, install, maintain, and operate all equipment required to keep excavations and other work areas free from water in order to construct the facilities as specified.

Water required by the Contractor for dust suppression or soil-moisture conditioning shall be obtained from the Owner.

1.11 Historical and Archeological Considerations

The Contractor shall immediately notify the Owner if materials of potential historical or archeological significance are discovered or uncovered. The Owner may stop work in a specific area until the materials can be evaluated for historical, cultural, or archeological significance. All materials determined to be of significance shall be protected as determined by appropriate regulatory agencies, including removal or adjustment of work areas.

1.12 Health and Safety Requirements

Work outlined in these Technical Specifications shall be conducted under the Owner's Radiation Protection Manual for Reclamation, as directed by the RSO.

The Contractor shall suspend construction or demolition operations or implement necessary precautions whenever (in the opinion of the Reclamation Project Manager or RSO), unsatisfactory conditions exist due to rain, snow, wind, cold temperatures, excessive water, or unacceptable traction or bearing capacity conditions. The CQA Manager, Reclamation Project

Manager, and RSO each have the authority to stop Contractor work if unsafe conditions or deviations from Technical Specifications are observed.

1.13 Personnel Monitoring

Programs currently in place for monitoring of exposures to employees will remain in effect throughout the time period during which tailings cell reclamation, mill decommissioning and clean up of windblown contamination are conducted. These programs will include personnel monitoring and the ongoing bioassay program. Access control will be maintained at the Restricted Area boundary to ensure employees and equipment are released from the site in accordance with the current License conditions. In general, no changes to the existing programs are expected and reclamation activities are not expected to increase exposure potential beyond the current levels. The Owner will assign an employee to act as RSO responsible for assuring site workers comply with the Owner's Radiation Protection Manual for Reclamation and the requirements set forth in the Owner's radioactive materials license.

1.14 Environmental Monitoring

Existing environmental monitoring programs will continue during the time period in which reclamation and decommissioning is conducted. This includes monitoring of surface and groundwater, airborne particulates, radon, soils and vegetation, according to the existing License conditions. In general, no changes to the existing programs are expected and reclamation activities are not expected to increase exposure potential beyond the current levels.

2.0 SITE CONDITIONS

2.1 Site Location

The White Mesa mill site is located about 6 miles south of Blanding, Utah in San Juan County, along County Road 191.

2.2 Climate and Geology

The climate of southeastern Utah is classified as dry to arid continental. Although varying somewhat with elevation and terrain, the climate in the vicinity of the mill can be considered as semi-arid with normal annual precipitation of about 13.3 inches. The mean annual relative humidity is about 44 percent and is normally highest in January and lowest in July. The average annual Class A pan evaporation rate is 68 inches (National Oceanic and Atmospheric Administration and U.S. Department of Commerce, 1977), with the largest evaporation rate typically occurring in July. (Denison, 2009)

The mill is located within the Blanding Basin of the Colorado Plateau physiographic province. The average elevation of the site is approximately 5,600 ft (1,707 m) above mean sea level (amsl). Typical of large portions of the Colorado Plateau province, the rocks underlying the site are relatively undeformed. The site is underlain by unconsolidated alluvium and indurated sedimentary rocks consisting primarily of sandstone and shale. The alluvial materials consist mostly of aeolian silts and fine-grained aeolian sands with a thickness varying from a few feet to as much as 25 to 30 ft (7.6 to 9.1 m) across the site. The alluvium is underlain by the Dakota Sandstone and Burro Canyon Formation, which are sandstones having total thicknesses ranging from approximately 100 to 140 ft (31 to 43 m). (Denison, 2009)

2.3 Past Operations

The mill is a uranium/vanadium mill that was developed in the late 1970's by Energy Fuels Nuclear, Inc. ("EFN") as an outlet for the many small mines located in the Colorado Plateau and for the possibility of milling Arizona strip ores. Construction on the tailings area began on August 1, 1978. The mill was operated by EFN from the initial start-up date of May 6, 1980 until the cessation of operations in 1983 and then intermittently under different ownership through present-day. Denison (then named International Uranium (USA) Corporation), and its affiliates, purchased the assets of EFN in May 1997. Energy Fuels Resources (USA), Inc. purchased the facility in 2012 and is the current owner.

2.4 Facilities Demolition

Demolition of equipment, structures, and associated facilities at the mill site will be conducted according to applicable conditions of the radioactive materials license, the demolition plan for the facility, and the Owner's Radiation Protection Manual for Reclamation. Facilities demolition is not included in this document.

2.5 Disposed Materials

Materials to be placed in the disposal and tailings cells consists of process waste materials, structural debris, underlying liner materials, and subsoils from planned site cleanup activities. Additional detail on each material type is outlined later in the Specification. The four major types of materials are outlined below:

- Raffinate Crystals – located in Cell 1,
- Synthetic Liner – PVC liner from Cell 1,
- Contaminated Soils - soils located in and around the mill site with concentrations exceeding prescribed unity rule concentrations (see Section 6)
- Mill Debris – all equipment and structures from the demolition of the mill

2.6 Construction Materials

Construction materials for the disposal cell liner, cover system, and for erosion protection of the cover and discharge channel will include soils and aggregates from on-site and off-site sources. These materials are outlined below.

2.6.1 Liner Materials

The disposal cell will be constructed, prior to the placement of contaminated soils and mill demolition debris, with a compacted clay liner consisting of fine-grained soils. The fine-grained soils will be obtained from suitable materials stockpiled on site during cell construction.

2.6.2 Random Fill

Random fill will be used within the disposal cell and tailings cells, placed on and around mill material and debris and placed for the components of the cover system. Fill materials will be obtained from soils stockpiled on site.

2.6.3 Topsoil

Topsoil for the surface of the disposal cell and surrounding areas to be revegetated will be obtained from on-site stockpile areas.

2.6.4 Rock Mulch

A mixture of gravel and topsoil will be used in select areas on the cover. The mixture will be 25 percent gravel (with a D_{100} less than 1-inch) by weight. The sources of rock are nearby commercial sources of alluvial gravel. Rock mulch shall meet the particle-size distribution requirements outlined in Section 8.

2.6.5 Erosion Protection and Perimeter Apron Material

A layer of rock will form the erosion protection zone on the side slopes and on the perimeter apron of the disposal cell as well as within the discharge channel. The sources of rock are nearby commercial sources of alluvial gravel and cobbles. Perimeter apron material shall meet the particle-size distribution and durability requirements outlined in Section 8, and shall meet requirements for rock durability outlined in NRC (1990) and Johnson (1999, 2002).

2.6.6 Filter Materials

Filter layer materials will be obtained from an off-site local commercial source or from select on-site borrow areas.

2.6.7 Granular Materials

Granular materials will be used for filter material and may also be used for subsurface fill for the cell base. These materials will be obtained from off-site commercial sources of alluvial sand and gravel.

2.7 Staging and Stockpile Areas

Areas on site identified as staging areas or stockpile locations shall be approved by the Owner. These areas will be constructed and used in a manner consistent with the Owner's plans for storm water management. The contractor shall maintain proper erosion control measures for stockpiles and may be required to cover piles in situations where precipitation is anticipated.

2.8 Access and Security

Access to the site will be controlled at gated entrances through the existing restricted area fencing. All gated entrances and security for EFRI property will be maintained by the Owner.

2.9 Utilities

Utilities on site will be maintained by the Owner outside of work areas (areas to be demolished or reclaimed). Utilities inside of work areas will be provided and maintained by the Contractor.

2.10 Sanitation Facilities

The Contractor, in accordance with the Owner's Radiation Protection Manual for Reclamation, will maintain sanitation facilities required during construction.

3.0 WORK AREA PREPARATION

3.1 General

This Section describes the preparation of site areas for reclamation. This work will be conducted according to applicable sections of the Owner's Radiation Protection Manual for Reclamation.

3.2 Water Management

Preparation for work in the site area will include water management tasks outlined below.

a. Removal of raffinate crystals from Cell 1.

b. Breaching of the Cell 1 dike for construction the cell as a sedimentation basin. Re-route runoff from the mill area and areas immediately north of the cell into the sedimentation basin for discharge onto the natural ground via the channel to be located at the southwest corner of the basin.

c. Diversion of clean area storm water runoff from work areas (where facilities demolition and material excavation will take place) and from the disposal cell footprint area.

d. Collection of storm water runoff from within the work areas and the disposal cell footprint for treatment and permitted discharge, or for disposed material compaction or dust control. The planned storage location for this affected storm water is the sedimentation pond.

e. Isolation of water used for processing operations associated with reclamation from storm water runoff. Water from processing operations or other contaminated water will not be used for disposal cell construction.

3.3 Cell Construction

A clay lined disposal area will be constructed adjacent to and parallel with the existing Cell 1 dike for permanent disposal of contaminated material and debris from the mill site decommissioning and the Cell 1 Disposal Area. The area will be lined with a 12-inch thick layer of compacted clay prior to placement of contaminated materials and installation of the final reclamation cap. If there is not sufficient debris, rubble and contaminated soil to fill Cell 1 as designed, the footprint of Cell 1 can be reduced to decrease the horizontal dimension extending out from Cell 2 and the lateral extent of the disposed materials, to be closer to the base of the Cell 2 dike. If a design modification is required for Cell 1, it will be submitted to DWMRC for review and approval and these Technical Specifications will be revised accordingly.

3.4 Soil Borrow Areas

Disposal cell fill and liner materials will be excavated from among the identified borrow areas on site. Cover and liner soil will be from suitable materials stockpiled on site during cell construction.

Specific soil borrow areas will be selected based on haul distance to the disposal cell, ease of excavation of cover material, geotechnical characteristics, uniformity of the borrow material, and acceptable radiological and geochemical characteristics.

Borrow area preparation will consist of setup for storm water management (Section 3.2) and clearing and stripping (Section 3.5).

3.5 Clearing and Stripping

For work areas that are vegetated, preparation work will include tasks outlined below.

3.5.1 Clearing

Clearing of vegetation and grubbing of roots will be in identified work areas. Clearing and grubbing shall not extend beyond 20 feet from the edge of the work area, unless as shown on the Drawings or as approved by the Reclamation Project Manager.

Vegetation from clearing and grubbing may be shredded or chipped to form mulch. Alternative methods of on-site or off-site disposal or burning of stripped vegetation shall be conducted only as approved by the Reclamation Project Manager.

3.5.2 Stripping

Stripping of salvageable topsoil (if present) shall be done within the entire work area. Stripping of topsoil shall not extend beyond 10 feet from the edge of the work area, unless approved by the Reclamation Project Manager. The depth of stripping of reclamation soil shall be based on the presence of suitable topsoil and approved by the Reclamation Project Manager. Water shall be added to the area of excavation if the soils are dry and stripping work is generating dust.

Topsoil shall be stockpiled in approved stockpile areas. The final stockpile surface shall be graded and smoothed to minimize erosion and facilitate interim revegetation of the stockpile surfaces.

4.0 CELL 1 DISPOSAL AREA BASE CONSTRUCTION

4.1 General

This section outlines work associated with construction of the disposal cell base for receipt of materials (as described in Section 7.0) within Cell 1. The base of the disposal cell will be lined with a compacted clay liner. The cell base will be constructed as shown on the Drawings and outlined in these Technical Specifications.

4.2 Materials Description

4.2.1 Subgrade Fill

The disposal cell footprint is likely to have an irregular surface from areas that have been excavated. Low areas of the excavated surface should be filled to form a smooth, competent foundation for clay liner construction. Subgrade fill will be used in excavated areas of the disposal cell footprint to meet desired grades and elevations for the disposal cell foundation (shown on the Drawings).

Subgrade fill may consist of off-site granular materials, or soils and weathered sedimentary rock from approved on-site excavation areas. Subgrade fill shall be minus 6-inch size, and shall be free from roots, branches, rubbish, and process area debris.

4.2.2 Clay Liner Material

Clay liner material shall be minus 1-inch size, and shall be free from roots, branches, rubbish, and process area debris. Clay liner material shall have a minimum of 40 percent passing the No. 200 sieve and a minimum plasticity index (PI) of 15 percent. Suitable materials will classify as CL, CH, or SC materials under the Unified Soil Classification System.

4.3 Work Description

4.3.1 Foundation Preparation

The footprint of the disposal cell shall form a competent foundation for clay liner and cover construction. The surface of the disposal cell footprint shall be filled (where required) in low areas to form a smooth, competent foundation for clay liner and cover construction. Subgrade fill (Section 4.2.1) shall be placed in lifts and compacted in excavated areas of the disposal cell footprint to meet desired grades and elevations for the disposal cell foundation (shown on the Drawings). The final filled surface shall be compacted with approved construction equipment to provide a foundation surface with uniform density for clay liner placement.

4.3.2 Disposal Cell Foundation Area

The footprint of the disposal cell is established along the north side of the tailings dike along the south edge of Cell 1 (shown on the Drawings).

4.3.3 Subgrade Fill Placement

Subgrade fill (Section 4.2.1) shall be placed in lifts and compacted in excavated areas of the disposal cell footprint to meet desired grades and elevations for the disposal cell foundation. Subgrade fill may be (1) granular material from off-site commercial sources, or (2) soils and weathered sedimentary rock from approved on-site excavation areas.

4.3.4 Clay Liner Material Placement

Clay liner material (Section 4.2.2) shall be placed in lifts with a maximum compacted thickness of 6 inches to form a continuous layer with a total minimum compacted layer thickness of 12 inches. Clay liner material shall be placed over the prepared subgrade surface of the disposal cell (Section 4.3.1).

Compaction of the clay liner material shall be done with a sheepsfoot or tamping-foot roller of sufficient weight to achieve the required compaction specifications. Rubber-tired equipment shall not be used solely to compact the clay liner material.

If the moisture content of any layer of clay liner is outside of the allowable placement moisture content range specified, the material shall be moistened and/or reworked with a harrow, scarifier, or other suitable equipment to a sufficient depth to provide relatively uniform moisture content and a satisfactory bonding surface before the next layer of clay material is placed. If the compacted surface of any layer of clay liner material is too wet (due to precipitation) for proper compaction of the fill material to be placed thereon, it will be reworked with a harrow, scarifier or other suitable equipment to dry out the layer and reduce the moisture content to within the required limits. The layer would then be re-compacted.

The layers of the placed clay liner will be such that the liner will, as far as practicable, be free of lenses, pockets, streaks or layers of material differing substantially in texture, gradation or moisture content from the surrounding material. Oversized material will be controlled through selective excavation of stockpiled material, observation of placement by a qualified individual with authority to stop work and reject material being placed and by culling oversized material from the fill.

No clay liner material will be placed when either the materials, or the underlying material, is frozen or when ambient temperatures do not permit the placement or compaction of the materials to the specified density without developing frost lenses in the fill.

Any holes in the clay liner material resulting from testing should be repaired by hand by filling with clay fill, or by filling with bentonite powder which is hydrated to fully seal the hole.

4.4 Performance Standards and Testing

Test results indicating dry densities less than the specified values will be rejected. Such rejected material shall be reworked by the contractor as necessary and rerolled until a dry density equal to or greater than the specified percent of standard Proctor maximum density is attained. Material that is too dry or too wet to permit bonding of layers during compaction will be rejected and shall be reworked by the contractor until the moisture content is within the specified limits. Reworking may include removal, re-harrowing, reconditioning, rerolling, or combinations of these procedures.

4.4.1 Subgrade Testing

Where required, checking of compaction of compacted subgrade fill and the final subgrade surface shall consist of a minimum of one field density test per 1,000 cubic yards of material compacted. A minimum of two tests will be taken for each day that an applicable amount of fill is placed in excess of 150 cubic yards. A minimum of one test per lift and at least one test for every full shift of compaction operations will be taken.

Field density tests shall be compared with standard Proctor tests (ASTM D698 Method A or C). Where required, standard Proctor or Maximum Index Density tests shall be conducted at a frequency of at least one test per 5,000 cubic yards of material compacted, or when material characteristics show significant variation.

Field density testing may be conducted with the sand cone test (ASTM D1556) or a nuclear density gauge (ASTM D6938, or as modified by the QA Manager). Correlation of nuclear density gauge results shall be by comparison with results from sand cone test(s) and laboratory testing for water content(s) using the oven drying method (ASTM D2216) on similar material.

Subgrade fill will be placed in lifts not exceeding 8 inches in loose thickness. Each lift shall be compacted to a minimum of 90 percent of standard Proctor (ASTM D698) density and within three percent of the optimum moisture content for the material.

4.4.2 Clay Liner Testing

Material specifications for the clay liner material shall be confirmed by gradation testing conducted by approved personnel. Testing shall consist of No. 200 sieve wash and maximum particle size testing (ASTM D422), and Atterberg limits testing (ASTM D4318) on samples of clay liner materials, at a frequency of at least one test per 2,500 cubic yards of fill placed, or when material characteristics show a significant variation.

Checking of compaction of the clay liner material shall consist of a minimum of one field density test per 500 cubic yards of material compacted. A minimum of two tests will be taken for each day that an applicable amount of fill is placed in excess of 150 cubic yards. A minimum of one test per lift and at least one test for every full shift of compaction operations will be taken.

Field density tests shall be compared with standard Proctor tests (ASTM D698 Method A or C) on the same material. Standard Proctor tests shall be conducted at a frequency of at least one test per 2,500 cubic yards of material compacted, or when material characteristics show significant variation.

Field density testing may be conducted with the sand cone test (ASTM D1556) or a nuclear density gauge (ASTM D6938, or as modified by the QA Manager). Correlation of nuclear density gauge results shall be by comparison with results from sand cone test(s) and laboratory testing for water content(s) using the oven drying method (ASTM D2216) on similar material.

Each lift of clay liner material shall be compacted to at least 95 percent of the maximum dry density for the material, as determined by the standard Proctor test (ASTM D698). During compaction, the material shall be within 2 percent above to 2 percent below optimum moisture content for the material, as determined by the standard Proctor test. If water addition is required to achieve this range of moisture contents, the added water shall be thoroughly mixed into the material prior to compaction.

4.4.3 Grading Tolerances

The completed grading for the clay liner shall be within 1.0 foot (horizontally) of the lines as designed, and within 0.1 foot (vertically) of the elevations as designed. The final surfaces shall be smoothed to avoid abrupt changes in surface grade or areas of runoff concentration. The layer thicknesses shall meet the required minimum thicknesses.

5.0 DISCHARGE CHANNEL GRADING

5.1 General

This section outlines specifications for the work associated with excavating the discharge channel into competent bedrock. Portions of the grading for the sedimentation basin may be in soil, while other areas may require rock excavation. In general, the rock is believed to be rippable, however the Contractor should account for the possibility that harder rock may be encountered in the excavation areas.

5.2 Work Description

5.2.1 Discharge Channel Excavation

The discharge channel shall be excavated to the slopes and grades shown on the Drawings. The channel width(s) shall be constructed to the dimensions shown on the Drawings. The side slopes of the channel shall be 3:1 (horizontal to vertical).

Discharge channel excavation will include breaching of the Cell 1 dike on the east side. Riprap will not be required to armor the discharge channel when the channel excavation is into competent sedimentary rock. The competency of the sedimentary rock must be verified in the field by the CQA Manager.

5.2.2 Grading Tolerances

Completed grading for the sedimentation basin, in soil, shall be within 1.0 foot (horizontally) of the lines as designed, and within 0.1 foot (vertically) of the elevations as designed. Final surfaces shall be smoothed to avoid abrupt changes in surface grade or areas of runoff concentration.

The completed grading for the discharge channel (and portions of the sedimentation basin) in rock shall be within 2.0 foot (horizontally) of the lines as designed, and within 0.5 foot (vertically) of the elevations as designed. The final rock surfaces will be rough and should not be filled to make grade. The bedrock channel should be constructed at or below the design grades in order to meet the intent of the design.

6.0 MILL DECOMMISSIONING

The following subsections describe decommissioning plans for the mill buildings and equipment, the mill site, and associated windblown contamination.

6.1 Mill Buildings and Equipment

The uranium and vanadium processing areas of the Mill, including all equipment, structures and support facilities, will be decommissioned by demolition and disposed of in tailings or buried on site as appropriate. All equipment, including tankage and piping, agitation equipment, process control instrumentation and switchgear, and contaminated structures will be cut up, removed and buried in tailings prior to final cover placement. Concrete structures and foundations will be broken up and removed. Concrete foundations may be left in place and covered with soil as appropriate.

Decommissioned areas will include, but not be limited to the following:

- Coarse ore bin and associated equipment, conveyors and structures
- Grind circuit including semi-autogeneous grind (SAG) mill, screens, pumps and cyclones
- Three pulp storage leach tanks to the east of the mill building, including all tankage, agitation equipment, pumps and piping
- Seven leach tanks inside the main mill building, including all agitation equipment, pumps and piping
- The counter-current decantation (CCD) circuit including all thickeners and equipment, pumps and piping
- Uranium precipitation circuit, including all thickeners, pumps and piping
- Two yellow cake dryers and all mechanical and electrical support equipment, including uranium packaging equipment

- Clarifiers to the west of the mill building including the preleach thickener (PLT)
- The boiler and all ancillary equipment and buildings
- The entire vanadium precipitation, drying and fusion circuit
- All external tankage not included in the previous list including reagent tanks for the storage of acid, ammonia, kerosene, water, dry chemicals, etc. and the vanadium oxidation circuit
- The uranium and vanadium solvent extraction (SX) circuit including all SX and reagent tankage, mixers and settlers, pumps and piping
- The SX building
- The mill building
- The alternate feed processing circuit
- The decontamination pads
- The office building
- The shop and warehouse building
- The sample plant building
- The reagent storage building

The sequence of demolition will proceed so as to allow the maximum use of support areas of the facility such as the office and shop areas. It is anticipated that all major structures and large equipment will be demolished using hydraulic shears. This equipment will expedite the process, provide proper sizing of the materials for transport and placement, and reduce exposure to radiation and other safety hazards during the demolition. Any uncontaminated or decontaminated equipment to be considered for salvage and remediation equipment will be released in accordance with the terms of License Condition 9.10 and NUREG 1575 Supplement 1, Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual (MARSAME) (NRC, 2009) as appropriate and applicable. Contaminated soils from the mill area will be disposed of in the tailings cells in accordance with Section 7.0 of the Technical Specifications.

6.2 Mill Site and Windblown Contamination

Areas with contamination around the mill site are expected to be primarily surficial and include the ore storage area and surface contamination of some roads. All ore and alternate feed materials will have been previously removed from the ore stockpile area. All contaminated materials will be excavated and be disposed in one of the tailings cells in accordance with Section 7.0 of these Technical Specifications. The depth of excavation will vary depending on the extent of contamination and will be based on the criteria in Section 7.2.3 of these Technical Specifications. All other 11e.(2) byproduct materials will be disposed of in the tailings cells.

As discussed in Section 6.1, as well as above, EFRI proposes to reclaim the mill and surrounding land areas within the property boundary by excavating and placing wastes, demolition debris and contaminated soils into a fenced and controlled permanent tailings disposal area. The permanent tailings disposal area, the current restricted area, and the property boundary, are delineated in Figure REC-1. EFRI proposes to survey and release all areas within the property boundary, excluding the proposed tailings disposal area, for unrestricted use. Contaminants of concern are Ra-226, Th-230 and natural uranium (U-nat). The evaluation and remediation will be by Ra-226, which is the contaminant with the most restrictive cleanup standard based on the SENES Consultants, Inc. letter to EFRI dated August 15, 2012. This letter was provided as Attachment I to EFRI's Supporting Documentation for Response to Utah DWMRC Interrogatory 13/1 (SENES 2012). The relationship between Ra-226 and the remaining two contaminants will be developed as discussed in subsequent sections of this Specification. Verification of the remediation will be established through a Wilcoxon Rank Sum (WRS) test between the study areas and local background areas. The procedure for verification will follow guidance from NUREG 1575 Multi-

Agency Radiation Survey and Site Investigation Manual (MARSSIM) (NRC, 2000). The procedure will include:

- Scoping and characterization surveys: soil samples will be collected to develop a correlation between gamma radiation levels and the unity rule.
- Classification of land areas: to (MARSSIM) Class 1 through Class 3.
- Remediation of land areas driven by correlation-based prediction equation between gamma radiation and the unity rule for multiple radionuclides.
- Final Status Survey using the Wilcoxon Rank Sum (WRS) test with local background areas.

The procedure also follows the Data Quality Objective (DQO) process defined in the MARSSIM Guidance, as discussed in Section 6.6, below and NUREG-1757 Volume 2 Consolidated Decommissioning Guidance, Characterization, Survey, and Determination of Radiological Criteria (NRC, 2006).

6.3 Scoping and Characterization Surveys

Areas contaminated through process activities or windblown contamination from the tailings areas will be remediated to meet applicable cleanup criteria for Ra-226, Th-230, and U-nat. Contaminated areas will be remediated such that the residual radionuclides remaining on the site, which are distinguishable from background, will not result in a dose that is greater than that which would result from the Ra-226 soil standard, that is, 5 pCi/g above background for the surface 15 cm soil layer and 15 pCi/g for the subsurface 15 cm soil layer, respectively as discussed in Section 6.6.3.3 and hereafter referred to as “5/15”.

An initial scoping survey for windblown contamination will be conducted based on analysis of pertinent past radiometric and land use information. Operational surveys of the areas surrounding the mill and tailings area have indicated potential windblown contamination only to the north and east of the ore storage area, and to the southwest of Cell 3. The initial scoping survey will be conducted using calibrated gamma radiation instruments on 15 meter (15 m) transects. Additional surveys will be conducted in a halo, or buffer zone, around the projected impact area.

The survey in the halo will be conducted using 25 m transects. Areas where no readings exceed 75 percent of the gamma radiation guideline value, as developed per Section 6.3.2, will be classified as unaffected, and will not require remediation. Areas where one or more readings exceed the gamma radiation guideline value will be further investigated to determine whether or not remediation is required.

Prior to initiating cleanup of windblown contamination, a statistically-based soil sampling program will be conducted in an area within or outside the property boundary that is similar to the areas to be remediated, to determine the average background Ra-226 concentration, or concentrations, to be ultimately used for the cleanup. Similarity, or representativeness, will be determined based on geology, soil type and soil chemistry.

Soil cleanup verification will be accomplished by use of calibrated gamma radiation instruments. Multiple instruments will be maintained and calibrated to ensure availability and consistency during remediation efforts (Section 6.3.4).

6.3.1 Scoping and Characterization Survey for the Subsurface

The subsurface will only be investigated in areas where the historical site assessment (HSA) demonstrates the possibility of contamination below the surface 15 cm. This does not include areas of windblown contamination, or the ore storage area (unless also affected by an event demonstrated by the HSA). The method for the subsurface investigation will include boreholes where soil sampling and downhole gamma radiation investigations may occur. This method will be developed based on the HSA.

6.3.2 Gamma Radiation to Unity Rule Correlation

EFRI plans to use radiation measurement instrumentation for soil background analyses, unity rule – gamma radiation correlations, verification data, and sensitivity analyses. Soil background analyses will be completed using MARSSIM methodology for background reference areas.

Soil samples taken during characterization for correlation will be analyzed by a certified laboratory to determine the on-site correlation between the gamma radiation readings and the concentration of Ra-226, Th-230 and U-nat, in the samples. Samples will be taken from:

- Areas known to be contaminated with only processed uranium materials (i.e. tailings sand and windblown contamination)
- Areas in which it is suspected that unprocessed uranium materials (i.e. ore pad and windblown areas downwind of the ore pad) are present

The actual number of samples used will depend on the correlation of the results between gamma radiation readings and the unity rule as discussed below. Windblown contamination to the northeast of the mill area is primarily associated with the unprocessed ore from the ore storage pad. The slightly larger windblown contamination area to the southwest of the mill area is primarily associated with the processed tailings. A minimum of 35 samples of windblown tailings (to the southwest), and 15 samples of windblown unprocessed ore materials (to the northeast) will be collected.

Sufficient samples will be taken to ensure that prediction equations can be developed to adequately calculate the linear regression lines and the corresponding upper and lower 95 percent confidence levels for each of the instruments. The upper one-sided 95 percent confidence limit will be used for the guideline value for correlation between gamma radiation readings and Ra-226 concentration. Because the unprocessed materials are expected to have proportionally higher values of uranium in relation to the Ra-226 and Th-230 content, the correlation to the gamma radiation readings are expected to be slightly different than readings from areas known to be contaminated with only processed materials. Areas expected to have contamination from both processed and unprocessed materials will be evaluated on the more conservative correlation, or will be excavated to the Ra-226 standard which should ensure that the uranium is removed.

The samples will be judgmentally selected with Ra-226 concentration at three different intervals:

- Twenty-five percent of the guideline value (5 pCi/g above background)

- Approximately the guideline level (5 pCi/g)
- Approximately twice the guideline level for the area of interest

This selection will maximise the precision of the correlation relationship at 5.0 pCi/g above background. Background Ra-226 concentrations have been gathered over a 16-year period at sample station BHV-3 located upwind and 5 miles west of the mill. The Ra-226 background concentration from this sampling location is 0.93 pCi/g. This value and the concentrations of U-nat and Th-230 assumed in equilibrium with the Ra-226 will be used as an interim value for the background concentration used only in the initial planning for this project (e.g. use of historical knowledge for preliminary setting of verification sample sizes). Background locations for the verification test will have the three contaminants measured at multiple locations.

Because Ra-226 has short-lived radioactive decay products that are strong gamma radiation emitters (namely Pb-214 and Bi-214), gamma radiation surveys can be effective for characterizing soil Ra-226 distributions across large areas, including on relatively small spatial scales. The well-established, effective, and widely-used analytical approach for spatially comprehensive characterization of Ra-226 concentrations in surface soils involves spatially intensive gamma radiation surveys combined with the use of gamma radiation and soil Ra-226 concentration correlations.

If a gamma radiation and Ra-226 concentration correlation is statistically significant, Ra-226 concentrations in surface soils can be predicted with reasonable accuracy based on gamma radiation readings collected at a high density of measurements across large areas. The same is true for other radionuclides, though correlative relationships tend to be less statistically significant and estimation uncertainty can be higher. The advantage of gamma radiation surveys is that a much higher density of measurements of terrestrial sources of gamma radiation is possible and when combined with gamma radiation/soil radionuclide correlation analysis, the approach produces a more comprehensive spatial characterization for comparisons against baseline conditions and evaluation of potential radiological contamination.

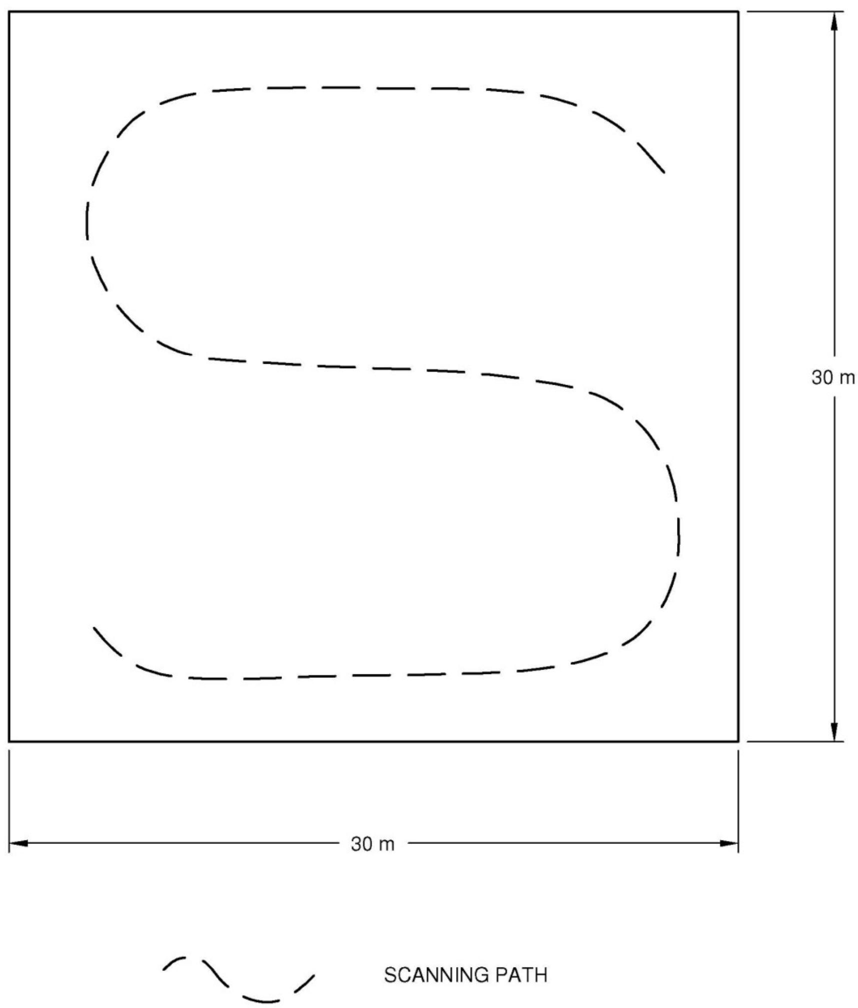
Fifteen soil samples will be collected in the restricted area to establish a correlation between the soil sampling analysis and the gamma radiation count. Additional measurement locations will be added, if necessary, to reach suitable precision, as defined in Section 6.6.3.7. The method that will be used in an effort to develop statistically significant gamma radiation/soil radionuclide correlations is as follows:

1. At each correlation plot, a 100 m^2 (10 m x 10 m) plot for correlation measurements and soil sampling will be established with pin flags. A gamma radiation scan will be performed across each correlation plot (5 m transects at a detector height of 18 inches). The average gamma radiation reading (e.g. cpm) from scan data across each correlation plot will be calculated and recorded in the field logbook, or developed using data collected from the gamma radiation scan. See Figure A-1 for the scan path.
2. Within each 10 m x 10 m, correlation plot nine sub samples of surface soils, one in the center, and eight against the edges of the plot, will be collected across the plot (at a depth of 15 cm) and composited into a single sample to represent average soil radionuclide characteristics across the correlation plot. Composite surface soil samples from each correlation plot will be submitted to a qualified commercial laboratory for analysis of U-nat, Ra-226, Th-230, Th-232 (by Ra-228), and K-40. The correlation plot scanning and sampling design for each location is illustrated in Figure A-1.
3. The laboratory chain of custody/analysis request form to be submitted with composite correlation plot soil samples will specify the following requirements:
    a. Thorough homogenization of each sample at the laboratory.
    b. Ra-226 analysis by EPA Method 901.1, modified for soil samples, with sample counting to be performed at least 21 days after sealing in the counting tin to ensure full ingrowth of Rn-222 and its decay products. Analysis of K-40 will also be conducted with EPA method 901.1, as will analysis of Ra-228 (to determine Th-232 concentrations under the assumption of radiological equilibrium).

c. U-nat analysis by EPA Method 200.8 (ICP-MS) or equivalent, preferably with soil matrix digestion using EPA Method 3052 (microwave assisted acid digestion). EPA Method 3050B or equivalent digestive methods may alternatively be used, however digestion will not be as complete.

d. Th-230 analysis by EPA Method 200.8 (ICP-MS) or equivalent, preferably with soil matrix digestion using EPA Method 3052 (microwave assisted acid digestion). Ten percent of the correlation plot samples will also be analyzed for Th-230 by alpha spectroscopy.

4. Upon receiving soil analysis results from the laboratory, regression analysis will be performed to determine, based on paired data from all correlation plots, if significant statistical correlations exists between average gamma radiation readings and soil Ra-226, U-nat, Th-230, Th-232 by Ra-228 and K-40 concentrations.



Denison Mines (USA) Corp

PROJECT
WHITE MESA MILL TAILINGS RECLAMATION

TITLE
TYPICAL SCANNING PATH SCOPING SURVEY

MWH

DATE SEP 2011 | FIGURE A-1
FILE NAME 1009740 SCAN PATH

L:\Design-Drafting\Clients-A-H\DENISON MINES\013-Sheet Set\2011-08-26 COVR DSGN REP\1009740 SCAN PATH

6.3.3 Area Classification

The characterization and scoping surveys will be used to classify areas as either non-impacted or impacted areas. The impacted areas will be further classified into Classes 1-3 (NUREG 1575). The classification of the areas will determine the rigor required to survey and release the areas.

- Class 1 areas are areas which have, or had prior to remediation, a potential for radioactive contamination based on mill operating history, or known contamination based on previous radiological surveys. Areas containing contamination in excess of the release criterion, specifically the Derived Concentration Guideline Level (DCGL) associated with the Wilcoxon Rank Sum Test ($DCGL_W$), established by the radium benchmark dose (RBD) approach in Section 6.6.3.3 prior to remediation should be classified as Class 1 areas. The concentration terms "$DCGL_W$", "release criterion", and "unity rule", have been used interchangeably throughout the remainder of this Specification. However, where a gamma radiation-based level is meant, the term "gamma guideline level" is used specifically.

- Class 2 areas are areas which have, or had prior to remediation, a potential for radioactive contamination or known radioactive contamination, but are not expected to exceed the $DCGL_W$.

- Class 3 areas are any impacted areas not expected to contain any residual radioactivity, or are expected to contain levels of residual radioactivity at a small fraction of the $DCGL_W$, based on mill operating history and previous radiological surveys

Table 6.1 - Final Status Survey Unit Classification for Land Areas

Survey Unit Classification		Statistical Test	Elevated Measurement Comparison	Sampling and/or Direct Measurements	Suggested Area (m^2)	Scanning
Impacted	Class 1	Yes	Yes	Systematic	2000	100% Coverage
	Class 2	Yes	Yes	Systematic	10,000	10-100% Systematic
	Class 3	Yes	Yes	Random	No limit	Judgmental
Non-Impacted		No	No	No	None	None

6.3.4 Remediation

Remediation will only occur in survey units that cannot pass the release criterion ($DCGL_W$). Remediation will consist of excavation of soils and placement in the tailing cells, as stated in Section 7.2.3, below. Remedial action support surveys will be conducted to guide the remediation. Remedial action support surveys will be conducted in a manner similar to the Final Status Surveys (FSSs), described in Sections 6.4 and 6.6, to ensure that the remedial action achieves the $DCGL_W$. Excavation will continue until the gamma radiation guideline value is achieved for surface soils

Upon completion of remediation, gamma radiation surveys will be conducted on the excavated area and areas surrounding the excavation.

6.4 Final Status Surveys

Areas of the site will be released through the final status survey (FSS) process (see Section 6.6). Survey units will be released through FSS reports provided to DWMRC for each survey unit. Survey units that require remediation will undergo the FSS process after remediation. Survey units must meet the release criterion set forth in this section. Each survey unit that meets the release criterion will be released, pending DWMRC approval.

6.4.1 Release Criterion

Release criteria have been established and are discussed in more detail in Section 6.6.

6.4.2 Statistical Test

The WRS test will be performed using the background reference data set and the systematic sample data set from the survey unit under investigation. The background reference data set will be added to the unity rule (1) prior to the statistical test being completed. The two data sets will be derived using the weighted sum for multiple radionuclides set forth in MARSSIM:

For surface soils:

$$\frac{A\ (pCi/g\ Ra226)}{5\ (pCi/g)} + \frac{B\ (pCi/g\ \ Unat)}{545\ (pCi/g)} + \frac{C\ (pCi/g\ \ Th230)}{46\ (pCi/g)} + 1$$

For subsurface soils:

$$\frac{A\ (pCi/g\ \ Ra226)}{15\ (pCi/g)} + \frac{B\ (pCi/g\ \ Unat)}{2908\ (pCi/g)} + \frac{C\ (pCi/g\ \ Th230)}{142\ (pCi/g)} + 1$$

For instance, if the background reference area surface soil data set showed that one sample contained 2.2 pCi/g Ra-226, 2.2 pCi/g U-nat, and 2.0 pCi/g Th-230, the sample would be represented in the WRS data set as the following:

$$\frac{2.2\ (pCi/g\ \ Ra226)}{5\ (pCi/g)} + \frac{2.2\ (pCi/g\ \ Unat)}{545\ (pCi/g)} + \frac{2.0\ (pCi/g\ \ Th230)}{46\ (pCi/g)} + 1 = 1.49$$

Thus, 1.49 (unitless) for this particular background sample would be used in the WRS comparison data set for the background reference area to be compared to the survey unit data. If this sample were from the survey unit, the value would be 0.49 (unitless).

The WRS test will be performed on the survey unit and background reference area using the method in MARSSIM. For Class 1 to Class 3 survey units, the null hypothesis is that the survey unit exceeds the release criterion. If the null hypothesis is rejected, the mean for the survey unit does not exceed the $DCGL_W$, and no area exceeds the DCGL Elevated Measurement Comparison ($DCGL_{EMC}$) then the survey unit is presumed to meet the release criterion and, pending DWMRC approval, released.

If an area in a survey unit exceeds the $DCGL_W$, the area of the contamination will be determined using a mixture of soil sampling and gamma radiation surveying.

A comparison will be made to the EMC will be made to determine if the area presents a dose equal to, or lower than, the $DCGL_W$ scenario. This determination will be completed through the derivation of area factors based on the size of hypothetical areas of contamination. The area factor for a contaminated area will be multiplied by the $DCGL_W$ to determine the allowable contaminant concentration for that size of area, which still meets the unity rule. Area factors will be determined prior to FSS's and will be approved by DWMRC.

Areas of elevated activity that do not meet the $DCGL_{EMC}$ will be remediated.

6.5 Instrument Quality Assurance/Quality Control (QA/QC)

Field gamma radiation survey instrumentation will be sodium iodide (NaI) detectors. To the extent possible, the same instruments will be use throughout the characterization, remediation and final status survey. These instruments will be cross calibrated to allow other identical instruments or similar instruments to be used. Individuals will be appropriately trained to use the selected instrumentation and the instrumentation will be suitable for its intended use. Instrumentation shall be operated in accordance with written procedures and manufacturer's manuals which will provide guidance to field personnel on the proper use and limitations of the instruments.

6.5.1 Calibration

The manufacturer's current calibration/maintenance records will be kept on site for review and inspection for all instruments used during the survey. Past calibration records will be retained for inclusion in the FSS report.

The records will include, at a minimum, the following:

- Equipment identification (name, model, and serial number)
- Manufacturer
- Date of calibration

- Calibration due date

Instrumentation must be maintained and calibrated to manufacturer's specifications to ensure that required traceability, sensitivity, accuracy, and precision of the equipment/instruments are maintained. Instruments will be maintained and calibrated in accordance with American National Standards Institute N323A (ANSI, 1997).

6.5.2 Source and Background Checks

Prior to and after daily use, instruments will be QC-checked by comparing the instrument's response to a designated gamma radiation source and to ambient background. Prior to commencement of field operations, a site reference location will be selected for the performance of these checks. Acceptable ranges (count rate) for each instrument will be established by performing a series of counts. The acceptable range will be ± 2 sigma of the mean of the series of counts. QC source checks will consist of one-minute integrated counts with the designated source position in a reproducible geometry, performed at the designated location. Background checks will be performed in an identical fashion with the source removed. Results of the background and QC checks will be recorded in a field logbook.

Instrument response to the designated QC check source will be plotted on control charts or in tabular form (spreadsheets) and evaluated against the average source and background readings established at the start of the field activities. A performance criterion of +/– 2 sigma of this average will be used as an investigation action level, and a repeat of the measurement will be performed. A performance criterion of +/– 3 sigma of this average will be used as a failure level requiring corrective action. Results exceeding this criterion will be investigated and appropriate corrections to instrument readings will be made if the response is affected by factors beyond personnel control, such as large humidity or temperature changes. The instrument(s) in question will be removed from service while investigations and corrective actions are in progress.

Instrument response to ambient background will be used to establish a mean background response for each instrument, to monitor gross fluctuations in background activity (e.g., from changes in barometric pressure and other, non-contaminant related causes), and to evaluate detector response. The background measurements are performed for the purpose of checking for detector contamination and electronic stability (especially cabling).

Instrument response to source checks are used to prove detector efficiency and electronics stability.

During QC checks, instruments shall be inspected for physical damage, current calibration and erroneous readings. The individual performing these tasks shall document the results in accordance with the instrument protocol within MARSSIM, as provided in Exhibit A-1. Instrumentation that does not meet the specified requirements of calibration, inspection, or response check will be removed from operation. If the instrument fails the QC response check, any data obtained to that point, but after the last successful QC check will be considered invalid due to potentially faulty instrumentation.

6.6 Data Quality Objectives

This plan was developed using guidance from MARSSIM was developed to ensure surveys are conducted with the proper rigor, quality assurance, and statistical analysis to make proper decisions. A key step in the MARSSIM process is the development of DQOs. DQOs ensure collection of data of the right type, quality, and quantity to support decisions, the decommissioning process, and the achievement of the desired end state. The DQOs are outlined below, and include systematic processes to:

1) State the problem
2) Identify the goal of the characterization
3) Identify inputs to the decision
4) Define the study boundaries
5) Develop the decision rules/analytical approach
6) Define acceptable decision errors

7) Optimize the design

6.6.1 State the Problem

Ultimately, the mill will be decommissioned, the demolition and decommissioning waste disposed in the tailings cells, and the tailings system reclaimed as approved by Utah DWMRC. The reclamation objective is to release the mill's land areas other than the tailings area, for unrestricted use. Land areas may have radiological contamination from milling operations. The scanning procedure needs to identify and distinguish areas that can be released, from areas that must be remediated prior to being released. The data collected following excavation in remediation areas must also be suitable for use in the final status survey (FSS) to demonstrate that the clean-up criteria have been met.

6.6.2 Identify the Decisions

The decision process will be based on data from scoping and characterization surveys, gamma radiation correlation, remediation and final status surveys.

Survey and sampling data will be used to:

1) Assist in classification of survey units

2) Determine areas requiring remediation

3) Develop Final Status Surveys to verify that clean-up criterion has been met

6.6.3 Identify Inputs to the Decision

6.6.3.1 Characterization and Scoping

HSAs, scoping surveys, and characterization surveys will be used to determine the extent of the contamination as well as the presence of useable relationships/ratios between the radionuclides of background reference areas. The presence of useable relationships will be established in accordance with Section 4.5 of MARSSIM. Soil sampling will be conducted in the survey areas and samples will be analyzed for U-nat, Th-230 and Ra-226.

The background must be correctly characterized and a proper background reference area chosen to represent the background for the mill soils. This will ensure that the soil will be cleaned up to the appropriate level. Goals of the characterization include selecting an appropriate background reference area(s) and appropriate background(s), and correctly comparing selected background(s) with the survey units. Multiple backgrounds may be selected for different survey units depending on the characterization and scoping surveys in conjunction with the HSA.

From MARSSIM Section 4.5, a site background reference area should have similar physical, chemical, geological, radiological, and biological characteristics as the survey unit being evaluated. Background reference areas are normally selected from non-impacted areas, but are not limited to natural areas undisturbed by human activities. In some situations, a reference area may be associated with the survey unit being evaluated, but cannot be potentially contaminated by site activities. For example, background measurements may be taken from core samples of a building or structure surface, pavement, or asphalt. The selected reference areas will be reviewed with Utah DWMRC.

Systematic soil sampling will occur prior to the FSS, and samples will be analyzed for Ra-226, Th-230, and U-nat to determine background concentrations to be used for the cleanup. The soil sampling to determine the average background radionuclide concentrations to ultimately be used for the cleanup will be conducted prior to remediation. Background sampling will be conducted in a reference area within or outside of the property boundary that is similar to the area to be remediated.

Background reference areas will be chosen such that they are representative of the survey unit locations but are non-impacted from site operations. Representativeness shall be determined on the basis of geomorphology, geological, geochemical, and radiological, considerations.

6.6.3.2 Correlation

A correlation of the unity rule in the soil to the gamma radiation will be developed. This correlation will guide remediation and excavation. This correlation is explained in Section 6.3.2.

Remediation of the soil to meet the unity rule is described in Section 6.3.4. The final status survey reports will be the definitive source of information to describe the final impacts on the soil left by the mill. The reports will detail how the cleanup met the Site Cleanup Criteria and show that each survey unit meets the cleanup criteria. The FSS reports will verify that the remediation has achieved the cleanup criteria.

6.6.3.3 Site Cleanup Criteria

The DCGLs for Ra-226 are set at 5 pCi/g for the surface 15 cm soil layer and 15 pCi/g for the subsurface 15 cm soil layer, respectively (hereafter referred to as “5/15”) (See Attachment I for further discussion).

The DCGLs for radionuclides other than Ra-226 are derived from doses calculated for Ra-226 at 5/15 using the same exposure scenarios as were used to estimate the dose from Ra-226 at 5/15. This is referred to as the radium benchmark dose (RBD).

Generally, elevation of U-nat and Th-230 concentrations relative to Ra-226 is unexpected since the contaminated materials will either be ore (which are at or near secular equilibrium) or tailings where U-nat is reduced relative to the other uranium decay series radionuclides of interest. Possible exceptions are:

- Areas with raffinate crystals which may have higher Th-230 concentrations compared to Ra-226 concentrations
- Areas of spilled yellowcake product near the mill where U-nat may be elevated relative to Ra-226

The RBD approach was applied as described in Attachment I Supporting Documentation for Interrogatory 13/1: The Radium Benchmark Dose Approach. The RESRAD (Version 6.5) code (Yu et al. 2001) was used to implement the RBD approach. As described in NUREG-1569 as Appendix E (NRC 2003, a Guidance document for NRC Commission Staff on the Radium Benchmark Dose Approach), NRC considers the RESRAD code as an acceptable code for application of the Ra-226 benchmark dose approach. In brief, radionuclides at their respective DCGLs result in the same benchmark dose as the Ra-226 DCGL.

The DCGLs for the radionuclides of interest for the surface and subsurface layers were calculated and are provided in Table 6.2. The scenario is for a rancher with the doses determined using the RESRAD Version 6.5 model. The default RESRAD dietary and inhalation data which apply for the adult are carefully selected from literature and are already considered to represent conservative parameter values. Details on the calculation of DCGL's are provided in Attachment I.

Table 6.2 - DCGL above background

DCGL (pCi/gram) above background		
Radionuclide	**Surface**	**Subsurface**
Ra-226	5	15
U-nat	545	2908
Th-230	46	142

Since there is more than one radionuclide of concern, the criteria for unrestricted use is applied using the unity rule such that the RBD is never exceeded.

In the equations below, the numerator is determined by subtracting the local background from the sample analysis following remediation. It is possible that the background may vary between survey units due to variation in soil types.

The unity rules are:

For surface soil:

$$\frac{A\ (pCi/g\ Ra226)}{5\ (pCi/g)} + \frac{B\ (pCi/g\ Unat)}{545\ (pCi/g)} + \frac{C\ (pCi/g\ \ Th230)}{46\ (pCi/g)} \leq 1$$

For subsurface soil:

$$\frac{A\ (pCi/g\ \ Ra226)}{15\ (pCi/g)} + \frac{B\ (pCi/g\ \ Unat)}{2908\ (pCi/g)} + \frac{C\ (pCi/g\ Th230)}{142\ (pCi/g)} \leq 1$$

MARSSIM requires that the median concentration in a survey unit be demonstrably lower than the $DCGL_W$ following remediation. This is accomplished with a WRS test between soil concentrations in the survey unit and appropriate background reference locations. For the WRS test, the actual concentrations are used for the survey unit rather than using the incremental concentrations, discussed previously in Section 6.4.2.

6.6.3.4 Gamma Radiation Surveys

Gamma radiation surveys will be conducted with a GPS-integrated system using 2-inch by 2-inch sodium iodide (NaI) detectors or the equivalent. Statistical correlations will be developed between the radiological soil sample analysis and the gamma radiation count rate. See Section 6.4.2 for the method for development and use of the gamma radiation correlation.

With the GPS-integrated method, high density gamma radiation scanning surveys will be done using the Ludlum 44-10 detectors at a height of 18 inches above the ground. The surveyor speed will be approximately 0.5 m/s.

For Class 1 survey units, transects will be 5 m apart and gamma radiation scanning surveys will continue up to 20 m outside the excavation with averages calculated on each 10-m by 10-m block. Class 1 survey units will scanned at a density to ensure that 95 percent of the 10-m by 10-m blocks have at least 20 gamma radiation measurements for blocks in and adjacent to the excavation areas with measurements in at least three of the four quadrants of the 10-m by 10-m block

The remainder of the survey area outside the remediation area will be classified as Class 2 and will be surveyed at 10 m transects. The requirement for the remainder of the survey area, Class 2, will be that 95 percent of the blocks have at least 10 gamma radiation measurements.

The Class 3 area will include the buffer areas outside the area of contamination, and this area will be surveyed with planned transects of 50 m. Twenty percent or more of the 10 m by 10 m blocks will have at least 10 gamma radiation measurements.

The mean, median, and standard deviation of the 10-m by 10-m averages will be calculated by survey unit for data logged during the scanning surveys.

6.6.3.5 Gamma Radiation Guideline Level

The average gamma radiation count rate will be established over the 10-m by 10-m blocks. A correlation will be established between the gamma radiation level and the unity rule using co-located gamma radiation and soil concentration measurements. The gamma radiation guideline value will be the gamma radiation counts that equate to 0.8 (80 percent of unity rule) from the correlation equation. Locations where the gamma radiation guideline is exceeded will have additional gamma radiation surveys and potentially additional excavation before verification sampling.

6.6.3.6 Selection of Verification Samples

Following completion of excavation, if necessary, verification sampling will be carried out for each survey unit to allow a WRS test with background samples to confirm that the compliance criteria has been met. Ten sampling blocks will be determined from a random sampling approach for each survey unit. Following the final status gamma radiation survey, a minimum of 15 blocks in the survey unit will be measured to confirm the gamma radiation guideline level. For these 15 samples, the five 10- by 10-m blocks with the highest average gamma radiation will be sampled along with another 10 sample blocks randomly selected from the area.

The soil samples from the 10 randomly selected locations will be assessed to determine if the mean concentration in the survey unit is statistically below the unity rule with an alpha error of 0.05 using the MARSSIM WRS test.

The number of samples may be increased per Section 6.6.8.

6.6.3.7 Revision of Correlation

The verification sample measurements (soil analysis and mean gamma radiation counts) will be compared to the correlation to determine if the correlation is statistically valid. The correlation will be updated with the verification measurements if there is less than a 95 percent probability (p-value of 0.05) that the random verification data is less than $DCGL_W$. Verification measurements (soil sample and mean gamma radiation counts) will be taken with the same method as the correlation measurements.

6.6.3.7.1 Reporting

For each survey unit, the following will be reported:

1. Number of blocks remediated during remediation phase.

2. Number of blocks with subsequent remediation initiated by gamma radiation measurement.

3. Gamma radiation coverage compliance (i.e. percentage of blocks meeting number of measurement criteria).

4. Mean gamma radiation level averaged over the 10-meter by 10-meter blocks.

5. Mean and range of predicted unity rules based on gamma radiation survey.

6. Mean and range of measured unity rules based on verification sampling.

6.6.3.8 Field Data

The objectives of the survey and sampling activities are to identify the concentrations of residual radioactive material in the survey units so that the unity rule can be evaluated. This information will allow a determination of whether a survey unit is likely to be suitable for release. The average soil concentrations will be evaluated to verify that each radiological $DCGL_W$ is met.

6.6.4 Define the Study Boundaries

The soil in the restricted area will be surveyed for radiological contamination of U-nat, Th-230, and Ra-226. This does not include the tailings cells, and unrestricted areas. Survey units will be established in the unrestricted area if, during the survey of the restricted area, contamination is found at the boundary of the restricted area or if there is reason to believe contamination is present in the unrestricted area.

6.6.5 Develop the Decision Rules/Analytical Approach

If soils exhibit widespread contamination above the $DCGL_W$, then removal of the soil will be necessary or the EMC process will need to be followed to ensure that areas of contamination will not exceed the $DCGL_W$ following excavation.

6.6.6 Define Acceptable Decision Errors

6.6.6.1 Statistical Tests

The WRS test will be used to compare background reference areas to survey units in the MARSSIM framework for the FSS reporting. The WRS test is a nonparametric test used to test for a difference in values between two populations; that is, one data population is hypothesized to consist of higher average values than the other data population.

MARSSIM suggests using the WRS test in cases where the contaminant is present in background at a significant fraction of the $DCGL_W$. Since the DCGL is 5 pCi/g for Ra-226 and the background is in the order of 1 pCi/g or more for Ra-226, the WRS test is the preferred test.

The soil concentrations from the 10 randomly selected locations as defined in Section 6.6.3.6 will be assessed with the WRS test to determine if the median concentration in the survey unit is statistically below the unity rule with an alpha error of 0.05 using the MARSSIM WRS test.

6.6.6.2 Hypothesis

The decisions necessary to determine compliance with the soil cleanup criteria are based on precise statistical statements called hypotheses, which are tested using the data from the survey unit

Null Hypotheses - The situation that is presumed to exist is expressed as the null hypothesis (H_0), which states "*the median concentration in the survey unit exceeds the median concentration in the background reference area by more than the DCGL.*"

Alternative Hypotheses - For a given H_0, there is a specified alternative hypothesis (H_a), which is an expression of what is believed to be the situation if the null hypothesis is not true. The H_a

states "*the median concentration in the survey unit does not exceed the median concentration in the background reference area by more than the DCGL.*"

These hypotheses were chosen for the following two reasons: (1) the burden of proof is placed on the H_A and, (2) the survey unit will not be released until proven to meet the cleanup criterion. In order to pass the WRS using the above H_0, the median concentration of the systematic samples in the survey unit must be less than the $DCGL_W$ above background.

6.6.6.3 Error Types

Decision errors help to determine the number of samples required. Generally, more samples are required to generate lower decision errors (i.e., the fewer samples, the larger the uncertainty).

The statistical acceptability decisions are designed to avoid two kinds of errors:

- Releasing a survey unit which requires additional remediation
- Remediating a survey unit which is already below the $DCGL_W$

Two possible error types are associated with such decisions, Type I and Type II, which are described below.

Type I – which is also referred to as a false positive, occurs when H_0 is rejected when it is actually true. The probability of a Type I error is usually denoted by α. This error could result in higher potential doses to future site occupants than prescribed by the dose-based criterion. The maximum Type I error rate has been set at $\alpha = 0.05$ (there is less than 5 percent chance of error).

Type II - which is referred to as a false negative, occurs when H_0 is not rejected when it is actually false. The probability of a Type II error is usually denoted by β. Consequences of Type II errors include unnecessary remediation expense and project delays. The Type II error rate has been set at $\beta=0.10$ (there is less than 10 percent chance of error).

Statistical correlations will be developed between the unity rule and the gamma radiation measurements. The unity rule will be determined from measurement data for incremental concentrations at each sample location. The correlation between the unity rule and the gamma radiation measurement at the sample location will produce a prediction equation. MARSSIM requires that the mean concentration in a survey unit be demonstrably lower than criteria following remediation but does not require all sampling units, in this case the 10-m by 10-m areas, to be lower than the criteria. The precision goal for the relationship will be that the mean prediction uncertainty for the survey unit will be +/- 0.2 when the predicted unity rule is equal to "1".

Protocols will be in place to ensure decision errors are kept to a minimum. For example, instrument quality assurance checks will be required and minimum detectable concentrations (MDCs) will be met.

The gamma radiation survey will be limited by the minimum detectable concentration (MDC) for the 2-inch x 2-inch sodium iodide (NaI) detector which is approximately 104 Bq/Kg (2.8 pCi/gram) for Ra-226, MARSSIM Table 6.7. This MDC is dependent on the background which may raise or lower the MDC (NRC, 2000).

Table 6.3. Reported MDC's from MARSSIM Table 6.7

Nuclide	MDC (Bq/kg)	MDC (pCi/gram)
U-Nat	2960	80
Th-230	78,400	2100
Ra-226 (with decay products in equilibrium)	104	2.8

6.6.7 Relative Shift and Number of Samples

The target decision errors are 0.05 and 0.10 for α and β, respectively. The major contributor to the unity rule is Ra-226 since the criterion is much lower for Ra-226 compared to U-nat and Th-230. The lower bound of the gray region (LBGR) has been set to 0.8 as Ra-226 has a typically concentration that is only about 25 percent of the LBGR and the uncertainty will likely be of this order.

The preliminary estimate is that a relative shift of 2.0 based on the LBGR of 0.8 and an uncertainty of twice the background concentration. Using Table 5.3 of MARSSIM, the required number of samples is 8.

Should any area exceed the $DCGL_{EMC}$ or large areas exceed the $DCGL_W$, remediation of the affected areas would be completed prior to resampling.

6.6.8 Optimize the Design

Initially, gamma radiation scans will be conducted in the restricted areas of the mill site. The data from these scans will be reviewed to determine the location of any hotspots. These hotspot locations will be sampled to determine the activity concentrations of U-nat, Th-230, and Ra-226. A prediction equation of the unity rule will provide the basis for scanning large areas effectively to direct focused remediation and to ensure that the cleanup criterion is met.

The statistical test (WRS test) could fail to show that the mean is below the criterion due to the initial number of verification samples, since there may be insufficient samples to achieve the desired decision error rates given the characteristics of the survey unit. In cases where data suggest that the concentration is below the criterion (e.g., the mean bases), additional samples would reduce the decision error and potentially allow the survey unit to pass. In this case, the mean and variability of the 10 randomly selected measurements will be used to determine MARSSIM's relative shift with the lower bound of the gray region equal to 0.8 of the unity rule. The α error will be set to 5 percent and the β error set to 10 percent to determine the required total number of samples. These samples would be collected and the WRS repeated on the larger data set.

6.7 Soil Sampling

6.7.1 Laboratory Approval

All samples will be analyzed for radionuclide concentration (pCi/g). All analyses will be performed by a Utah DWMRC-approved/certified laboratory and a DOE-certified, or National Environmental Laboratory Accreditation Program (NELAP)-certified laboratory. The laboratory shall analyze method blanks, matrix spike samples, laboratory control samples and replicates**.** Typical required detection levels will be less than or equal to one tenth of the DCGL for each radionuclide.

6.7.2 Data Validation

Laboratory analytical results from the final status survey will be validated and will be reviewed by the data validator for the following:

- Data completeness/sample integrity
- Holding times
- Calibration
- Alpha spectroscopy tracer analysis
- Laboratory and field blanks
- Laboratory control samples
- Laboratory and field duplicates
- Alpha spectroscopy matrix spikes
- Quantitation and detection limits
- Alpha spectroscopy chemical separation specificity
- Gamma radiation spectroscopy target radionuclide list identification
- Secular equilibrium verification, and result verification

Review of these parameters serves to ensure the quality of the data with respect to:

- <u>Precision</u> – which is a measure of the reproducibility of an analysis under a given set of conditions. Precision was evaluated through a review of field duplicate and laboratory duplicate samples.

- <u>Accuracy</u> – which is a measure of the bias that exists in a measurement system. Accuracy was evaluated through a review of laboratory control samples, matrix spike samples, method blanks, and tracer recoveries.

- Representativeness – which is a measure of the degree to which the sampling data accurately and precisely represent site conditions. Representativeness was evaluated through a review of raw data and through a comparison of whether the proposed scoping survey was implemented.

- Comparability – which is a measure of the degree of confidence with which two data sets can be compared to each other. Comparability was evaluated through an assessment of whether appropriate and acceptable analytical methods were used.

- Completeness – which is a measure of the amount of valid data obtained.

6.8 Employee Health and Safety

Programs currently in place for monitoring of exposures to employees will remain in effect throughout the time period during which tailings cell reclamation, mill decommissioning and clean up of windblown contamination are conducted. This will include personal monitoring and the ongoing bioassay program. Access control will be maintained at the Restricted Area boundary to ensure employees and equipment are released from the site in accordance with the current License conditions. In general, no changes to the existing programs are expected and reclamation activities are not expected to increase exposure potential beyond current levels.

6.9 Environment Monitoring

Existing environmental monitoring programs will continue during the time period in which reclamation and decommissioning is conducted. This includes monitoring of surface and groundwater, airborne particulates, radon, soils and vegetation according to the existing License conditions. In general, no changes to the existing programs are expected and reclamation activities are not expected to increase exposure potential beyond current levels.

6.10 Quality Assurance

In general, the QA/QC Plan details the Owner's organizational structure and responsibilities, personnel qualifications, operating procedures and instructions, record keeping and document control, sampling procedures and outside laboratory testing.

7.0 MATERIAL DISPOSAL

7.1 General

This section outlines work associated with placement of materials in the disposal cell and tailings cells.

7.2 Materials Description

The types of materials to be disposed of are outlined below.

7.2.1 Raffinate Crystals

After the residual liquid in Cell 1 has been evaporated, the Contractor will remove the raffinate crystals from Cell 1 and move them to the tailings disposal cells. The crystals are likely to have the consistency of a granular material and have larger crystal masses that require breaking down for loading and transport (using the loading equipment).

7.2.2 Synthetic Liner

The existing PVC liner shall be removed from Cell 1 and disposed of in the tailings disposal area.

7.2.3 Contaminated Soils

During remediation, soils located in and around the mill site exceeding the gamma radiation guideline value will be placed in the tailings disposal cells. Soils excavated from Cell 1 shall be placed in the tailings disposal cells.

7.2.4 Mill Debris

The mill debris will include all equipment, including tankage and piping, agitation equipment, process control instrumentation and switchgear, and contaminated structures; including concrete structures and foundations, will be placed in the disposal cell.

7.3 Work Description

Materials described will be spread over the working surface as much as possible to provide relatively uniform settlement and consolidation characteristics of the cleanup materials.

7.3.1 Raffinate Crystals

Raffinate crystals will be removed from Cell 1 and transported to the tailings cells. Placement of the crystals will be performed as a granular fill, with care being taken to avoid nesting of large sized material. Voids around large material will be filled with finer material or the crystal mass will be broken down by the equipment. Actual placement procedures will be evaluated by the QC officer during construction as crystal materials are placed in the cells and modified with the agreement of the DWMRC.

7.3.2 Synthetic Liner

The PVC liner will be cut, folded (when necessary), removed from Cell 1, and transported to the tailings cells. The liner material will be spread as flat as practical over the designated area. After placement, the liner will be covered as soon as possible with at least one foot of soil, crystals or other materials for protection against wind uplift, as approved by the CQA Manager.

7.3.3 Contaminated Soils

The extent of contamination of the mill site will be determined by gamma radiation survey as described in Section 6. A correlation between gamma survey readings and the unity rule concentrations will be developed. Gamma survey readings can then be used to define cleanup areas and to monitor the cleanup. Soil sampling will be conducted to confirm that the cleanup results in levels that meet criteria described in 7.2.3.

Where surveys indicate the above criteria have not been achieved, the soil will be removed to meet the criteria. Soil removed from Cell 1 will be excavated and transported to the tailings cells.

7.3.4 Mill Debris

Placed debris will be spread across the bottom of the disposal cell to avoid nesting and to reduce the volume of voids present in the disposed mass. Stockpiled soils and/or other approved materials will be placed over and into the scrap in sufficient amount to fill the voids between the large pieces and the volume within the hollow pieces to form a coherent mass. It is recognized that some voids will remain because of the scrap volume reduction specified, and because of practical limitations of these procedures. Reasonable effort will be made to fill the voids. The approval of the CQA Manager or a designated representative will be required for the use of materials other than stockpiled soils for the purpose of filling voids.

7.3.5 Material Sizing and Preparation

Demolition debris to be placed in the disposal cell will consist of equipment and structural material from facilities demolition. Demolition procedures are outlined in the Preliminary Mill Decommissioning Plan. Because of the wide variety in shape and size of demolition debris, material of odd shapes will be cut or dismantled, to the extent practical, prior to disposal, to facilitate handling and placement and minimize void spaces in the disposal cell. The maximum size of dismantled or cut materials shall not exceed 20 feet in the longest dimension and a maximum volume of 30 cubic feet for placement in the cells. Smaller dimensions may be necessary for loading, handling, hauling, and placement of material in the disposal cell.

The debris, after having been reduced in dimension and volume if required, will be placed in the tailings cells as directed by the CQA Manager.

7.3.6 Incompressible Debris

Material that is not compressible (steel columns and beams, concrete, and other solid material) shall be reduced in size for loading, hauling, and placement in the disposal cell. Incompressible debris shall be placed, oriented, or spread in a manner that minimizes void spaces below, between, and above these materials. Incompressible debris shall be placed on and covered with soils or similar materials (Specification Section 7.3.3). Incompressible debris such as steel members shall be placed in the disposal cell with the longest dimension oriented horizontally.

Thick-walled pipe, conduit, tanks, vats, pressure vessels, and other hollow materials that cannot be crushed or dismantled shall be transported to the planned location within the disposal cell and oriented for filling and burial. The voids on the inside of the item shall be filled with contaminated soil, clean fill soil, or grout (controlled low-strength material, flowable fill, etc.). Contaminated soil (Section 7.3.3) or clean fill will be placed outside of the items and compacted with standard compaction equipment (where possible) or hand-operated equipment to the compaction requirements in Specification Section 7.4. Several lifts of compacted contaminated soil or clean fill may be necessary to fill around and cover these items.

For debris where internal voids cannot practically be filled with soil, a grouting program would be initiated to pump controlled low strength material (CLSM, flowable fill) into the voids. Debris would be grouped together and characterized as materials that would require grouting, so that a significant volume of debris can be grouted in a single action, rather than grouting individual lengths of pipe. Pipe sections could be stacked horizontally, or cut short enough to stand vertically in a safe manner. Grout would then likely be batched offsite and delivered to the site and a pump truck would likely be required to place the material within the debris, within the cell. A soil berm would be used to contain the grout laterally around the perimeter of the selected debris. The debris voids would be grouted, and grout would also be placed around the debris to develop a monolithic grouted mass.

If CLSM is required for the grouting of voids that cannot be filled mechanically with soil, the mix design for the grout should mimic, as closely as possible, the strength and hydraulic properties of the contaminated soil that will also be used for filling voids within the debris. This will minimize any effects of differential settlement that would result from the grout having a higher strength and being less compressible than the surrounding soil.

The unconfined compressive strength of the CLSM should be between 30 psi (minimum) and 150 psi (maximum), and unit weights should be approximately 100 to 120 pcf.

7.3.7 Compressible Debris

Materials that are compressible (such as thin-walled piping and thin-walled tanks) shall be flattened or crushed in the disposal cell, prior to final placement. Flattening or crushing shall be done with hydraulic excavator attachments, or with a dozer or other steel-tracked equipment.

These materials shall be placed in the disposal cell and spread to form a lift with a maximum thickness of two feet. Spreading shall be done in a manner resulting in materials lying flat and minimizing void spaces. All pipe that shall be cut into lengths of approximately 10 feet or less for disposal. Pipe larger than 12 inches in diameter shall be longitudinally split or cut.

7.3.8 Organic Debris

The volume of organic materials (such as wood and paper) that may be prone to long-term biodegradation within the cell is anticipated to be a small percentage of the material being disposed. However, to limit the potential for settlement due to consolidation of organics, the contractor shall not dispose of organic materials in any lift thicker than 12 inches. The material shall be spread with a dozer in lifts, or thoroughly mixed with soil that will be placed around incompressible debris, and compacted. Organics mixed with soil for spreading shall be limited to 30 percent by volume of the mixture.

7.3.9 Soils and Similar Materials

Soils and soil-like materials to be placed in the disposal cell will be from on-site areas identified by EFRI for excavation. Soil or soil-like material shall be placed and compacted over each lift of debris (Section 7.2.4) or other materials in lifts not to exceed two feet in loose thickness and compacted prior to placement of additional lifts. Soils will also be used for interim soil cover to minimize exposure of demolition materials and other materials to air and meteoric water.

7.4 Performance Standards and Testing

7.4.1 Material Compaction – Debris Lifts

During construction, the compaction requirements for the crystals will be evaluated based on field conditions and material quantities. The compaction requirements will be determined by the

CQA Manager and the Reclamation Project Manager or a designated representative, with the agreement of the Owner.

The debris, contaminated soils and other materials for the first lift will be placed to a depth of up to four feet thick, in a bridging lift, to allow access for placing and compacting equipment. The first lift will be compacted by the tracking of heavy equipment, such as a Caterpillar D6 Dozer (or equivalent), using at least four passes, prior to the placement of the next lift. Subsequent lifts will not exceed 12 inches and will be compacted using a minimum of four passes with the tracked equipment.

Soil or similar material shall be compacted with a minimum of 6 passes with self-propelled, towed, or hand-held vibratory compaction equipment. The number of passes shall be confirmed with actual compaction equipment on site with a field test section of soil to establish a correlation between the field compaction method and 80 percent of maximum dry density for the soil, as determined by the standard Proctor test (ASTM D698). During compaction, the material shall be within 1 percent above to 4 percent below optimum moisture content for the material, as determined by the standard Proctor test. If water addition is required to achieve this range of moisture contents, the added water shall be thoroughly mixed into the material prior to compaction.

The CQA technicians will monitor and approve of the final debris placement. In areas where voids are observed during placement, the contractor shall re-excavate the area, fill any voids encountered with soil and recompact the materials, or grout the voids. The CQA technicians will make a recommendation to the Contractor for the implementation of a grouting program where voids, either within a debris mass, or within a vessel, cannot be properly filled with soil using conventional equipment.

7.4.2 Material Compaction - Disposed Materials

The upper 12 inches of the final disposed material surface shall be compacted to 90 percent of the maximum dry density for the material, as determined by the Standard Proctor test. During compaction, the material shall be within 1 percent above to 4 percent below optimum moisture content for the material, as determined by the standard Proctor test. If water addition is required to achieve this range of moisture contents, the added water shall be thoroughly mixed into the material prior to compaction.

7.4.3 Testing Frequency

Field density tests shall be compared with standard Proctor tests (ASTM D698 Method A or C) on the same material. Standard Proctor tests shall be conducted at a frequency of at least one test per 5,000 cubic yards of material compacted, or when material characteristics show significant variation.

Field density testing may be conducted with the sand cone test (ASTM D1556) or a nuclear density gauge (ASTM D6938, or as modified by the QA Manager). Correlation of nuclear density gauge results shall be by comparison with results from sand cone test(s) and laboratory testing for water content(s) using the oven drying method (ASTM D2216) on similar material.

The frequency of the field density and moisture tests will be not less than one test per 1,000 cubic yards of compacted fill. A minimum of two tests will be taken for each day that an applicable amount of fill is placed in excess of 150 cubic yards. A minimum of one test per lift and at least one test for every full shift of compaction operations will be taken.

7.4.4 Final Slope and Grades

The final disposed material surface shall have maximum side slopes of 5:1 and a top surface sloping in the directions and grades shown on the Drawings. The side slopes and top surface shall be free from abrupt changes in grade or areas of runoff concentration. The final disposed material surface shall be compacted with approved construction equipment to form a smooth surface with uniform density for subsequent cover placement.

8.0 COVER CONSTRUCTION

8.1 General

This section outlines work associated with construction of the earthen cell cover. A multi-layered earthen cover will be placed over tailings Cells 2, 3 and 4A and a portion of Cell 1 used for disposal of contaminated materials (the Cell 1 Disposal Area).

8.2 Materials Description

8.2.1 Cover Random Fill

The random fill for the radon attenuation layers, and the water storage/frost protection layer will consist of a mixture of sands and silts with varying amounts of clay.

In the initial bridging (platform) lift of the tailings, rock sizes of up to 2/3 of the thickness of the lift will be allowed. On all other fill lifts, rock sizes will be limited to 2/3 of the lift thickness, with at least 30 percent of the material finer than the No. 40 sieve. The portion passing the No. 40 sieve, will classify as CL, SC, ML or SM materials under the Unified Soil Classification System. Oversized material will be controlled through selective excavation at the stockpiles and through the utilization of a grader, bulldozer or backhoe to cull oversize materials from the fill.

The source of these materials will be on-site stockpiles from previous cell construction activities.

8.2.2 Organic Matter Amendment

Composted biosolids will be used to amend the physical and chemical properties of the water storage/frost barrier material for plant growth (Section 8.3.7). Composted biosolids will be added to the upper six inches of the water storage fill material at a rate of 10 tons/acre.

8.2.3 Rock Mulch

Gravel will be mixed with topsoil and placed on portions of the cover on Cells 2, 3, 4A, and 4B top surfaces (as shown on the Drawings) for erosion protection. Rock mulch material shall be shall be free from roots, branches, rubbish, and debris.

The rock portion of the rock mulch will consist of granular materials from approved off-site areas. The mixture shall be 25 percent gravel by weight. The rock (gravel) portion of the rock mulch shall be a screened product and have a D_{100} particle size of less than 1-inch (100 percent passing the 1-inch sieve).

The soil portion of the rock mulch will consist of select material from the on-site topsoil borrow area (Section 3.5).

8.2.4 Erosion Protection and Perimeter Apron Rock

Material for the perimeter apron erosion protection will consist of granular materials from approved off-site sources. The perimeter apron rock will be placed along the toe of the disposal cell and the tailings cells in the erosion protection areas (as shown on the Drawings). Perimeter apron rock shall meet NRC long-term durability requirements (a rock quality designation of 65 or more).

Perimeter apron rock shall be shall be a screened product, free from roots, branches, rubbish, and debris. The specifications as given below are for rock quality designations of 70 or higher. If actual rock quality designation is between 65 and 69, oversizing will be required. Rock quality designations below 65 will not be acceptable.

Designated gradations for the apron rock will be as specified on the Drawings. Apron rock will be imported from off-site.

- Side Slope riprap shall have a minimum D_{50} as listed below and a minimum layer thickness of 1.5 times the D_{50} or the D_{100} of the riprap, whichever is greater:
    - 1.7 in. for non-accumulating flow side slopes
    - 5.3 in. for Cell 4A and Cell 4B southern side slopes
    - 4.5 in. for Cell 1 Disposal Area side slope

- Rock aprons shall have a minimum D_{50} as listed below and a minimum layer thickness of 1.5 times the D_{50} or the D_{100} of the riprap, whichever is greater
    - 3.4 in. for Rock Apron A
    - 10.5 in. for Rock Apron B
    - 9.0 in. for Rock Apron C

8.2.5 Erosion Protection Filter

Erosion protection filter material shall be shall be free from roots, branches, rubbish, and debris. The filter material will generally classify as sand containing gravel and fines and shall meet the following gradation specifications.

Table 8.1 – Filter Material Gradation

Sieve Size	Percent Passing, By Weight
3-inch	100
No. 4	70-100
No. 20	40-60
No. 200	0-5

8.2.6 Topsoil

Topsoil will consist of select material from the designated, on-site topsoil borrow area (Section 3.5). The topsoil shall have a plasticity index (PI) less than 10 (%), as determined by Atterberg limits testing.

8.3 Work Description

The contractor will place cover materials based on a schedule determined by the Owner and the Owner's analysis of settlement data, piezometer data and equipment mobility considerations. The DWMRC must approve fill grades and elevations prior to placement of final cover materials. Settlement monitoring points (both temporary and permanent) will be established and monitored in accordance with Sections 8.3.1 to 8.3.3 of the Technical Specifications and the Settlement Monitoring Plan approved by DWMRC for the site.

In each layer of the cover, the distribution and gradation of the materials throughout each fill layer will be such that the fill will, as far as practicable, be free of lenses, pockets, or layers of material differing substantially in texture, gradation or moisture content from the surrounding material. Nesting of oversized material will be controlled through selective excavation of stockpiled material, observation of placement by a qualified individual with authority to stop work and reject material being placed and by culling oversized material from the fill utilizing a grader. Successive loads of material will be placed on the fill so as to produce the best practical distribution of material.

If the compacted surface of any layer of fill is too dry or smooth to bond properly with the layer of material to be placed thereon, it will be moistened and/or reworked with a harrow, scarifier, or other suitable equipment to a sufficient depth to provide relatively uniform moisture content and a satisfactory bonding surface before the next succeeding layer of fill is placed. If the compacted surface of any layer of fill in-place is too wet, due to precipitation, for proper compaction of the fill material to be placed thereon, the contractor will rework the material with a harrow, scarifier or other suitable equipment to reduce the moisture content to the specified range. The contractor will then recompact the fill.

No material will be placed when either the material being compacted, or the underlying material, is frozen or when ambient temperatures do not permit the placement or compaction of the materials to the specified density, without developing frost lenses in the fill.

8.3.1 Monitoring Interim Cover Settlement

The contractor will maintain the existing settlement monitoring points located within tailings disposal cells by extending them through additional fill placement. For areas without settlement monitoring points, the contractor will install temporary settlement points to monitor settlements of the interim cover surface. The temporary settlement points will consist of wooden stakes, rebar, or an approved equivalent; set a minimum of 12 inches into the interim cover surface.

Settlement data will be collected and analyzed; and the reclamation techniques and schedule will be adjusted accordingly.

8.3.2 Monitoring Final Cover Settlement

After placement of final cover material, the contractor will install permanent settlement plates to monitor settlement of the final cover surface. The settlement plates will consist of a corrosion resistant steel plate (1/4-inch thick; two-foot square to which a one-inch diameter corrosion resistant monitor pipe has been welded. The one-inch diameter monitor pipe will be surrounded by a three-inch diameter guard pipe which will not be attached to the base plate.

The installation will consist of leveling an area on the surface and placing the base plate directly on the cover soil. A minimum of two feet of initial soil will be placed on the base plate for a minimum radial distance of five feet from the center pipe.

8.3.3 Monitoring Settlement Points

Settlement monument placement and data collection will be made in accordance with the DWMRC approved Settlement Monitoring Plan.

8.3.4 Platform Layer Fill

A layer of 2.5 feet of platform fill will be placed over the tailings surface to form a stable working platform for subsequent controlled fill placement. This platform fill will be placed by pushing random fill material across the tailings in increments such that the underlying tailings are displaced as little as possible. The fill soils shall be placed in lifts of 12-inch maximum loose thickness to form a uniform subsoil layer for the cover system. A rough surface will be maintained on the surface of each lift.

8.3.5 Highly Compacted Layer

The highly compacted layer shall be placed in lifts with maximum compacted thickness of 6 inches to form a continuous layer with a total minimum compacted layer thickness of 30 inches. A rough surface will be maintained on the surface of each lift. If water addition is required to achieve the required range of moisture contents, the added water shall be thoroughly mixed into the material prior to compaction.

8.3.6 Water Storage Layer Fill Placement

Random fill will be placed to a minimum of 42 inches thick, above the highly compacted layer in 18-inch lifts. If oversized material is observed during the excavation of fill material, it will be removed, as far as practicable, before it is placed in the fill. A rough surface will be maintained on the surface of all but the uppermost lift. If water addition is required to achieve the required range of moisture contents, the added water shall be thoroughly mixed into the material prior to placement.

8.3.7 Organic Matter Amendment

Composted biosolids will be applied prior to the placement of topsoil or the topsoil-gravel mixture. Composted biosolids will be uniformly spread over the surface of the water storage layer (frost barrier) and mixed to a depth of 6 in. (15 cm). The soil amendment will be applied prior to placement of the topsoil and topsoil-rock mixture.

8.3.8 Rock Mulch Placement

The contractor shall provide a method of thoroughly mixing the topsoil and the gravel mixture to provide the 25 percent gravel- 75 percent topsoil mixture (by weight). The mixture shall be prepared prior to transport to the placement areas. Gradation samples will be collected at the point of placement (on the topdeck) to verify the mixture’s content. The CQA manager will approve the contractor’s proposed method of mixing based on the gradation results during initial placement.

The mixture shall be placed in one loose lift to form a uniform layer with a final thickness of 6 inches on the slope surfaces of the disposal cell (shown on the Drawings). The gravel-topsoil mixture shall be spread with tracked equipment and compacted using two passes with rubber-tracked equipment. Low-ground pressure equipment may be necessary to prevent over-compaction of the mixture. Field density tests will be conducted to monitor and prevent overcompaction of the material.

The topsoil-gravel erosion control layer will not be amended for organic matter or nutrients to avoid the stimulation of undesirable weedy species.

Following placement of the topsoil-gravel erosion protection layer, the area shall be harrowed to reduce any compaction that may have occurred during placement of the cover and to create an uneven surface for optimum seedbed conditions.

8.3.9 Topsoil Placement

Topsoil (Section 8.2.7) shall be placed in one loose lift to form a uniform layer with a final thickness of 6 inches on the top and side slope surfaces of the disposal cell (shown on the Drawings). The topsoil shall be spread with tracked equipment and compacted using two passes with rubber-tracked equipment. Low-ground pressure equipment may be necessary to prevent over-compaction of the topsoil.

The topsoil layer will not be amended for organic matter or nutrients to avoid the stimulation of undesirable weedy species.

Following placement of the topsoil layer, the area will be harrowed to reduce any compaction that may have occurred during placement of the cover and to create an uneven surface for optimum seedbed conditions.

8.3.10 Rock and Filter Material Placement

The side slopes of the reclaimed cover will be protected by rock surfacing. Riprap, perimeter apron rock (Section 8.2.5), and erosion protection filter material (Section 8.2.6) shall be placed in one or more lifts to the depths outlined in the Drawings and using the methods outlined below.

The Drawings show the location of rock protection with the size and thickness requirements for the various side slopes and aprons.

Filter material and rock shall be handled, loaded, transported, stockpiled, and placed in a manner that minimizes segregation. Rock and filter material shall be placed in or near its final location by dumping, then spreading with a small dozer, the bucket of a trackhoe, or other suitable equipment. Rock and filter material shall be placed and spread in a manner that minimizes displacement of underlying cover soils, natural soils, or filter material. Each layer of rock and filter material shall be track-walked with a small dozer, tamped with the bucket of a trackhoe, or densified by other approved methods.

Placement of the riprap will avoid accumulation of riprap sizes less than the minimum D_{50} size and nesting of the larger sized rock. The riprap layer will be compacted by at least two passes by a D7 Dozer, tamping with the bucket of a trackhoe, or equivalent methods in order to key in the rock particles for stability. The completed layer of rock mulch and filter material shall be well-graded in particle-size distribution and free from pockets of smaller material and free from large voids or loose areas.

8.4 Performance Standard and Testing

8.4.1 Platform Fill Testing

Compaction of the platform fill will be dictated by the methods used by EFRI in platform fill placement.

Prior to placement of the highly compacted layer material, the top surface platform fill will be compacted to at least 95 percent of the maximum dry density for the material as determined by the standard Proctor test. The upper 6 inches of the platform fill shall be tested for compaction according to Section 8.4.2. Placement of platform fill will be monitored by a qualified individual with the authority to stop work and reject material being placed.

8.4.2 Highly Compacted Layer Testing

Each lift of the highly compacted layer shall be compacted to at least 95 percent of the maximum dry density for the material, as determined by the standard Proctor test (ASTM D698). Water contents should be adjusted, as needed, to meet the density requirements.

Material specifications for the random fill material shall be confirmed by gradation testing conducted by approved personnel. Testing shall consist of No. 200 sieve wash and particle-size distribution testing (ASTM D422) and Atterberg limits (ASTM D4318) at a frequency of at least one test per 2,000 cubic yards of fill placed, or when material characteristics show a significant variation.

Checking of compaction shall consist of a minimum of one field density test per 500 cubic yards of material compacted. A minimum of two tests shall be taken for each day that an applicable amount of fill is placed in excess of 150 cubic yards. A minimum of one test per lift and at least one test for every full shift of compaction operations will be taken.

Field density tests shall be compared with Standard Proctor tests (ASTM D698 Method A or C) on the same material. Standard Proctor tests shall be conducted at a frequency of at least one test per 2,500 cubic yards of material compacted, or when material characteristics show significant variation.

Field density testing may be conducted with the sand cone test (ASTM D1556) or a nuclear density gauge (ASTM D6938, or as modified by the QA Manager). Correlation of nuclear density gauge results shall be by comparison with results from sand cone test(s) and laboratory testing for water content(s) using the oven drying method (ASTM D2216) on similar material.

8.4.3 Water Storage Layer Fill Material Testing

Material specifications for the random fill for water storage layer shall be confirmed by gradation testing conducted by approved personnel. Testing shall consist of No. 200 sieve wash and particle-size distribution testing (ASTM D422) and Atterberg limits (ASTM D4318) at a frequency of at least one test per 2,000 cubic yards of fill placed, or when material characteristics show a significant variation. Cover material compaction will be verified by the maximum lift thickness outlined in Section 8.3.6.

Each lift of this upper fill material layer shall be compacted to at least 85 percent of the maximum dry density for the material, as determined by the standard Proctor test (ASTM D698). Water contents should be adjusted, as needed, to meet the density requirements.

The frequency of the field density and moisture tests will be not less than one test per 1,000 cubic yards of compacted fill. A minimum of two tests will be taken for each day that an applicable amount of fill is placed in excess of 150 cubic yards. A minimum of one test per lift and at least one test for every full shift of compaction operations will be taken.

Field density tests shall be compared with Standard Proctor tests (ASTM D698 Method A or C) on the same material. Standard Proctor tests shall be conducted at a frequency of at least one test per 5,000 cubic yards of material compacted, or when material characteristics show significant variation.

Field density testing may be conducted with the sand cone test (ASTM D1556) or a nuclear density gauge (ASTM D6938, or as modified by the QA Manager). Correlation of nuclear density gauge results shall be by comparison with results from sand cone test(s) and laboratory testing for water content(s) using the oven drying method (ASTM D2216) on similar material.

8.4.4 Topsoil Testing

Material specifications for the topsoil material shall be confirmed by Atterberg limits testing (ASTM D4318) on samples of the topsoil, once for each 1,000 cubic yards of total topsoil material placed (including the quantity of topsoil added to the rock mulch mixture).

The topsoil shall be compacted to between 80 and 85 percent of the maximum dry density for the material, as determined by the standard Proctor test. During placement, the material shall be within the optimum moisture content and 3 percent below the optimum moisture content for the material, as determined by the standard Proctor test.

Checking of compaction of the topsoil shall consist of a minimum of one field density test per 500 cubic yards of material placed. A minimum of two tests shall be taken for each day that an applicable amount of fill is placed in excess of 150 cubic yards. A minimum of one test per lift and at least one test for every full shift of placement operations will be taken.

Field density tests shall be compared with Standard Proctor tests (ASTM D698 Method A or C) on the same material. Standard Proctor tests shall be conducted at a frequency of at least one test per 2,500 cubic yards of material placed, or when material characteristics show significant variation.

Field density testing may be conducted with the sand cone test (ASTM D1556) or a nuclear density gauge (ASTM D6938, or as modified by the QA Manager). Correlation of nuclear density gauge results shall be by comparison with results from sand cone test(s) and laboratory testing for water content(s) using the oven drying method (ASTM D2216) on similar material.

8.4.5 Rock Mulch Testing

The maximum particle size for the rock used for rock mulch material shall be confirmed by gradation testing prior to mixing with the topsoil, to determine the maximum particle size. Testing shall consist of particle-size distribution testing (ASTM D422) at a frequency of at least one test per 2,000 cubic yards of rock delivered to the site, or when rock characteristics show a significant variation.

The gradation specifications for the rock mulch material (topsoil-gravel mixture) (Specification Section 8.2.4) shall be confirmed by gradation testing, on samples collected from the point of placement (on the topdeck). Testing shall consist of particle-size distribution testing (ASTM D422) at a frequency of at least one test per 2,000 cubic yards of mixture placed, or when the characteristics of the mixture show a significant variation. The QA Manager may choose to conduct to increase the frequency of testing at the beginning of placement to evaluate the mixing method proposed by the contractor.

Rock mulch thickness will be controlled through the establishment of grade stakes placed on a 200 x 200 foot grid on the top of the cells and by a 100 x 100 foot grid on the cell slopes. Physical checks of rock mulch depth will be accomplished through the use of hand dug test pits at the center of each grid in addition to monitoring the depth indicated on the grade stakes.

The rock mulch mixture shall be compacted to between 80 and 85 percent of the maximum dry density for the material, as determined by the standard Proctor test. During placement, the material shall be within the optimum moisture content and 3 percent below the optimum moisture content for the material, as determined by the standard Proctor test.

Checking of compaction of the rock mulch mixture shall consist of a minimum of one field density test per 500 cubic yards of material placed. A minimum of two tests shall be taken for each day that an applicable amount of fill is placed in excess of 150 cubic yards. A minimum of one test per lift and at least one test for every full shift of placement operations will be taken.

Field density tests shall be compared with Standard Proctor tests (ASTM D698 Method A or C) on the same material. Rock corrections (ASTM D4718) for oversize particles may be required for the mixture depending on the gradation of the gravel material selected. Standard Proctor tests shall be conducted at a frequency of at least one test per 2,500 cubic yards of material placed, or when material characteristics show significant variation.

Field density testing may be conducted with the sand cone test (ASTM D1556) or a nuclear density gauge (ASTM D6938, or as modified by the QA Manager). Correlation of nuclear density gauge results shall be by comparison with results from sand cone test(s) and laboratory testing for water content(s) using the oven drying method (ASTM D2216) on similar material.

The durability of the rock shall be verified by durability tests outlined in Specification Section 8.4.8.

8.4.6 Erosion Protection and Perimeter Apron Rock Testing

Material specifications for the perimeter apron rock shall be confirmed by gradation testing conducted by approved personnel. Testing shall consist of particle-size distribution testing (ASTM D422) at a frequency of at least one test per 2,000 cubic yards of rock delivered to the site, or when rock characteristics show a significant variation.

Rock layer thickness will be controlled through the establishment of grade stakes placed on a 200 x 200 foot grid on the top of the cells and by a 100 x 100 foot grid on the cell slopes. Physical checks of riprap depth will be accomplished through the use of hand dug test pits at the center of each grid in addition to monitoring the depth indicated on the grade stakes.

The durability of the rock shall be verified by durability tests outlined in Specification Section 8.4.8.

8.4.7 Erosion Protection Filter Testing

Material specifications for erosion protection filter material (Section 8.2.6) shall be confirmed by gradation testing conducted by approved personnel. Testing shall consist of No. 200 sieve wash and maximum particle size testing (ASTM D422) at a frequency of at least one test per 10,000 cubic yards of fill placed, or when material characteristics show a significant variation.

Filter layer thickness will be established during construction with grade stakes placed on a grid or centerline and offset pattern and layer thickness marks on each grade stake. The minimum thickness of the layer will be verified by spot checking of layer thickness by hand excavation in selected locations.

8.4.8 Rock Durability Testing

For riprap materials, each load of material will be visually checked against standard piles for gradation prior to transport to the tailings piles. Prior to delivery of any riprap materials to the site, rock durability tests will be performed for each gradation to be used. Test series for riprap durability will include specific gravity, absorption, sodium soundness and LA abrasion. During construction, additional test series and gradations will be performed for each type of riprap when approximately one-third (1/3) and two-thirds (2/3) of the total volume of each type have been produced or delivered. For any type of riprap where the volume is greater than 30,000 cubic yards, a test series and gradations will be performed for each additional 10,000 cubic yards of riprap produced or delivered.

8.5 Surface Slopes and Grades

The final cover surface shall have maximum side slopes of 5:1 and a top surface sloping in the direction and grade shown on the Drawings. The side slopes and top surface shall be free from abrupt changes in grade or areas of runoff concentration. The perimeter apron at the toe of the side slopes shall have a minimum width of 20 feet from the toe of the side slopes and slope away from the toe of the side slopes (as shown on the Drawings).

8.6 Grading Tolerances

The completed cover surface shall be constructed to within 1.0 foot (horizontally) of the lines as designed, and within 0.1 foot (vertically) of the elevations as designed. The final surface of the subsoil zone shall be smoothed to avoid abrupt changes in surface grade. The layer thicknesses shall meet the required minimum thicknesses.

The completed riprap shall be placed to within 5.0 foot (horizontally) of the layout as designed, and within 0.5 foot (vertically) of the elevations as designed. The rock layer thicknesses shall meet the minimum requirements.

9.0 REVEGETATION

9.1 General

Following topsoil placement, the cover surface and other areas disturbed during reclamation work will be revegetated. This section outlines the requirements for vegetation establishment where required. This section may be revised as necessary based on field requirements and soil nutrient analyses at the time of revegetation.

9.2 Materials Description

The soil amendments, seed mixture, and erosion control materials for revegetation are outlined below. Submittals for each of the following products shall be provided to the Owner for approval prior to use of such products.

9.2.1 Soil Amendments

The proposed application rate may be adjusted up or down based on soil chemical analysis that is conducted prior to placement of the water storage layer.

Composted biosolids shall be added at a rate of 10 tons/acre and uniformly spread over the surface of the water storage layer and mixed to a depth of 15 cm. This treatment will be applied after the water storage layer is in-place and before placement of the topsoil-gravel erosion protection layer.

9.2.2 Seed Mix

Species selection for the seed mixture was based on native vegetation found in the area as well as soil and climatic conditions of the mill site. Changes to the seed mixture will be as approved by EFRI. The following seed mixture shall be used on all seeded areas.

Table 9.1. Species and seeding rates proposed for Mill site.

Scientific Name	Common Name	Varietal Name	Native/ Introduced	Seeding Rate (lbs PLS/acre)†	Seeding Rate (# seeds/ft²)
Grasses					
Pascopyrum smithii	Western wheatgrass	Arriba	Native	3.0	7.9
Pseudoroegneria spicata	Bluebunch wheatgrass	Goldar	Native	3.0	9.6
Elymus trachycaulus	Slender wheatgrass	San Luis	Native	2.0	6.2
Elymus lanceolatus	Streambank wheatgrass	Sodar	Native	2.0	7.3
Elymus elymoides	Squirreltail bottlebrush	Toe Jam	Native	2.0	8.8
Thinopyrum intermedium	Pubescent wheatgrass	Luna	Introduced‡	1.0	1.8
Achnatherum hymenoides	Indian ricegrass	Paloma	Native	4.0	14.7
Poa secunda	Sandberg bluegrass	Canbar	Native	0.5	11.4
Festuca ovina	Sheep fescue	Covar	Introduced‡	1.0	11.5
Bouteloua gracilis	Blue grama	Hachita	Native	1.0	16.5
Hilaria jamesii	Galleta	Viva	Native	2.0	7.3
Forbs					
Achillea millefolium, variety *occidentalis*	Common yarrow	VNS*	Native	0.5	32
Artemisia ludoviciana	White sage	VNS	Native	0.5	45
Shrubs					
Atriplex canescens	Fourwing saltbush	Wytana	Native	3.0	3.4
Ericameria nauseosa	Rubber rabbitbrush	VNS	Native	0.5	4.6
Total				26.5	188

†Seeding rate is for broadcast seed and presented as pounds of pure live seed per acre (lbs PLS/acre).
‡Introduced refers to species that have been 'introduced' from another geographic region, typically outside of North America. Also referred to as 'exotic' species. *VNS=Variety Not Specified and seed source will be from sites that are climatically similar to White Mesa.

Seed shall be purchased as pounds of pure live seed and will be certified by the Utah State Department of Agriculture and Food. Certification will verify that the seed is correctly identified and genetically pure. Once the seed is obtained, seed labels will be checked to determine the percent PLS and the date that the seed was tested for percent purity and percent germination. If the test date is greater than 6 months old, the seed will be tested again before being accepted.

9.2.3 Erosion Control Materials

Wood fiber mulch will consist of specially prepared wood fibers and will not be produced from recycled material such as sawdust, paper, cardboard, or residue from pulp and paper plants. The fibers will be dyed an appropriate color, with non-toxic, water-soluble dye to facilitate visual metering during application. Wood-fiber mulch will be supplied in packages and each package will be marked by the manufacturer to show the air-dry weight.

A tackifier will be used with the wood-fiber mulch to improve adhesion. The tackifier will be a biodegradable organic formulation processed specifically for the adhesive binding of mulch. In addition, the tackifier will uniformly disperse when mixed with water and will not be detrimental to the homogeneous properties of the mulch slurry.

9.3 Work Description

Revegetation efforts shall be directed at all reclaimed and disturbed areas. The goal of the revegetation plan is to ensure that a self-sustaining vegetative community is established.

9.4 Soil Amendment Application

Following final placement and grading of the frost barrier layer, amendments will be applied as discussed in Section 9.2.1. Inorganic sources of nitrogen, phosphorus, and potassium will not be applied to the soil because composted biosolids will provide all the macronutrients required for long-term sustainability.

9.5 Growth Zone Preparation

A favorable seedbed shall be prepared on the topsoil layer or topsoil-rock mixture, prior to seeding operations. The soil should be loose and friable so as to maximize contact with the seed. The soil will be tilled, following site contours with a disc or harrow (or similar approved equipment) to a maximum depth of 6 inches. The depth of valleys and the height of ridges caused by the final tillage operations are not to exceed 3 inches.

9.6 Seed Application

Seeding will follow the application of soil amendments and seedbed preparation, by broadcast spreading method. This procedure will use a centrifugal type broadcaster (or similar implement), also called an end gate seeder. The broadcasters will have a minimum effective spreading width of 20 feet. Seed will be applied in two separate passes. One-half of the seed will be spread in one direction and the other half of seed will be spread in a perpendicular direction. This will ensure that seed distribution across the site is highly uniform and also provide the opportunity to adjust the seeding rate if the specified rate is not being achieved. Seeding will not occur if wind speeds exceed 10 mph.

Immediately following seeding, the area will be lightly harrowed to provide seed coverage and to maximize seed-soil contact. Broadcast seed shall be harrowed into the soil to a depth of 0.25 to 0.75 inches.

Seeding will take place as soon as practical after the cover system is in place. Successful seeding in southeastern Utah can occur either in late fall (e.g. October) as a dormant seeding, with germination and establishment occurring the following spring or can be conducted in June, prior to the summer monsoon season. Timing for seeding will depend upon the construction schedule for the cover system.

9.7 Erosion Control Material Application

Mulch will be applied immediately following seeding. A weed-free, wood-fiber mulch shall be applied to the seeded area at a minimum rate of 1.5 tons/acre. The wood-fiber mulch will be applied by means of hydraulic equipment that utilizes water as the carrying agent. A continuous agitator action, that keeps the mulching material and approved additives in uniform suspension, will be maintained throughout the distribution cycle.

The pump pressure will be capable of maintaining a continuous non-fluctuating stream of slurry. The slurry distribution lines will be large enough to prevent stoppage and the discharge line will be equipped with a set of hydraulic spray nozzles that will provide even distribution of the mulch slurry to the seedbed. Mulching will not be done in the presence of free surface water resulting from rains, melting snow, or other causes. Tackifier may be added either during the manufacturing of the mulch or incorporated during mulch application.

9.8 Performance Standard and Testing

The following section describes performance-based criteria for successful revegetation.

9.8.1 Seeding Rates

Prior to seeding, a known area will be covered with a tarp and seed will be distributed using the broadcaster and simulating conditions that would exist under actual seeding conditions. Seed will then be collected and weighed to determine actual seeding rate in terms of pounds per acre. This process will be repeated until the specified seeding rate is obtained.

During the seeding process, the seeding rate will be verified at least once by comparing pounds of seed applied to the size of the area seeded.

9.8.2 Erosion Control

The cover shall be inspected two times per year for eroded areas. Any area that has experienced erosion shall be backfilled and reseeded. Erosion control materials shall also be reapplied over reseeded areas.

9.8.3 Weed Control

Weed management would be conducted on the Mill site by identifying the presence of any noxious weeds during annual vegetation surveys and developing a weed control plan that is specific to the species that are present (Table 9.2). Noxious weed control is species-dependent and both method and timing will vary from species to species.

Table 9.2. Noxious weed species.

Scientific Name	Common Name
Utah State—Listed Noxious Weeds	
Acroptilon repens	Russian knapweed
Cardaria spp.	Whitetop (all species)
Carduus nutans	Musk thistle
Centaurea diffusa	Diffuse knapweed
Centaurea solstitialis	Yellow star thistle
Centaurea stoebe ssp. micranthos	Spotted knapweed
Centaurea virgate ssp. Squarrosa	Squarrose knapweed
Cirsium arvense	Canada thistle
Convolvulus spp.	Bindweed (all species)
Cynodon dactylon	Bermuda grass
Elymus repens	Quackgrass
Euphorbia esula	Leafy spurge
Isatis tinctoria	Dyer's woad
Lepidium latifolium	Broadleaf pepperweed
Lythrum salicaria	Purple loosestrife
Onopordum acanthium	Scotch thistle
Sorghum almum	Perennial sorghum (all species)
Taeniatherum caput-medusae	Medusahead
San Juan County—Listed Noxious Weeds	
Aegilops cylindrical	Jointed goatgrass
Alhagi maurorum	Camelthorn
Asclepias subverticillata	Western whorled milkweed
Solanum elaeegnifolium	Silverleaf nightshade
Solanum rostratum	Buffalobur

Each survey will identify noxious weed populations and locate these populations on a map using a set of symbols to identify species, size of the infestation, and density of the population. The effectiveness of control methods will be documented in each annual survey. In addition, immediately adjacent off-site properties will be visually surveyed to a distance of 100 feet. Inspections will be conducted by personnel familiar with the identification of noxious weeds in the area and based on Utah's Noxious Weed List.

The selected control methods will be based on the type, size, and location of the mapped noxious weeds. The treated area(s) will be monitored and re-inspected annually for new weed introductions and to evaluate the success of the control methods. Prevention is the highest priority weed management practice on non-infested lands; therefore protecting weed-free plant communities is the most economical and efficient land management practice. Prevention is best accomplished by ensuring that new weed species seed or vegetative reproductive plant parts of weeds are not introduced into new areas, and by early detection of any new weed species before they begin to spread.

Control methods may include chemical or mechanical approaches. The optimum method or methods for weed management vary depending on a number of site-specific variables such as associated vegetation, weed type, stage of growth, and severity of the weed infestation.

Chemical Control

Chemical control consists mostly of selective and non-selective herbicides. Considerations for chemical controls include: herbicide selection, timing of application, target weed, desirable plant species being grown or that will be planted, number of applications per year and number of years a particular species will need to be treated for desired control. Also important are the health and safety factors involved, and the need to consider undesirable impacts. The use of herbicides will be in compliance with all Federal and State laws on proper use, storage, and disposal. The chemical application will be done by a licensed contractor in accordance with all applicable laws and regulations and all label instructions will be strictly followed. Applications of herbicides would not be permitted when the instructions on the herbicide label indicate conditions that are not optimal.

Mechanical Control

Mechanical control is the physical removal of weeds from the soil and includes tilling, mowing, and pulling undesirable plant species. Tillage is most effective prior to seeding and establishment of desirable vegetation. The tillage method of weed control can be effective in eliminating noxious perennial weeds when repeated at short intervals (every 1-2 weeks) throughout the growing season. Tillage has the drawback of indiscriminately impacting all vegetation interspersed with weeds in established areas and can eliminate competitive, desirable vegetation leaving behind a prime seedbed for weeds to reinvade. Mowing can be an effective method for controlling the spread of an infestation and preventing the formation and dispersal of seeds. Mowing is most effective on weeds which spread solely or primarily by seed. In order to achieve this, it must be repeated at least twice during the growing season prior to, or shortly after bloom. Also, even the most intense mowing treatment will not kill hardy perennial weeds. Additional considerations will be made when selecting control treatments when specific situations arise regarding type, size, and location of weed infestations. Examples of this are perennial versus biennial, broadleaf versus grasses, noxious weeds interspersed with desirable vegetation, large monoculture patches, or small patches requiring spot treatment.

Treatment windows schedules, based on the control methods chosen and the noxious weeds present, will be established for each treatment area. The best time to treat perennial noxious weeds is in the spring or fall during their active growth phase. Different species will have different optimum treatment times even with the same type of control. Perennial weeds usually grow vegetatively in the spring, flower and seed in late spring and early summer, enter dormancy during the summer and actively grow again in the fall. The treatment windows selected will depend on the species present and control methods selected.

The final preparatory step is to determine the priority for areas to be treated. Prioritization ensures that the most important areas are dealt with at the most effective times. Important areas of concern include areas that may transport weed seeds. These areas include ditches, roadsides, and land equipment storage sites. Large monoculture patches are of concern wherever they occur and would always be high priority. Also, small patches of weeds would be treated to prevent expansion of weed populations.

Once the treatment plan is implemented, detailed records will be kept, and success or failure of treatment will be recorded so as to eliminate unsuccessful treatments.

9.8.4 Vegetation Establishment Performance

The following Revegetation Acceptance Goals/Criteria have been adapted from the Monticello Site and would be used at the Mill Site to determine reclamation success.

Revegetation Acceptance Goal/Criteria:

Criterion 1 Species Composition

a. The vegetative cover (the percentage of ground surface covered by live plants) shall be composed of a minimum of five perennial grass species (at least four listed as native), and one perennial forb species, and two shrub species listed in Table 9.1

Criterion 2 Vegetative Cover

a. Attain a minimum vegetative cover percentage of 40 percent.
b. Individual grass and forb species listed in Table 9.1 that are used to achieve the cover criteria shall have a minimum relative cover (the cover of a plant species expressed as a percentage of total vegetative cover) of 4 percent and a maximum relative cover of 40 percent.
c. Individual species not listed in Table 9.1 may be accepted as part of the cover criteria if it is demonstrated that the species is native or adapted to the area and is a desirable component of the reclaimed project site.
d. Species not listed in Table 9.1, including annual weeds or other undesirable species such as those listed in Table 9.2, shall not count toward the minimum vegetative cover requirement. Every attempt should be made to minimize establishment of all non-noxious weeds.

e. Reclaimed areas shall be free of state- and county-listed noxious weeds (Table 9.2).

f. The vegetative cover shall be self-regenerating and permanent. Self-regeneration shall be demonstrated by evidence of reproduction, such as tillers and seed production.

Criterion 3 Shrub Density

a. A minimum shrub density of 500 stems per acre.

b. Shrubs shall be healthy and have survived at least two complete growing seasons before being evaluated against success criteria

Plant cover would be measured annually on the tailing cells for a minimum of ten years or until the revegetation goals stated above are achieved. Cover would be measured by the point method, using a vegetation sighting scope mounted on an adjustable tripod with a level. Cover would be measured for each species encountered, as well as litter, rock, and bareground. Cover measurements would be made along a minimum of ten randomly placed transects on each tailing cell that are 100 feet long. A total of 100 points would be sited at one-foot intervals along each transect to collect cover data in the categories of live vegetation, litter, rock, and bareground. Sample adequacy would be determined for each tailing cell using the following formula that identifies the minimum number of samples that are necessary to estimate the population mean at a 90 percent level of confidence. Total live vegetation cover would be used to calculate sample adequacy.

$$n = \frac{t^2 s^2}{(.10x)^2}$$

Where: n = minimum number of samples required to meet sample adequacy requirements

s^2 = variance

t^2 = 1.64 for 90% confidence

x = sample mean

Shrub density would be measured in belt transects placed on either side of the cover transects. All shrubs would be counted within a three-foot wide strip or belt transect along each side of the transect used for point cover measurements, resulting in a belt transect that is six-feet wide and 100 feet long.

In addition to the above cover sampling, annual observations would be made of overall plant community health and sustainability. Overall health would be based on plant vigor, presence of annual weeds, and signs of plant deficiencies or toxicities. Plant community sustainability would be based on observations of reproduction, including both vegetative reproduction, such as tillering, and seed production.

If revegetated areas are not making satisfactory progress in meeting revegetation goals outlined above, then remedial actions will be implemented as needed. These actions may include fertilization/soil amendments, reseeding, weed control, and/or erosion control depending upon the cause of the problem that may exist and the best remediation approach to ensure plant community success.

10.0 REFERENCES

American National Standards Institute (ANSI) 1997. ANSI N323A American National Standard Calibration Standard Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments.

Denison Mines (USA) Corp. 2009. *Reclamation Plan White Mesa mill, Blanding Utah, Rev. 4*. November.

Johnson, T.L., 1999. "Design of Protective Covers." U.S. Nuclear Regulatory Commission (NRC), NUREG 2615 Draft for Comment. February.

Johnson, T.L., 2002. "Design of Erosion Protection for Long-Term Stabilization." U.S. Nuclear Regulatory Commission (NRC), NUREG 1623, Final Report. September.

National Oceanic and Atmospheric Administration (NOAA), 1977. Probable Maximum Precipitation Estimates, Colorado River and Great Basin Drainages. Hydrometerological Report (HMR) No. 49.

SENES 2012. Letter to J.A. Tischler, Energy Fuels Resources, Inc. Radium Benchmark Dose Approach. August 15, 2012, as provided in EFRI Responses to Utah DRC Interrogatories Round 1. August 2012.

United States Nuclear Regulatory Commission (NRC), 1990. "Final Staff Technical Position, Design of Erosion Protective Covers for Stabilization of Uranium mill Tailings Sites." January.

United States Nuclear Regulatory Commission (NRC) 2000. Multi-Agency Radiation Survey and Site Investigation Manual. NUREG-1575. August.

United States Nuclear Regulatory Commission (NRC). 2003. NUREG 1569, Appendix E, Guidance to the U.S. Nuclear Regulatory Commission Staff on the Radium Benchmark Dose Approach.

United States Nuclear Regulatory Commission (NRC). 2006 NUREG 1757 Volume 2, Consolidated Decommissioning Guidance, Characterization, Survey, and Determination of Radiological Criteria. Revision 1.

United States Nuclear Regulatory Commission (NRC). 2009 NUREG 1575 Supplement 1, Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual.

Yu, C., Zielen, A.J., Cheng, J-J, Le Poire, D.J., Gnanapragasam, E., Kamboj, S., Arnish, J., Wallo III, A., Williams, W.A., and Peterson, H., 2001. User's Manual for RESRAD Version 6. ANL/EAD-4. July.

Exhibit A-1:
Daily QA/QC Checks

1.0 INTRODUCTION

A background count rate and reliability check using a check source shall be performed daily, prior to use, when the detector/scaler is used for counting. Background count rates and source checks shall be input on a control chart after developing of the mean and standard deviation (sigma) as discussed below.

2.0 QC CONTROL CHARTING

Select a background location such as an office or other location where background gamma radiation gamma values are not expected to vary. Take ten 30-second count readings and record them on Form 1. Using the ten readings, calculate the mean, sigma, and 2 sigma). These results should also be recorded on Form 1.

Daily, prior to use, and at the end of surveys, perform a 30-second background and source count at the same location and in the same configuration as the acceptable ranges were developed. If the background or source check result exceeds a difference of two standard deviations, (2s or 2 sigma) from the mean, as shown on Figure 2, the Instrument Control Chart, re-count the background or source, log the results, and enter the new data on the Instrument Control Chart. Two successive background or source check counts outside the 2s Instrument Control Chart range indicates possible problems with the detector/electronics.

Values between ± 2s of the mean net counts generally indicate normal operation of the instrument. Values outside the mean ± 2s will occur with a frequency of less than 5 percent. Values greater than 3s from the mean will occur with a frequency of less than one percent and should be investigated. Two consecutive measurements outside 3s indicate problems with equipment and require adjustments and/or repairs as necessary. The scaler shall be removed from service and immediate notification shall be made to the RSO or designee prior to counting any samples.

Calibrations shall be checked whenever a significant change or repair is made to the measurement system, or when changes are detected as a result of check source measurements.

Control charts shall be maintained to indicate instrument operability and/or malfunction problems on a daily basis when instruments are in use. Use the attached control chart. Control charts should be kept for both background counts and counts with a check source, such as a 5 μCi Cs-137 source.

FORM 1: CALCULATION OF INSTRUMENT STANDARD DEVIATION							
Date of 1st Instrument Use	**Count 1**	**Count 2**	**Count 3**	**Count 4**	**Count 5**	**Count 6**	**Count 7**
	Count 8	**Count 9**	**Count 10**	**Sample Mean (λ)**	**Sample Standard Deviation (σ)**	**Lower Control Limit (λ-2s)**	**Upper Control Limit (λ+2s)**

$$\lambda = \frac{1}{10}\sum_{i=1}^{10} n_i$$

Where λ is the mean of the counts, and n is the 30 second count rate

$$s = \sqrt{\frac{\sum_{i=1}^{m}(n_i - \lambda)}{9}}$$

Where σ is the standard deviation, λ is the mean of the counts, and n is the 30 second count rate

FORM 2: INSTRUMENT CONTROL CHART							
Initials	Date	Count	Sample Mean (λ)	Sample Standard Deviation (s)	Lower Control Limit (λ-2s)	Upper Control Limit (λ+2s)	Pass?
							Y or N
							Y or N
							Y or N
							Y or N
							Y or N
							Y or N
							Y or N
							Y or N
							Y or N
							Y or N
							Y or N
							Y or N
							Y or N
							Y or N
							Y or N
							Y or N
							Y or N
							Y or N
							Y or N
							Y or N
							Y or N
							Y or N
							Y or N
							Y or N
							Y or N
							Y or N
							Y or N
							Y or N

ATTACHMENT C.2

REVISED CONSTRUCTION QUALITY ASSURANCE/ QUALITY CONTROL PLAN TO ATTACHMENT B OF RECLAMATION PLAN, REVISION 5.0

CONSTRUCTION QUALITY ASSURANCE/QUALITY CONTROL PLAN

FOR RECLAMATION OF WHITE MESA MILL FACILITY

BLANDING, UTAH

TABLE OF CONTENTS

1 INTRODUCTION

This Construction Quality Assurance/Quality Control Plan (CQA/QC Plan) has been prepared for construction activities related to the reclamation of the Energy Fuels Resources (USA) Inc. (”EFRI”) White Mesa Mill Facility located in Blanding, Utah and is submitted as an attachment to the Reclamation Plan.

1.1 Purpose and Scope

The purpose of this CQA/QC Plan is to address the Construction Quality Assurance (CQA) and Construction Quality Control (CQC) procedures and requirements to be used during reclamation activities at the site to assure that the project is constructed in conformance with the Technical Specifications, Drawings, and applicable regulatory requirements and permit conditions. The CQA/QC Plan is intended to: 1) define individuals and organizations who will be involved in reclamation activities and their respective responsibilities and qualifications; 2) establish guidelines for the flow of information and project communication; 3) establish protocols for project documentation; and 4) establish specific CQA/CQC procedures for the major components of the project.

This CQA/QC Plan addresses reclamation of the following facilities:

- Cell 1 (evaporation)
- Cells 2, 3, 4A and 4B (tailings)
- Mill buildings and equipment
- On-site contaminated areas
- Off-site contaminated areas (i.e., potential areas affected by windblown tailings)

Reclamation of the above facilities will include the following:

- Placement of contaminated soils, crystals, and synthetic liner material and any contaminated underlying soils from Cell 1 into the last active tailings cell
- Placement of a compacted clay liner on a portion of the Cell 1 impoundment areas to be used for disposal of contaminated materials and debris from the Mill site

- Decommissioning the Cell 1 (evaporation) area
- Reclamation of the Mill and ancillary areas
- Placement of materials and debris from Mill decommissioning into the Cell 1 Disposal Area or the last active tailings cell
- Placement of an Evapotranspiration (ET) cover over the entire area of Cells 2, 3, 4A, 4B and the Cell 1 Disposal Area
- Construction of runoff control and diversion channels as necessary
- Reclamation of borrow sources

1.2 Definition of Terms

In the context of this CQA/QC Plan, the following definitions apply:

Construction Quality Assurance (CQA) – A planned and systematic pattern of means and actions designed to assure adequate confidence that the materials or services meet contractual and regulatory requirements and will perform satisfactorily in service. CQA refers to means and actions employed by the involved parties to assure conformity of the project work with this CQA/QC Plan, the Drawings, and the Technical Specifications.

Construction Quality Control (CQC) – Actions that provide a means to measure and regulate the characteristics of an item or service in relation to contractual and regulatory requirements. CQC refers to those actions taken by the Contractor, technicians, or other involved parties to verify that the materials and the workmanship meet the requirements of this CQA/QC Plan, the Drawings, and the Technical Specifications.

Technical Specifications – The document that prescribes requirements and standards for specific elements of the reclamation. This document is included as Attachment A to the 2011 Reclamation Plan. Technical Specifications will be prepared in final form prior to commencement of reclamation activities.

Drawings – Detailed project drawings to be used in conjunction with the Technical Specifications. These drawings will be prepared in final form as construction drawings prior to reclamation.

Construction Project – The total authorized/approved reclamation project that requires several construction segments to complete.

Construction Segment – A portion of the total construction project involving a specific area or type of work. Several construction segments will likely take place simultaneously during reclamation.

Construction Task – A basic construction feature of a construction segment involving a specific construction activity.

ASTM Standards – The latest versions of the American Society for Testing and Materials specifications, procedures and methods.

2 INVOLVED PARTIES AND PERSONNEL

Each construction task within each segment of the overall project will consist of both a QC and QA component. Compliance reporting will be completed for each segment. Upon completion of all project segments, a final construction report will be prepared for the project. Following is a listing of the parties (organizations and individuals) that will be involved in the implementation of the CQA/QC Plan during the reclamation at the site, including a discussion of each party's responsibility, authority and qualifications.

2.1 Owner

The Owner of this project is EFRI.

2.2 Construction Manager

Responsibility & Authority: The on-site Construction Manager is responsible for the conduct, direction and supervision of all reclamation activities as detailed in the Drawings and Technical Specifications. The Construction Manager will be selected/appointed by the Owner. The Construction Manager is responsible for maintaining a detailed schedule for the various Construction Segments so that each is performed according to the schedule for the overall Reclamation Project. The Construction Manager will interact as required with all other parties involved in implementing the reclamation including the Contractor, the CQA/QC personnel, and the DWMRC Project Manager. In the temporary absence of the Construction Manager, a designated representative will assume the duties of the Construction Manager. The Owner may appoint separate Construction Managers to oversee the various Construction Segments within the overall Reclamation Project. The Construction Manager(s) will report directly to the Owner.

Qualifications: The Construction Manager(s) shall have the mine reclamation and construction experience necessary to manage a large-scale reclamation project.

2.3 Design Engineer

Responsibility & Authority: The Design Engineer is responsible for the design of the various elements of the reclamation project and for preparing the Drawings and Technical Specifications. Throughout the project, the Design Engineer will interact as necessary with the Owner, Construction Manager, CQA/QC staff, and the DWMRC Project Manager. The Design Engineer will approve all design changes that arise during the course of the Reclamation Project.

Qualifications: The Design Engineer shall be a qualified Professional Engineer registered in the State of Utah. The Design Engineer shall have expertise which demonstrates significant familiarity with the design and construction of the various elements of mine and mill site reclamation including earthwork, cover design, mill demolition and disposal.

2.4 Contractor

Responsibility & Authority: The Contractor refers to an independent party or parties, contracted by the Owner, performing the work in accordance with this CQA/QC Plan, the Drawings, and the Technical Specifications. It is anticipated that various Contractors will be employed to perform the various Construction Segments within the overall Reclamation Project. The Contractor will work under the direction of and report directly to the Construction Manager.

Qualifications: Qualifications of the Contractor are specific to the construction contract and the specific Construction Segment. The Contractor shall have a demonstrated history of successful construction experience as appropriate for the Construction Segment. The Contractor shall maintain current state and federal licenses as appropriate.

2.5 Surveyor

Responsibility & Authority: The Surveyor is a party, independent from the Owner or Contractor, who is responsible for surveying, documenting, and verifying the location of all significant components of the work. The Surveyor is responsible for issuing Record Drawings of the completed elements of the Construction Project. The Surveyor's work is coordinated with the Contractor and CQA Consultant. The Surveyor will report directly to the Construction Manager.

Qualifications: The Surveyor will be a well-established surveying company with at least 3 years of surveying experience in the State of Utah. All survey activities shall be performed under the direction of a Professional Land Surveyor, licensed as required by State of Utah regulations. The Surveyor shall be fully equipped and experienced in the use of total stations and the most recent version of AutoCAD.

2.6 CQA/QC Consultant

Responsibility & Authority: The CQA/QC Consultant is a party, independent from the Owner or Contractor, who is responsible for observing, testing, and documenting the various activities comprising the Reclamation Project in accordance with this CQA/QC Plan, the Technical Specifications and the Drawings. The CQA/QC Consultant will be responsible for issuing a CQA report at the completion of the Reclamation Project which will document construction and associated CQA/QC activities. The CQA/QC Consultant will work in coordination with the Contractor, Surveyor and other parties and will report directly to the Construction Manager.

Qualifications: The CQA Consultant shall be a well-established firm specializing in geotechnical and reclamation engineering that possesses the equipment, personnel, and licenses necessary to conduct the observation and testing required. The CQA/QC Consultant will be experienced with earthwork, mill decommissioning, and other reclamation activities. The CQA/QC Consultant will be experienced in preparation of CQA documentation including field documentation, field testing procedures, laboratory testing procedures, and CQA reports.

The CQA Consultant will provide qualified staff for the project which will include the following individuals.

1) CQA Officer
2) CQA Site Manager
3) QC Technicians

2.7 CQA Officer

Responsibility & Authority: The CQA Officer will be responsible for overall implementation and management of the CQA/QC Plan for the reclamation project. The CQA Officer works from the office of the CQA Consultant and conducts periodic visits to the site as required. The CQA Officer will supervise the CQA Site Manager and all QC Technicians and will coordinate with the Surveyor, the Contractor and other staff. The CQA Officer will report directly to the Construction Manager.

The CQA Officer will be expected to maintain a thorough understanding of the existing White Mesa facilities and the reclamation project design documents including the Drawings, Technical

Specifications, and this CQA/QC Plan. He/she will have the authority to reject work or material, to require removal or placement, to specify and require appropriate corrective actions if it is determined that the Quality Control/Quality Assurance, personnel, instructions, controls, tests, records are not conforming to the CQA/QC Plan, the Construction Plans, or the Technical Specifications. The approval of the CQA Officer is required on all Compliance Reports required in this CQA/QC Plan. Specific responsibilities of the CQA Officer will include the following:

1. Administer the CQA program (i.e., provide supervision of and manage all CQA personnel and activities)
2. Provide and document all necessary training and certifications for CQA personnel
3. Review and approve the Contractor's QC Plan(s), if applicable
4. Attend Project Kickoff and Pre-Construction Meetings, and make site visits as needed
5. Perform ongoing, timely review of all CQA documentation and provide signature on all CQA documentation

Qualifications: The CQA Officer will be a Professional Engineer registered in the State of Utah and will be experienced in providing CQA oversight for large construction projects.

2.8 CQA Site Manager

Responsibility & Authority: The CQA Site Manager will be appointed by the CQA Consultant to provide day-to-day, on-site oversight of the CQA/CQC activities. The CQA Site Manager will report directly to the CQA Officer and will interact with the Construction Manager, Contractor and others on a daily basis, as project activities take place. The CQA Site Manager will maintain a thorough understanding of the Drawings, Technical Specifications, and this CQA/QC Plan. Specific responsibilities of the CQA Site Manager will include the following:

1. Attend all CQA-related meetings including Project Kickoff and Pre-Construction Meetings
2. Provide direct oversight of QC Technicians
3. Assign locations for testing and sampling
4. Oversee the collection and shipping of laboratory test samples

5. Review results of field and laboratory testing and any test results provided by the Contractor and make appropriate recommendations
6. Review the calibration and condition of onsite testing equipment, and maintain necessary equipment documentation
7. Report any deviations from the CQA/QC Plan, Drawings, or Technical Specifications to the Construction Manager and CQA Officer and arrange consultation with other parties as necessary to find solutions to unsolved problems
8. Prepare a daily field report for submittal to the CQA Officer and Construction Manager

Qualifications: The CQA Site Manager will be an engineer experienced in providing field CQA/CQC oversight for construction projects.

2.9 QC Technicians

Responsibility & Authority: The CQA Consultant will utilize various QC Technicians to assist the on-site CQA Site Manager to perform specific tasks through the project to verify the adequacy of construction materials and procedures. The QC Technicians will work under the direct supervision of the CQA Site Manger and will work in close coordination with the Contractor. The number of technicians will depend on the project needs as the work progresses.

Qualifications: The CQA Consultant will identify areas of competency and select technicians as necessary. The QC Technicians will receive on-the-job training or off-site training as required under the direction of the CQA Consultant. The CQA Officer will determine the areas of expertise of the respective technician and maintain a file on each technician's training and certifications.

2.10 Document Control Officer

Responsibility & Authority: The Document Control Officer will be appointed by the Construction Manager to assist with managing the various documents that will be produced throughout the project. The Document Control Officer will maintain permanent files for the Construction Project. All tests, surveys, monitoring and report originals will be maintained in the project files. The Document Control Officer will oversee document reproduction and distribution. A distribution list will be prepared in coordination with the Owner, Construction Manager, and CQA Officer.

Qualifications: The Document Control Officer will have the organizational and computer skills necessary to manage and distribute the various project documents.

2.11 CQA Laboratory

Responsibility & Authority: The CQA Laboratory is a party, independent from the Owner and Contractor, responsible for conducting tests of soils and other project materials in accordance with ASTM and other applicable standards in either an on-site or off-site laboratory. It is likely that more than one CQA Laboratory will be used to perform testing during reclamation activities, depending upon the material being tested. The CQA Laboratory will work in coordination with other personnel and will report directly to the CQA Consultant.

Qualifications: The CQA Laboratory will be an AASHTO AMRL accredited laboratory in testing soils using the ASTM standards outlined in the Technical Specifications. The CQA Laboratory will be capable of providing test results within a maximum of seven days of receipt of samples and will maintain that capability throughout the duration of the project.

2.12 DWMRC Project Manager

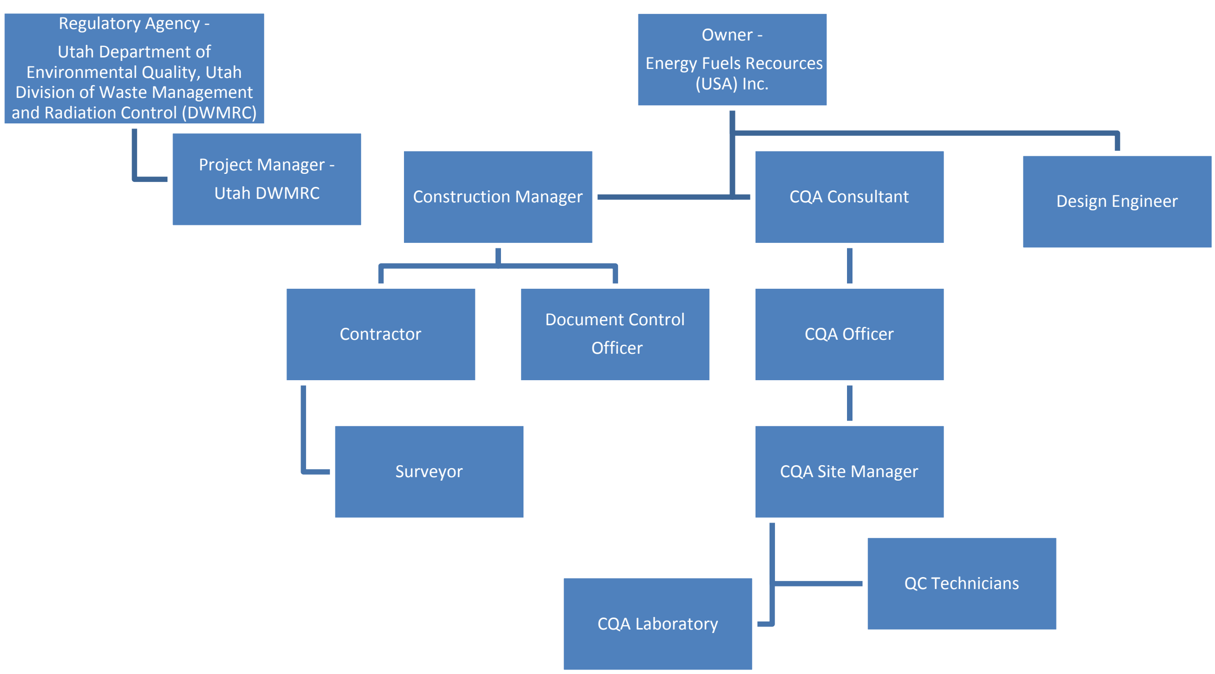
The DWMRC Project Manager will represent the DWMRC's interests in the Reclamation Project. The DWMRC Project Manager may choose to review selected procedures, personnel qualifications, equipment, calculations, and documentation. DWMRC personnel will be granted full access to the project files upon request.

3 PROJECT COMMUNICATION

3.1 Flow of Information

Effective communication is necessary to ensure a high degree of quality during the Reclamation Project. Specific meetings of key project personnel will take place including a Project Kickoff Meeting, Pre-Construction Meetings, weekly Progress Meetings, and Problem or Work Deficiency Meetings. In addition, informal communication and cooperation will take place between the various parties listed in Section 2 above. The organizational chart showing the proposed lines of communication between the various parties is shown in Figure 1. The planned project meetings are described in the following sections.

Figure 1 – Project Organization



3.2 Project Kickoff Meeting

At the beginning of major reclamation activities, a Project Kickoff Meeting will take place at the site. At a minimum, this meeting will be attended by the Owner, the Construction Manager, the Contractors, the CQA Consultant, the Engineer, and the DWMRC Project Manager. The Construction Manager will conduct a site tour to observe the current site conditions and to identify various areas of the site including equipment storage areas, soil stockpiling areas, and staging areas. The Construction Manager will appoint an individual to record the discussions and decisions of the meeting and distribute meeting minutes to all attendees. Specific items for discussion will include:

1. The Drawings, Technical Specifications, and CQA/QC Plan and any modifications or clarifications to these documents
2. Lines of communication and authority
3. The responsibilities of each party
4. The overall schedule for the Reclamation Project and the anticipated sequencing and schedule of the various Construction Segments
5. Documentation requirements

3.3 Pre-Construction Meetings

The overall Reclamation Project will be comprised of several individual Construction Segments. At the beginning of each Construction Segment, a Pre-Construction meeting will take place at the site and will be attended by the Construction Manager, the Contractor, the CQA Consultant, and the DWMRC Project Manager. The Construction Manager will conduct a tour of the work area to observe the current site conditions and to identify various areas of the site including equipment storage areas, soil stockpiling areas, staging areas, and other details related to the Construction Segment. The Construction Manager will appoint an individual to record the discussions and decisions of the meeting and distribute meeting minutes to all attendees. Specific items for discussion at the Pre-Construction Meetings include the following:

1. The Drawings, Technical Specifications, and CQA/QC Plan and any modifications or clarifications to these documents

2. Safety procedures
3. Lines of communication and authority
4. The responsibilities of each party
5. The overall schedule for the Construction Segment
6. Acceptance and rejection criteria
7. Protocols for handling deficiencies, repairs, and re-testing
8. Documentation requirements

3.4 Progress Meetings

Progress meetings will be held weekly between the CQA Site Manager, the Contractor, the Construction Manager, and other concerned parties participating in the construction of the project. This meeting will include discussions of the progress of the project, planned activities for the next week, and revisions to the work plan or schedule. The Construction Manager will appoint an individual to document the meeting and send meeting minutes to all attendees for review and comment.

3.5 Problem or Work Deficiency Meetings

It is anticipated that most work deficiencies will be minor and can be resolved in the field by the QC Technicians, the CQA Site Manager, and the Contractor. The deficiency and resolution will be recorded in daily field reports and weekly summary reports prepared by the CQA Site Manager.

A special meeting will be held when a problem or deficiency is present, or likely to occur, that cannot be easily resolved in the field. The meeting will be attended by the Contractor, the Construction Manager, the CQA Site Manager, and other parties as appropriate. If the problem requires a design modification, the Engineer should either be present at, consulted prior to, or notified immediately upon conclusion of this meeting. The Construction Manager will appoint an individual to record the meeting and send meeting minutes to all attendees for review and approval. The purpose of the work deficiency meeting is to define and resolve the problem or work deficiency as follows:

1. Define and discuss the problem or deficiency
2. Review alternative solutions
3. Select a suitable solution agreeable to all parties
4. Implement an action plan to resolve the problem or deficiency

4 DOCUMENTATION

4.1 Overview

The CQA Consultant will be responsible to prepare documentation that demonstrates that CQA/CQC requirements have been addressed and satisfied. Documentation will include monitoring logs, testing data sheets, photo logs, equipment calibration forms, daily field reports, weekly summary reports, reports of design or specification changes, and a final CQA Report. Documentation will be maintained in the White Mesa Project files and will be available to the Owner, Engineer, CQA Officer, and the DWMRC Project Manager at all times.

The CQA Officer and Site Manager will be responsible for preparing forms required throughout the Reclamation Project. These forms will be used by QC Technicians and other parties to document QC activities.

4.2 Daily Field Reports

The CQA Site Manager will prepare daily field reports that will document each day’s activities. These daily reports will include the following, as applicable:

1. Basic information including date, project name, weather conditions, and the applicable Construction Segment
2. A summary of construction locations, activities, and observations an QC activities performed
3. Equipment and personnel on the project and a summary of meetings and attendees
4. Monitoring logs, testing data sheets, photo logs, and equipment calibration forms
5. A description of materials used and result of testing and documentation
6. Laboratory test reports
7. Reports of construction problems and resolution data sheets
8. Identification of deficient work or materials, and results of re-testing of deficient work
9. The signature of the CQA Site Manager

4.3 Weekly Summary Reports

At the end of each work week, a weekly summary report will be prepared and submitted to the Construction Manager and the CQA Officer. Weekly summary reports will include a brief description of the week's activities and all of the week's daily field reports. The CQA Officer will be responsible to review and sign each weekly summary report.

4.4 Field Change Reports

Changes that do not alter the intent of the Construction Plans or Technical Specifications may be made during construction to fit field conditions. Field changes require the approval of the Construction Manager and the CQA Site Manager. Field changes are to be reported on Form No. F-25 (Included in Section 6.0).

4.5 Construction Problems and Resolution Data Sheets

If significant recurring nonconformance occurs, or if special construction situations arise, the Construction Manager and CQA Officer will be made aware of the situation. The cause of the nonconformance will be determined and appropriate changes in procedures or specifications may be recommended. A Construction Problems and Resolution Data Sheet will be prepared to describe the situation and the resolution. Supporting documentation, such as photos or testing data sheets, will be attached to the data sheet. Data sheets will be included in the daily field reports and weekly summary reports.

4.6 Design or Specification Changes

During construction, design or specification changes may be required. Design changes will require the written approval of the Engineer and will take the form of technical memorandum and/or an addendum to the Drawings or Technical Specifications. Design changes are to be reported on Form No. F-26 (Included in Section 6.0).

4.7 CQA Compliance Reports

At the completion of each Construction Segment, the CQA Consultant will prepare a CQA Compliance Report signed and sealed by a Professional Engineer licensed in the State of Utah. The CQA Report will acknowledge that the work has been performed in conformance with the

Drawings and Technical Specifications. The CQA Report will incorporate supporting documentation including:

1. All daily field reports and weekly summary reports
2. Laboratory test reports
3. Field change reports
4. Construction problems and resolution data sheets
5. Documentation of design or specification changes

Any subsequent Construction Segment that is dependent upon successful completion of a specific Construction Segment cannot be initiated until a Compliance Report is prepared and approved for the previous dependent Construction Segment. Compliance Reports are to be completed on Form No. F-23 (Included in Section 6.0).

4.8 Final Construction Report

At the conclusion of the Reclamation Project, the Construction Manager or a designated representative will prepare a Final Construction Report. This report will be submitted to the DWMRC for review and approval within 180 calendar days after completion of construction. This report will be prepared under the direct supervision of and stamped by a Professional Engineer registered in the state of Utah. This report will include, at a minimum:

1. All of the individual CQA Compliance Reports which will summarize all CQA/CQC operations, construction equipment and processes, results, and observations of conformance/verification testing
2. A summary of any actions taken to resolve construction problems encountered
3. Field notes and photographs
4. As-built drawings and details

5 CQA/CQC PROCEDURES

This section describes the CQA/CQC monitoring and testing procedures to be used during the Reclamation Project to ensure that construction takes place in accordance with the Drawings and Technical Specifications. Specific requirements for construction procedures and materials are presented in the Drawings and Technical Specifications, along with criteria for site cleanup activities.

5.1 Contractor Evaluation

Prior to construction, each Contractor will submit a summary of proposed construction methods, equipment and testing protocols. The Construction Manager, CQA Officer, and Engineer will review the submittal and provide approval, in writing, of the Contractor's plans. The Contractor may be required to modify proposed methods, equipment, or testing protocols prior to approval.

5.2 Testing Methods

Throughout the Reclamation Project, various field and laboratory testing will be conducted to ensure that materials meet the Technical Specifications. Where applicable, testing will be conducted in accordance with the current versions of the corresponding ASTM test procedures. Any revisions to the testing methods will be reviewed and approved by the Engineer and the CQA Officer prior to usage. Testing methods to be used are summarized in Table 1. The required frequency of testing is described in the applicable Sections that follow.

Table 1 - Summary of Testing Methods

TEST METHOD	TEST STANDARD
Particle Size Analysis (Gradation)	ASTM D422
Atterberg Limits	ASTM D4318
Standard Proctor	ASTM D698
Rock Correction of Unit Weight & Water Content	ASTM D4718
Nuclear Moisture/Density Gauge	ASTM D6938
Sand-Cone Test	ASTM D1556
LA Abrasion – Coarse	ASTM C535

TEST METHOD	TEST STANDARD
LA Abrasion – Fine	ASTM C131
Specific Gravity – Aggregate	ASTM C127
Absorption – Aggregate	ASTM C127
Sodium Soundness – Aggregate	ASTM C88

During earthwork operations and fill placement, testing will be conducted to verify that the materials meet the gradation and classification specifications. Testing will include gradation testing (ASTM D422) and Atterberg Limit testing (ASTM D4318).

Moisture-density curves will be developed using the standard Proctor test (ASTM D698). Rock corrections (ASTM D4718) for the Proctor tests may be required depending on the material being tested. Field density testing may be conducted with the sand cone test (ASTM D1556) or a nuclear density gauge (ASTM D6938, or as modified by the QA Manager). Correlation of nuclear density gauge results shall be by comparison with results from sand cone test(s) and laboratory testing for water content(s) using the oven drying method (ASTM D2216) on similar material. A sufficient number of sand cone tests and moisture content tests will be performed to provide a correlation between the sand cone and nuclear density tests.

Rock protection aggregate will be tested using the LA Abrasion test for coarse or fine material (ASTM C535 or C131), the sodium soundness test (ASTM C88), and the specific gravity and absorption test (ASTM C127).

Other field or laboratory testing may be required throughout the Reclamation Project. Any testing shall be performed in accordance with the applicable ASTM or other industry standard.

5.3 Cell 1 Reclamation

Reclamation of Cell 1 will include the removal of contaminated materials including raffinate crystals, PVC liner, and contaminated site soils and the construction of a clay-lined area for permanent disposal of contaminated site materials. This disposal area (the Cell 1 Disposal Area) will be constructed adjacent to and parallel with the existing Cell 1 dike. A sedimentation basin will then be constructed and a drainage channel provided.

5.3.1 Removal of Contaminated Materials

QC staff will monitor of the removal of raffinate crystals, liner, and contaminated soils from Cell 1 and placement in the designated area. QC procedures for the placement of these materials are described in Section 5.4.

5.3.2 Subgrade Preparation

Subgrade for the clay liner may be leveled and filled as needed to provide a stable base for the placement of the clay liner. The QC staff will monitor placement and compaction of any subgrade fill.

5.3.3 Clay-Lined Cell 1 Disposal Area

A clay lined area will be constructed adjacent to and parallel with the existing Cell 1 dike for permanent disposal of contaminated material and debris. Tailings will not be placed in the Cell 1 Disposal Area. The area will be lined with a 12-inch thick clay layer prior to placement of contaminated materials and installation of the final reclamation cap. Placement of clay liner materials will be based on a schedule determined by the availability of contaminated materials removed from the Mill decommissioning area in order to maintain optimum moisture content of the clay liner prior to placing of contaminated materials.

5.3.4 Clay Fill Conformance Monitoring and Testing

The CQA Contractor will perform monitoring and frequent verification testing to verify that the clay fill meets the gradation and classification specifications. The CQA Contractor will monitor earthmoving operations to ensure that fill material is taken from the proper borrow sources.

Clay liner material shall be minus 1-inch size, and shall be free from roots, branches, rubbish, and process area debris. Liner material shall have a minimum of 40 percent passing the No. 200 sieve and a minimum plasticity index (PI) of 15. Suitable soils will classify as CL, CH, or SC materials under the Unified Soil Classification System.

Gradation and classification testing will be performed at a minimum of one test per 1,000 cubic yards of clay liner material or when the material shows significant variation. Samples should be randomly selected for testing.

Laboratory test results for the clay liner shall be verified for compliance and approved by the CQA site manager prior to placement of disposed materials in the cell.

5.3.5 Clay Liner and Subgrade Material Placement

QC Technicians will observe the surface condition prior to fill placement. If the compacted surface of any layer of fill is too dry or smooth to bond properly with the layer of material to be placed thereon, it will be moistened and/or reworked with a harrow, scarifier, or other suitable equipment to a sufficient depth to provide relatively uniform moisture content and a satisfactory bonding surface before the next succeeding layer of earthfill is placed. If the compacted surface of any layer of earthfill in-place is too wet (due to precipitation) for proper compaction, it will be reworked with harrow, scarifier or other suitable equipment to dry out the layer and reduce the moisture content to within the required limits. It will then be recompacted to the earthfill requirements.

QC Technicians will monitor the weather and temperature conditions. No material will be placed when fill material or the underlying material is frozen or when ambient temperatures do not permit the placement or compaction of the materials to the specified density without developing frost lenses in the fill.

The QC Technicians will monitor lift thicknesses frequently to verify the specifications are being met. The required layer and lift thicknesses for the clay liner and subgrade fill are listed in Table 2.

Table 2 - Summary of Liner Component Layers and Lift Thicknesses

Liner Component	Material Type (USCS)	Layer Thickness	Lift Thickness
Subgrade Fill	CL, ML, SC, SP, or SM	Variable	8 in. loose (max.)
Clay Liner	CL, SC, or CH	12 in. (min.)	6 in. compacted (max.)

5.3.6 Moisture and Density Control

The QC Technicians will monitor placement, moisture conditioning, and compaction of the fill as it is placed. Prior to the start of field compaction operations, appropriate laboratory compaction curves will be obtained for the range of materials to be placed. Laboratory compaction curves based on complete Proctor tests will be obtained at the frequencies outlined in Table 3, depending on the variability of materials being placed.

Each layer of the fill will be conditioned so that the moisture content is uniform throughout the layer prior to and during compaction. As far as practicable, materials will be brought to the proper moisture content before placement. If necessary, water will be added after lift placement to the material by sprinkling on the layer. Each lift will be compacted by a sufficient number of roller passes or other compaction equipment to achieve the required dry density. Material that is too dry or too wet or does not meet the required dry density will be rejected and reworked until the moisture content and dry density are within the specified limits. Reworking may include removal, re-harrowing, reconditioning, rerolling, or combinations of these procedures.

The required density testing frequencies are included in Table 3. For all materials, a minimum of two tests will be taken for each day that an applicable amount of fill is placed in excess of 150 cubic yards. A minimum of one test per lift and at least one test for every full shift of compaction operations will be taken.

Field density testing may be conducted with the sand cone test (ASTM D1556) or a nuclear density gauge (ASTM D6938, or as modified by the QA Manager). Correlation of nuclear density gauge results shall be by comparison with results from sand cone test(s) and laboratory testing for water content(s) using the oven drying method (ASTM D2216) on similar material. A sufficient number of sand cone tests and moisture content tests will be performed to provide a correlation between the sand cone and nuclear density tests. Field density tests shall be compared with standard Proctor tests (ASTM D698 Method A or C) on the same material.

Testing frequency may be increased by the CQA Site Manager if variability of materials is noted at the site, during adverse conditions, or to isolate failing areas of the construction.

Field density testing should not jeopardize the integrity of the clay liner. Holes in the clay material resulting from testing should be repaired by hand by filling with clay fill, or by filling with bentonite powder which is hydrated to fully seal the hole.

Table 3 - Summary of Liner Component Moisture-Density Testing Frequencies and Requirements

Liner Component	Test Frequency	Density Requirement*	Moisture Requirement*	Proctor Frequency
Subgrade Fill	1/1,000 cubic yards placed	90% (min.)	+/- 3%	1/5,000 cubic yards placed
Clay Liner	1/500 cubic yards placed	95% (min.)	+/- 2%	1/2,500 cubic yards placed

* Based on maximum dry density and optimum water contents as determined by standard Proctor tests (ASTM D698 Method A or C) on the same material.

5.3.7 Sedimentation Basin and Discharge Channel

After contaminated material is removed from Cell 1 and the Cell 1 Disposal Area clay liner has been constructed, Cell 1 will be breached and constructed as a sedimentation basin. A discharge channel out of the sedimentation basin will be constructed. Details of these features are provided in the Drawings and Technical Specifications. The QC staff will monitor the excavation and construction of these features to ensure conformance with the Technical Specifications.

The channel excavation will be located within competent bedrock. The CQA team must document and verify the competency of the sedimentary bedrock along the channel for the Engineer and the Owner's approval.

5.3.8 Riprap Conformance Monitoring and Testing

A rock apron will be constructed at the transition from soil to bedrock within the sedimentation basin. Rock apron riprap material of the specified size shall have a minimum rock quality designation or durability score of 70 or higher. If actual rock quality designation is between 65 and 69, oversizing will be required. Rock quality designations below 65 will not be acceptable.

The rock size specifications for the riprap shall be confirmed by particle-size distribution testing prior to placement, using ASTM D422, ASTM D5519, or an approved equivalent method for large-sized material. Testing shall be at a frequency of at least one test per 10,000 cubic yards of riprap placed, per select size, or when riprap characteristics show significant variation.

Test series for rock durability will include specific gravity, absorption, sodium soundness and LA abrasion. During construction additional test series and gradations will be performed for each type of riprap when approximately one-third (1/3) and two-thirds (2/3) of the total volume of each type have been produced or delivered. For any type of rock where the volume is greater than 30,000 cubic yards, a test series and gradations will be performed for each additional 10,000 cubic yards of rock produced or delivered.

5.3.9 Material Placement

In subgrade areas requiring fill placement to achieve final grades, after liner removal, the upper 12 inches should be scarified, moisture conditioned and compacted prior to fill placement.

Riprap shall be placed in one or more lifts to form a continuous, uniform layer on top for the filter material layers with a minimum thickness of 12 inches (2 times the specified D_{50}). The top surface of the riprap shall be track-rolled or tamped with the bucket of a track-hoe to provide a uniform riprap surface and minimize void spaces within the riprap.

5.3.10 Tolerances

Completed grading for the sedimentation basin, in soil, shall be within 1.0 foot (horizontally) of the lines as designed, and within 0.1 foot (vertically) of the elevations as designed. Final surfaces shall be smoothed to avoid abrupt changes in surface grade or areas of runoff concentration.

The completed grading for the discharge channel (and portions of the sedimentation basin) in rock shall be within 2.0 foot (horizontally) of the lines as designed, and within 0.5 foot (vertically) of the elevations as designed. The final rock surfaces will be rough and should not be filled to make grade. The bedrock channel should be constructed at or below the design grades in order to meet the intent of the design.

5.3.11 Nonconformance, Corrective Action and Stop Work

The CQA staff, including the CQA Site Manager and QC Technicians, will have the authority to reject material brought to the site or material that has been placed. For a failed field moisture/density test, the QC Technician will determine the extent and depth of the affected area and require the Contractor to re-work the material as described above. If persistent failed tests occur (indicating inadequate compaction methods), the CQA Site Manager will have the authority to stop the work until the underlying cause is determined and the Contractor can demonstrate that moisture/density specifications can be met.

Laboratory test results for the clay liner shall be verified for compliance and approved by the CQA site manager prior to placement of disposed materials in the cell.

5.3.12 Documentation

Field and laboratory test results, observations of fill placement, and field compaction test results will be recorded using the appropriate field forms and reports, as described in Section 4. Table 4 includes a summary of the required materials testing and frequencies.

Table 4 - Summary of Testing Frequency and Criteria for Clay Liner and Sedimentation Basin Riprap

Component	Test	ASTM Standard	Frequency	Criteria
Clay Liner	Gradation (200 Wash)	D422	1/2,500 cubic yards	40% min. passing the 200 sieve
	Atterberg Limits	D4318	1/2,500 cubic yards	Min. PI = 15
Riprap*	Gradation with 200 Wash	D422	1/10,000 cubic yards	D_{50}, Durability

*Rock durability testing per section 5.3.8

5.4 Mill Decommissioning

Decommissioning of the Mill will include:

- Disposal of the Mill processing equipment and structures and contaminated soils in the Mill area
- Cleanup of contaminated areas of the Mill Site including ore storage area and roadways
- Cleanup of windblown contamination

These areas are shown on the Drawings. The Technical Specifications describe methods and cleanup criteria, including radiological equipment that will be used and the development of cleanup criteria. Contaminated materials will be disposed of in the designated areas of the tailings impoundment.

The CQA Contractor will provide specialized QC Technicians qualified to monitor the dismantling of the Mill equipment and structures and the cleanup of contaminated soils. These Technicians will be trained in the proper use and calibration of radiological monitoring equipment and will monitor the work to ensure the cleanup criteria are met.

5.4.1 Characterization Surveys

Following scanning, classification and cleanup (as required), the areas will be scanned again to verify compliance with activity criteria. QC Technicians will use calibrated beta/gamma instruments capable of detecting activity levels of less than or equal to 25 percent of the guideline values.

After removal of contamination, the technicians will make final surveys over the remediated areas. The QC Technicians will document within the specific ten meter by ten meter grids, the sample point locations, as detailed in the Specifications. Soil samples from 10 percent of the surveyed grids will be chemically analyzed to confirm the initial correlation factors utilized and confirm the success of cleanup effort for radium, thorium and uranium. Ten percent of the samples chemically analyzed will be split and duplicates will be sent to an off-site laboratory. Spikes and blanks, equal to 10 percent of the samples that are chemically analyzed, will be processed with the samples.

5.4.2 Contaminated Material Disposal

Contaminated materials including mill debris, site soils, liner material, and raffinate crystals will be disposed of in the designated portion of the Cell 1 Disposal Area. Material specifications and placement methods are described in the Construction Plans and Technical Specifications. The CQA Contractor will provide full-time monitoring and testing during material placement.

5.4.3 Material Conformance Monitoring

For scrap and debris, the QC Technicians will monitor the volume and size of the material to ensure compliance with the maximum dimensions provided in the Technical Specifications (a maximum dimension of 20 feet and a maximum volume of 30 cubic ft) and to ensure that containers are properly pierced. If the size limits are exceeded, the QC staff will require the Contractor cut the material down to size.

5.4.4 Material Placement

QC Technicians will monitor material placement to verify the debris is spread out and placed according to the specifications and that voids are filled with stockpiled soils, contaminated soils, tailings and/or other approved materials. The approval of the Construction Manager and CQA Officer will be required for the use of other materials to fill voids.

A minimum of one foot of compacted soil will be required above the clay liner prior to placing any scrap or debris.

When liner or other lightweight material is placed, the QC staff will ensure that at least one foot of soil, crystals or other materials is placed above for protection against wind.

To the extent practicable, the various materials will not be concentrated in thick deposits on top of the tailings, but will be spread over the working surface as much as possible to provide relatively uniform settlement and consolidation characteristics of the cleanup materials.

It is anticipated that raffinate crystals will have a consistency similar to a granular material when brought to the cells, with large crystal masses being broken down for transport. Placement of the crystals will be performed as a granular fill, with care being taken to avoid nesting of large sized material. Actual placement procedures will be evaluated by the QC staff during construction as crystal materials are brought and placed in the cells.

Soil or soil-like material shall be placed and compacted over each lift of debris or other materials in lifts not to exceed two feet in loose thickness and compacted prior to placement of additional lifts.

5.4.5 Material Compaction

CQA staff will monitor material compaction to verify compliance with the specifications. The first lift (bridging lift) will be compacted by the tracking of heavy equipment, such as a Caterpillar D6 Dozer (or equivalent), using at least 4 passes, prior to the placement of a subsequent lift. Contaminated soils and other cleanup materials after the bridging lift will be compacted to the density requirement provided in the Technical Specifications. During construction, compaction requirements for the raffinate crystals will be re-evaluated based on field conditions and modified by the Construction Manager and CQA Officer, with the agreement of the DWMRC personnel.

Soil or similar material shall be compacted with a minimum of six passes with self-propelled, towed, or hand-held vibratory compaction equipment. The number of passes shall be confirmed with actual compaction equipment on site with a field test section of soil to establish a correlation between the field compaction method and 80 percent of maximum dry density for the soil, as determined by the standard Proctor test (ASTM D698). During compaction, the material shall be within 1 percent above to 4 percent below optimum moisture content for the material, as determined by the standard Proctor test.

The upper 12 inches of the final disposed material surface shall be compacted to 90 percent of the maximum dry density for the material, as determined by the standard Proctor test. During compaction, the material shall be within 1 percent above to 4 percent below optimum moisture content for the material, as determined by the standard Proctor test. If water addition is required to achieve this range of moisture contents, the added water shall be thoroughly mixed into the material prior to compaction.

Field density tests shall be compared with standard Proctor tests (ASTM D698 Method A or C) on the same material. Standard Proctor tests shall be conducted at a frequency of at least one test per 5,000 cubic yards of material compacted, or when material characteristics show significant variation.

Field density testing may be conducted with the sand cone test (ASTM D1556) or a nuclear density gauge (ASTM D6938, or as modified by the QA Manager). Correlation of nuclear density gauge results shall be by comparison with results from sand cone test(s) and laboratory testing for water content(s) using the oven drying method (ASTM D2216) on similar material. A sufficient number of sand cone tests and moisture content tests will be performed to provide a correlation between the sand cone and nuclear density tests.

The frequency of the field density and moisture tests will be not less than one test per 1,000 cubic yards of compacted fill. A minimum of two tests will be taken for each day that an applicable amount of fill is placed in excess of 150 cubic yards. A minimum of one test per lift and at least one test for every full shift of compaction operations will be taken. Tables 5 and 6 summarize the placement and testing criteria for the disposed materials.

Table 5 - Summary of Disposed Materials and Lift Thicknesses

Disposed Materials	Material Type (USCS)	Layer Thickness	Lift Thickness
Debris Lift	Variable	48 in. (max.)	As needed to fill voids
Fill Above Debris Lift	Variable	36 in. (min.)	12 in. compacted (max.)

Table 6 - Summary of Disposed Materials Moisture-Density Testing Frequencies and Requirements

Disposed Materials	Test Frequency	Density Requirement *	Moisture Requirement *	Proctor Frequency
Fill around debris	1/1,000 cubic yards placed	80% (min.)	- 4% to +1	1/5,000 cubic yards placed
Upper Debris Fill	1/1,000 cubic yards placed	90% (min.)	- 4% to +1	1/5,000 cubic yards placed

* Based on maximum dry density and optimum water contents as determined by standard Proctor tests (ASTM D698 Method A or C) on the same material.

5.4.6 Final Slope and Grades

The final disposed material surface shall have maximum side slopes of 5:1 and a top surface sloping in the directions and grades shown on the Drawings. The side slopes and top surface shall be free from abrupt changes in grade or areas of runoff concentration. The final disposed material surface shall be compacted with approved construction equipment to form a smooth surface with uniform density for subsequent cover placement.

5.4.7 Tolerances

The final surface of the disposed material shall be smoothed to avoid abrupt changes in surface grade. The layer thicknesses shall meet the required minimum thicknesses.

5.4.8 Nonconformance, Corrective Action and Stop Work

The CQA Site Manager and QC Technicians will have the authority to reject scrap and debris that is not properly prepared for placement. The Contractor may be required to reduce the size of large pieces of material or pierce drums or other containers. CQ staff may also require site soils to be re-worked if a failed test indicates the compaction requirements were not met. If persistent inadequacies occur during the placement of contaminated materials, the CQA Site Manager will have the authority to stop the work until the underlying cause is determined and the Contractor can demonstrate that the specifications can be met.

5.4.9 Documentation

All observations and monitoring of contaminated material placement and all field compaction test results will be recorded using the appropriate field forms and reports, as described in Section 4.

5.5 Settlement Plates

The CQA team will need to verify proper construction and placement of the settlement points. The Surveyor will conduct the settlement plate measurements based on the DWMRC approved monitoring plan.

5.6 Cover System

A multi-layered earthen cover will be placed over tailings Cells 2, 3, 4A, and 4B and the portion of Cell 1 used for disposal of contaminated materials (the Cell 1 Disposal Area). The cover layers, from bottom to top, will include: 1) platform fill, 2) high compacted layer 3) water storage layer, and 4) erosion protection layer. Layers 1 through 3 will consist of the same material type and are all identified as “random fill”. The material specifications, layer configurations, layer thicknesses, borrow sources, placement methods, and compaction requirements are described in the Technical Specifications. The CQA Contractor will provide full-time monitoring and testing during material placement.

5.6.1 Material Conformance Monitoring and Testing

The CQA Contractor will perform monitoring and frequent verification testing to ensure that the fill materials meet the gradation and classifications specifications. The CQA Consultant will monitor earthmoving operations to ensure that the fill material is taken from the proper borrow sources.

Prior to the placement of the next layer of the cover, the CQA Site Manager or the QC Technicians under the supervision of the CQA Site Manager shall inspect the completed layer and document any of the following:

- Erosion of the layer surface
- Cracking or desiccation of the surface
- Fill areas that may contain excessive organics or other debris
- Depressions, or settlement of the layer
- Irregularities in the layer surface (e.g. grading errors)

Any documented items that constitute non-conformance with the Drawings and Technical Specifications should be corrected prior to placement of the subsequent layer of the cover.

5.6.1.1 Random Fill

Random fill will be used for each of the lower three layers of the cover system. The fill will consist of mixtures of sands and silts with varying amounts of clay and random amounts of gravel and rock-size material. In the initial bridging lift of the platform fill, rock sizes of up to 2/3 of the thickness of the lift will be allowed. On all other random fill lifts, rock sizes will be limited to 2/3 of the lift thickness, with at least 30 percent of the material finer than the No. 40 sieve. The portion passing the No. 40 sieve, will classify as CL, SC, ML or SM materials under the Unified Soil Classification System. Oversized material will be controlled through selective excavation at the stockpiles and through the utilization of a grader, bulldozer or backhoe to cull oversize materials from the fill. The source of these materials will be site stockpiles from previous cell construction activities.

Testing for all layers except the lower layer of platform fill shall consist of No. 200 sieve wash and particle-size distribution testing (ASTM D422), and Atterberg limits (ASTM D4318) at a frequency of at least one test per 2,000 cubic yards of fill placed, or when material characteristics show a significant variation.

5.6.1.2 Rock Mulch

Rock mulch material shall be free from roots, branches, rubbish, and debris. The rock portion of the rock mulch will consist of granular materials from approved off-site sources.

The mixture will be 25 percent gravel (with a D_{100} less than 1-inch) by weight. Rock will be purchased from nearby commercial sources of alluvial gravel and cobbles. The rock portion of the rock mulch shall be a screened product and have a maximum particle size of less than 1-inch. The soil portion of the rock mulch will consist of select material from the on-site topsoil borrow area.

Gradation specifications for the rock used for rock mulch material shall be confirmed by gradation testing prior to mixing with the topsoil, to determine the maximum particle size. Testing shall consist of particle-size distribution testing (ASTM D422) at a frequency of at least one test per 2,000 cubic yards of rock delivered to the site, or when rock characteristics show a significant variation.

Gradation specifications for rock mulch material (topsoil-gravel mixture) shall be confirmed by gradation testing, on samples collected from the point of placement (on the topdeck). Testing shall consist of particle-size distribution testing (ASTM D422) at a frequency of at least one test per 2,000 cubic yards of mixture placed, or when the characteristics of the mixture show a significant variation.

Rock mulch thickness will be controlled through establishment of grade stakes placed on a 200 x 200 foot grid on the top of the cells and by a 100 x 100 foot grid on the cell slopes. Physical checks of rock mulch depth will be accomplished through the use of hand dug test pits at the center of each grid in addition to monitoring the depth indicated on the grade stakes.

5.6.1.3 Topsoil

Topsoil will consist of select material from the on-site topsoil borrow area. The topsoil shall have a plasticity index (PI) less than 10 (%), as determined by Atterberg limits testing.

Material specifications for the topsoil material shall be confirmed by Atterberg limits testing (ASTM D4318) on samples of the topsoil, once for each 1,000 cubic yards of total topsoil material placed (including the quantity of topsoil added to the rock mulch mixture).

5.6.2 Material Placement

QC Technicians will observe the surface condition prior to fill placement. If the compacted surface of any layer of fill is too dry or smooth to bond properly with the layer of material to be placed thereon, it will be moistened and/or reworked with a harrow, scarifier, or other suitable equipment to a sufficient depth to provide relatively uniform moisture content and a satisfactory bonding surface before the next succeeding layer of earthfill is placed. If the compacted surface of any layer of earthfill in-place is too wet (due to precipitation) for proper compaction of the earthfill material to be placed thereon, it will be reworked with harrow, scarifier or other suitable equipment to reduce the moisture content to the required level. It will then be recompacted to the earthfill requirements.

Nesting of oversized material will be controlled through selective excavation of stockpiled material, observation of placement by QC Technicians with authority to stop work and reject material being placed and by culling oversized material from the fill utilizing a grader. Successive loads of material will be placed on the fill so as to produce the best practical distribution of material.

QC Technicians will monitor the weather and temperature conditions. No material will be placed when the fill material or the underlying material is frozen or when ambient temperatures do not permit the placement or compaction of the materials to the specified density without developing frost lenses in the fill.

QC Technicians will monitor and document lift thicknesses frequently to ensure the specifications are being met. The required layer and lift thicknesses are listed in Table 7.

Table 7 - Summary of Cover Component Layer and Lift Thicknesses

Cover Component	Material Type (USCS)	Layer Thickness	Lift Thickness
Platform Fill	CL, SC, ML or SM	30 in. (min.)	12 in. loose (max.)
Highly Compacted Layer	CL, SC, ML or SM	30 in. (min.)	6 in. compacted (max.)
Water Storage/Frost Barrier/Root zone	CL, SC, ML or SM	42 in. (min.)	18 in. loose (max.)
Topsoil or Rock Mulch	CL, ML, SC, SP, or SM	6 in. (min.)	6 in. (max.)

5.6.3 Moisture and Density Control

The QC Technicians will monitor placement, moisture conditioning, and compaction of the fill as it is placed. Prior to the start of field compaction operations, appropriate laboratory compaction curves will be obtained for the range of materials to be placed. Laboratory compaction curves based on complete Proctor tests will be conducted at the frequencies outlined in Table 8, depending on the variability of materials being placed.

Each layer of the fill will be conditioned so that the moisture content is uniform throughout the layer prior to and during compaction. As far as practicable, materials will be brought to the proper moisture content before placement. If necessary, water will be added after lift placement to the material by sprinkling on the layer. Each lift will be compacted by a sufficient number of roller passes or other compaction equipment to achieve the required dry density. Material that is too dry or too wet or does not meet the required dry density will be rejected and will be reworked until the moisture content and dry density are within the specified limits. Reworking may include removal, re-harrowing, reconditioning, re-rolling, or combinations of these procedures.

The required testing frequencies are included in Table 8. For all materials (except lower layer of platform fill at 80 percent compaction), a minimum of two tests will be taken for each day that an applicable amount of fill is placed in excess of 150 cubic yards. A minimum of one test per lift and at least one test for every full shift of compaction operations will be taken.

Table 8 - Summary of Cover Component Moisture-Density Testing Frequencies and Requirements

Cover Component	Test Frequency	Density Requirement*	Moisture Requirement*	Proctor Frequency
Upper Layer of Placed Platform Fill	1/1,000 cubic yards placed	** 95% (min.)***	n.a.	1/5,000 cubic yards placed
Highly Compacted Layer	1/500 cubic yards placed	95% (min.)	n.a.	1/2,500 cubic yards placed
Water Storage/Frost Barrier/Root zone)	1/1,000 cubic yards placed	85% (min.)	n.a.	1/5,000 cubic yards placed
Topsoil or Rock Mulch	1/500 cubic yards placed	80-85%	-3% to Optimum	1/2,500 cubic yards placed

* Based on maximum dry density and optimum water contents as determined by standard Proctor tests (ASTM D698 Method A or C) on the same material.
**Lower layer of platform fill will be placed at 80 percent compaction and does not require compaction testing.
***Upper 6 inches of the platform fill only.

Field density testing may be conducted with the sand cone test (ASTM D1556) or a nuclear density gauge (ASTM D6938, or as modified by the QA Manager). Correlation of nuclear density gauge results shall be by comparison with results from sand cone test(s) and laboratory testing for water content(s) using the oven drying method (ASTM D2216) on similar material. A sufficient number of sand cone tests and moisture content tests will be performed to provide a correlation between the sand cone and nuclear density tests. Field density tests shall be compared with standard Proctor tests (ASTM D698 Method A or C) on the same material. Rock corrections (ASTM D4718) for oversize particles may be required for the rock mulch mixture (or other materials) depending on the gradation of the gravel material selected.

The actual frequency of testing may be increased by the CQA Site Manager if variability of materials is noted at the site, during adverse conditions, or to isolate failing areas of the construction.

5.6.4 Surface Slopes and Grades

The final cover surface shall have maximum side slopes of 5:1 and a top surface sloping in the direction and grade shown on the Drawings. The side slopes and top surface shall be free from abrupt changes in grade or areas of runoff concentration. The perimeter apron at the toe of the side slopes shall have a minimum width of 20 feet from the toe of the side slopes and slope away from the toe of the side slopes (as shown on the Drawings).

5.6.5 Tolerances

The completed cover surface shall be constructed to within 1.0 foot (horizontally) of the lines as designed, and within 0.1 foot (vertically) of the elevations as designed. The final surface of the subsoil zone shall be smoothed to avoid abrupt changes in surface grade. The layer thicknesses shall meet the required minimum thicknesses.

5.6.6 Nonconformance, Corrective Action and Stop Work

The CQA Site Manager and QC Technicians will have the authority to reject material that is brought to the site or material that has been placed. For a failed field moisture/density test, the

QC Technician will determine the extent and depth of the affected area and require the Contractor to re-work the material as described above. If persistent failed tests occur (indicating inadequate compaction methods), the CQA Site Manager will have the authority to stop the work until the underlying cause is determined and the Contractor can demonstrate that the moisture/density specifications can be met.

5.6.7 Documentation

All field and laboratory test results, observations of fill placement, and field compaction test results will be recorded using the appropriate field forms and reports, as described in Section 4. Table 9 includes a summary of the required materials testing and frequencies for the cover components.

Table 9 - Summary of Testing Frequency and Criteria for Cover Components

Component	Test	ASTM Standard	Frequency	Criteria
Random Fill (highly compacted & water storage layers)	Gradation with 200 Wash	D422	1/2,000 cubic yards	Max. Particle = 2/3 of lift thickness, Min. 30% passing the No. 40 sieve*
	Atterberg Limits	D4318	1/2,000 cubic yards	CL, SC, ML or SM
Rock Mulch	Gradation	D422	1/2,000 cubic yards	D_{100} < 1 inch
Topsoil	Atterberg Limits	D4318	1/1,000 cubic yards	Max PI < 10

*Each lift after the initial tailings bridging lift.

5.7 Rock Protection and Erosion Control

The top and side slopes of the reclaimed cover will be protected by rock surfacing. The size, thickness and gradation requirements for the rock protection are provided in the Drawings and Technical Specifications.

5.7.1 Material Conformance Monitoring and Testing

Riprap will be a screened product transported from gravel sources north of the project site. The CQA Contractor will perform monitoring and frequent verification testing to confirm that the riprap meets the gradation and durability specifications.

During active riprap placement, each load of material will be visually checked against standard piles for gradation prior to transport to the tailings cells.

5.7.1.1 Erosion Protection and Apron Rock

Material for the perimeter aprons and slope erosion protection will consist of granular materials from approved off-site areas. Perimeter apron rock shall meet NRC long-term durability requirements (rock quality designation of 65 or more).

Perimeter apron rock shall be a screened product, free from roots, branches, rubbish, and debris. The specifications as given below are for rock quality designations of 70 or higher. If actual rock quality designation is between 65 and 69, additional oversizing will be required. Rock quality designations below 65 will not be acceptable.

Designated gradations for the apron rock will be specified on the final drawings for construction. Apron rock will be imported from off-site.

- Side slope riprap shall have a minimum D_{50} as listed below and a minimum layer thickness of 1.5 times the D_{50} or the D_{100} of the riprap, whichever is greater:
  - 1.7 in. for non-accumulating flow side slopes
  - 5.3 in. for Cell 4A and Cell 4B southern side slopes
  - 4.5 in. for Cell 1 Disposal Area side slope
- Rock aprons shall have a minimum D_{50} as listed below and a minimum layer thickness of 1.5 times the D_{50} or the D_{100} of the riprap, whichever is greater:
  - 3.4 in. for Rock Apron A
  - 10.5 in. for Rock Apron B
  - 9.0 in. for Rock Apron C

Rock Apron C shall have a minimum D_{50} of 9.0. Material specifications for the perimeter apron rock shall be confirmed by gradation testing conducted by the CQA Laboratory. Testing shall consist of particle-size distribution testing (ASTM D422) at a frequency of at least one test per 10,000 cubic yards of rock delivered to the site, or when rock characteristics show a significant variation.

Rock layer thickness will be controlled through establishment of grade stakes placed on a 200 x 200 foot grid on the top of the cells and by a 100 x 100 foot grid on the cell slopes. Physical checks of riprap depth will be accomplished through the use of hand dug test pits at the center of each grid in addition to monitoring the depth indicated on the grade stakes.

Test series for rock durability will include specific gravity, absorption, sodium soundness and LA abrasion. During construction additional test series and gradations will be performed for each type of riprap when approximately one-third (1/3) and two-thirds (2/3) of the total volume of each type have been produced or delivered. For any type of rock where the volume is greater than 30,000 cubic yards, a test series and gradations will be performed for each additional 10,000 cubic yards of rock produced or delivered. Gradations will also be performed at the direction of the QC Technician for any locations considered inadequate based on visual inspection by the QC Technician, or if difficulties are experienced by the Contractor during rock placement.

5.7.1.2 Erosion Protection Filter

Erosion protection filter material shall be free from roots, branches, rubbish, and debris. Filter material will generally be classified as sand containing gravel and fines and shall meet the following gradation specifications.

Table 10 – Filter Material Gradation

Sieve Size	Percent Passing, by Weight
3-inch	100
No. 4	70-100
No. 20	40-60
No. 200	0-5

Material specifications for the perimeter apron rock shall be confirmed by gradation testing conducted by the CQA Laboratory. Testing shall consist of particle-size distribution testing (ASTM D422) at a frequency of at least one test per 10,000 cubic yards of rock delivered to the site, or when rock characteristics show a significant variation.

Filter layer thickness will be established during construction with grade stakes placed on a grid or centerline and offset pattern and layer thickness marks on each grade stake. The minimum thickness of the layer will be verified by spot checking of layer thickness by hand excavation in selected locations.

5.7.2 Material Placement

QC Technicians will monitor riprap placement. An initial section of each type of riprap constructed shall be visually examined and used to evaluate future placement. The initial section will be constructed with material meeting gradation and riprap thickness requirements. Initial testing should be conducted to determine the gradation and the rock weight/unit volume that will be achieved in future rock placement activities. Riprap material will be hauled to the reclaimed surfaces and placed on the surfaces using belly dump highway trucks and road graders. Riprap will be dumped in windrows and the grader will spread the riprap in a manner to minimize segregation of the material. Depth of placement will be controlled through the establishment of grade stakes. Minimum required thicknesses for riprap layers are provided in Section 5.7.1. Physical checks of riprap depth will be accomplished through the use of hand dug test pits at the center of each grid in addition to monitoring the depth indicated on the grade stakes. The Contractor will excavate the test pits, and QC Technicians will observe and document the excavation. Placement of riprap will avoid accumulation of riprap sizes less than the minimum D_{50} size and nesting of the larger sized rock. Additional riprap placement requirements include:

- Individual stones shall not be greater than 90 percent of the riprap layer thickness.
- Dumped riprap shall be placed to its full course thickness in one operation and in such a manner as to avoid displacing bedding material.

- Hand placement or rearrangement of individual stones will be required only to the extent necessary to secure the results specified above. Larger stones may require individual placement by equipment.

- Any stones that are not firmly wedged shall be adjusted and additional selected stones inserted or existing stones replaced, so as to achieve a solid interlock.

5.7.3 Compaction

QC staff will monitor riprap placement. The riprap layer will be compacted by at least two passes by a D7 Dozer, tamping with the bucket of a trackhoe, or equivalent methods in order to key the rock for stability.

5.7.4 Tolerances

The completed riprap shall be placed to within 5.0 foot (horizontally) of the layout as designed, and within 0.5 foot (vertically) of the elevations as designed. The rock layer thicknesses shall meet the minimum requirements. Minimum required thicknesses for riprap layers are provided in Section 5.7.1. Riprap layer thickness will be directly measured as outlined in Section 5.7.2. A measurement device (i.e. tape measure) may be used to determine the distance from the top of the bedding or filter layer to the top of the riprap layer.

5.7.5 Nonconformance, Corrective Action and Stop Work

The CQA Site Manager and QC Technicians will have the authority to reject riprap that is brought to the site or riprap that has been placed. For rejected riprap, QC Technicians will identify the extent of inadequate riprap and will require the Contractor to excavate the material and place additional riprap. If persistent failed tests occur (indicating inadequate placement methods), the CQA Site Manager will have the authority to stop the work until the underlying cause is determined and the Contractor can demonstrate that the riprap can be placed according to the specifications.

5.7.6 Documentation

All field and laboratory test results, observations of riprap placement, and field compaction test results will be recorded using the appropriate field forms and reports, as described in Section 4.

Table 11 includes a summary of the required materials testing and frequencies for the erosion protection materials.

Table 11 - Summary of Testing Frequency and Criteria for Erosion Protection

Component	Test	ASTM Standard	Frequency	Criteria
Riprap*	Gradation with 200 Wash	D422	1/10,000 cubic yards	D_{50} and Durability*
Riprap Filter	Gradation with 200 Wash	D422	1/10,000 cubic yards	See Table 10

*Rock durability testing per section 5.7.1.1

5.8 Protection of Soil Stockpiles

The Contractor shall maintain proper erosion control measures for stockpiles and may be required to cover piles in situations where precipitation is anticipated. The CQA Site Manager should document improper stockpile management in situations where the integrity of the material is affected. The Construction Manager and/or the CQA Officer should determine corrective measures.

6 FIELD REPORT FORMS

Form No. F-23

COMPLIANCE REPORT

Project No.________________________________ Date:______________________________

Construction Segment:____

____

Drawing No.:_______________________

Specification No.:___________________

Description of Completed Construction Segment:

____

____

____

____

____

____

____

____

____

____

____

____

By: CQA Officer ____

Approvals:

CQA Site Manager ____

DWMRC Project Manager ______________________________________

Form No. F-25

FIELD CHANGE ORDER

Project No.________________________________ Date:______________________________

Drawing No.:_______________________

Specification No.:___________________

Design Feature:

____

____

____

____

Modifications:

____

____

____

____

Reason:

____

____

____

____

Initiated by:____

Approved by:____
CQA Site Manager

Form No. F-26

DESIGN CHANGE ORDER

Project No.________________________________ Date:______________________________

Drawing No.:_______________________

Specification No.:___________________

Design Feature:

____

____

____

Change in Design:

____

____

____

Reason:

____

____

____

Initiated by:____

Approvals:

CQA Site Manager:____

DWMRC Project Manager:_______________________________________

Design Engineer:____

ATTACHMENT D

SUPPORTING DOCUMENTATION FOR INTERROGATORY 06/1:

REVISED APPENDIX E, SLOPE STABILITY ANALYSIS, TO THE UPDATED TAILINGS COVER DESIGN REPORT (APPENDIX D OF RECLAMATION PLAN, REVISION 5.0)

APPENDIX E

SLOPE STABILITY ANALYSIS

E.1 INTRODUCTION

This appendix presents the methods, input and results of slope stability analyses of the tailings cells at the Energy Fuels Resources (USA) Inc. (EFRI) White Mesa Uranium Mill (Mill). The Mill is located approximately 6.0 miles south of Blanding, Utah. These analyses were conducted according to applicable stability criteria under static and seismic conditions, including geotechnical stability criteria in NRC (2003). These analyses are an update to the slope stability analyses presented in MWH (2011) to incorporate revisions to the analyses to address State of Utah, Division of Waste Management and Radiation Control (DWMRC) (formerly Utah Division of Radiation Control, DRC) interrogatories (DRC, 2012) and review comments on EFRI responses to 2012 interrogatories (DRC, 2013). These analyses also incorporate the revised cover grading design, results of cover material testing conducted in 2010 and 2012 (summarized in Attachment B of EFRI, 2012), and the results of tailings testing conducted in 2013 (presented in MWH, 2015b).

Slope stability analyses were performed using limit equilibrium methods with the aid of the computer program SLOPE/W (GEO-SLOPE, 2007). The SLOPE/W program calculates factors of safety by any of the following methods: (1) Ordinary Fellenius, (2) Bishop's Simplified, (3) Janbu's Simplified, (4) Spencer, (5) Morgenstern-Price, (6) U.S. Army Corps of Engineers, (7) Lowe-Karafiath, and (8) Generalized Limit Equilibrium. The Morgenstern-Price method (Morgenstern and Price, 1965) with a half-sine function for inter-slice forces was selected for performing the computations in SLOPE/W. The method uses both circular and non-circular shear surfaces and satisfies both moment and force equilibrium.

E.2 CRITICAL CONDITIONS AND GEOMETRY

Slope stability analyses are typically conducted for scenarios that represent the critical conditions for post-reclamation. For the White Mesa Mill tailings cells, critical conditions for post-reclamation were evaluated and included: (1) reclaimed outside surfaces of the embankment with a 5H:1V slope, (2) existing inside surfaces of the embankments with a 2H:1V slope, and (3) conservative shear strength parameters based on previous reports.

A critical cross section, cross section A, was selected through the southern dike of Cell 4A near the southeast corner of the impoundment. The cross section location was selected based on overall impoundment height as well as base topography and is similar to the location used for the slope stability analyses presented in Titan (1996). The location of cross section A is shown in Figure E.1. The tailings are planned to be dewatered prior to placement of the final portion of cover. The phreatic surface was estimated to be five feet above the liner system for the analyses.

A second cross section, cross section B, was selected through the northern embankment of the Cell 1 Disposal Area. This location was chosen to address DRC interrogatories (DRC, 2012). The location of cross section B is shown in Figure E.2. The material placed in the Cell 1 Disposal Area will include mill debris and contaminated soils. The embankment cross section was assumed to be fully drained and therefore a phreatic surface was not included in the analyses.

Slope stability analyses were performed by calculating factors of safety along circular and non-circular failure surfaces for both static and pseudo-static conditions. Circular failure surface analyses were conducted by targeting both shallow and deep failure surfaces. Block failure surfaces through the clay liner system were evaluated for cross section B. A number of failure surfaces were analyzed in order to calculate the factor of safety for the critical failure.

E.3 MATERIAL PROPERTIES

Material strength parameters used for the slope stability analysis are based on parameters presented in Denison (2009) for the Cell 4B slope stability analyses conducted by Geosyntec, historical laboratory testing on tailings and clay materials (Advanced Terra Testing, 1996; Chen and Associates, 1987; D'Appolonia, 1982; and Western Colorado Testing, 1999), laboratory testing conducted in 2010 and 2012 on potential cover borrow materials (see Attachment B of EFRI, 2012), laboratory testing conducted in 2013 on tailings (MWH, 2015b) and typical published values. The parameters for each material are discussed below and summarized in Table E.1.

Erosion Protection: The erosion protection materials include riprap and filter material on the embankment slopes, and rock mulch on the top surface of the cover system. Typical density values for sand and gravel were used for the riprap and filter materials. The riprap and filter material strength parameters were estimated based on the lower bound typical values from Lambe (1969) for loose to medium dense sand and gravel. The rock mulch consists of topsoil material mixed with 25 percent gravel by weight. The density of the rock mulch was based on the 2012 laboratory testing results for topsoil (see Attachment B of EFRI, 2012) and applying a rock correction based on 25 percent gravel by weight. The total unit weight of the rock mulch was calculated using the estimated dry density and the long-term water content presented in the radon analyses. Effective strength parameters of the rock mulch were estimated as an angle of internal friction of 33 degrees and no cohesion, based on a maximum plasticity index (PI) of the topsoil of 10 percent (listed in the specifications), and using the generalized relationship between PI and effective angle of internal friction presented in Holtz and Kovacs (1981).

Cover System: The cover system material properties were estimated based on the updated geotechnical site investigation in April 2012. The total unit weight values used in the model for the random fill layers were estimated using 2010 and 2012 laboratory tests conducted on potential cover borrow materials (see Appendix A.2) and based on the compaction effort for each layer. The total unit weights for the cover layers were calculated using the long-term water contents for the cover layers used in the radon analyses. Effective strength parameters for the cover materials were estimated based on the maximum measured PI (30) from the 2010 and 2012 laboratory test results and using the generalized relationship between PI and effective angle of internal friction presented in Holtz and Kovacs (1981), resulting in an angle of internal friction of 29 degrees and no cohesion.

Tailings Material: The dry density of the tailings was estimated as 96 pcf, based on laboratory tests (Chen and Associates, 1987 and Western Colorado Testing, 1999) and assuming the upper bound long-term density of the tailings should be no greater than 90 percent of the average laboratory measured maximum dry density for tailings. This is the same density used for the radon analyses. The total unit weight of the tailings was calculated using the long-term water content assumed for the tailings in the radon analyses. Based on existing operations at the site, the tailings deposits are primarily fine sands with silt and some clay. The strength parameters of the tailings were conservatively estimated using the Naval Design Manual for Soil Mechanics DM7-01 (NAVFAC, 1986) as zero percent relative density silty sand. The strength parameters used for the tailings (no cohesion and an effective angle internal friction of 25 degrees) are consistent with the values presented in Denison (2009) for the Cell 4B design stability analyses.

Contaminated Soils/Mill Debris: The materials to be placed in the Cell 1 Disposal Area include contaminated soils and mill debris. The contaminated soils will be from on-site and have similar properties as the cover soils. The material properties for the contaminated soils and mill debris were conservatively assumed to be the same as the cover soils (compacted to 85 percent standard Proctor compaction).

Clay Liner: Cell 1 will be lined with a clay liner. The dry density of the clay was estimated based on laboratory tests performed on Section 16 clay (D'Appolonia, 1982; Advanced Terra Testing, 1996) and assuming the clay will be compacted to 95 percent of standard Proctor compaction. The total unit weight for the clay was calculated using the estimated dry density and a long-term water content of 14 percent. The long-term water content was estimated based on 15 bar water contents measured for Section 16 clay samples by Chen and Associates (1987) presented in Titan (1996). The strength parameters for the clay were estimated using the average measured PI (60) of samples meeting the placement specifications for minimum PI and percent passing the No. 200 sieve, and the generalized relationship between PI and effective angle of internal friction presented in Holtz and Kovacs (1981), resulting in an angle of internal friction of 24 degrees and no cohesion.

Dike and Foundation: Density and strength parameters for the existing foundation and dike material were estimated as the values presented in stability analyses performed for the design of Cell 4B by Geosyntec (Denison, 2009). The strength parameters used in the model were based on laboratory testing results from samples obtained from the existing berm between Cell 4A and 4B (Denison, 2009).

Bedrock: Failures are not anticipated to occur within the bedrock underlying the embankment, due to the relatively high strength of the underlying sedimentary rock. Therefore, the material properties for the bedrock were modelled as those consistent with sedimentary rock.

Table E.1. Material Parameters Used in Model

Material	Total Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (deg.)
Riprap	125	0	36
Riprap Filter	125	0	30
Rock mulch	110	0	33
Cover Upper Layer (85% SP compaction)	107	0	29
Cover Middle Layer (95% SP compaction)	120	0	29
Cover Lower Layer (80% SP compaction)	100	0	29
Random Fill	100	0	29
Tailings	95	0	25
Contaminated Soils/Mill Debris	107	0	29
Clay Liner	110	0	24
Dike	137	900	26
Foundation	137	900	26
Bedrock	130	10000	45

E.4 SEISMIC ANALYSIS AND SEISMICITY

Stability analyses under seismic conditions were conducted as pseudo-static analyses, where a horizontal acceleration or seismic coefficient is applied to both cross-sections. This seismic coefficient represents the horizontal accelerations applied on the structure by an earthquake. A coefficient of 0.1 g was used for the analyses based on the site-specific probabilistic seismic hazard analysis (MWH, 2015a). This seismic coefficient represents the seismic loading for the Maximum Credible Earthquake (MCE) calculated to occur during the long-term life of the embankment. A summary of the site seismicity is provided in the MWH (2015a).

A liquefaction analysis was conducted for the tailings and is presented in Appendix F (revised version provided as Attachment G to this submittal). The results indicate the tailings are not susceptible to earthquake-induced liquefaction. For materials that do not liquefy or lose shear strength with seismic shaking, seismic slope stability is analyzed by a pseudo-static approach. This consists of application of an equivalent horizontal acceleration or seismic coefficient to the structure being analyzed. The seismic coefficient represents an inertial force due to strong ground motions during the design earthquake, and is represented as a fraction of the peak ground acceleration (PGA) at the site (typically at the base of the structure). The strategy of representing the seismic coefficient as a fraction of the PGA has been adopted in review of uranium tailings facility design and documented in DOE (1989). A seismic coefficient of 2/3 of the PGA typically represents the post-reclamation conditions. MWH (2015a) estimated the mean PGA for reclaimed conditions to be 0.15g. The seismic coefficient used for the pseudo-static stability analysis is 0.10g (equal to 2/3 of the PGA).

E.5 DISCUSSION OF STABILITY ANALYSIS RESULTS

The results of stability analyses for Cross-section A and B are presented in Table E.2. These values represent the lowest calculated factor of safety from a number of individual failure surfaces for a Morgenstern-Price Analysis.

Table E.2. Slope Stability Analysis Results

Cross-Section	Failure Type	Loading Condition	Required Factors of Safety	Calculated Factors of Safety
Cross Section A - Cell 4A Embankment	Shallow Circular	Static	1.5	3.05
		Pseudo-Static	1.1	1.99
	Deep Circular	Static	1.5	3.86
		Pseudo-Static	1.1	2.53
Cross Section B – Cell 1 Embankment	Shallow Circular	Static	1.5	2.64
		Pseudo-Static	1.1	1.71
	Deep Circular	Static	1.5	2.71
		Pseudo-Static	1.1	1.76
	Block	Static	1.5	2.76
		Pseudo-Static	1.1	1.80

As shown in Table E.2, all calculated factors of safety were significantly above the NRC recommended values of 1.5 for static conditions and 1.1 for pseudo-static conditions. The model profile figures and SLOPE/W output figures for static and pseudo-static loading conditions are shown in Figures E.3 through E.14.

E.6 REFERENCES

Advanced Terra Testing (1996). Physical soil data, White Mesa Project, Blanding Utah, July 25.

Chen and Associates, Inc., 1987. Physical Soil Data, White Mesa Project, Blanding Utah, Report prepared for Energy Fuels Nuclear, Inc.

D'Appolonia Consulting Engineers, Inc. (1982), Letter Report, Section 16 Clay Material Test Data, White Mesa Uranium Project, Blanding, Utah, Report prepared for Energy Fuels Nuclear, Inc. on 8 March 1982.

Denison Mines (USA) Corporation (Denison), 2009. Cell 4B Lining System Design Report, Response to Division of Radiation Control ("DRC") Request of Additional Information – Round 1 interrogatory, Cell 4B Design, Exhibit A, Geosyntec Slope Stability Analysis Calculation Package. January 9.

Energy Fuels Resources (USA), Inc. (EFRI), 2012. Responses to Interrogatories – Round 1 for Reclamation Plan, Revision 5.0, March 2012. August 15.

GEO-SLOPE International Ltd, 2007. Slope/W, Version 7.17, Calgary, Alberta.

Holtz, R.D. and Kovacs, W.D., 1981. *An Introduction to Geotechnical Engineering.* New York: Prentice-Hall, 1981.

Lambe, T.W. and Whitman, R.V., 1969. *Soil Mechanics.* New York: John Wiley & Sons, 1969.

Morgenstern, N.R., and V.E. Price, 1965. The Analysis of the Stability of General Slip Surfaces. Geotechnique, Vol. 15, pp. 79-93.

MWH Americas, Inc. (MWH), 2011. Updated Tailings Cover Design. Prepared for Denison Mines (USA) Corp. September.

MWH Americas, Inc. (MWH), 2015a. White Mesa Mill Probabilistic Seismic Hazard Analysis Report. Prepared for Energy Fuels Resources (USA) Inc. April.

MWH Americas, Inc. (MWH), 2015b. White Mesa Mill Tailings Data Analysis Report. Prepared for Energy Fuels Resources (USA) Inc. April.

Naval Facilities Engineering Command (NAVFAC), 1986. Soil Mechanics Design Manual 7.01.

Nuclear Regulatory Commission (NRC), 2003. "Standard Review Plan for the Review of a Reclamation Plan for the Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act." NUREG-1620. Division of Waste Management, June.

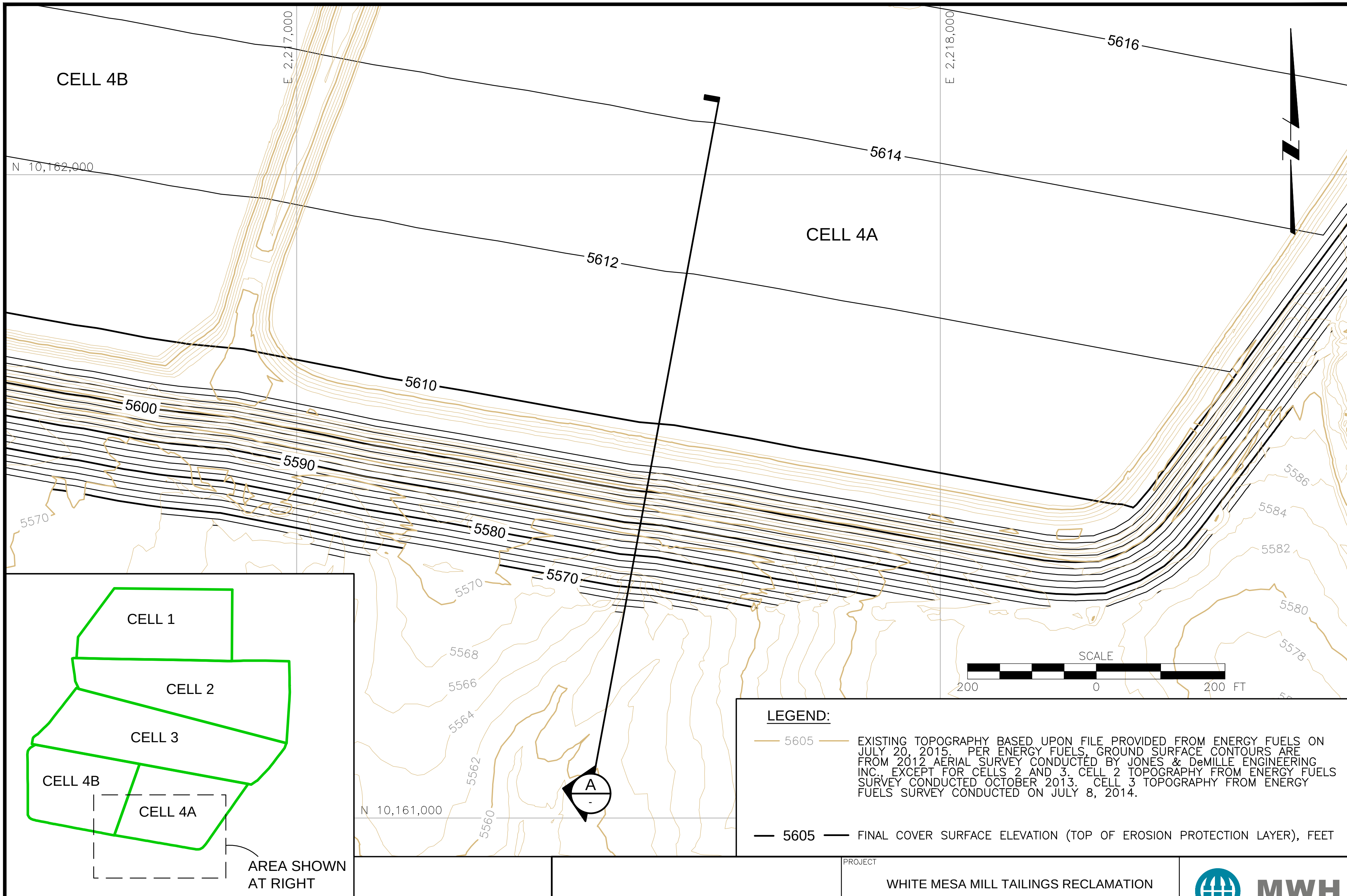
Titan Environmental Corporation (Titan), 1996. Tailings Cover Design, White Mesa Mill, October 1996.

U.S. Department of Energy (DOE), 1989. Technical Approach Document, Revision II, UMTRA-DOE/AL 050425.0002, Uranium Mill Tailings Remedial Action Project, Albuquerque, New Mexico.

Utah Department of Environmental Quality, Utah Division of Radiation Control (DRC). 2012. Denison Mines (USA) Corp's White Mesa Reclamation Plan, Rev. 5.0, Interrogatories - Round 1. March.

Utah Department of Environmental Quality, Division of Radiation Control (DRC), 2013. Review of August 15, 2012 (and May 31, 2012) Energy Fuels Resources (USA), Inc. Responses to Round 1 Interrogatories on Revision 5 Reclamation Plan Review, White Mesa Mill, Blanding, Utah, report dated September 2011. February 13.

Western Colorado Testing, Inc., 1999. Report of Soil Sample Testing of Tailings Collected from Cell 2 and Cell 3, Prepared for International Uranium (USA) Corporation. May 4.



KEY MAP

NOT TO SCALE

LEGEND:

— 5605 — EXISTING TOPOGRAPHY BASED UPON FILE PROVIDED FROM ENERGY FUELS ON JULY 20, 2015. PER ENERGY FUELS, GROUND SURFACE CONTOURS ARE FROM 2012 AERIAL SURVEY CONDUCTED BY JONES & DeMILLE ENGINEERING INC., EXCEPT FOR CELLS 2 AND 3. CELL 2 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED OCTOBER 2013. CELL 3 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED ON JULY 8, 2014.

— 5605 — FINAL COVER SURFACE ELEVATION (TOP OF EROSION PROTECTION LAYER), FEET

Energy Fuels Resources (USA) Inc.

PROJECT: WHITE MESA MILL TAILINGS RECLAMATION

TITLE: SLOPE STABILITY CROSS SECTION A LOCATION

MWH

DATE: AUG 2015

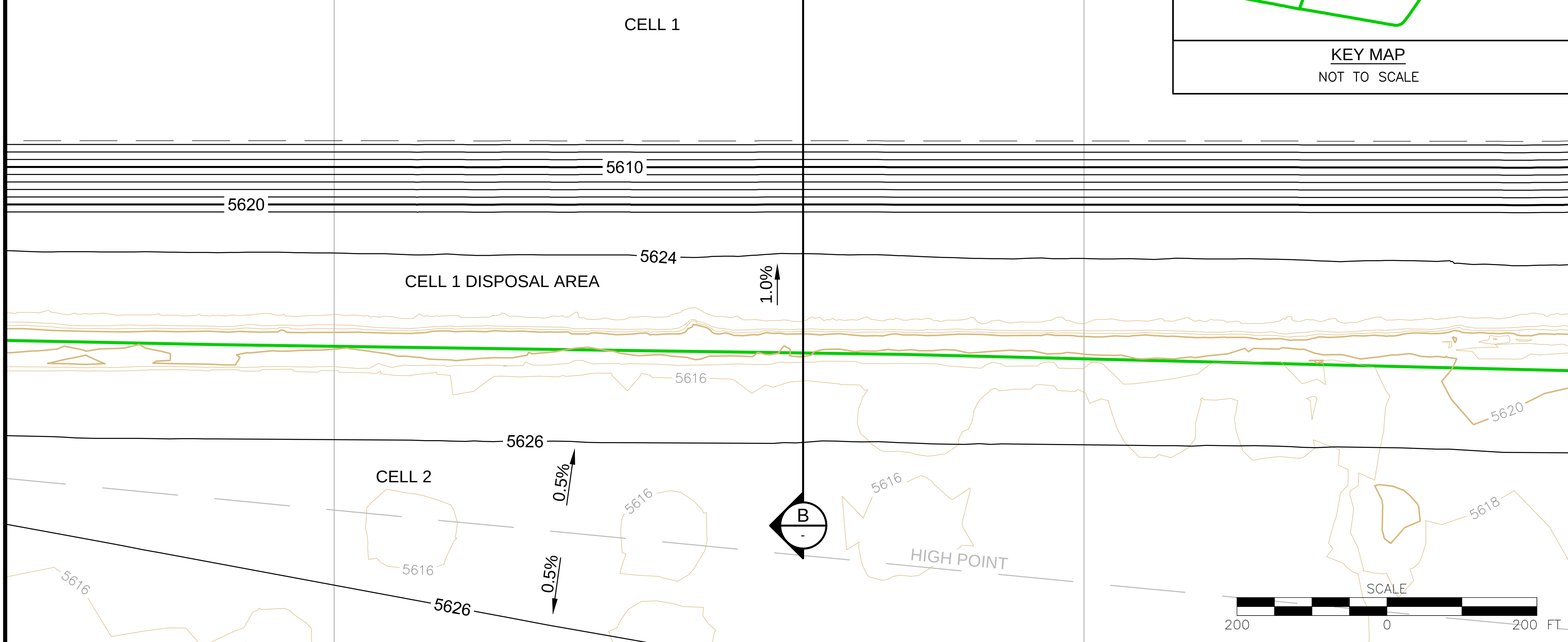
FIGURE E.1

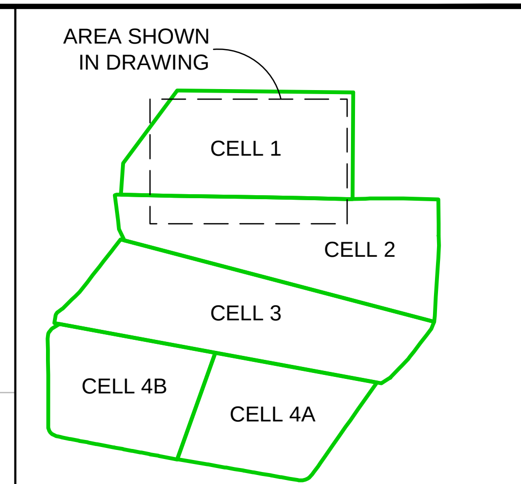
FILE NAME: WMM SLOPE STABILITY

LEGEND:

5605 — EXISTING TOPOGRAPHY BASED UPON FILE PROVIDED FROM ENERGY FUELS ON JULY 20, 2015. PER ENERGY FUELS, GROUND SURFACE CONTOURS ARE FROM 2012 AERIAL SURVEY CONDUCTED BY JONES & DeMILLE ENGINEERING INC., EXCEPT FOR CELLS 2 AND 3. CELL 2 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED OCTOBER 2013. CELL 3 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED ON JULY 8, 2014.

5605 — FINAL COVER SURFACE ELEVATION (TOP OF EROSION PROTECTION LAYER), FEET





KEY MAP

NOT TO SCALE

Energy Fuels Resources (USA) Inc.

PROJECT: WHITE MESA MILL TAILINGS RECLAMATION

TITLE: SLOPE STABILITY CROSS SECTION B LOCATION

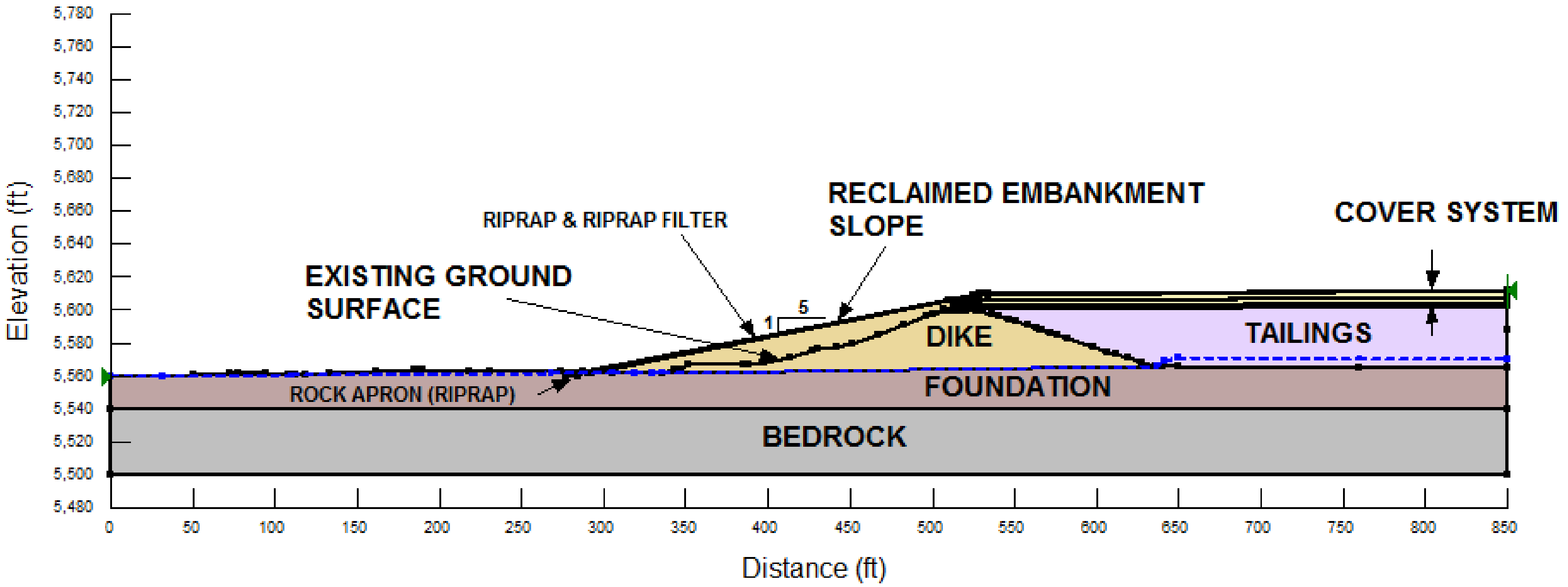
MWH

DATE: AUG 2015

FIGURE E.2

FILE NAME: WMM SLOPE STAB B

EFRI - White Mesa Mill
Cross Section A
Closure



Energy Fuels Resources (USA) Inc.

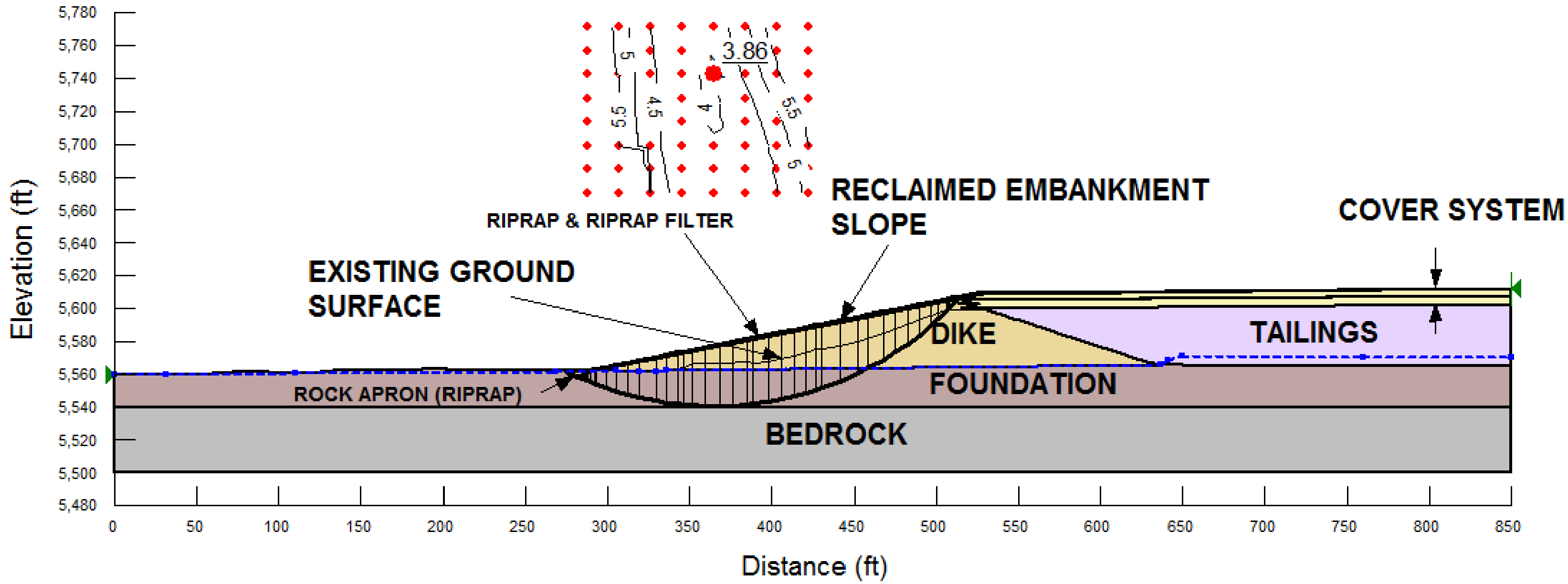
PROJECT	White Mesa Mill Reclamation
TITLE	Cross Section A on Cell 4A Slope Stability Analysis Model Profile

MWH

DATE AUG 2015	FIGURE E.3
FILENAME Appendix E Slope Stability Results.pptx	

EFRI - White Mesa Mill
Cross Section A
Closure

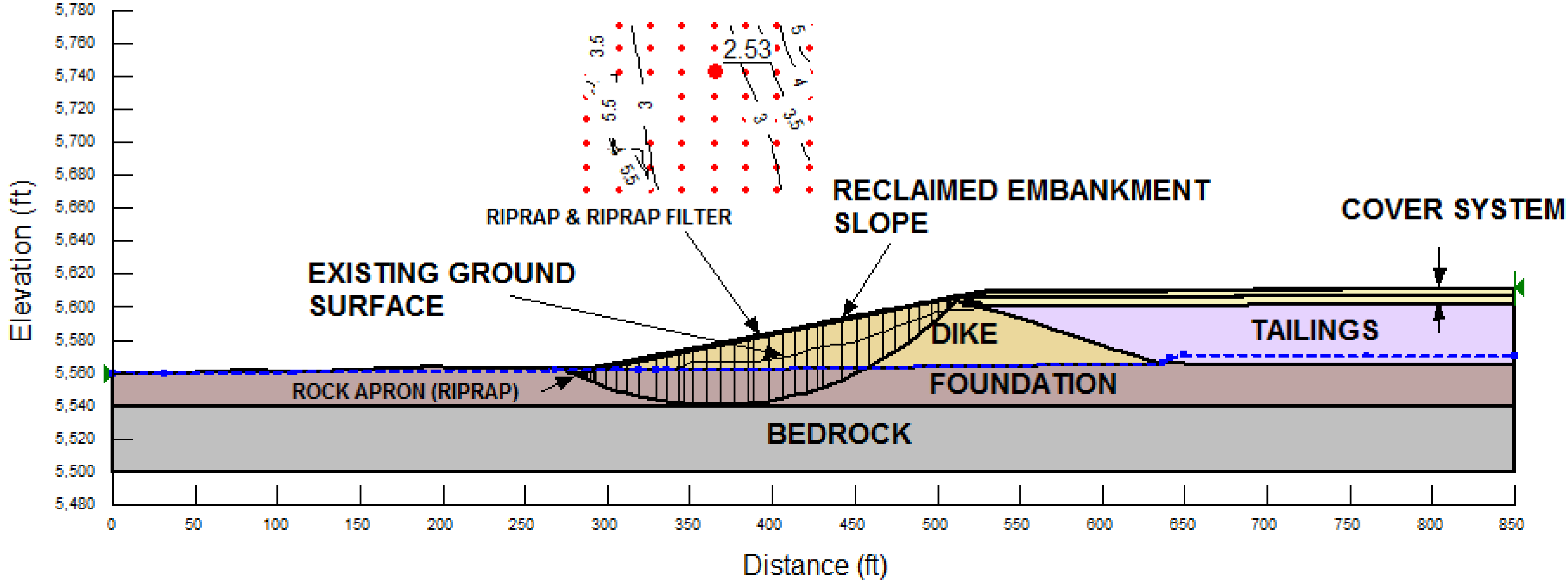
Static Loading Conditions
Required Factor of Safety: 1.5



Energy Fuels Resources (USA) Inc.	PROJECT White Mesa Mill Reclamation	MWH	
	TITLE Cross Section A on Cell 4A Slope Stability Analysis Static Conditions - Deep Circular	DATE AUG 2015	FIGURE E.4
		FILENAME Appendix E Slope Stability Results.pptx	

EFRI - White Mesa Mill
Cross Section A
Closure

Pseudo-Static (k = 0.1g) Loading Conditions
Required Factor of Safety: 1.1



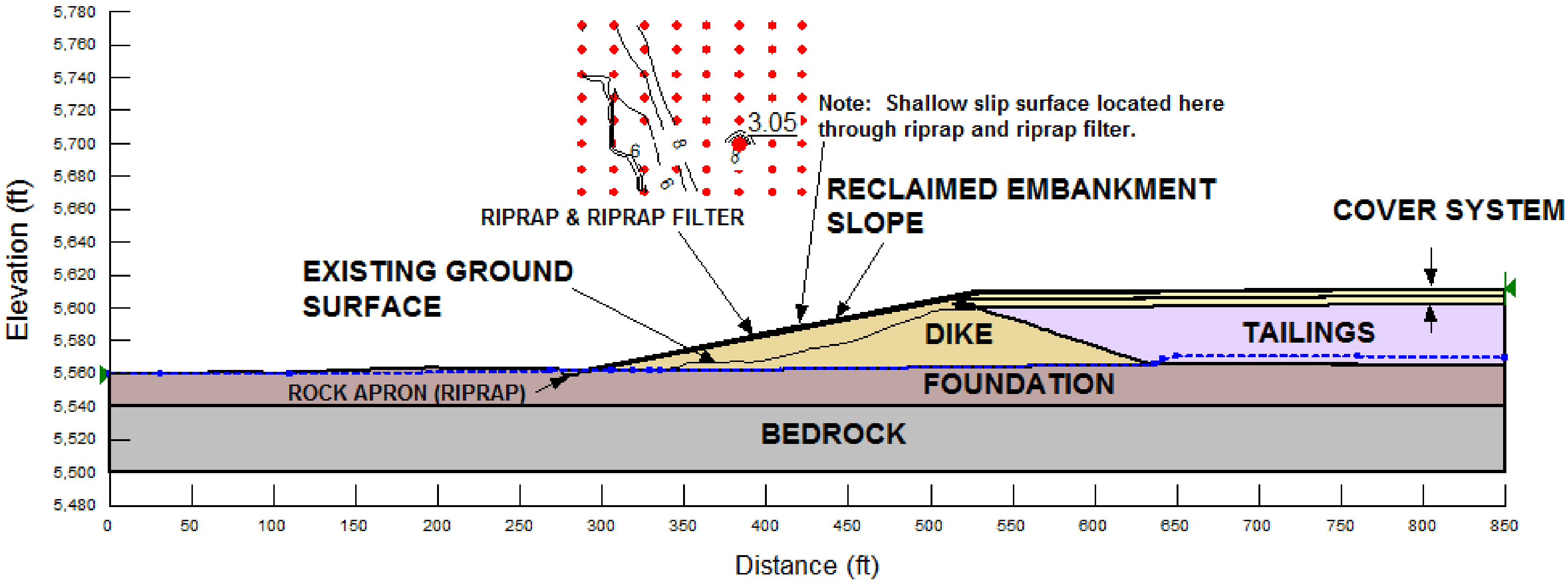
PROJECT	White Mesa Mill Reclamation
TITLE	Cross Section A on Cell 4A Slope Stability Analysis Pseudo-Static Conditions - Deep Circular
DATE	AUG 2015
	FIGURE E.5
FILENAME	Appendix E Slope Stability Results.pptx

Energy Fuels Resources (USA) Inc.

MWH

EFRI - White Mesa Mill
Cross Section A
Closure

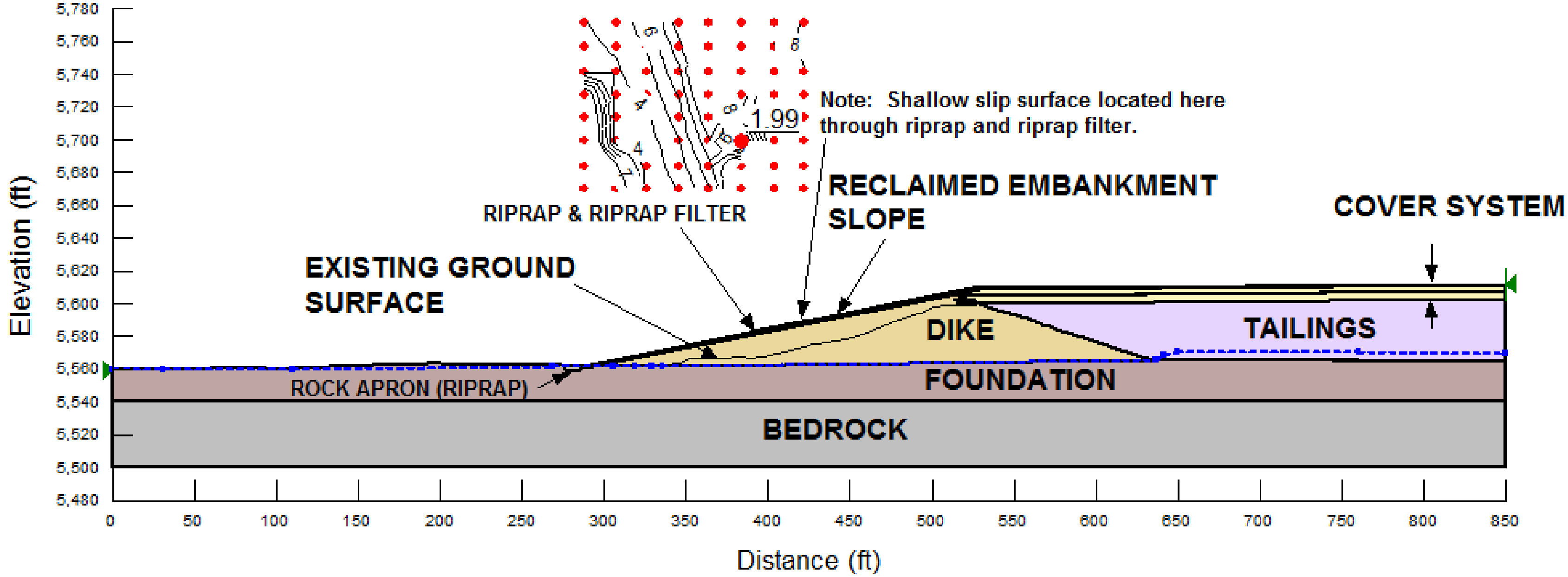
Static Loading Conditions
Required Factor of Safety: 1.5



	Energy Fuels Resources (USA) Inc.	PROJECT White Mesa Mill Reclamation TITLE Cross Section A on Cell 4A Slope Stability Analysis Static Conditions - Shallow	MWH DATE AUG 2015 FIGURE E.6 FILENAME Appendix E Slope Stability Results.pptx

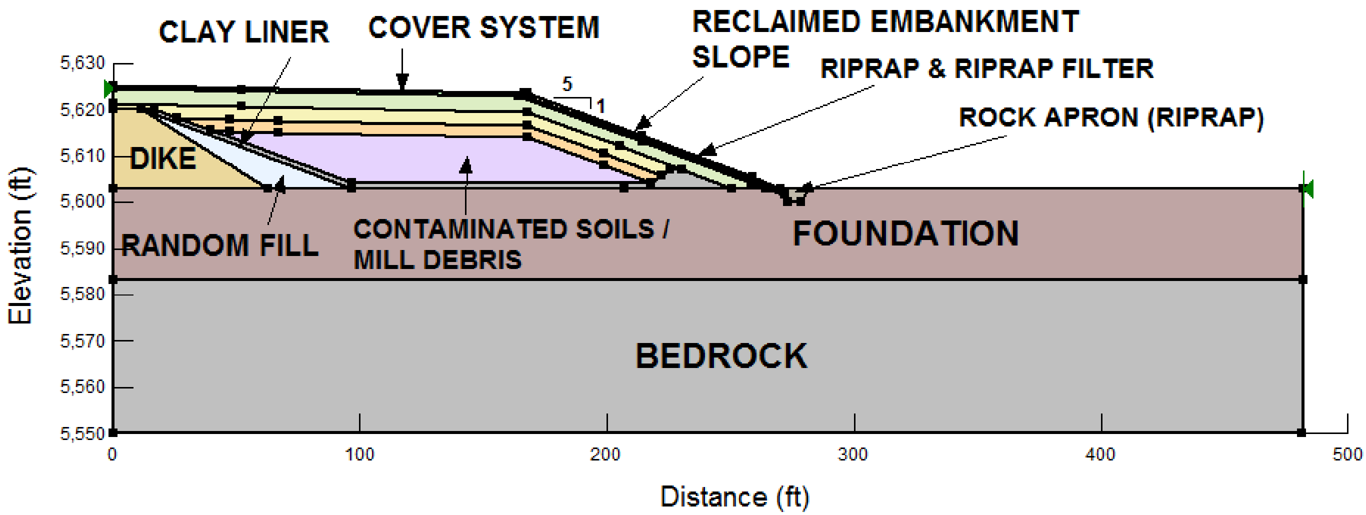
EFRI - White Mesa Mill
Cross Section A
Closure

Pseudo-Static (k = 0.1g) Loading Conditions
Required Factor of Safety: 1.1



Energy Fuels Resources (USA) Inc.	PROJECT: White Mesa Mill Reclamation		MWH
	TITLE: Cross Section A on Cell 4A Slope Stability Analysis Pseudo-Static Conditions - Shallow	DATE: AUG 2015	FIGURE E.7
		FILENAME: Appendix E Slope Stability Results.pptx	

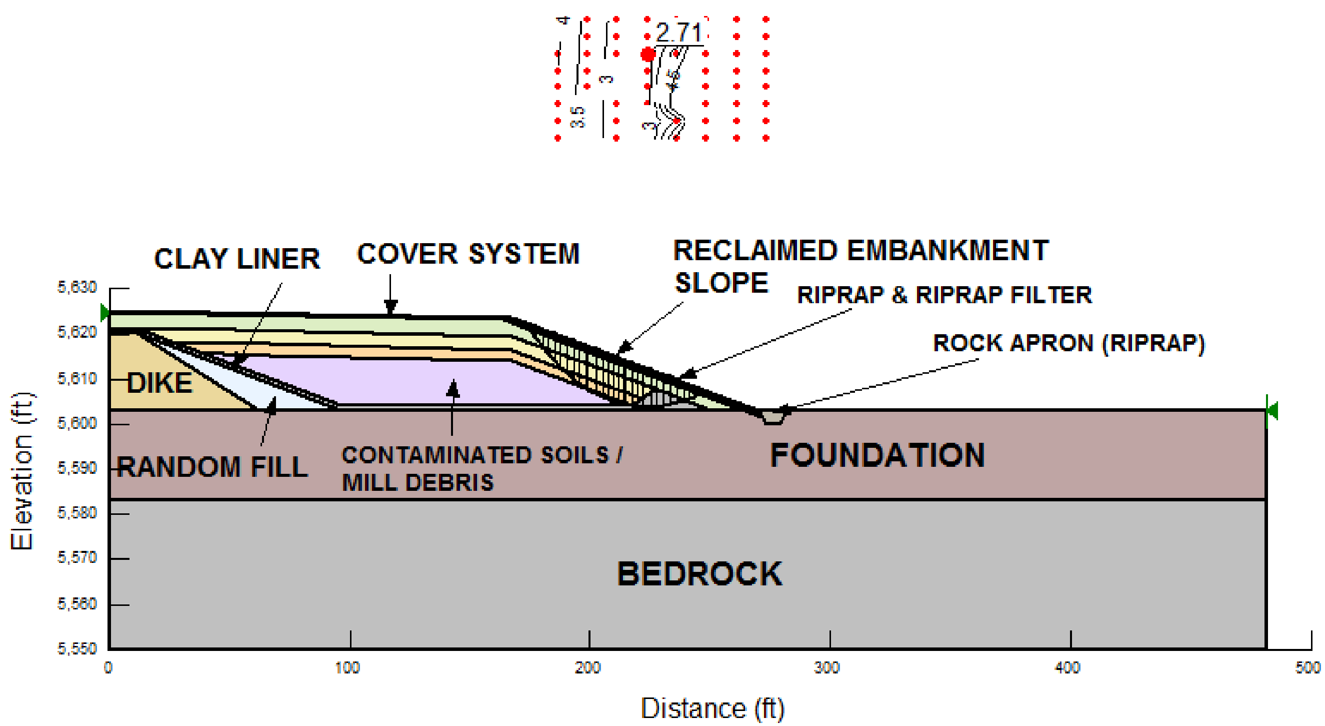
EFRI - White Mesa Mill
Cross Section B
Closure



	Energy Fuels Resources (USA) Inc.	PROJECT White Mesa Mill Reclamation	MWH
		TITLE Cross Section B on Cell 1 Slope Stability Analysis Model Profile	DATE AUG 2015 / FIGURE E.8 / FILENAME Appendix E Slope Stability Results.pptx

EFRI - White Mesa Mill
Cross Section B
Closure

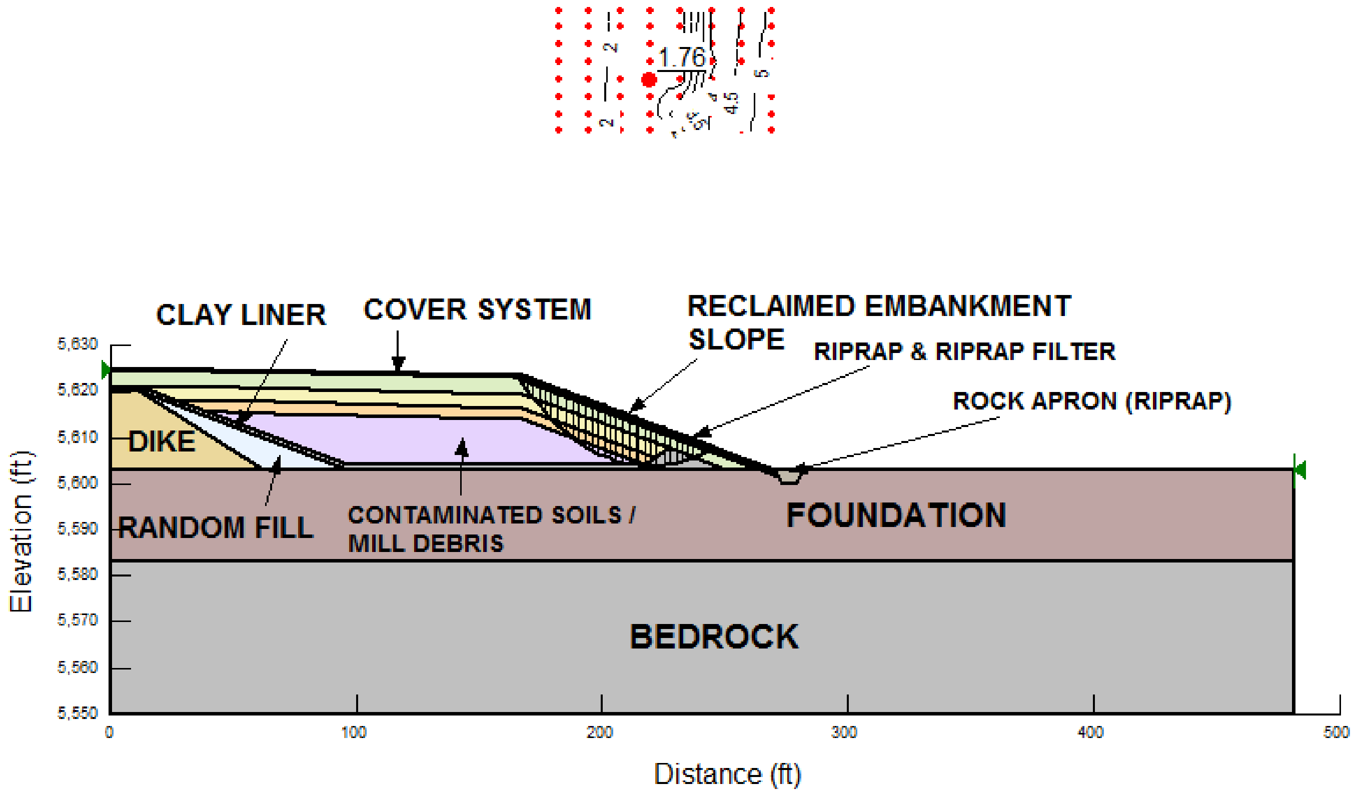
Static Loading Conditions
Required Factor of Safety: 1.5



Energy Fuels Resources (USA) Inc.	PROJECT White Mesa Mill Reclamation		MWH
	TITLE Cross Section B on Cell 1 Slope Stability Analysis Static Conditions - Deep Circular	DATE AUG 2015	FIGURE E.9
		FILENAME Appendix E Slope Stability Results.pptx	

EFRI - White Mesa Mill
Cross Section B
Closure

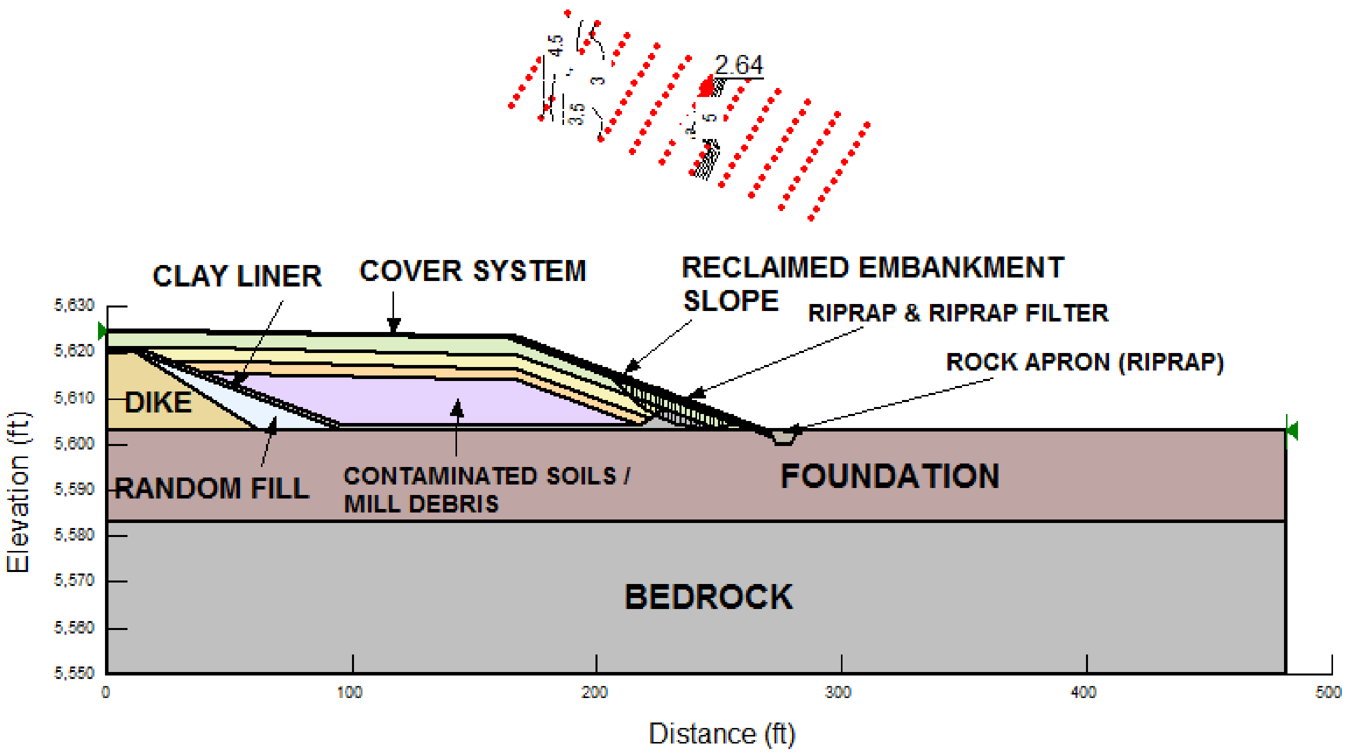
Pseudo-Static Loading Conditions
Required Factor of Safety: 1.1



Energy Fuels Resources (USA) Inc.	PROJECT White Mesa Mill Reclamation	MWH	
	TITLE Cross Section B on Cell 1 Slope Stability Analysis Pseudo-Static Conditions - Deep Circular	DATE AUG 2015	FIGURE E.10
		FILENAME Appendix E Slope Stability Results.pptx	

EFRI - White Mesa Mill
Cross Section B
Closure

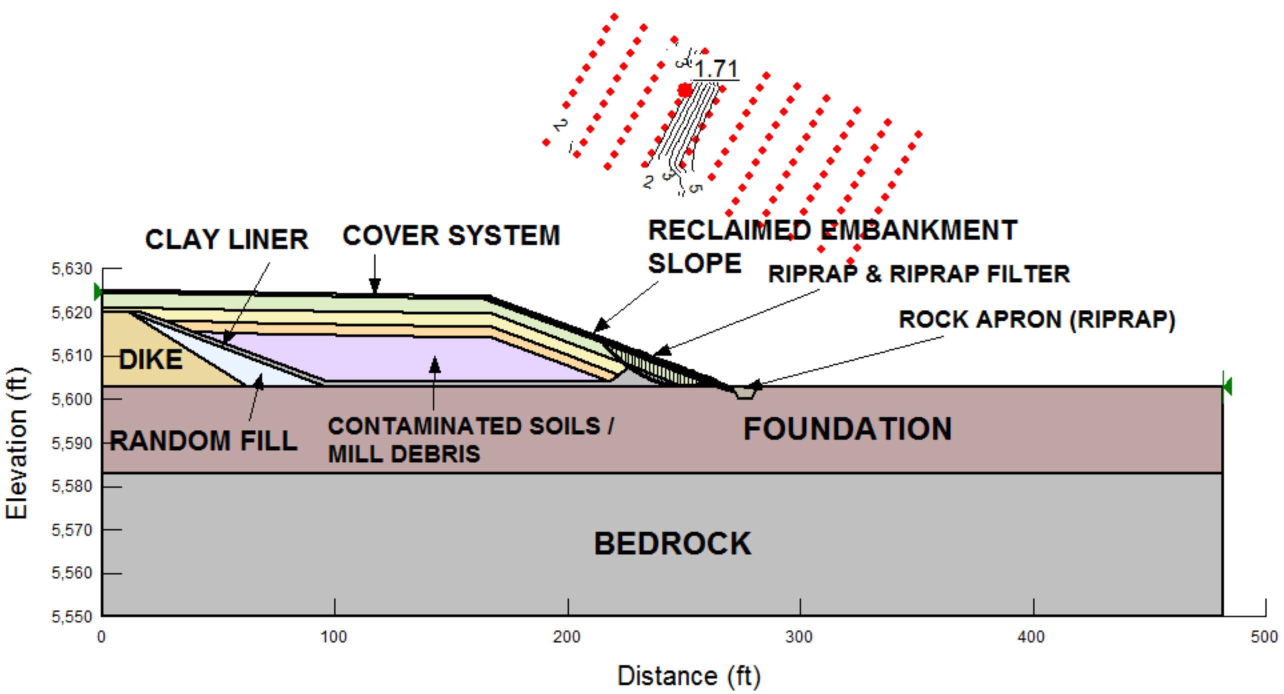
Static Loading Conditions
Required Factor of Safety: 1.5



	Energy Fuels Resources (USA) Inc.	PROJECT White Mesa Mill Reclamation	MWH
		TITLE Cross Section B on Cell 1 Slope Stability Analysis Static Conditions - Shallow Circular	DATE AUG 2015 / FIGURE E.11 FILENAME Appendix E Slope Stability Results.pptx

EFRI - White Mesa Mill
Cross Section B
Closure

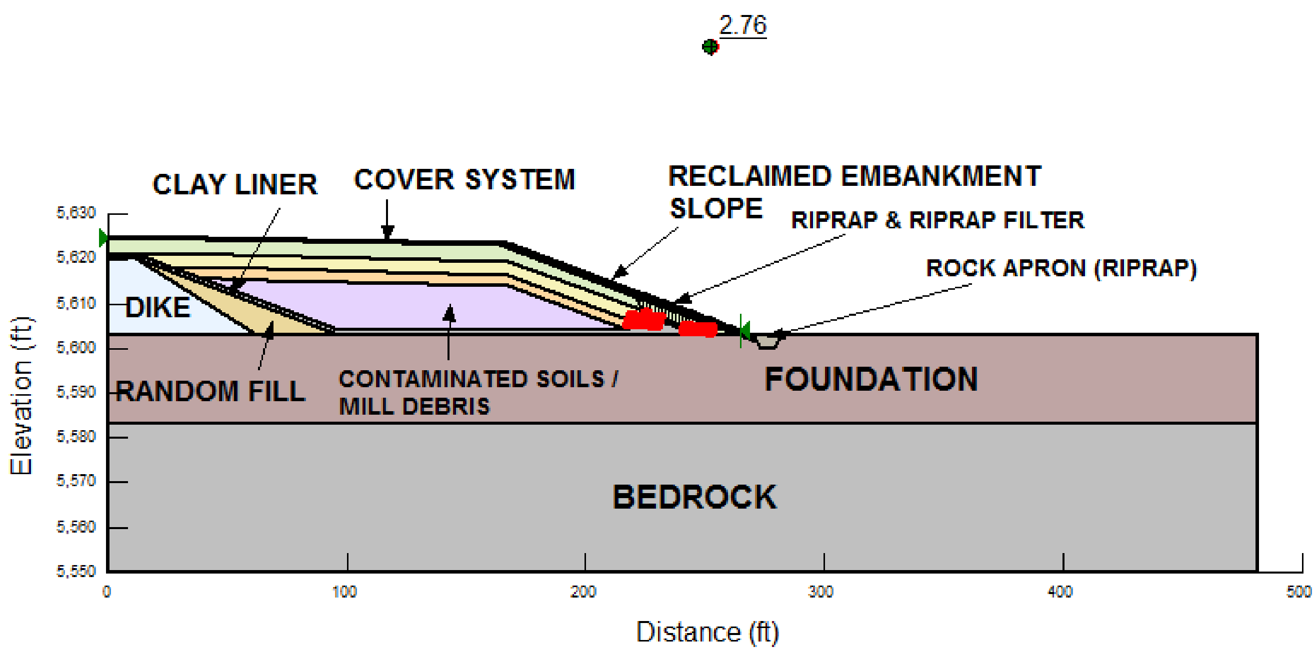
Pseudo-Static (k = 0.1g) Loading Conditions
Required Factor of Safety: 1.1



Energy Fuels Resources (USA) Inc.	PROJECT White Mesa Mill Reclamation	MWH
	TITLE Cross Section B on Cell 1 Slope Stability Analysis Pseudo-Static Conditions - Shallow Circular	DATE AUG 2015 — FIGURE E.12 FILENAME Appendix E Slope Stability Results.pptx

EFRI - White Mesa Mill
Cross Section B
Closure

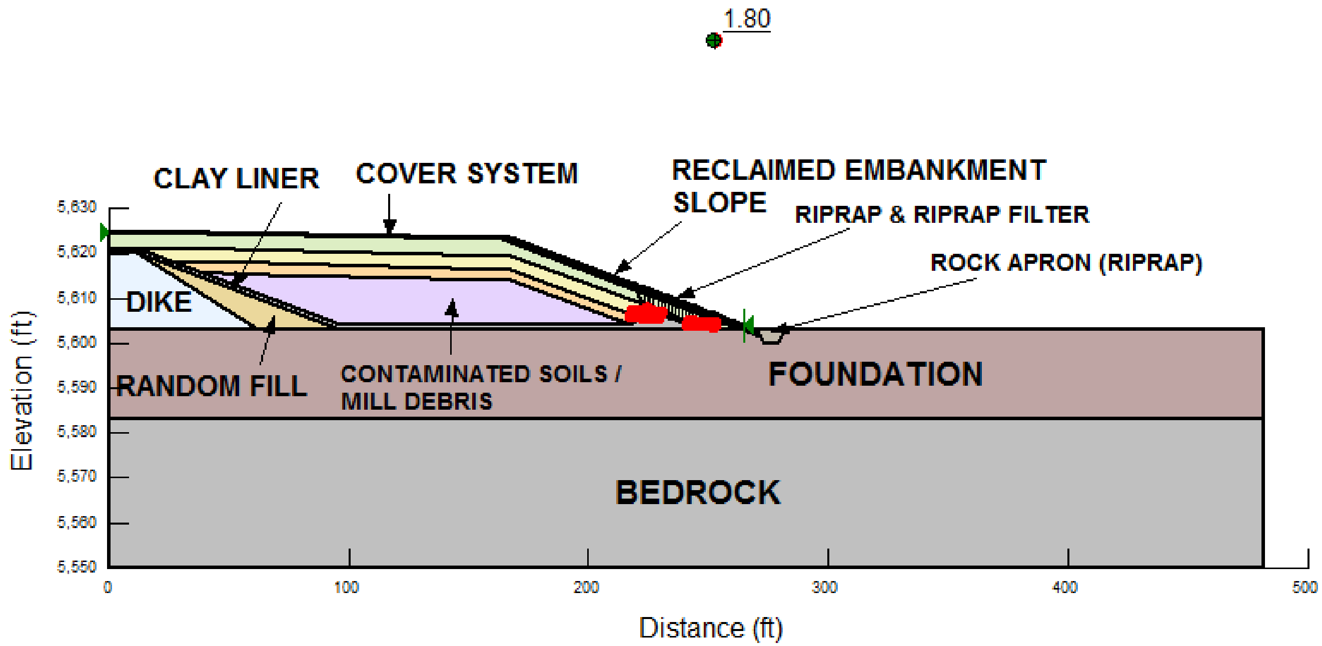
Block Failure - Static Loading
Required Factor of Safety: 1.5



	Energy Fuels Resources (USA) Inc.	PROJECT White Mesa Mill Reclamation	MWH
		TITLE Cross Section B on Cell 1 Slope Stability Analysis Static Conditions - Block	DATE AUG 2015 / FIGURE E.13
			FILENAME Appendix E Slope Stability Results.pptx

EFRI - White Mesa Mill
Cross Section B
Closure

Block Failure - Pseudo-Static (k = 0.1g) Loading Conditions
Required Factor of Safety: 1.1



Energy Fuels Resources (USA) Inc.	PROJECT: White Mesa Mill Reclamation		MWH
	TITLE: Cross Section B on Cell 1 Slope Stability Analysis Pseudo-Static Conditions - Block	DATE: AUG 2015	FIGURE E.14
		FILENAME: Appendix E Slope Stability Results.pptx	

ATTACHMENT E

SUPPORTING DOCUMENTATION FOR INTERROGATORY 07/1 and 09/1:

REVISED APPENDIX F, SETTLEMENT AND LIQUEFACTION ANALYSES, TO THE UPDATED TAILINGS COVER DESIGN REPORT (APPENDIX D OF THE RECLAMATION PLAN, REVISION 5.0)

APPENDIX F

SETTLEMENT AND LIQUEFACTION ANALYSES

F.1 BACKGROUND

This appendix presents results of settlement analyses and evaluation of liquefaction potential of tailings for the Energy Fuels Resources (USA) Inc. (EFRI) White Mesa Uranium Mill tailings disposal cells. These analyses are an update to the settlement and liquefaction analyses presented in MWH (2011) to address State of Utah, Division of Waste Management and Radiation Control (DWMRC) (formerly Utah Division of Radiation Control, DRC) interrogatories (DRC, 2012) and review comments on EFRI responses to 2012 interrogatories (DRC, 2013). These analyses also incorporate (1) the revised cover grading design, (2) results of cover material testing conducted in 2010 and 2012 (summarized in Attachment B of EFRI, 2012), (3) results of the recent site-specific probabilistic hazard analysis (presented in MWH, 2015a), (4) results of tailings testing conducted in 2013 (presented in MWH, 2015b), and (5) updated calculation methods for the seismic settlement and liquefaction potential.

Settlement analyses were conducted to evaluate settlement due to placement of final cover, dewatering of the tailings cells, long-term static (creep) settlement, and seismically induced (seismic) settlement. The results of these analyses were used to evaluate differential settlement and the potential for cover cracking. The settlement analyses are discussed in Section F.2. The tailings cells were also evaluated for liquefaction potential and discussion is provided in Section F.3.

The monolithic ET cover system evaluated in this appendix consists of the following layers from top to bottom:

- 0.5 ft (15 cm) Erosion Protection Layer (gravel-admixture)
- 3.5 ft (107 cm) Water Storage/Biointrusion/Frost Protection/Radon Attenuation Layer (loam to sandy clay)
- 3.0 to 4.0 ft (91 to 122 cm) Radon Attenuation Layer (highly compacted loam to sandy clay)
- 2.5 ft (75 cm) Radon Attenuation and Grading Layer (loam to sandy clay)

F.2 SETTLEMENT ANALYSES

F.2.1 Method of Analyses

General. One-dimensional (1-D) settlement analyses were conducted for the tailings in Cells 2 and 3 to estimate total potential future settlement of the tailings after placement of the final cover. The cone penetration testing (CPT) locations from the October 2013 tailings investigation (MWH, 2015b) were selected as the locations for the settlement analyses. The CPT locations are shown on Figure F.1, along with the settlement monument locations. All CPT locations were adjacent to settlement monuments.

The settlement analyses were conducted for two time periods as described below.

1. Settlement during active maintenance. This settlement was calculated as the settlement due to placement of the final cover and dewatering. Water levels during

active maintenance were assumed to be drawn down from water level elevations presented in MWH (2015b) for the October 2013 tailings elevation to five feet above the liner. EFRI proposes to dewater the tailings during active maintenance and draw down the water levels with in Cells 2 and 3 such that there are not issues with cover stability. This water level has been assumed as 5 feet for these analyses. Once dewatering to this water level has been completed, remaining primary consolidation due to placement of the cover will be very small.

2. Settlement after active maintenance. This settlement was calculated as the sum of settlement due to creep and seismic settlement. The water level within the tailings was assumed to be located five feet above the liner after active maintenance based EFRI's plan for dewatering during active maintenance for Cells 2 and 3.

1-D Column Geometry. Vertical soil profiles presented in MWH (2015b) for each CPT location were used in the 1-D consolidation analyses, with the water levels presented in that report being used for initial pore pressure conditions. This assumption is considered conservative since water levels will continue to decrease due to dewatering prior to final cover placement. Cover thicknesses are based on the cover design as listed above, with total cover thicknesses of 10.5 and 10 feet for Cells 2 and 3, respectively. The stress state for the layers within each column is calculated at the midpoint of each tailings layer. Additional vertical column geometry details are provided in Attachment F.1.

Total Settlement During Active Maintenance. Settlement during active maintenance is assumed to be due to primary consolidation caused by cover loading and dewatering (i.e. creep and initial compression are neglected). Settlement is calculated using the following equation:

$$S = \frac{C_C H}{1+e_0} \log \frac{\sigma'_f}{\sigma'_i}$$

Where:

S = settlement
C_c = compression index
H = thickness of tailings layer (ft)
e_i = initial void ratio of tailings
σ'_i = initial average effective overburden pressure (psf)
σ'_f = final effective vertical pressure (psf)

Total Settlement After Active Maintenance. Settlement after active maintenance is completed is assumed to be due to creep and seismic settlement.

Creep Settlement. Creep settlement was calculated using the method presented in Holtz and Kovacs (1981) and assuming a typical value for the ratio of the secondary compression index to the compression index (C_α/C_c) of 0.02 based on the upper bound average C_α estimated from laboratory testing on sand-slime and slime tailings (MWH, 2015b). The secondary settlements are based on a time period of 1,000 years.

Seismic Settlement. Seismic settlement was estimated using methods presented in Stewart et al. (2004), and seismic parameters presented in the site-specific probabilistic seismic hazard analysis for the site (MWH, 2015a). The mean peak ground acceleration (PGA) for reclaimed (long-term) conditions is 0.15 g for an average return period of 10,000 years. The mean seismic source is from a magnitude 5.5 event occurring 20 km from the site. The equations used from Stewart et al. (2004) are provided below.

Shear strain and related equations:

$$\gamma = \frac{1 + g_1 \cdot e^{g_2 \cdot P}}{1 + g_1} P \cdot 100 \text{ (units of \%)}$$

$$\text{PI} \approx 0: \quad g_1 = 0.199 \cdot (\sigma' / p_a)^{0.231} \quad g_2 = 10850 \cdot (\sigma' / p_a)^{-0.410}$$

$$\text{PI} \approx 15: \quad g_1 = 0.194 \cdot (\sigma' / p_a)^{0.265} \quad g_2 = 7490 \cdot (\sigma' / p_a)^{-0.418}$$

$$\text{PI} \approx 30: \quad g_1 = 4.0 \quad g_2 = 1400$$

$$\gamma_{eff} \frac{G_{eff}}{G_{\max}} = \frac{0.65 \cdot PHA \cdot \sigma_0 \cdot r_d}{g \cdot G_{\max}} \equiv P$$

Where:

γ : shear strain
PI: plasticity index
σ': effective stress
p_a : atmospheric pressure (calculated for an average elevation of 5,600 feet for the site)
G_{eff}: effective shear modulus
G_{max}: small strain shear modulus
PHA: peak horizontal acceleration
σ_o: total overburden pressure
r_d: reduction factor, ratio of actual shear stress at depth vs. theoretical "rigid body" shear stress
g: acceleration due to gravity

Volumetric strain at 15 cycles equation:

$$\varepsilon_{v,N=15} = a(\gamma_c - \gamma_{tv})^b$$

Where:

$\varepsilon_{v,\, N=15}$: volumetric strain at 15 cycles
a, b, and γ_{tv}: material-specific constants (estimated based on relative compaction, soil type, fines content, and plasticity using Figures 6.5 – 6.7 in Stewart et. al, 2004)
γ_c: shear strain (same as shear strain, γ, listed above)

Volumetric strain for design event:

$$\varepsilon_V = \varepsilon_{V,\,N=15} * C_n * 2$$

$$C_N = R\ln(N) + c$$

$$c = 1 - \ln(15) \times R$$

$$N = \frac{\left(\frac{\exp(b_1 + b_2(m - m^*))}{10^{1.5m+16.05}}\right)^{-\frac{1}{3}}}{4.9 \cdot 10^6 \beta} + Sc_1 + rc_2$$

Where:

ε_V: volumetric strain for design event
C_N: normalized vertical strain
R: slope parameter (estimated as 0.36, 0.32, and 0.34 for soils with non-plastic fines, soils with low-plasticity fines, and soils with medium plasticity fines, respectively, as presented in Stewart et al., 2004 pages 86 through 89)
N: equivalent number of uniform strain cycles
c: slope parameter estimated from equation listed above
b_1: 1.53 (Stewart et al., 2004)
b_2: 1.51 (Stewart et al., 2004)
c_1: 0.75 (Stewart et al., 2004)
c_2: 0.095 (Stewart et al., 2004)
β: 3.2 (Stewart et al., 2004)
m: 5.8 (Stewart et al., 2004)*
m: design earthquake magnitude
r: site-source distance (km)
S: equal to 0 if rock or shallow soil (<20m) underlies the fill and 1 if >20m underlies the fill

F.2.2. Material Properties

EFRI conducted a tailings investigation of Cells 2 and 3 in October 2013 at the White Mesa Mill site to collect site-specific tailings data to supplement existing tailings data used for the settlement analyses. The results are presented in MWH (2015b). The tailings profiles and properties used for the settlement analyses are based on the results presented in MWH (2015b). Parameters used for the cover materials are based on cover material testing conducted in 2010 and 2012 (summarized in Attachment B of EFRI, 2012). Parameters used for the settlement analyses are summarized in Table F.1 and discussed in the following paragraph. Additional detail on soil properties and consolidation parameters used in the analyses are provided in Attachments F.1 through F.3.

Table F.1 Summary of Soil Parameters used for Settlement Analyses

Material Type	Initial Dry Density (pcf)	Specific Gravity	Initial void Ratio, e	Average Percent Passing No. 200 Sieve (%)	Com-pression Index, C_c	Secondary Com-pression Index, C_α
Erosion Protection Layer (topsoil)	100[1]	2.61[1]	0.61[2]	51[1]	0.14[3]	NA
Erosion Protection Layer (rock mulch)	106[1]	2.62[1]	0.54[2]	45[1]	0.14[3]	NA
Evapotransporation Cover Layer	100[1]	2.63[1]	0.64[2]	51[1]	0.14[3]	NA
High-Compaction Cover Layer	112[1]	2.63[1]	0.46[2]	51[1]	0.14[3]	NA
Platform Fill/Interim Cover	94[1]	2.63[1]	0.74[2]	51[1]	0.14[3]	NA
Sand Tailings	97[5]	2.70[5]	0.74[2]	18[5]	0.12[6]	0.002[4]
Sand-Slime Tailings	88[5]	2.80[5]	0.99[2]	47[5]	0.24[5]	0.005[4]
Slime Tailings	78[5]	2.86[5]	1.29 [2]	71[5]	0.28[5]	0.006[4]

[1]From laboratory values presented in EFRI (2012)
[2]Calculated value
[3] Calculated from empirical equation for soil types similar to cover material (as presented in Holtz and Kovacs, 1981).
[4] Estimated from laboratory results presented in MWH (2015b), upper bound average C_α for sand-slime and slime tailings of 0.02
[5]From laboratory results presented in MWH (2015b)
[6]Based on lab testing performed on uranium tailings sands and presented in Keshian and Rager (1988)

Additional assumptions for soil parameters used in the analyses are provided below.

- For the consolidation, dewatering, and creep settlement analyses, the moist unit weight for all tailings layers (saturated and unsaturated) was estimated as the saturated unit weight which results in a conservative estimate of loading.
- For the consolidation, dewatering, and creep settlement analyses, properties of the layers of tailings between the liner and the bottom of the CPT depth were estimated as sand-slime tailings. The sand-slime tailings comprise approximately 65 percent of the total tailings in Cells 2 and 3.
- For calculating loading conditions for seismic settlement and evaluation of liquefaction, the moist unit weight for unsaturated tailings layers were estimated based on the long-term moisture content of the tailings as presented in the radon emanation modeling.
- Initial stress conditions for liquefaction analyses were estimated using CPT data from MWH (2015b) assuming the initial conditions in the future will be the same as in October 2013. This is conservative as it does not account for the effects of consolidation and aging that will occur in the tailings during the active maintenance period. For the seismic settlement analyses of Cell 3, the average shear wave velocities with depth measured for Cell 2 tailings were used in the analyses to partially account for consolidation and aging that will occur during this period. These values range from 460 to 600 feet per second. Tailings in Cell 2 were placed earlier than Cell 3 and have been actively dewatered since 2009. This use of the shear wave velocities measured in October 2013 is conservative for these analyses for both tailings cells since further densification of the tailings will occur during the active maintenance period.

F.2.3 Results

As discussed previously, settlement analyses were conducted for two time periods to estimate future settlement (1) settlement during active maintenance due to final cover placement and dewatering, and (2) settlement after active maintenance due to creep and seismic settlement. The results are summarized in Tables F.2 and F.3 and Figures F.2 and F.3. The spreadsheet calculations of are provided in Attachments F.1 (settlement due to dewatering of tailings and placement of final cover), F.2 (creep settlement), and F.3 (seismic settlement). Total settlement during active maintenance is conservatively estimated to range from 0.9 to 1.6 feet. Total remaining settlement due to dewatering from 5 feet above the liner to the liner is approximately 0.01 feet. Total potential future settlement due to creep is estimated to range from 0.05 to 0.09 feet, and due to seismic settlement is estimated to range from 0.23 to 0.62 feet. The total potential future long-term settlement due to creep and seismic settlement of the tailings is estimated to range from 0.29 to 0.71 feet**.** The estimates of total long term settlement were calculated by summing the static creep settlement estimate and the seismic settlement estimates. As such, these estimates are considered to be somewhat conservative as they are not independent (i.e. as long-term static creep progresses, void ratio reduction will occur and the potential for seismic settlement will reduce over time as a result).

Table F.2 Future Settlement During Active Maintenance

Location	Settlement due to Consolidation and Dewatering Prior to t_1 (ft)
2W2	1.09
2W3	1.15
2W4-C	1.29
2W5-C	1.26
2W6-S	1.29
2W7-C	1.17
2E1	1.30
3-1S	0.88
3-2C	1.19
3-3S	1.47
3-4N	1.56
3-6N	1.34
3-8N	1.03
3-8S	1.06

Notes:
t_1 corresponds to dewatering of the tailings to a level 5 feet above the liner

Table F.3 Future Settlement After Active Maintenance

Location	Settlement due to 1000 years of Creep (ft)	Seismic Settlement (ft)	Total Potential Future Settlement after Active Maintenance (ft)
2W2	0.06	0.35	0.41
2W3	0.05	0.36	0.42
2W4-C	0.05	0.43	0.48
2W5-C	0.07	0.49	0.56
2W6-S	0.06	0.48	0.54
2W7-C	0.06	0.35	0.40
2E1	0.07	0.47	0.54
3-1S	0.05	0.23	0.29
3-2C	0.05	0.40	0.45
3-3S	0.09	0.41	0.50
3-4N	0.09	0.62	0.71
3-6N	0.06	0.54	0.60
3-8N	0.05	0.34	0.39
3-8S	0.08	0.35	0.43

F.2.4 Differential Settlement and Cover Cracking Potential

Differential Settlement. After placement of the final cover and during active maintenance, additional fill may be placed in any low areas to maintain positive drainage of the cover surface. Therefore, the critical time period where differential settlement is a concern for the cover grading (i.e. potential for slope reversal) is after active maintenance is complete. Potential maximum future settlement after active maintenance is estimated as 0.29 to 0.71 feet. Based on the settlement analyses results as shown on Figure F.2, the critical location for the ratio of maximum differential settlement over distance is estimated to occur between the CPT location 3-3S and the dike between Cells 3 and 4A (conservatively assuming no settlement of the dike fill). Although the differential settlement is higher between CPT location 3-4N and 3-6N and the dike between Cells 2 and 3, differential settlement at these location would result in an increase in cover slope, therefore the former location is more critical for slope reversal. Locations on Cell 2 with higher settlement (2W4-C, 2W5-C, 2W6-S) than the 3-3S location are located within the center of Cell 2, however the highest differential settlement associated with these points is lower than the selected critical case.

The total potential differential settlement between 3-3S and the dike between Cells 3 and 4A is 0.50 feet over a distance of approximately 175 feet. The estimated differential settlement is sufficiently low such that ponding and slope reversal is not expected to occur. These calculations are based on conservative assumptions for seismic settlement with little to no credit taken for densification of tailings prior to placement of final cover and during active maintenance of the tailings cells. In addition, as mentioned above, creep and seismic settlement are not independent, however they have been treated as such in the calculations. Actual differential settlement for long-term (after active maintenance) conditions is expected to be lower.

Cover Cracking. Cover cracking analyses were performed for the highly-compacted radon barrier. The critical location for the cover cracking analyses for maximum differential settlement due to final cover placement, dewatering of tailings, creep, and a seismic event is 2.27 feet between the settlement monument 3-4N and dike between Cells 2 and 3 as shown on Figure F.3. This location has the maximum differential settlement over the shortest horizontal distance. The maximum differential settlement, assuming there is no settlement of the dike, is 2.27 feet. The horizontal distance between the two locations is approximately 150 feet.

Morrison-Knudsen Environmental Corporation (1993) presents a method for determining the tensile strain required to cause cracking of the radon barrier as a function of the plasticity index (PI) of the soil. The tensile strain at cracking is calculated by the equation below:

$$\varepsilon_f\,(\%) = 0.05 + 0.003 \times (PI)$$

where: $\varepsilon_f(\%)$ = tensile strain to cause cracking of the radon barrier
PI = plasticity index of radon barrier

The PI value for the highly compacted radon attenuation layer was estimated as the weighted average (based on soil volumes) of the measured PIs (11) for composite samples collected during the 2010 and 2012 borrow investigations (see Attachment B of EFRI, 2012). Using this value for PI, the minimum tensile strain that will induce cracking is 0.08 percent. The maximum settlement-induced horizontal tensile strain on the radon attenuation layer must be less than 0.08 percent so that cover cracking will not occur.

The horizontal movement at the top of the radon barrier can be calculated based on the following equation (Lee and Shen, 1969), which is referenced in NUREG 1620 (NRC, 2003) for cover cracking analysis:

$$m = \frac{2}{3} H\alpha$$

where: m = horizontal movement in feet
H = thickness of relatively incompressible material (in this analysis H is the thickness of the highly compacted radon barrier)
α = local slope of the settlement profile (expressed as decimal fraction)

Horizontal movement at the maximum tailing thickness is calculated to be 0.035 feet using a maximum thickness of relatively incompressible material of 3.5 feet, and a total differential settlement of 2.27 feet over 150 feet. The thickness of relatively incompressible material was estimated assuming a maximum 3.5-ft highly compacted radon barrier for Cell 3. The peak horizontal movement is assumed to be twice the average horizontal movement based on relationships presented in Gourc et al. (2010) and Rajesh and Viswanadham (2010). The peak horizontal movement is then calculated as 0.07.

The horizontal strain between any two settlement monitoring locations is the maximum horizontal movement divided by the horizontal distance (0.07 ft/150 ft). Using these values, the maximum horizontal strain is calculated as 0.05 percent. This value is lower than the maximum allowable strain of 0.08 percent and indicates that cracking of the radon attenuation layer due to settlement is not expected.

F.3 LIQUEFACTION ANALYSIS

F.3.1 Method of Analysis

Two procedures were used to evaluate the potential for liquefaction of the tailings based on the results of the CPT soundings. These methods (Idriss and Boulanger, 2008; Youd et al., 2001) are described below. The average factor of safety calculated from the two methods was used as the factor of safety for evaluating the liquefaction potential of the tailings.

Idriss and Boulanger (2008). The Idriss and Boulanger (2008) liquefaction triggering method estimates the cyclic stress ratio (CSR) based on the seismic design criteria and estimates the cyclic resistance ratio (CRR) based on the CPT readings and site conditions. CSR is calculated using a simplified procedure to estimate earthquake induced stresses, calculated using the following relationship:

$$CSR_{M=7.5,\sigma'_{vc}=1} = 0.65\frac{a_{max}}{g}\frac{\sigma_{vc}}{\sigma'_{vc}}\frac{1}{MSF}\frac{1}{K_\sigma}\frac{1}{K_\alpha}$$

Where:

a_{max}: maximum horizontal ground surface acceleration
σ_{vc}': effective vertical confining stress
σ_{vc}: total vertical confining stress
MSF: earthquake magnitude scaling factor
K_σ: overburden correction factor
K_α: static shear stress correction factor
g: acceleration due to gravity

The equations for the correction factors applied to the CSR for this evaluation are the following:

$$r_d = \exp(\alpha(z) + \beta(z)M)$$

$$\alpha(z) = -1.012 - 1.126\sin\left(\frac{z}{11.73} + 5.133\right)$$

$$\beta(z) = 0.106 + 0.118\sin\left(\frac{z}{11.28} + 5.142\right)$$

$$\text{MSF} = 6.9\exp\left(\frac{-M}{4}\right) - 0.058 \quad \leq 1.8$$

$$K_\sigma = 1 - C_\sigma \ln\left(\frac{\sigma'_{vc}}{P_a}\right) \leq 1.1$$

$$C_\sigma = \frac{1}{37.3 - 8.27(q_{c1N})^{0.264}} \leq 0.3$$

Where:
r_d: shear stress reduction coefficient
q_{c1N}: tip resistance normalized to atmospheric pressure and overburden pressure
z: depth below ground surface

P_a: atmospheric pressure (calculated for an average elevation of 5,600 feet for the site)
M: design earthquake magnitude

The tailings pile was evaluated assuming essentially flat ground, and ignored the effects of the slope at the edge of the tailings pile. Thus, a static shear stress correction factor of $K_\alpha=1$ was used for all calculations.

The relationship for CRR is based on liquefaction case histories and is expressed as:

$$\mathrm{CRR}_{M=7.5,\sigma'_{vc}=1} = \exp\left(\frac{q_{c1Ncs}}{540} + \left(\frac{q_{c1Ncs}}{67}\right)^2 - \left(\frac{q_{c1Ncs}}{80}\right)^3 + \left(\frac{q_{c1Ncs}}{114}\right)^4 - 3\right)$$

Where:

q_{c1Ncs}: equivalent clean-sand corrected normalized tip resistance

$$q_{c1Ncs} = q_{c1N} + \Delta q_{c1N}$$

$$\Delta q_{c1N} = \left(5.4 + \frac{q_{c1N}}{16}\right) \cdot \exp\left(1.63 + \frac{9.7}{\mathrm{FC}+0.01} - \left(\frac{15.7}{\mathrm{FC}+0.01}\right)^2\right)$$

FC = Fines Content in %

The factor of safety against liquefaction was computed as:

$$FS_{liq} = \frac{\mathrm{CRR}_{M=7.5,\sigma'_{vc}=1}}{\mathrm{CSR}_{M=7.5,\sigma'_{vc}=1}}$$

The correlation between CSR, CRR, and q_{c1N} is shown in Figure 67 of Idriss and Boulanger (2008).

Youd et al. (2001). The Youd et al. (2001) liquefaction triggering method estimates the CSR based on the seismic design criteria and estimates the CRR based on the CPT readings and site conditions. CSR is calculated using a simplified procedure to estimate earthquake induced stresses, calculated using the following relationship:

$$CSR_{M=7.5,\sigma'_{vc}=1} = 0.65\frac{a_{max}}{g}\frac{\sigma_{vc}}{\sigma'_{vc}}\frac{1}{MSF}\frac{1}{K_\sigma}\frac{1}{K_\alpha}$$

Where:

a_{max}: maximum horizontal ground surface acceleration
σ_{vc}': effective vertical confining stress
σ_{vc}: total vertical confining stress
r_d: shear stress reduction coefficient

MSF: earthquake magnitude scaling factor
K_σ: overburden correction factor
K_α: static shear stress correction factor
g: acceleration due to gravity

The equations for the correction factors applied to the CSR for this evaluation are the following:

$$r_d = 1.0 - 0.00765z \quad \text{for } z \leq 9.15 \text{ m}$$

$$r_d = 1.174 - 0.0267z \quad \text{for } 9.15 \text{ m} < z \leq 23 \text{ m}$$

Revised Idriss Scaling Factor: $\text{MSF} = 10^{2.24}/M_w^{2.56}$

$$K_\sigma = (\sigma'_{vo}/P_a)^{(f-1)}$$

Where:

z: Depth below ground surface
M_w: Design earthquake magnitude
P_a: Atmospheric Pressure
σ_{vc}': effective vertical overburden pressure
f=0.7 to 0.8 for 40% ≤ relative density, D_r ≤ 60%
0.6 to 0.7 for 60% < relative density, D_r ≤ 80%

$$D_r = \sqrt{\frac{q_{c1n}}{300}}$$

The tailings pile was evaluated assuming flat ground conditions. Thus, a static shear stress correction factor of *K_α=1* was used for all calculations.

The relationship for CRR is based on liquefaction case histories and is expressed as:

$$\text{If } (q_{c1N})_{cs} < 50 \quad \text{CRR}_{7.5} = 0.833[(q_{c1N})_{cs}/1{,}000] + 0.05$$
$$\text{If } 50 \leq (q_{c1N})_{cs} < 160 \quad \text{CRR}_{7.5} = 93[(q_{c1N})_{cs}/1{,}000]^3 + 0.08$$

Where:

$q_{c1Ncs} = K_c * q_{c1N}$

$$\text{for } I_c \leq 1.64 \quad K_c = 1.0$$

$$\text{for } I_c > 1.64 \quad K_c = -0.403I_c^4 + 5.581I_c^3 - 21.63I_c^2 + 33.75I_c - 17.88$$

The factor of safety against liquefaction was computed as:

$$FS_{liq} = \frac{\mathrm{CRR}_{M=7.5,\sigma'_{vc}=1}}{\mathrm{CSR}_{M=7.5,\sigma'_{vc}=1}}$$

The correlation between CSR, CRR, and q_{c1N} is shown in Figure 4 of Youd et al. (2001).

F.3.2. Material Properties

Liquefaction evaluation was performed for all CPT locations from the October 2013 tailings investigation (MWH, 2015b). The liquefaction evaluation used the same assumptions for soil profile, water table elevation, and density of the tailings material as described above for the long-term settlement analyses. Other parameters used for the evaluation were based on CPT data as presented in Attachment F.4 and as outlined in Idriss and Boulanger (2008) and Youd et al. (2001). It is assumed that the compacted cover materials are not susceptible to liquefaction and therefore were not included in the analyses.

F.3.3. Site Seismicity

Results of the site-specific probabilistic seismic hazard analysis presented in MWH (2015a) were used in the analysis of liquefaction potential. The mean peak ground acceleration for reclaimed (long-term) conditions is 0.15 g for an average return period of 10,000 years. The mean seismic source is from a magnitude 5.5 event occurring 20 km from the site.

F.3.4 Results

Table F.4 presents a summary of the results of the liquefaction analysis. Further details of the calculation can be found in Attachment F.4.

Table F.4 Summary of Liquefaction Results

Location	Minimum Factor of Safety
2W2	2.58
2W3	2.37
2W4-C	2.11
2W5-C	2.08
2W6-S	2.24
2W7-C	2.10
2E1	1.96
3-1S	2.41
3-2C	2.59
3-3S	2.36
3-4N	2.46
3-6N	2.30
3-8N	2.84
3-8S	2.38

Based on the factors of safety presented in Table F.4, the tailings are judged not to be susceptible to earthquake-induced liquefaction. The computed factors of safety against liquefaction range from 2.0 to 2.6.

F.4 CONCLUSIONS

Evaluation total settlement due to final cover placement and dewatering indicates potential future settlement during the active maintenance to range from approximately 0.9 to 1.6 feet. During this time, additional fill can be placed in any low areas in order to maintain positive drainage of the cover surface. The total predicted future long-term settlement that could occur (due to creep and seismic settlement) after the maintenance time period is complete is estimated to range from approximately 0.3 to 0.7 feet. The estimates of total long-term settlement were calculated by summing the static creep settlement estimate and the seismic settlement estimates. As such, these estimates are considered to be somewhat conservative as they are not independent (i.e. as long-term static creep progresses, void ratio reduction will occur and the potential for seismic settlement will reduce over time as a result). The estimated differential settlement after completion of active maintenance is sufficiently low that slope reversal and ponding is not expected to occur on a cover slope of 0.5 to 1.0 percent. In addition, the results indicate that cracking of the highly-compacted radon barrier due to settlement-induced strains is not expected. The results of the liquefaction analyses indicate the tailings are not susceptible to earthquake-induced liquefaction.

Similar results are expected for Cells 4A and 4B. Although Cells 4A and 4B have higher tailings thicknesses, these cells have a more effective dewatering systems and a low water level requirement for dewatering. These cells also have a slightly steeper average cover slope (approximately 0.8 percent) than Cells 2 and 3.

F.5 REFERENCES

Energy Fuels Resources (USA) Inc. (EFRI), 2012. Responses to Interrogatories – Round 1 for Reclamation Plan, Revision 5.0, March 2012. August 15.

Gourc, J.P., S. Camp, B.V.S. Viswanadham, and S. Rajesh, 2010. “Deformation behavior of clay cap barriers of hazardous waste containment systems: Full-scale and centrifuge tests,” Geotextiles and Geomembranes. Elsevier. Vol. 28: 281-291.

Holtz, R.D., W.D. Kovacs, 1981. An Introduction to Geotechnical Engineering.

Idriss, I., and R. Boulanger, 2008. Soil Liquefaction During Earthquakes. EERI monograph MNO-12.

Keshian, B., and R. Rager, 1988. Geotechnical Properties of Hydraulically Placed Uranium Mill Tailings, in Hydraulically Fill Structures, Geotechnical Special Publication No. 21, Eds. Van Zyl, D., and Vick, S., ASCE, August.

Lee, K.L., and C.K. Shen, 1969. “Horizontal Movements Related to Subsidence.” Journal of Soil Mechanics and Foundation Division, ASCE Volume 95. January.

Morrison-Knudsen Environmental Corporation (Morrison-Knudsen), 1993. UMTRA-Naturita, Embankment Design, Settlement Analysis and Cracking Potential Evaluation. Calc. No. 17-740-02-01. May.

MWH Americas, Inc. (MWH), 2011. Updated Tailings Cover Design. Prepared for Denison Mines (USA) Corp. September.

MWH Americas, Inc. (MWH), 2015a. White Mesa Mill Probabilistic Seismic Hazard Analysis Report. Prepared for Energy Fuels Resources (USA) Inc. April.

MWH Americas, Inc. (MWH), 2015b. White Mesa Mill Tailings Data Analysis Report. Prepared for Energy Fuels Resources (USA) Inc. April.

Rajesh, S. and B.V.S. Viswanadham, 2010. "Performance Assessment of Deformation Behavior of Landfill Barriers at the Onset of Differential Settlement," International Journal of Environmental Engineering, Vol. 2.1, pp. 269-289.

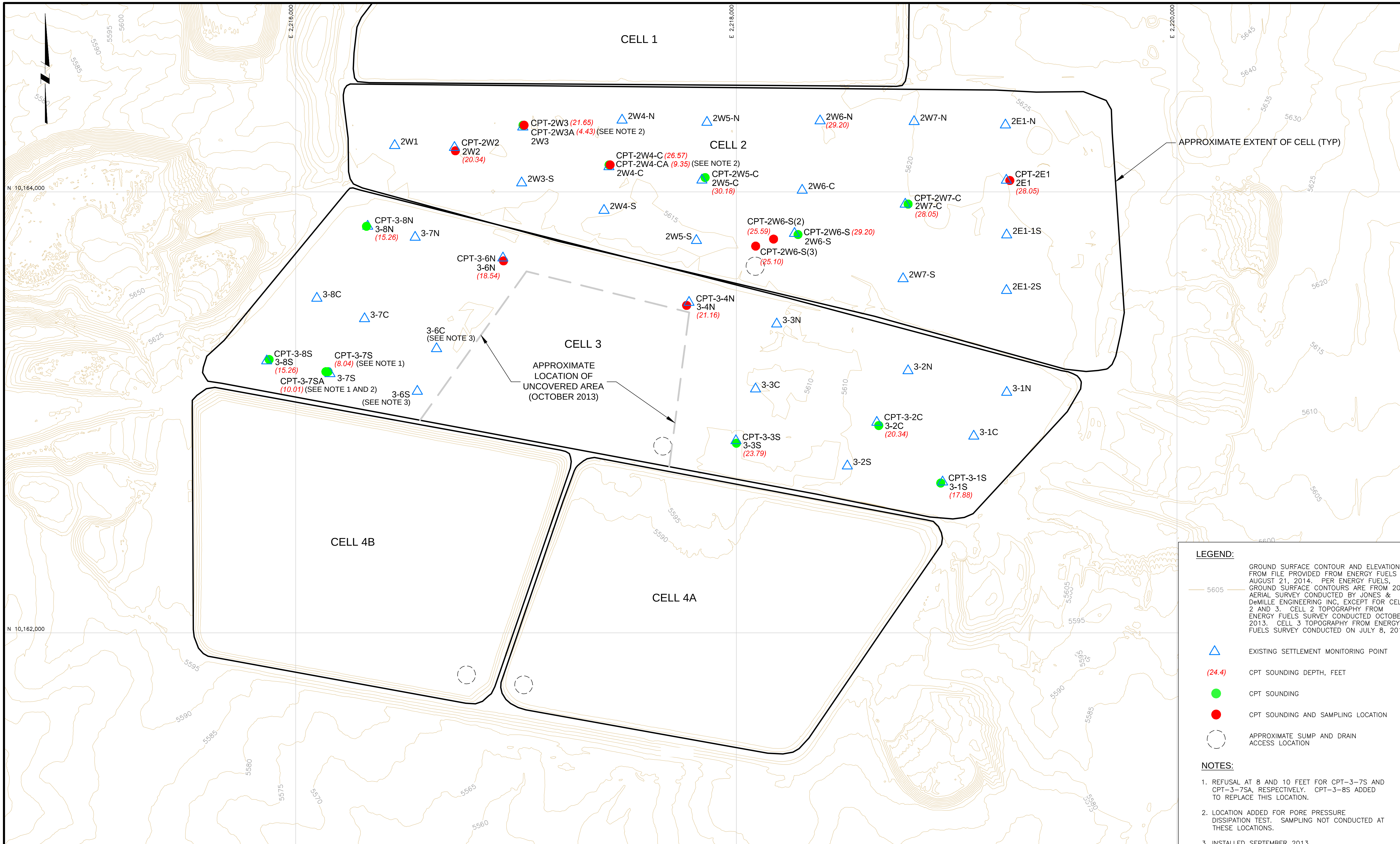
Stewart, J.P., D. Whang, M. Moyneur, and P. Duku, 2004. Seismic Compression of As-Compacted Fill Soils With Variable Levels of Fines Content and Fines Plasticity. CUREE Publication No.EDA-05. July.

U.S. Nuclear Regulatory Commission (NRC), 2003. "Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of Uranium Mill Tailings Radiation Control Act of 1978, Final Report." NUREG-1620. June.

Utah Department of Environmental Quality, Utah Division of Radiation Control (DRC). 2012. Denison Mines (USA) Corp's White Mesa Reclamation Plan, Rev. 5.0, Interrogatories - Round 1. March.

Utah Department of Environmental Quality, Division of Radiation Control (DRC), 2013. Review of August 15, 2012 (and May 31, 2012) Energy Fuels Resources (USA), Inc. Responses to Round 1 Interrogatories on Revision 5 Reclamation Plan Review, White Mesa Mill, Blanding, Utah, report dated September 2011. February 13.

Youd, T., I. Idriss, R. Andrus, I. Arango, G. Castro, J. Christian, R. Dobry, W. Liam Finn, L. Harder, M. Hynes, K. Ishihara, J. Koester, S. Liao, W. Marcuson, G. Martin, J. Mitchell, Y. Moriwaki, M. Power, P. Robertson, R. Seed, and K. Stokoe, 2001. Liquefaction Resistance of Soils: Summary report from the 1996 NCEER and 1998 NCEER/NSF Workshops of Evaluation of Liquefaction Resistance of Soils, Journal of Geotechnical and Geoenvironmental Engineering, October.



SCALE
200 0 200 400 FT
CONTOUR INTERVAL = 5 FEET

Energy Fuels Resources (USA) Inc.

PROJECT
ENERGY FUELS - WHITE MESA
OCTOBER 2013 TAILINGS INVESTIGATION

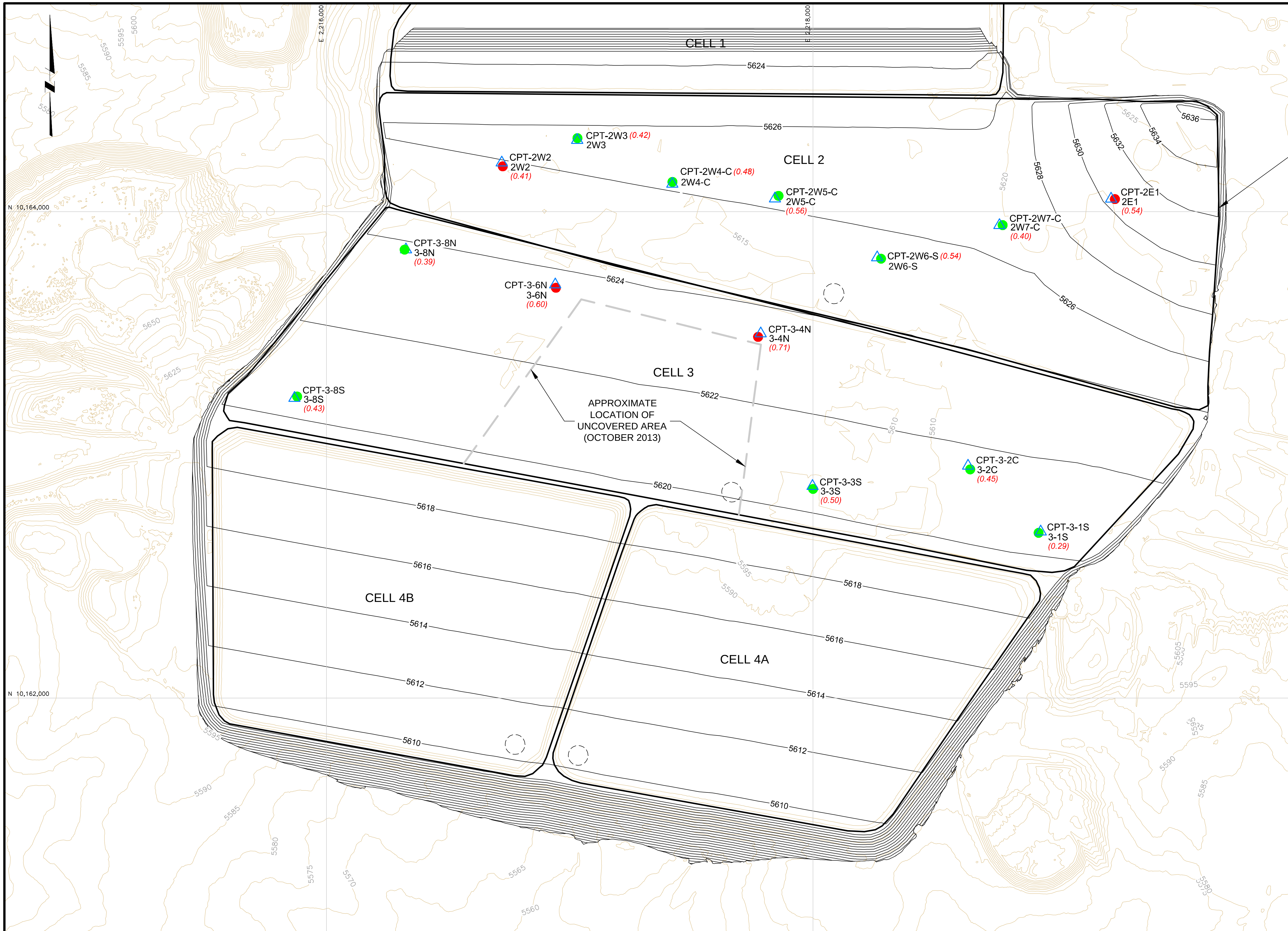
TITLE
TAILINGS CPT SOUNDING AND SAMPLING LOCATIONS

MWH

FIGURE F.1

FILE NAME: WMM CPT LOC
DATE: AUG 2015

L:\Design-Drafting\Clients-A-H\ENERGY FUELS\013-Sheet Set\2015-08-31 COVER DSGN FIGS\WMM CPT LOC



LEGEND:

5605	GROUND SURFACE CONTOUR AND ELEVATION FROM FILE PROVIDED FROM ENERGY FUELS ON AUGUST 21, 2014. PER ENERGY FUELS, GROUND SURFACE CONTOURS ARE FROM 2012 AERIAL SURVEY CONDUCTED BY JONES & DeMILLE ENGINEERING INC, EXCEPT FOR CELLS 2 AND 3. CELL 2 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED OCTOBER 2013. CELL 3 TOPOGRAPHY FROM ENERGY FUELS SURVEY CONDUCTED ON JULY 8, 2014.
5605	FINAL GRADING SURFACE CONTOUR AND ELEVATION, FEET
△	EXISTING SETTLEMENT MONITORING POINT
(1.0)	PREDICTED SETTLEMENT, FEET
● (green)	CPT SOUNDING
● (red)	CPT SOUNDING AND SAMPLING LOCATION
◌	APPROXIMATE SUMP AND DRAIN ACCESS LOCATION

SCALE 200 0 200 400 FT

Energy Fuels Resources (USA) Inc.

PROJECT: ENERGY FUELS - WHITE MESA OCTOBER 2013 TAILINGS INVESTIGATION

TITLE: PREDICTED SETTLEMENT AFTER ACTIVE MAINTENANCE

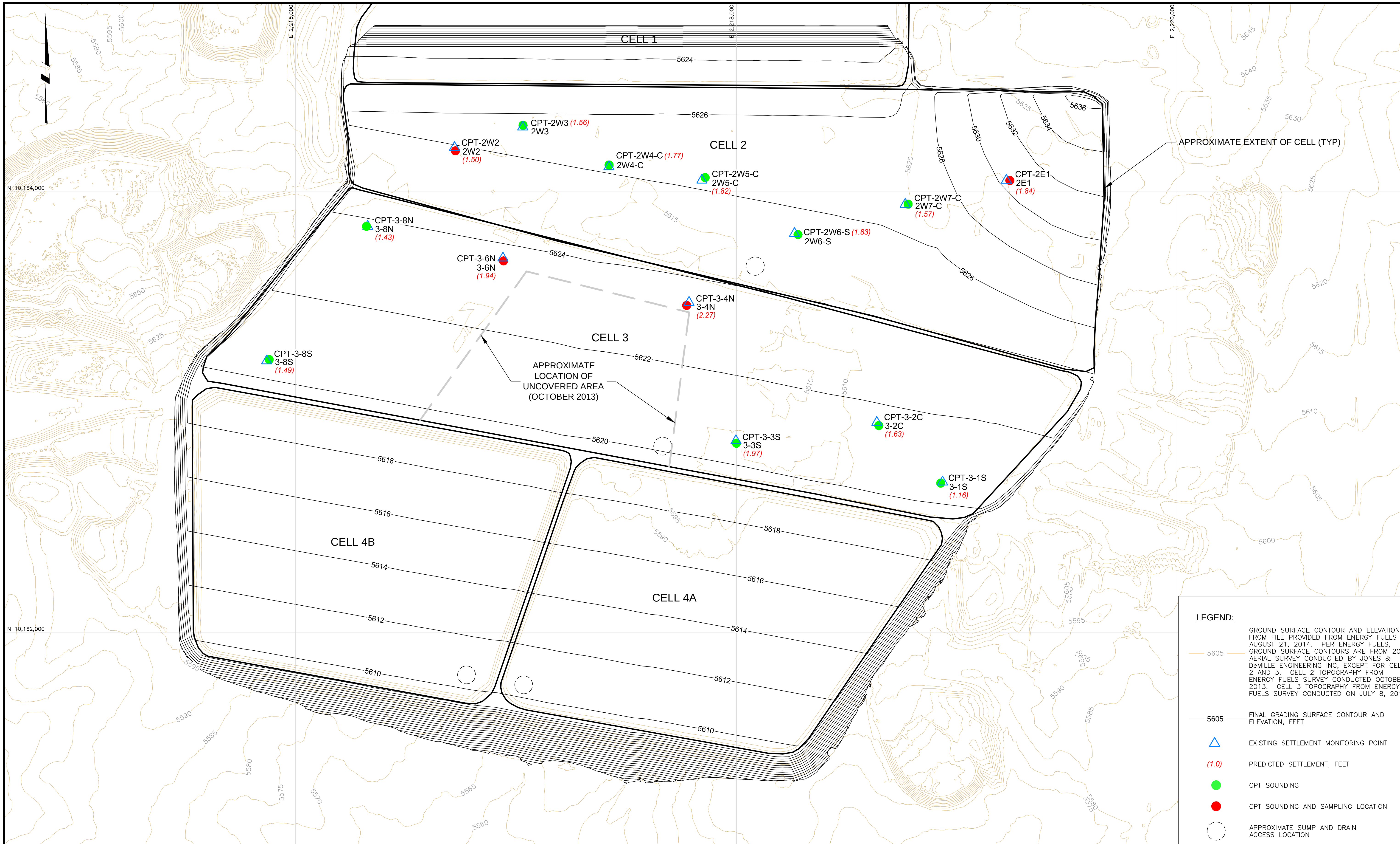
MWH

FIGURE F.2

FILE NAME: WMM CPT SETL A

DATE: AUG 2015

L:\Design-Drafting\Clients-A-H\ENERGY FUELS\013-Sheet Set\2015-08-31 COVER DSGN FIGS\WMM CPT SETL A



L:\Design-Drafting\Clients-A-H\ENERGY FUELS\013-Sheet Set\2015-08-31 COVER DSGN FIGS\WMM CPT SETL B

Energy Fuels Resources (USA) Inc.

PROJECT
ENERGY FUELS - WHITE MESA
OCTOBER 2013 TAILINGS INVESTIGATION

TITLE
TOTAL PREDICTED FUTURE SETTLEMENT

MWH

FIGURE F.3

FILE NAME: WMM CPT SETL B
DATE: AUG 2015

ATTACHMENT F.1

SETTLEMENT CALCULATIONS FOR SETTLEMENT DUE TO DEWATERING THE TAILINGS AND PLACMENT OF THE FINAL COVER

Notes

t_0 corresponds to beginning of final cover placement — Assumes 99% of consolidation due to existing stress conditions has taken place

t_1 corresponds to dewatering of the tailings to a level 5 feet above the liner

t_2 corresponds to completion of dewatering

SOIL PROPERTIES

TAILINGS

Specific Gravity, G_s		
2.70	Specific gravity of tailing sands, $G_{s\text{-TSand}}$	Based on lab testing performed on uranium tailings sands and presented in Keshian and Rager (1988)
2.80	Specific gravity of tailing sand-slimes, $G_{s\text{-TS-S}}$	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015)
2.86	Specific gravity of tailing slimes, $G_{s\text{-TSlime}}$	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015)
Fines Content		
18%	Fines content of tailings sands (%)	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015)
47%	Fines content of tailings sand-slimes (%)	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015)
71%	Fines content of tailings slimes (%)	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015)
Dry Unit Weight, γ_d		
97	In-situ dry unit weight of tailings sands at t_0, $\gamma_{d0\text{-Tsand}}$ (pcf)	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015)
88	In-situ dry unit weight of tailings sand-slimes at t_0, $\gamma_{d0\text{-TS-S}}$ (pcf)	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015)
78	In-situ dry unit weight of tailings slimes at t_0, $\gamma_{d0\text{-Tslime}}$ (pcf)	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015)
Saturated Unit Weight, γ_{sat}		
123	In-situ saturated unit weight of tailings sands at t_0, $\gamma_{sat0\text{-Tsand}}$ (pcf)	Calculated
119	In-situ saturated unit weight of tailings sand-slimes at t_0, $\gamma_{sat0\text{-TS-S}}$ (pcf)	Calculated
113	In-situ saturated unit weight of tailings slimes at t_0, $\gamma_{sat0\text{-Tslime}}$ (pcf)	Calculated
Moist Unit Weight, γ_m		
123	Moist unit weight of tailings sands, $\gamma_{m\text{-Tsand}}$ (pcf)	Calculated, assuming 100% degree of saturation (conservative estimate of loading from these layers)
119	Moist unit weight of tailings sand-slimes, $\gamma_{m\text{-TS-S}}$ (pcf)	Calculated, assuming 100% degree of saturation (conservative estimate of loading from these layers)
113	Moist unit weight of tailings slimes, $\gamma_{m\text{-Tslime}}$ (pcf)	Calculated, assuming 100% degree of saturation (conservative estimate of loading from these layers)
Void Ratio, e		
0.74	Void ratio of tailing sands at t_0, $e_{0\text{-TSand}}$	Calculated
0.99	Void ratio of tailing sand-slimes at t_0, $e_{0\text{-TS-S}}$	Calculated
1.29	Void ratio of tailing slimes at t_0, $e_{0\text{-TSlime}}$	Calculated
Saturated Water Content, w_{Sat}		
27%	Saturated water content of tailings sands at t_0, $w_{sat0\text{-TSand}}$ (%)	Calculated
35%	Saturated water content of tailings sand-slimes at t_0, $w_{sat0\text{-TS-S}}$ (%)	Calculated
45%	Saturated water content of tailings slimes at t_0, $w_{sat0\text{-TSlime}}$ (%)	Calculated
Water Content of Moist Tailings, $w_{m\text{-T}}$		
27%	Water content of moist tailings sands, $w_{m\text{-TSand}}$ (%)	Calculated, assuming 100% saturation (conservative value used to estimate loading from these layers, actual long-term water content will be lower)
35%	Water content of moist tailings sand-slimes, $w_{m\text{-TS-S}}$ (%)	Calculated, assuming 100% saturation (conservative value used to estimate loading from these layers, actual long-term water content will be lower)
45%	Water content of moist tailings slimes, $w_{m\text{-TSlime}}$ (%)	Calculated, assuming 100% saturation (conservative value used to estimate loading from these layers, actual long-term water content will be lower)
Compression Index, C_c		
0.12	Compression index of tailings sands, $C_{c\text{-TSand}}$	Based on lab testing performed on uranium tailings sands and presented in Keshian and Rager (1988)
0.24	Compression index of tailings sand-slimes, $C_{c\text{-TS-S}}$	Median value from lab testing of tailings sand-slimes samples obtained on-site (Tailings Data Analysis Report. MWH, 2015)
0.28	Compression index of tailings slimes, $C_{c\text{-TSlime}}$	Median value from lab testing of tailings slimes samples obtained on-site (Tailings Data Analysis Report. MWH, 2015)
Other		
62.4	Unit Weight of Water, γ_w	
5.0	Height of water table above liner at t_1, $H_{sat\text{-}1}$ (ft)	Assumed for end of active maintenance
0.0	Height of water table above liner at t_2, $H_{sat\text{-}2}$ (ft)	

82.4	Atmospheric Pressure, P_a (kPa)	Calculated assuming elev=5600' amsl. http://www.engineeringtoolbox.com/air-altitude-pressure-d_462.html
1722.0	Atmospheric Pressure, P_a (psf)	Unit conversion calculation
5.2%	Long-term moisture content of tailings, $w_{tailings}$ (%)	From Attachment H - Radon Emanation Modeling including with this submittal
0.020	Ratio of Secondary Compression Index to Primary Compression Index, C_α/C_c	Estimated from laboratory results presented in MWH (2015b), upper bound average C_α for sand-slime and slime tailings of 0.02

COVER SOIL

Specific Gravity, G_s		
2.61	Specific gravity of topsoil, $G_{s\text{-}Topsoil}$	From Attachment H - Radon Emanation Modeling including with this submittal
2.62	Specific gravity of rock mulch, $G_{s\text{-}mulch}$	From Attachment H - Radon Emanation Modeling including with this submittal
2.63	Specific gravity of cover soil, $G_{s\text{-}cover}$	From Attachment H - Radon Emanation Modeling including with this submittal
Unit Weight, γ		
118.0	Maximum dry unit weight of cover soil $\gamma_{cover\text{-}max}$ (pcf)	Average calculated from laboratory testing results (UWM, 2012)
100.7	Moist unit weight of cover soil at 80% relative compaction, $\gamma_{cover80}$ (pcf)	Calculated
107.0	Moist unit weight of cover soil at 85% relative compaction, $\gamma_{cover85}$ (pcf)	Calculated
119.6	Moist unit weight of cover soil at 95% relative compaction, $\gamma_{cover95}$ (pcf)	Calculated
127.5	Saturated unit weight of cover soil at 80% relative compaction, $\gamma_{cover80\text{-}sat}$ (pcf)	Calculated
100	Dry unit weight of topsoil layer at 85% relative compaction, $\gamma_{topsoil5}$ (pcf)	From Attachment H - Radon Emanation Modeling including with this submittal
105	Moist unit weight of topsoil layer at 85% relative compaction, $\gamma_{topsoil5}$ (pcf)	Calculated
106	Dry unit weight of rock mulch layer at 85% relative compaction, $\gamma_{mulch85}$ (pcf)	From Attachment H - Radon Emanation Modeling including with this submittal
110	Moist unit weight of rock mulch layer at 85% relative compaction, $\gamma_{mulch85}$ (pcf)	From Attachment H - Radon Emanation Modeling including with this submittal
Void Ratio, e		
0.74	Void Ratio of cover soil at 80% relative compaction, $e_{cover80}$	Calculated
0.64	Void Ratio of cover soil at 85% relative compaction, $e_{cover85}$	Calculated
0.46	Void Ratio of cover soil at 95% relative compaction, $e_{cover95}$	Calculated
0.61	Void Ratio of topsoil at 85% relative compaction, $e_{topsoil85}$	Calculated from porosity presented in Attachment H - Radon Emanation Modeling including with this submittal
0.54	Void Ratio of rock mulch at 85% relative compaction, $e_{mulch85}$	Calculated from porosity presented in Attachment H - Radon Emanation Modeling including with this submittal
Other		
6.7%	Long-term moisture content of cover soil, w_{cover} (%)	Estimated based on measured 15bar water content. (UWM, 2012)
5.2%	Long-term moisture content of topsoil, $w_{topsoil}$ (%)	From Attachment H - Radon Emanation Modeling including with this submittal
4.0%	Long-term moisture content of rock mulch, $w_{rockmulch}$ (%)	From Attachment H - Radon Emanation Modeling including with this submittal
0.14	Compression index of cover soil, $C_{c\text{-}cover}$	Calculated from empirical equation for soil types similar to cover material (as presented in Holtz and Kovacs, 1981. Page 341). $C_c = 0.30*(e_0\text{-}0.27)$

REFERENCES

Energy Fuels Resources (USA) Inc. (EFRI), 2012. Responses to Interrogatories – Round 1 for Reclamation Plan, Revision 5.0, March 2012. August 15.

Holtz, R.D. and Kovacs, W.D., 1981. An Introduction to Geotechnical Engineering. Prentice Hall, Inc. New Jersey

Keshian, B., and Rager, R. 1988. Geotechnical Properties of Hydraulically Placed Uranium Mill Tailings, in Hydraulically Fill Structures, Geotechnical Special Publication No. 21, Eds. Van Zyl, D., and Vick, S., ASCE, August.

MWH Americas, Inc. (MWH), 2015. White Mesa Mill Tailings Data Analysis Report. Prepared for Energy Fuels Resources (USA) Inc. April.

University of Wisconsin-Madison (UWM), Wisconsin Geotechnics Laboratory, 2012. Compaction and Hydraulic Properties of Soils from Banding, Utah. Geotechnics Report NO. 12-41 by C.H. Benson and X. Wang. July 24.

2W2

FINAL COVER		
5625.87	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
4.00	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
2.02	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
1111.60	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION		
5613.10	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5607.7	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013
5598.51	Water surface elevation at t_1 (ft amsl)	
5593.51	Water surface elevation at t_2 (ft amsl)	

2W2

CONSOLIDATION SETTLEMENT

Soil Layer	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl) [1]	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Material Type [1]	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Effective Stress at Midpoint of Layer at t_2, $\sigma'_{i\text{-}mid2}$ (psf)	Effective Stress at Bottom of Layer at t_2, $\sigma'_{i\text{-}bott2}$ (psf)	Consolidtion of Layer from t_0 to t_1 due to Final Cover Placement and Dewatering, $\delta_{ci\text{-}t1}$ (ft)	Consolidtion of Layer from t_1 to t_2 due to Dewatering, $\delta_{ci\text{-}t2}$ (ft)
Layer 1	5615.85	5614.30	5612.74	3.11	Int. Cover	156.63	313.25	1268.22	1424.85	1268.22	1424.85	0.23	0.00
Layer 2	5612.74	5612.25	5611.76	0.98	Sand-Slime	371.55	429.85	1483.15	1541.44	1483.15	1541.44	0.07	0.00
Layer 3	5611.76	5611.68	5611.59	0.17	Slime	439.46	449.08	1551.06	1560.68	1551.06	1560.68	0.01	0.00
Layer 4	5611.59	5611.43	5611.27	0.32	Sand	468.83	488.59	1580.43	1600.19	1580.43	1600.19	0.01	0.00
Layer 5	5611.27	5611.19	5611.10	0.17	Sand-Slime	498.70	508.81	1610.30	1620.41	1610.30	1620.41	0.01	0.00
Layer 6	5611.10	5610.69	5610.28	0.82	Slime	555.20	601.58	1666.79	1713.18	1666.79	1713.18	0.05	0.00
Layer 7	5610.28	5610.20	5610.12	0.16	Sand-Slime	611.10	620.61	1722.69	1732.21	1722.69	1732.21	0.01	0.00
Layer 8	5610.12	5609.88	5609.63	0.49	Slime	648.33	676.05	1759.93	1787.64	1759.93	1787.64	0.03	0.00
Layer 9	5609.63	5609.38	5609.13	0.50	Sand-Slime	705.79	735.53	1817.39	1847.13	1817.39	1847.13	0.02	0.00
Layer 10	5609.13	5608.56	5607.99	1.14	Slime	800.02	864.50	1911.61	1976.09	1911.61	1976.09	0.05	0.00
Layer 11	5607.99	5607.83	5607.66	0.33	Sand-Slime	884.13	898.77	1995.73	2015.36	1995.73	2015.36	0.01	0.00
Layer 12	5607.66	5607.25	5606.84	0.82	Slime	919.56	940.36	2061.74	2108.12	2061.74	2108.12	0.04	0.00
Layer 13	5606.84	5606.51	5606.18	0.66	Sand-Slime	959.03	977.70	2147.38	2186.64	2147.38	2186.64	0.03	0.00
Layer 14	5606.18	5605.94	5605.69	0.49	Slime	990.13	1002.56	2214.36	2242.07	2214.36	2242.07	0.02	0.00
Layer 15	5605.69	5605.53	5605.36	0.33	Sand-Slime	1011.89	1021.22	2261.70	2281.33	2261.70	2281.33	0.01	0.00
Layer 16	5605.36	5605.20	5605.03	0.33	Slime	1029.59	1037.96	2300.00	2318.67	2300.00	2318.67	0.01	0.00
Layer 17	5605.03	5604.87	5604.70	0.33	Sand-Slime	1047.30	1056.63	2338.30	2357.93	2338.30	2357.93	0.01	0.00
Layer 18	5604.70	5604.46	5604.21	0.49	Slime	1069.06	1081.49	2385.64	2413.36	2385.64	2413.36	0.02	0.00
Layer 19	5604.21	5604.05	5603.88	0.33	Sand-Slime	1090.82	1100.16	2432.99	2452.62	2432.99	2452.62	0.01	0.00
Layer 20	5603.88	5603.39	5602.90	0.98	Slime	1125.01	1149.87	2508.05	2563.48	2508.05	2563.48	0.04	0.00
Layer 21	5602.90	5602.82	5602.74	0.16	Sand-Slime	1154.40	1158.92	2573.00	2582.52	2573.00	2582.52	0.01	0.00
Layer 22	5602.74	5602.33	5601.92	0.82	Slime	1179.72	1200.52	2628.90	2675.28	2628.90	2675.28	0.03	0.00
Layer 23	5601.92	5601.67	5601.42	0.50	Sand-Slime	1214.66	1228.80	2705.03	2734.77	2705.03	2734.77	0.02	0.00
Layer 24	5601.42	5601.34	5601.26	0.16	Slime	1232.86	1236.92	2743.82	2752.87	2743.82	2752.87	0.01	0.00
Layer 25	5601.26	5601.18	5601.10	0.16	Sand-Slime	1241.45	1245.97	2762.39	2771.91	2762.39	2771.91	0.01	0.00
Layer 26	5601.10	5600.69	5600.28	0.82	Slime	1266.77	1287.57	2818.29	2864.67	2818.29	2864.67	0.03	0.00
Layer 27	5600.28	5599.87	5599.46	0.82	Sand-Slime	1310.76	1333.96	2913.45	2962.23	2913.45	2962.23	0.03	0.00
Layer 28	5599.46	5598.72	5597.98	1.48	Slime	1371.50	1409.03	3045.94	3096.58	3045.94	3129.65	0.06	0.00
Layer 29	5597.98	5597.90	5597.82	0.16	Sand-Slime	1413.56	1418.08	3101.11	3105.63	3139.17	3148.69	0.01	0.00
Layer 30	5597.82	5597.49	5597.16	0.66	Slime	1434.82	1451.56	3122.37	3139.11	3186.02	3223.35	0.03	0.00
Layer 31	5597.16	5596.83	5596.50	0.66	Sand-Slime	1470.23	1488.90	3157.78	3176.45	3262.61	3301.88	0.03	0.00
Layer 32	5596.50	5596.34	5596.18	0.32	Slime	1497.02	1505.13	3184.57	3192.68	3319.98	3338.08	0.01	0.00
Layer 33	5596.18	5595.85	5595.52	0.66	Sand-Slime	1523.80	1542.47	3211.35	3230.02	3377.34	3416.60	0.03	0.00
Layer 34	5595.52	5594.52	5593.51	2.01	Sand-Slime	1599.33	1656.18	3286.88	3343.73	3536.16	3530.31	0.08	0.01

Total Consolidtion of Profile at t_1, $\delta_{c\text{-}t1}$ (ft):	**1.09**
Total Consolidtion of Profile at t_2, $\delta_{c\text{-}t2}$ (ft):	**0.01**

Notes:

[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

2W3

FINAL COVER

5626.27	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
4.00	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
2.55	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
1164.98	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION

5613.80	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5607.6	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013
5597.75	Water surface elevation at t_1 (ft amsl)	
5592.75	Water surface elevation at t_2 (ft amsl)	

2W3

CONSOLIDATION SETTLEMENT

Soil Layer	Elevation at Top of Layer at t_0, z_{i-top0} (ft amsl) [1]	Elevation at Midpoint of Layer at t_0, z_{i-mid0} (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i-bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Material Type [1]	Effective Stress at Midpoint of Layer at t_0, σ'_{i-mid0} (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i-bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, σ'_{i-mid1} (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i-bott1}$ (psf)	Effective Stress at Midpoint of Layer at t_2, σ'_{i-mid2} (psf)	Effective Stress at Bottom of Layer at t_2, $\sigma'_{i-bott2}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Final Cover Placement and Dewatering, δ_{ci-t1} (ft)	Consolidtion of Layer from t_1 to t_2 due to Dewatering, δ_{ci-t2} (ft)
Layer 1	5615.72	5614.17	5612.61	3.11	Int. Cover	156.63	313.25	1321.61	1478.24	1321.61	1478.24	0.23	0.00
Layer 2	5612.61	5612.37	5612.12	0.49	Sand-Slime	342.40	371.55	1507.38	1536.53	1507.38	1536.53	0.04	0.00
Layer 3	5612.12	5612.04	5611.95	0.17	Slime	381.17	390.78	1546.15	1555.76	1546.15	1555.76	0.01	0.00
Layer 4	5611.95	5611.46	5610.97	0.98	Sand-Slime	449.08	507.37	1614.06	1672.36	1614.06	1672.36	0.07	0.00
Layer 5	5610.97	5610.81	5610.64	0.33	Slime	526.04	544.71	1691.02	1709.69	1691.02	1709.69	0.02	0.00
Layer 6	5610.64	5609.82	5609.00	1.64	Sand-Slime	642.26	739.82	1807.24	1904.80	1807.24	1904.80	0.09	0.00
Layer 7	5609.00	5608.92	5608.83	0.17	Slime	749.43	759.05	1914.42	1924.03	1914.42	1924.03	0.01	0.00
Layer 8	5608.83	5608.59	5608.34	0.49	Sand-Slime	788.20	817.35	1953.18	1982.33	1953.18	1982.33	0.02	0.00
Layer 9	5608.34	5608.26	5608.18	0.16	Slime	826.40	835.45	1991.38	2000.43	1991.38	2000.43	0.01	0.00
Layer 10	5608.18	5608.10	5608.01	0.17	Sand-Slime	845.56	855.67	2010.54	2020.65	2010.54	2020.65	0.01	0.00
Layer 11	5608.01	5607.84	5607.67	0.34	Slime	874.90	894.14	2039.89	2059.12	2039.89	2059.12	0.02	0.00
Layer 12	5607.67	5607.02	5606.37	1.30	Sand-Slime	934.65	971.42	2136.45	2213.78	2136.45	2213.78	0.06	0.00
Layer 13	5606.37	5606.21	5606.05	0.32	Slime	979.54	987.65	2231.88	2249.98	2231.88	2249.98	0.01	0.00
Layer 14	5606.05	5604.98	5603.91	2.14	Sand-Slime	1048.19	1108.72	2377.28	2504.58	2377.28	2504.58	0.09	0.00
Layer 15	5603.91	5603.26	5602.60	1.31	Slime	1141.94	1175.17	2578.68	2652.78	2578.68	2652.78	0.06	0.00
Layer 16	5602.60	5601.62	5600.63	1.97	Sand-Slime	1230.89	1286.62	2769.96	2887.15	2769.96	2887.15	0.08	0.00
Layer 17	5600.63	5600.47	5600.30	0.33	Slime	1294.99	1303.36	2905.82	2924.48	2905.82	2924.48	0.01	0.00
Layer 18	5600.30	5600.14	5599.98	0.32	Sand-Slime	1312.41	1321.46	2943.52	2962.55	2943.52	2962.55	0.01	0.00
Layer 19	5599.98	5599.08	5598.17	1.81	Slime	1367.37	1413.28	3064.93	3167.31	3064.93	3167.31	0.08	0.00
Layer 20	5598.17	5597.85	5597.52	0.65	Sand-Slime	1431.66	1450.05	3205.98	3230.29	3205.98	3244.64	0.03	0.00
Layer 21	5597.52	5597.36	5597.19	0.33	Slime	1458.42	1466.79	3238.66	3247.03	3263.31	3281.98	0.01	0.00
Layer 22	5597.19	5596.54	5595.88	1.31	Sand-Slime	1503.84	1540.90	3284.09	3321.14	3359.90	3437.83	0.05	0.00
Layer 23	5595.88	5595.55	5595.22	0.66	Slime	1557.64	1574.38	3337.88	3354.62	3475.16	3512.49	0.03	0.00
Layer 24	5595.22	5595.06	5594.89	0.33	Sand-Slime	1583.71	1593.04	3363.96	3373.29	3532.12	3551.75	0.01	0.00
Layer 25	5594.89	5594.65	5594.40	0.49	Slime	1605.47	1617.90	3385.72	3398.15	3579.47	3607.19	0.02	0.00
Layer 26	5594.40	5594.24	5594.07	0.33	Sand-Slime	1627.23	1636.57	3407.48	3416.81	3626.82	3646.45	0.01	0.00
Layer 27	5594.07	5593.41	5592.75	1.32	Sand-Slime	1673.91	1711.24	3454.15	3491.49	3724.97	3721.12	0.05	0.00

Total Consolidtion of Profile at t_1, δ_{c-t1} (ft):	**1.15**
Total Consolidtion of Profile at t_2, δ_{c-t2} (ft):	**0.01**

Notes:

[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

2W4-C

FINAL COVER

5626.19	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
4.00	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
1.95	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
1104.55	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION

5611.20	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5608.1	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013
5593.51	Water surface elevation at t_1 (ft amsl)	
5588.51	Water surface elevation at t_2 (ft amsl)	

2W4-C

CONSOLIDATION SETTLEMENT

Soil Layer	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl) [1]	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Material Type [1]	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Effective Stress at Midpoint of Layer at t_2, $\sigma'_{i\text{-}mid2}$ (psf)	Effective Stress at Bottom of Layer at t_2, $\sigma'_{i\text{-}bott2}$ (psf)	Consolidtion of Layer from t_0 to t_1 due to Final Cover Placement and Dewatering, $\delta_{ci\text{-}t1}$ (ft)	Consolidtion of Layer from t_1 to t_2 due to Dewatering, $\delta_{ci\text{-}t2}$ (ft)
Layer 1	5616.24	5614.68	5613.12	3.12	Int. Cover	157.13	314.26	1261.68	1418.81	1261.68	1418.81	0.23	0.00
Layer 2	5613.12	5613.04	5612.96	0.16	Sand	324.14	334.02	1428.69	1438.56	1428.69	1438.56	0.01	0.00
Layer 3	5612.96	5611.32	5609.68	3.28	Sand-Slime	529.13	724.24	1633.68	1828.79	1633.68	1828.79	0.19	0.00
Layer 4	5609.68	5609.60	5609.51	0.17	Slime	733.86	743.48	1838.41	1848.02	1838.41	1848.02	0.01	0.00
Layer 5	5609.51	5608.28	5607.05	2.46	Sand-Slime	889.81	969.38	1994.36	2140.69	1994.36	2140.69	0.10	0.00
Layer 6	5607.05	5606.89	5606.73	0.32	Slime	977.49	985.61	2158.79	2176.89	2158.79	2176.89	0.01	0.00
Layer 7	5606.73	5606.57	5606.40	0.33	Sand-Slime	994.94	1004.28	2196.52	2216.15	2196.52	2216.15	0.01	0.00
Layer 8	5606.40	5606.32	5606.23	0.17	Slime	1008.59	1012.90	2225.77	2235.38	2225.77	2235.38	0.01	0.00
Layer 9	5606.23	5605.41	5604.59	1.64	Sand-Slime	1059.29	1105.68	2332.94	2430.50	2332.94	2430.50	0.07	0.00
Layer 10	5604.59	5604.51	5604.43	0.16	Slime	1109.74	1113.80	2439.55	2448.60	2439.55	2448.60	0.01	0.00
Layer 11	5604.43	5604.27	5604.10	0.33	Sand-Slime	1123.13	1132.46	2468.23	2487.86	2468.23	2487.86	0.01	0.00
Layer 12	5604.10	5603.94	5603.77	0.33	Slime	1140.83	1149.20	2506.52	2525.19	2506.52	2525.19	0.01	0.00
Layer 13	5603.77	5601.89	5600.00	3.77	Sand-Slime	1255.84	1362.48	2749.45	2973.71	2749.45	2973.71	0.16	0.00
Layer 14	5600.00	5599.43	5598.85	1.15	Slime	1391.65	1420.81	3038.76	3103.81	3038.76	3103.81	0.05	0.00
Layer 15	5598.85	5598.44	5598.03	0.82	Sand-Slime	1444.01	1467.20	3152.59	3201.37	3152.59	3201.37	0.03	0.00
Layer 16	5598.03	5597.95	5597.87	0.16	Slime	1471.26	1475.32	3210.42	3219.47	3210.42	3219.47	0.01	0.00
Layer 17	5597.87	5597.63	5597.38	0.49	Sand-Slime	1489.18	1503.04	3248.61	3277.76	3248.61	3277.76	0.02	0.00
Layer 18	5597.38	5597.22	5597.05	0.33	Slime	1511.41	1519.78	3296.43	3315.09	3296.43	3315.09	0.01	0.00
Layer 19	5597.05	5596.64	5596.23	0.82	Sand-Slime	1542.97	1566.17	3363.87	3412.65	3363.87	3412.65	0.03	0.00
Layer 20	5596.23	5595.82	5595.41	0.82	Slime	1586.97	1607.76	3459.03	3505.41	3459.03	3505.41	0.03	0.00
Layer 21	5595.41	5595.08	5594.75	0.66	Sand-Slime	1626.43	1645.10	3544.68	3583.94	3544.68	3583.94	0.03	0.00
Layer 22	5594.75	5594.67	5594.59	0.16	Slime	1649.16	1653.22	3592.99	3602.04	3592.99	3602.04	0.01	0.00
Layer 23	5594.59	5594.43	5594.26	0.33	Sand-Slime	1662.55	1671.89	3621.67	3641.30	3621.67	3641.30	0.01	0.00
Layer 24	5594.26	5594.10	5593.93	0.33	Slime	1680.26	1688.63	3659.96	3678.63	3659.96	3678.63	0.01	0.00
Layer 25	5593.93	5591.80	5589.67	4.26	Sand-Slime	1809.12	1929.62	3825.33	3945.83	3932.04	4185.45	0.17	0.00
Layer 26	5589.67	5589.09	5588.51	1.16	Sand-Slime	1962.43	1995.24	3978.64	4011.45	4254.45	4251.07	0.04	0.00

Total Consolidtion of Profile at t_1, $\delta_{c\text{-}t1}$ (ft):	1.29
Total Consolidtion of Profile at t_2, $\delta_{c\text{-}t2}$ (ft):	0.01

Notes:

[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

2W5-C

FINAL COVER		
5626.29	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
4.00	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
2.43	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
1152.89	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION		
5604.20	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5604.2	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013).
5589.01	Water surface elevation at t_1 (ft amsl)	
5584.01	Water surface elevation at t_2 (ft amsl)	

2W5-C

CONSOLIDATION SETTLEMENT

Soil Layer	Elevation at Top of Layer at t_0, z_{i-top0} (ft amsl) [1]	Elevation at Midpoint of Layer at t_0, z_{i-mid0} (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i-bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Material Type [1]	Effective Stress at Midpoint of Layer at t_0, σ'_{i-mid0} (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i-bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, σ'_{i-mid1} (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i-bott1}$ (psf)	Effective Stress at Midpoint of Layer at t_2, σ'_{i-mid2} (psf)	Effective Stress at Bottom of Layer at t_2, $\sigma'_{i-bott2}$ (psf)	Consolidtion of Layer from t_0 to t_1 due to Final Cover Placement and Dewatering, δ_{ci-t1} (ft)
Layer 1	5615.86	5614.31	5612.75	3.11	Int. Cover	156.63	313.25	1309.52	1466.15	1309.52	1466.15	0.23
Layer 2	5612.75	5612.59	5612.42	0.33	Sand-Slime	332.88	352.51	1485.78	1505.41	1485.78	1505.41	0.03
Layer 3	5612.42	5612.09	5611.76	0.66	Sand	393.26	434.01	1546.16	1586.90	1546.16	1586.90	0.03
Layer 4	5611.76	5611.60	5611.44	0.32	Sand-Slime	453.04	472.08	1605.94	1624.97	1605.94	1624.97	0.02
Layer 5	5611.44	5611.11	5610.78	0.66	Sand	512.82	553.57	1665.72	1706.47	1665.72	1706.47	0.02
Layer 6	5610.78	5609.96	5609.14	1.64	Sand-Slime	651.13	748.68	1804.02	1901.58	1804.02	1901.58	0.09
Layer 7	5609.14	5608.90	5608.65	0.49	Sand	778.94	809.19	1931.83	1962.08	1931.83	1962.08	0.01
Layer 8	5608.65	5604.88	5601.10	7.55	Sand-Slime	1258.30	1513.98	2411.20	2860.32	2411.20	2860.32	0.26
Layer 9	5601.10	5601.02	5600.94	0.16	Sand	1518.87	1523.75	2870.19	2880.07	2870.19	2880.07	0.00
Layer 10	5600.94	5600.12	5599.30	1.64	Sand-Slime	1570.14	1616.53	2977.63	3075.18	2977.63	3075.18	0.06
Layer 11	5599.30	5599.14	5598.97	0.33	Slime	1624.90	1633.27	3093.85	3112.52	3093.85	3112.52	0.01
Layer 12	5598.97	5596.92	5594.87	4.10	Sand-Slime	1749.24	1865.21	3356.41	3600.30	3356.41	3600.30	0.14
Layer 13	5594.87	5594.46	5594.05	0.82	Slime	1886.01	1906.81	3646.68	3693.06	3646.68	3693.06	0.03
Layer 14	5594.05	5593.81	5593.56	0.49	Sand-Slime	1920.67	1934.53	3722.21	3751.36	3722.21	3751.36	0.02
Layer 15	5593.56	5593.48	5593.39	0.17	Slime	1938.84	1943.15	3760.98	3770.59	3760.98	3770.59	0.01
Layer 16	5593.39	5592.57	5591.75	1.64	Sand-Slime	1989.54	2035.93	3868.15	3965.70	3868.15	3965.70	0.06
Layer 17	5591.75	5591.59	5591.42	0.33	Slime	2044.30	2052.67	3984.37	4003.04	3984.37	4003.04	0.01
Layer 18	5591.42	5589.46	5587.49	3.93	Sand-Slime	2163.83	2275.00	4236.82	4375.75	4236.82	4470.59	0.14
Layer 19	5587.49	5587.33	5587.16	0.33	Slime	2283.37	2291.74	4384.12	4392.49	4489.26	4507.93	0.01
Layer 20	5587.16	5586.75	5586.34	0.82	Sand	2316.78	2341.82	4417.53	4442.57	4558.55	4609.17	0.02
Layer 21	5586.34	5586.18	5586.01	0.33	Sand-Slime	2351.15	2360.49	4451.90	4461.24	4628.81	4648.44	0.01
Layer 22	5586.01	5585.85	5585.68	0.33	Sand	2370.56	2380.64	4471.31	4481.39	4668.81	4689.18	0.01
Layer 23	5585.68	5584.85	5584.01	1.67	Sand-Slime	2427.88	2475.11	4528.63	4575.86	4788.52	4783.66	0.05

Total Consolidtion of Profile at t_1, δ_{c-t1} (ft):	**1.26**
Total Consolidtion of Profile at t_2, δ_{c-t2} (ft):	**0.01**

Notes:

[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

2W6-S

FINAL COVER

5625.41	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
4.00	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
1.56	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
1065.26	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION

5604.40	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5604.4	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013
5588.59	Water surface elevation at t_1 (ft amsl)	
5583.59	Water surface elevation at t_2 (ft amsl)	

2W6-S

CONSOLIDATION SETTLEMENT

Soil Layer	Elevation at Top of Layer at t_0, $z_{i\text{-top0}}$ (ft amsl) [1]	Elevation at Midpoint of Layer at t_0, $z_{i\text{-mid0}}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-bott0}}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Material Type [1]	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-mid0}}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-bott0}}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-mid1}}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-bott1}}$ (psf)	Effective Stress at Midpoint of Layer at t_2, $\sigma'_{i\text{-mid2}}$ (psf)	Effective Stress at Bottom of Layer at t_2, $\sigma'_{i\text{-bott2}}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Final Cover Placement and Dewatering, $\delta_{ci\text{-}t1}$ (ft)	Consolidtion of Layer from t_1 to t_2 due to Dewatering, $\delta_{ci\text{-}t2}$ (ft)
Layer 1	5615.85	5614.29	5612.73	3.12	Int. Cover	157.13	314.26	1222.39	1379.53	1222.39	1379.53	0.22	0.00
Layer 2	5612.73	5612.49	5612.24	0.49	Sand-Slime	343.41	372.56	1408.67	1437.82	1408.67	1437.82	0.04	0.00
Layer 3	5612.24	5612.16	5612.07	0.17	Sand	383.05	393.55	1448.32	1458.81	1448.32	1458.81	0.01	0.00
Layer 4	5612.07	5611.66	5611.25	0.82	Sand-Slime	442.33	491.10	1507.59	1556.37	1507.59	1556.37	0.05	0.00
Layer 5	5611.25	5611.01	5610.76	0.49	Sand	521.36	551.61	1586.62	1616.87	1586.62	1616.87	0.02	0.00
Layer 6	5610.76	5609.78	5608.79	1.97	Sand-Slime	668.79	785.98	1734.06	1851.24	1734.06	1851.24	0.10	0.00
Layer 7	5608.79	5608.63	5608.46	0.33	Slime	804.65	823.31	1869.91	1888.58	1869.91	1888.58	0.01	0.00
Layer 8	5608.46	5608.30	5608.14	0.32	Sand	843.07	862.82	1908.33	1928.09	1908.33	1928.09	0.01	0.00
Layer 9	5608.14	5607.40	5606.66	1.48	Sand-Slime	950.86	1038.90	2016.13	2104.17	2016.13	2104.17	0.06	0.00
Layer 10	5606.66	5606.50	5606.33	0.33	Slime	1057.57	1076.23	2122.83	2141.50	2122.83	2141.50	0.01	0.00
Layer 11	5606.33	5606.09	5605.84	0.49	Sand-Slime	1105.38	1134.53	2170.65	2199.79	2170.65	2199.79	0.02	0.00
Layer 12	5605.84	5605.51	5605.18	0.66	Slime	1171.86	1209.19	2237.13	2274.46	2237.13	2274.46	0.02	0.00
Layer 13	5605.18	5604.86	5604.53	0.65	Sand-Slime	1247.86	1286.53	2313.12	2351.79	2313.12	2351.79	0.02	0.00
Layer 14	5604.53	5604.28	5604.03	0.50	Slime	1307.32	1320.00	2380.07	2408.35	2380.07	2408.35	0.02	0.00
Layer 15	5604.03	5603.95	5603.87	0.16	Sand-Slime	1324.53	1329.05	2417.87	2427.39	2417.87	2427.39	0.01	0.00
Layer 16	5603.87	5602.64	5601.41	2.46	Slime	1391.45	1453.84	2566.53	2705.68	2566.53	2705.68	0.08	0.00
Layer 17	5601.41	5601.17	5600.92	0.49	Sand-Slime	1467.70	1481.56	2734.83	2763.98	2734.83	2763.98	0.02	0.00
Layer 18	5600.92	5600.84	5600.75	0.17	Slime	1485.87	1490.19	2773.59	2783.21	2773.59	2783.21	0.01	0.00
Layer 19	5600.75	5600.67	5600.59	0.16	Sand-Slime	1494.71	1499.24	2792.73	2802.24	2792.73	2802.24	0.01	0.00
Layer 20	5600.59	5600.18	5599.77	0.82	Slime	1520.03	1540.83	2848.63	2895.01	2848.63	2895.01	0.03	0.00
Layer 21	5599.77	5599.20	5598.62	1.15	Sand-Slime	1573.36	1605.89	2963.42	3031.83	2963.42	3031.83	0.04	0.00
Layer 22	5598.62	5598.21	5597.80	0.82	Slime	1626.69	1647.49	3078.21	3124.59	3078.21	3124.59	0.03	0.00
Layer 23	5597.80	5596.98	5596.16	1.64	Sand-Slime	1693.88	1740.26	3222.15	3319.70	3222.15	3319.70	0.06	0.00
Layer 24	5596.16	5595.92	5595.67	0.49	Slime	1752.69	1765.12	3347.42	3375.14	3347.42	3375.14	0.02	0.00
Layer 25	5595.67	5595.51	5595.34	0.33	Sand-Slime	1774.45	1783.79	3394.77	3414.40	3394.77	3414.40	0.01	0.00
Layer 26	5595.34	5595.26	5595.18	0.16	Slime	1787.85	1791.90	3423.45	3432.50	3423.45	3432.50	0.01	0.00
Layer 27	5595.18	5592.72	5590.26	4.92	Sand-Slime	1931.07	2070.24	3725.17	4017.84	3725.17	4017.84	0.17	0.00
Layer 28	5590.26	5590.18	5590.09	0.17	Slime	2074.55	2078.86	4027.45	4037.07	4027.45	4037.07	0.01	0.00
Layer 29	5590.09	5588.62	5587.14	2.95	Sand-Slime	2162.30	2245.75	4212.55	4297.55	4212.55	4388.03	0.10	0.00
Layer 30	5587.14	5586.90	5586.65	0.49	Sand	2260.71	2275.67	4312.52	4327.48	4418.28	4448.54	0.01	0.00
Layer 31	5586.65	5585.12	5583.59	3.06	Sand-Slime	2362.23	2448.78	4414.03	4500.59	4630.56	4621.64	0.10	0.01

Total Consolidtion of Profile at t_1, $\delta_{c\text{-}t1}$ (ft):	**1.29**
Total Consolidtion of Profile at t_2, $\delta_{c\text{-}t2}$ (ft):	**0.01**

Notes:

[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

2W7-C

FINAL COVER

5626.65	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
4.00	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
-0.95	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
812.44	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION

5613.10	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5611.5	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013
5595.40	Water surface elevation at t_1 (ft amsl)	
5590.40	Water surface elevation at t_2 (ft amsl)	

2W7-C

CONSOLIDATION SETTLEMENT

Soil Layer	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl) [1]	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Material Type [1]	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Effective Stress at Midpoint of Layer at t_2, $\sigma'_{i\text{-}mid2}$ (psf)	Effective Stress at Bottom of Layer at t_2, $\sigma'_{i\text{-}bott2}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Final Cover Placement and Dewatering, $\delta_{ci\text{-}t1}$ (ft)	Consolidtion of Layer from t_1 to t_2 due to Dewatering, $\delta_{ci\text{-}t2}$ (ft)
Layer 1	5619.60	5618.04	5616.48	3.12	Int. Cover	157.13	314.26	969.58	1126.71	969.58	1126.71	0.20	0.00
Layer 2	5616.48	5615.17	5613.86	2.62	Sand-Slime	470.11	625.97	1282.56	1438.41	1282.56	1438.41	0.14	0.00
Layer 3	5613.86	5613.78	5613.69	0.17	Slime	635.58	645.20	1448.03	1457.64	1448.03	1457.64	0.01	0.00
Layer 4	5613.69	5612.79	5611.89	1.80	Sand-Slime	752.27	859.35	1564.72	1671.79	1564.72	1671.79	0.07	0.00
Layer 5	5611.89	5611.81	5611.72	0.17	Slime	868.96	878.58	1681.41	1691.02	1681.41	1691.02	0.01	0.00
Layer 6	5611.72	5610.99	5610.25	1.47	Sand-Slime	935.13	976.71	1778.47	1865.91	1778.47	1865.91	0.05	0.00
Layer 7	5610.25	5610.17	5610.08	0.17	Slime	981.03	985.34	1875.53	1885.14	1875.53	1885.14	0.01	0.00
Layer 8	5610.08	5610.00	5609.92	0.16	Sand-Slime	989.86	994.39	1894.66	1904.18	1894.66	1904.18	0.01	0.00
Layer 9	5609.92	5609.84	5609.75	0.17	Slime	998.70	1003.01	1913.79	1923.41	1913.79	1923.41	0.01	0.00
Layer 10	5609.75	5606.15	5602.54	7.21	Sand-Slime	1206.95	1410.89	2352.30	2781.19	2352.30	2781.19	0.25	0.00
Layer 11	5602.54	5602.21	5601.88	0.66	Slime	1427.63	1444.37	2818.53	2855.86	2818.53	2855.86	0.02	0.00
Layer 12	5601.88	5601.80	5601.72	0.16	Sand-Slime	1448.90	1453.42	2865.38	2874.89	2865.38	2874.89	0.01	0.00
Layer 13	5601.72	5601.56	5601.39	0.33	Slime	1461.79	1470.16	2893.56	2912.23	2893.56	2912.23	0.01	0.00
Layer 14	5601.39	5600.74	5600.08	1.31	Sand-Slime	1507.22	1544.27	2990.15	3068.08	2990.15	3068.08	0.05	0.00
Layer 15	5600.08	5600.00	5599.91	0.17	Slime	1548.58	1552.90	3077.69	3087.31	3077.69	3087.31	0.01	0.00
Layer 16	5599.91	5599.83	5599.75	0.16	Sand	1557.78	1562.67	3097.19	3107.07	3097.19	3107.07	0.00	0.00
Layer 17	5599.75	5599.67	5599.58	0.17	Sand-Slime	1567.48	1572.29	3117.18	3127.29	3117.18	3127.29	0.01	0.00
Layer 18	5599.58	5599.26	5598.93	0.65	Slime	1588.77	1605.26	3164.06	3200.82	3164.06	3200.82	0.02	0.00
Layer 19	5598.93	5598.52	5598.11	0.82	Sand-Slime	1628.45	1651.65	3249.60	3298.38	3249.60	3298.38	0.03	0.00
Layer 20	5598.11	5597.62	5597.12	0.99	Slime	1676.76	1701.87	3354.38	3410.38	3354.38	3410.38	0.04	0.00
Layer 21	5597.12	5596.96	5596.80	0.32	Sand-Slime	1710.92	1719.97	3429.41	3448.45	3429.41	3448.45	0.01	0.00
Layer 22	5596.80	5596.72	5596.63	0.17	Slime	1724.28	1728.59	3458.06	3467.68	3458.06	3467.68	0.01	0.00
Layer 23	5596.63	5596.39	5596.14	0.49	Sand-Slime	1742.45	1756.31	3496.83	3525.97	3496.83	3525.97	0.02	0.00
Layer 24	5596.14	5596.06	5595.98	0.16	Slime	1760.37	1764.43	3535.02	3544.07	3535.02	3544.07	0.01	0.00
Layer 25	5595.98	5595.57	5595.16	0.82	Sand-Slime	1787.62	1810.82	3592.85	3626.66	3592.85	3641.63	0.03	0.00
Layer 26	5595.16	5594.83	5594.50	0.66	Slime	1827.56	1844.30	3643.40	3660.14	3678.96	3716.30	0.02	0.00
Layer 27	5594.50	5594.42	5594.34	0.16	Sand-Slime	1848.82	1853.35	3664.66	3669.19	3725.81	3735.33	0.01	0.00
Layer 28	5594.34	5594.09	5593.84	0.50	Slime	1866.03	1878.71	3681.87	3694.55	3763.61	3791.89	0.02	0.00
Layer 29	5593.84	5593.60	5593.35	0.49	Sand-Slime	1892.57	1906.43	3708.41	3722.27	3821.04	3850.19	0.02	0.00
Layer 30	5593.35	5593.27	5593.19	0.16	Slime	1910.49	1914.55	3726.33	3730.39	3859.24	3868.29	0.01	0.00
Layer 31	5593.19	5592.62	5592.04	1.15	Sand-Slime	1947.08	1979.61	3762.92	3795.44	3936.70	4005.11	0.04	0.00
Layer 32	5592.04	5591.80	5591.55	0.49	Slime	1992.04	2004.46	3807.87	3820.30	4032.82	4060.54	0.02	0.00
Layer 33	5591.55	5590.98	5590.40	1.15	Sand-Slime	2036.99	2069.52	3852.83	3885.36	4128.95	4125.60	0.04	0.00

Total Consolidtion of Profile at t_1, $\delta_{c\text{-}t1}$ (ft):	**1.17**
Total Consolidtion of Profile at t_2, $\delta_{c\text{-}t2}$ (ft):	**0.01**

Notes:

[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

2E1

FINAL COVER		
5630.46	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
4.00	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
2.51	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
1160.95	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION		
5610.80	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5610.8	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013
5595.46	Water surface elevation at t_1 (ft amsl)	
5590.46	Water surface elevation at t_2 (ft amsl)	

2E1

CONSOLIDATION SETTLEMENT

Soil Layer	Elevation at Top of Layer at t_0, z_{i-top0} (ft amsl) [1]	Elevation at Midpoint of Layer at t_0, z_{i-mid0} (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i-bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Material Type [1]	Effective Stress at Midpoint of Layer at t_0, σ'_{i-mid0} (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i-bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, σ'_{i-mid1} (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i-bott1}$ (psf)	Effective Stress at Midpoint of Layer at t_2, σ'_{i-mid2} (psf)	Effective Stress at Bottom of Layer at t_2, $\sigma'_{i-bott2}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Final Cover Placement and Dewatering, δ_{ci-t1} (ft)	Consolidtion of Layer from t_1 to t_2 due to Dewatering, δ_{ci-t2} (ft)
Layer 1	5619.95	5618.39	5616.83	3.12	Int. Cover	157.13	314.26	1318.08	1475.21	1318.08	1475.21	0.23	0.00
Layer 2	5616.83	5616.50	5616.17	0.66	Sand	355.01	395.75	1515.96	1556.71	1515.96	1556.71	0.03	0.00
Layer 3	5616.17	5615.93	5615.68	0.49	Sand-Slime	424.90	454.05	1585.85	1615.00	1585.85	1615.00	0.03	0.00
Layer 4	5615.68	5615.52	5615.35	0.33	Slime	472.72	491.38	1633.67	1652.33	1633.67	1652.33	0.02	0.00
Layer 5	5615.35	5615.19	5615.02	0.33	Sand-Slime	511.01	530.64	1671.96	1691.60	1671.96	1691.60	0.02	0.00
Layer 6	5615.02	5614.61	5614.20	0.82	Sand	581.27	631.89	1742.22	1792.84	1742.22	1792.84	0.03	0.00
Layer 7	5614.20	5613.79	5613.38	0.82	Sand-Slime	680.67	729.45	1841.62	1890.40	1841.62	1890.40	0.04	0.00
Layer 8	5613.38	5613.22	5613.06	0.32	Sand	749.20	768.96	1910.16	1929.91	1910.16	1929.91	0.01	0.00
Layer 9	5613.06	5610.44	5607.81	5.25	Sand-Slime	1058.48	1206.98	2242.21	2554.51	2242.21	2554.51	0.21	0.00
Layer 10	5607.81	5607.73	5607.64	0.17	Slime	1211.30	1215.61	2564.13	2573.74	2564.13	2573.74	0.01	0.00
Layer 11	5607.64	5607.56	5607.48	0.16	Sand-Slime	1220.13	1224.66	2583.26	2592.78	2583.26	2592.78	0.01	0.00
Layer 12	5607.48	5607.40	5607.31	0.17	Slime	1228.97	1233.28	2602.40	2612.01	2602.40	2612.01	0.01	0.00
Layer 13	5607.31	5606.58	5605.84	1.47	Sand-Slime	1274.86	1316.44	2699.45	2786.90	2699.45	2786.90	0.06	0.00
Layer 14	5605.84	5605.76	5605.67	0.17	Slime	1320.75	1325.07	2796.51	2806.13	2796.51	2806.13	0.01	0.00
Layer 15	5605.67	5605.51	5605.35	0.32	Sand-Slime	1334.12	1343.17	2825.17	2844.20	2825.17	2844.20	0.01	0.00
Layer 16	5605.35	5605.27	5605.18	0.17	Slime	1347.48	1351.79	2853.82	2863.43	2853.82	2863.43	0.01	0.00
Layer 17	5605.18	5601.49	5597.80	7.38	Sand-Slime	1560.54	1769.29	3302.44	3741.44	3302.44	3741.44	0.29	0.00
Layer 18	5597.80	5597.64	5597.47	0.33	Slime	1777.66	1786.03	3760.11	3778.77	3760.11	3778.77	0.01	0.00
Layer 19	5597.47	5595.83	5594.19	3.28	Sand-Slime	1878.81	1971.58	3973.89	4089.75	3973.89	4169.00	0.13	0.00
Layer 20	5594.19	5594.03	5593.86	0.33	Slime	1979.95	1988.32	4098.12	4106.49	4187.67	4206.33	0.01	0.00
Layer 21	5593.86	5593.70	5593.54	0.32	Sand-Slime	1997.38	2006.43	4115.54	4124.60	4225.37	4244.40	0.01	0.00
Layer 22	5593.54	5593.38	5593.21	0.33	Slime	2014.80	2023.17	4132.97	4141.34	4263.07	4281.74	0.01	0.00
Layer 23	5593.21	5592.55	5591.89	1.32	Sand-Slime	2060.50	2097.84	4178.67	4216.01	4360.26	4438.78	0.05	0.00
Layer 24	5591.89	5591.18	5590.46	1.43	Sand-Slime	2138.29	2178.74	4256.46	4296.91	4523.84	4519.67	0.05	0.00

Total Consolidtion of Profile at t_1, δ_{c-t1} (ft):	**1.30**
Total Consolidtion of Profile at t_2, δ_{c-t2} (ft):	**0.01**

Notes:

[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

3-1S

FINAL COVER		
5620.47	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
0.41	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
887.10	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION		
5608.00	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5604.4	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013
5595.59	Water surface elevation at t_1 (ft amsl)	
5590.59	Water surface elevation at t_2 (ft amsl)	

3-1S

CONSOLIDATION SETTLEMENT

Soil Layer	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl) [1]	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Material Type [1]	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Effective Stress at Midpoint of Layer at t_2, $\sigma'_{i\text{-}mid2}$ (psf)	Effective Stress at Bottom of Layer at t_2, $\sigma'_{i\text{-}bott2}$ (psf)	Consolidtion of Layer from t_0 to t_1 due to Final Cover Placement and Dewatering, $\delta_{ci\text{-}t1}$ (ft)	Consolidtion of Layer from t_1 to t_2 due to Dewatering, $\delta_{ci\text{-}t2}$ (ft)
Layer 1	5612.56	5611.00	5609.44	3.12	Int. Cover	157.13	314.26	1044.24	1201.37	1044.24	1201.37	0.21	0.00
Layer 2	5609.44	5608.71	5607.97	1.47	Slime	397.41	480.56	1284.51	1367.66	1284.51	1367.66	0.09	0.00
Layer 3	5607.97	5607.89	5607.80	0.17	Sand-Slime	490.67	500.78	1377.78	1387.89	1377.78	1387.89	0.01	0.00
Layer 4	5607.80	5606.49	5605.18	2.62	Sand	662.53	824.29	1549.64	1711.39	1549.64	1711.39	0.07	0.00
Layer 5	5605.18	5604.93	5604.68	0.50	Sand-Slime	854.03	883.77	1741.13	1770.88	1741.13	1770.88	0.02	0.00
Layer 6	5604.68	5604.44	5604.19	0.49	Sand	913.71	928.67	1801.13	1831.38	1801.13	1831.38	0.01	0.00
Layer 7	5604.19	5603.78	5603.37	0.82	Sand-Slime	951.87	975.06	1880.16	1928.94	1880.16	1928.94	0.03	0.00
Layer 8	5603.37	5603.13	5602.88	0.49	Sand	990.03	1004.99	1959.19	1989.44	1959.19	1989.44	0.01	0.00
Layer 9	5602.88	5602.72	5602.55	0.33	Sand-Slime	1014.32	1023.66	2009.07	2028.70	2009.07	2028.70	0.01	0.00
Layer 10	5602.55	5602.47	5602.39	0.16	Slime	1027.72	1031.77	2037.75	2046.80	2037.75	2046.80	0.01	0.00
Layer 11	5602.39	5601.24	5600.09	2.30	Sand-Slime	1096.83	1161.89	2183.62	2320.43	2183.62	2320.43	0.08	0.00
Layer 12	5600.09	5600.01	5599.93	0.16	Sand	1166.77	1171.66	2330.31	2340.19	2330.31	2340.19	0.00	0.00
Layer 13	5599.93	5597.96	5595.99	3.94	Sand-Slime	1283.11	1394.55	2574.56	2808.94	2574.56	2808.94	0.14	0.00
Layer 14	5595.99	5595.91	5595.83	0.16	Slime	1398.61	1402.67	2817.99	2827.04	2817.99	2827.04	0.01	0.00
Layer 15	5595.83	5595.26	5594.68	1.15	Sand-Slime	1435.20	1467.72	2874.54	2907.07	2895.44	2963.85	0.04	0.00
Layer 16	5594.68	5592.64	5590.59	4.09	Sand-Slime	1583.41	1699.10	3022.76	3138.45	3207.15	3195.23	0.14	0.01

Total Consolidtion of Profile at t_1, $\delta_{c\text{-}t1}$ (ft):	**0.88**
Total Consolidtion of Profile at t_2, $\delta_{c\text{-}t2}$ (ft):	**0.01**

Notes:

[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

3-2C

FINAL COVER

5621.51	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.19	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
1167.12	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION

5605.30	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5602.7	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013
5591.64	Water surface elevation at t_1 (ft amsl)	
5586.64	Water surface elevation at t_2 (ft amsl)	

3-2C

CONSOLIDATION SETTLEMENT

Soil Layer	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl) [1]	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Material Type [1]	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Effective Stress at Midpoint of Layer at t_2, $\sigma'_{i\text{-}mid2}$ (psf)	Effective Stress at Bottom of Layer at t_2, $\sigma'_{i\text{-}bott2}$ (psf)	Consolidtion of Layer from t_0 to t_1 due to Final Cover Placement and Dewatering, $\delta_{ci\text{-}t1}$ (ft)	Consolidtion of Layer from t_1 to t_2 due to Dewatering, $\delta_{ci\text{-}t2}$ (ft)
Layer 1	5610.82	5609.27	5607.71	3.11	Int. Cover	156.63	313.25	1323.75	1480.37	1323.75	1480.37	0.23	0.00
Layer 2	5607.71	5607.63	5607.54	0.17	Sand	323.75	334.24	1490.87	1501.36	1490.87	1501.36	0.01	0.00
Layer 3	5607.54	5607.46	5607.38	0.16	Sand-Slime	343.76	353.28	1510.88	1520.40	1510.88	1520.40	0.01	0.00
Layer 4	5607.38	5606.89	5606.39	0.99	Slime	409.28	465.28	1576.40	1632.40	1576.40	1632.40	0.07	0.00
Layer 5	5606.39	5605.98	5605.57	0.82	Sand-Slime	514.05	562.83	1681.17	1729.95	1681.17	1729.95	0.05	0.00
Layer 6	5605.57	5605.41	5605.24	0.33	Slime	581.50	600.16	1748.62	1767.28	1748.62	1767.28	0.02	0.00
Layer 7	5605.24	5605.08	5604.92	0.32	Sand-Slime	619.20	638.24	1786.32	1805.36	1786.32	1805.36	0.02	0.00
Layer 8	5604.92	5604.59	5604.26	0.66	Slime	675.57	712.90	1842.69	1880.02	1842.69	1880.02	0.04	0.00
Layer 9	5604.26	5600.82	5597.37	6.89	Sand-Slime	1004.51	1199.40	2289.88	2699.73	2289.88	2699.73	0.30	0.00
Layer 10	5597.37	5597.29	5597.21	0.16	Slime	1203.45	1207.51	2708.78	2717.83	2708.78	2717.83	0.01	0.00
Layer 11	5597.21	5596.96	5596.71	0.50	Sand-Slime	1221.66	1235.80	2747.58	2777.32	2747.58	2777.32	0.02	0.00
Layer 12	5596.71	5596.22	5595.73	0.98	Slime	1260.66	1285.51	2832.75	2888.18	2832.75	2888.18	0.04	0.00
Layer 13	5595.73	5594.99	5594.25	1.48	Sand-Slime	1327.37	1369.24	2976.22	3064.26	2976.22	3064.26	0.06	0.00
Layer 14	5594.25	5594.17	5594.09	0.16	Slime	1373.30	1377.35	3073.31	3082.36	3073.31	3082.36	0.01	0.00
Layer 15	5594.09	5593.52	5592.94	1.15	Sand-Slime	1409.88	1442.41	3150.77	3219.18	3150.77	3219.18	0.05	0.00
Layer 16	5592.94	5592.78	5592.61	0.33	Slime	1450.78	1459.15	3237.84	3256.51	3237.84	3256.51	0.01	0.00
Layer 17	5592.61	5592.20	5591.79	0.82	Sand-Slime	1482.35	1505.54	3305.29	3354.07	3305.29	3354.07	0.03	0.00
Layer 18	5591.79	5591.63	5591.46	0.33	Slime	1513.91	1522.28	3371.80	3380.17	3372.73	3391.40	0.01	0.00
Layer 19	5591.46	5591.22	5590.97	0.49	Sand-Slime	1536.14	1550.00	3394.03	3407.89	3420.55	3449.70	0.02	0.00
Layer 20	5590.97	5590.89	5590.81	0.16	Slime	1554.06	1558.12	3411.95	3416.00	3458.75	3467.80	0.01	0.00
Layer 21	5590.81	5590.65	5590.48	0.33	Sand-Slime	1567.45	1576.78	3425.34	3434.67	3487.43	3507.06	0.01	0.00
Layer 22	5590.48	5588.56	5586.64	3.84	Sand-Slime	1685.40	1794.02	3543.29	3651.91	3735.48	3724.29	0.15	0.01

Total Consolidtion of Profile at t_1, $\delta_{c\text{-}t1}$ (ft):	**1.19**
Total Consolidtion of Profile at t_2, $\delta_{c\text{-}t2}$ (ft):	**0.01**

Notes:

[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

3-3S

FINAL COVER

5620.49	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.36	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
1184.24	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION

5605.60	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5601.5	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013
5582.14	Water surface elevation at t_1 (ft amsl)	
5577.14	Water surface elevation at t_2 (ft amsl)	

3-3S

CONSOLIDATION SETTLEMENT

Soil Layer	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl) [1]	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Material Type [1]	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Effective Stress at Midpoint of Layer at t_2, $\sigma'_{i\text{-}mid2}$ (psf)	Effective Stress at Bottom of Layer at t_2, $\sigma'_{i\text{-}bott2}$ (psf)	Consolidtion of Layer from t_0 to t_1 due to Final Cover Placement and Dewatering, $\delta_{ci\text{-}t1}$ (ft)	Consolidtion of Layer from t_1 to t_2 due to Dewatering, $\delta_{ci\text{-}t2}$ (ft)
Layer 1	5609.63	5608.08	5606.52	3.11	Int. Cover	156.63	313.25	1340.87	1497.50	1340.87	1497.50	0.23	0.00
Layer 2	5606.52	5606.11	5605.70	0.82	Sand	363.88	414.50	1548.12	1598.75	1548.12	1598.75	0.04	0.00
Layer 3	5605.70	5605.45	5605.20	0.50	Sand-Slime	444.25	473.99	1628.49	1658.23	1628.49	1658.23	0.03	0.00
Layer 4	5605.20	5604.47	5603.73	1.47	Sand	564.74	655.50	1748.99	1839.74	1748.99	1839.74	0.05	0.00
Layer 5	5603.73	5602.50	5601.27	2.46	Sand-Slime	801.83	932.57	1986.07	2132.41	1986.07	2132.41	0.12	0.00
Layer 6	5601.27	5601.11	5600.94	0.33	Slime	940.94	949.31	2151.07	2169.74	2151.07	2169.74	0.01	0.00
Layer 7	5600.94	5600.86	5600.78	0.16	Sand-Slime	953.83	958.36	2179.26	2188.78	2179.26	2188.78	0.01	0.00
Layer 8	5600.78	5600.62	5600.45	0.33	Slime	966.73	975.10	2207.44	2226.11	2207.44	2226.11	0.01	0.00
Layer 9	5600.45	5599.55	5598.64	1.81	Sand-Slime	1026.29	1077.49	2333.78	2441.45	2333.78	2441.45	0.08	0.00
Layer 10	5598.64	5598.23	5597.82	0.82	Slime	1098.29	1119.09	2487.83	2534.21	2487.83	2534.21	0.04	0.00
Layer 11	5597.82	5597.58	5597.33	0.49	Sand-Slime	1132.95	1146.81	2563.36	2592.51	2563.36	2592.51	0.02	0.00
Layer 12	5597.33	5597.25	5597.17	0.16	Slime	1150.87	1154.92	2601.56	2610.61	2601.56	2610.61	0.01	0.00
Layer 13	5597.17	5596.35	5595.53	1.64	Sand-Slime	1201.31	1247.70	2708.16	2805.72	2708.16	2805.72	0.07	0.00
Layer 14	5595.53	5595.45	5595.36	0.17	Slime	1252.01	1256.32	2815.34	2824.95	2815.34	2824.95	0.01	0.00
Layer 15	5595.36	5595.20	5595.03	0.33	Sand-Slime	1265.66	1274.99	2844.58	2864.21	2844.58	2864.21	0.01	0.00
Layer 16	5595.03	5594.71	5594.38	0.65	Slime	1291.48	1307.97	2900.98	2937.74	2900.98	2937.74	0.03	0.00
Layer 17	5594.38	5593.89	5593.39	0.99	Sand-Slime	1335.97	1363.97	2996.64	3055.53	2996.64	3055.53	0.04	0.00
Layer 18	5593.39	5593.07	5592.74	0.65	Slime	1380.46	1396.94	3092.29	3129.06	3092.29	3129.06	0.03	0.00
Layer 19	5592.74	5592.17	5591.59	1.15	Sand-Slime	1429.47	1462.00	3197.47	3265.88	3197.47	3265.88	0.05	0.00
Layer 20	5591.59	5591.51	5591.43	0.16	Slime	1466.06	1470.12	3274.93	3283.98	3274.93	3283.98	0.01	0.00
Layer 21	5591.43	5590.94	5590.44	0.99	Sand-Slime	1498.12	1526.12	3342.87	3401.76	3342.87	3401.76	0.04	0.00
Layer 22	5590.44	5590.36	5590.28	0.16	Slime	1530.18	1534.24	3410.81	3419.86	3410.81	3419.86	0.01	0.00
Layer 23	5590.28	5589.71	5589.13	1.15	Sand-Slime	1566.77	1599.30	3488.27	3556.68	3488.27	3556.68	0.05	0.00
Layer 24	5589.13	5588.97	5588.80	0.33	Sand	1609.37	1619.45	3577.05	3597.42	3577.05	3597.42	0.01	0.00
Layer 25	5588.80	5587.57	5586.34	2.46	Sand-Slime	1689.03	1758.62	3743.76	3890.09	3743.76	3890.09	0.10	0.00
Layer 26	5586.34	5586.10	5585.85	0.49	Sand	1773.58	1788.54	3920.34	3950.59	3920.34	3950.59	0.01	0.00
Layer 27	5585.85	5581.50	5577.14	8.71	Sand-Slime	2034.91	2281.28	4428.47	4674.84	4468.72	4443.33	0.36	0.00

Total Consolidtion of Profile at t_1, $\delta_{c\text{-}t1}$ (ft):	1.47
Total Consolidtion of Profile at t_2, $\delta_{c\text{-}t2}$ (ft):	0.00

Notes:

[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

3-4N

FINAL COVER

5623.36	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
7.16	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
1567.00	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION

5606.00	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5600.6	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013
5583.71	Water surface elevation at t_1 (ft amsl)	
5578.71	Water surface elevation at t_2 (ft amsl)	

3-4N

CONSOLIDATION SETTLEMENT

Soil Layer	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl) [1]	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Material Type [1]	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Effective Stress at Midpoint of Layer at t_2, $\sigma'_{i\text{-}mid2}$ (psf)	Effective Stress at Bottom of Layer at t_2, $\sigma'_{i\text{-}bott2}$ (psf)	Consolidtion of Layer from t_0 to t_1 due to Final Cover Placement and Dewatering, $\delta_{ci\text{-}t1}$ (ft)	Consolidtion of Layer from t_1 to t_2 due to Dewatering, $\delta_{ci\text{-}t2}$ (ft)
Layer 1	5608.70	5607.14	5605.58	3.12	Int. Cover	157.13	314.26	1724.13	1881.26	1724.13	1881.26	0.26	0.00
Layer 2	5605.58	5604.60	5603.61	1.97	Sand	435.88	557.51	2002.88	2124.50	2002.88	2124.50	0.09	0.00
Layer 3	5603.61	5601.32	5599.02	4.59	Sand-Slime	830.54	1006.24	2397.54	2670.58	2397.54	2670.58	0.26	0.00
Layer 4	5599.02	5598.20	5597.38	1.64	Slime	1047.84	1089.43	2763.35	2856.11	2763.35	2856.11	0.08	0.00
Layer 5	5597.38	5597.22	5597.05	0.33	Sand-Slime	1098.77	1108.10	2875.74	2895.37	2875.74	2895.37	0.02	0.00
Layer 6	5597.05	5596.72	5596.39	0.66	Sand	1128.26	1148.41	2936.12	2976.86	2936.12	2976.86	0.02	0.00
Layer 7	5596.39	5596.31	5596.23	0.16	Slime	1152.47	1156.53	2985.91	2994.96	2985.91	2994.96	0.01	0.00
Layer 8	5596.23	5596.07	5595.90	0.33	Sand-Slime	1165.86	1175.20	3014.59	3034.22	3014.59	3034.22	0.02	0.00
Layer 9	5595.90	5595.82	5595.74	0.16	Sand	1180.08	1184.97	3044.10	3053.98	3044.10	3053.98	0.00	0.00
Layer 10	5595.74	5595.66	5595.57	0.17	Slime	1189.28	1193.59	3063.60	3073.21	3063.60	3073.21	0.01	0.00
Layer 11	5595.57	5595.49	5595.41	0.16	Sand-Slime	1198.12	1202.64	3082.73	3092.25	3082.73	3092.25	0.01	0.00
Layer 12	5595.41	5595.00	5594.59	0.82	Slime	1223.44	1244.24	3138.63	3185.01	3138.63	3185.01	0.04	0.00
Layer 13	5594.59	5594.43	5594.26	0.33	Sand-Slime	1253.57	1262.91	3204.64	3224.27	3204.64	3224.27	0.02	0.00
Layer 14	5594.26	5594.10	5593.93	0.33	Slime	1271.28	1279.65	3242.94	3261.60	3242.94	3261.60	0.02	0.00
Layer 15	5593.93	5590.74	5587.54	6.39	Sand-Slime	1460.39	1641.14	3641.72	4021.83	3641.72	4021.83	0.31	0.00
Layer 16	5587.54	5583.13	5578.71	8.83	Sand-Slime	1890.90	2140.66	4510.59	4760.35	4547.09	4521.36	0.40	0.00

Total Consolidtion of Profile at t_1, $\delta_{c\text{-}t1}$ (ft):	**1.56**
Total Consolidtion of Profile at t_2, $\delta_{c\text{-}t2}$ (ft):	**0.00**

Notes:

[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

3-6N

FINAL COVER		
5623.62	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
8.68	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
1720.10	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION		
5604.20	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5599.3	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013
5590.44	Water surface elevation at t_1 (ft amsl)	
5585.44	Water surface elevation at t_2 (ft amsl)	

3-6N

CONSOLIDATION SETTLEMENT

Soil Layer	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl) [1]	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Material Type [1]	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Effective Stress at Midpoint of Layer at t_2, $\sigma'_{i\text{-}mid2}$ (psf)	Effective Stress at Bottom of Layer at t_2, $\sigma'_{i\text{-}bott2}$ (psf)	Consolidtion of Layer from t_0 to t_1 due to Final Cover Placement and Dewatering, $\delta_{ci\text{-}t1}$ (ft)	Consolidtion of Layer from t_1 to t_2 due to Dewatering, $\delta_{ci\text{-}t2}$ (ft)
Layer 1	5607.44	5605.88	5604.32	3.12	Int. Cover	157.13	314.26	1877.23	2034.36	1877.23	2034.36	0.27	0.00
Layer 2	5604.32	5604.24	5604.16	0.16	Sand-Slime	323.78	333.30	2043.88	2053.40	2043.88	2053.40	0.02	0.00
Layer 3	5604.16	5604.00	5603.83	0.33	Sand	353.67	374.04	2073.77	2094.14	2073.77	2094.14	0.02	0.00
Layer 4	5603.83	5603.67	5603.50	0.33	Sand-Slime	393.67	413.30	2113.77	2133.40	2113.77	2133.40	0.03	0.00
Layer 5	5603.50	5603.18	5602.85	0.65	Slime	450.07	486.84	2170.17	2206.94	2170.17	2206.94	0.05	0.00
Layer 6	5602.85	5602.44	5602.03	0.82	Sand-Slime	535.61	584.39	2255.71	2304.49	2255.71	2304.49	0.06	0.00
Layer 7	5602.03	5601.78	5601.53	0.50	Slime	612.67	640.96	2332.77	2361.06	2332.77	2361.06	0.04	0.00
Layer 8	5601.53	5601.29	5601.04	0.49	Sand-Slime	670.10	699.25	2390.20	2419.35	2390.20	2419.35	0.03	0.00
Layer 9	5601.04	5600.96	5600.88	0.16	Sand	709.13	719.01	2429.23	2439.11	2429.23	2439.11	0.01	0.00
Layer 10	5600.88	5600.72	5600.55	0.33	Sand-Slime	738.64	758.27	2458.74	2478.37	2458.74	2478.37	0.02	0.00
Layer 11	5600.55	5600.39	5600.22	0.33	Slime	776.94	795.60	2497.03	2515.70	2497.03	2515.70	0.02	0.00
Layer 12	5600.22	5600.06	5599.89	0.33	Sand-Slime	815.23	834.86	2535.33	2554.96	2535.33	2554.96	0.02	0.00
Layer 13	5599.89	5599.48	5599.07	0.82	Slime	881.24	912.03	2601.34	2647.73	2601.34	2647.73	0.05	0.00
Layer 14	5599.07	5598.91	5598.74	0.33	Sand-Slime	921.36	930.69	2667.36	2686.99	2667.36	2686.99	0.02	0.00
Layer 15	5598.74	5598.09	5597.43	1.31	Slime	963.92	997.15	2761.08	2835.18	2761.08	2835.18	0.07	0.00
Layer 16	5597.43	5597.27	5597.10	0.33	Sand-Slime	1006.48	1015.82	2854.81	2874.44	2854.81	2874.44	0.02	0.00
Layer 17	5597.10	5594.48	5591.86	5.24	Slime	1148.72	1281.63	3170.84	3467.23	3170.84	3467.23	0.28	0.00
Layer 18	5591.86	5590.88	5589.89	1.97	Sand-Slime	1337.35	1393.07	3584.42	3667.28	3584.42	3701.60	0.10	0.00
Layer 19	5589.89	5589.40	5588.90	0.99	Slime	1418.18	1443.29	3692.39	3717.50	3757.60	3813.60	0.05	0.00
Layer 20	5588.90	5587.17	5585.44	3.46	Sand-Slime	1541.16	1639.03	3815.37	3913.24	4019.42	4009.34	0.16	0.01

Total Consolidtion of Profile at t_1, $\delta_{c\text{-}t1}$ (ft):	**1.34**
Total Consolidtion of Profile at t_2, $\delta_{c\text{-}t2}$ (ft):	**0.01**

Notes:

[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

3-8N

FINAL COVER		
5623.82	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
7.95	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
1646.57	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated
PROFILE INFORMATION		
5604.90	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5600.3	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013
5595.24	Water surface elevation at t_1 (ft amsl)	
5590.24	Water surface elevation at t_2 (ft amsl)	

3-8N

CONSOLIDATION SETTLEMENT

Soil Layer	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl) [1]	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Material Type [1]	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Effective Stress at Midpoint of Layer at t_2, $\sigma'_{i\text{-}mid2}$ (psf)	Effective Stress at Bottom of Layer at t_2, $\sigma'_{i\text{-}bott2}$ (psf)	Consolidtion of Layer from t_0 to t_1 due to Final Cover Placement and Dewatering, $\delta_{ci\text{-}t1}$ (ft)	Consolidtion of Layer from t_1 to t_2 due to Dewatering, $\delta_{ci\text{-}t2}$ (ft)
Layer 1	5608.37	5606.81	5605.25	3.12	Int. Cover	157.13	314.26	1803.70	1960.83	1803.70	1960.83	0.27	0.00
Layer 2	5605.25	5605.17	5605.09	0.16	Slime	323.31	332.36	1969.88	1978.93	1969.88	1978.93	0.02	0.00
Layer 3	5605.09	5605.01	5604.92	0.17	Sand	342.86	353.35	1989.43	1999.92	1989.43	1999.92	0.01	0.00
Layer 4	5604.92	5604.60	5604.27	0.65	Sand-Slime	392.02	430.68	2038.59	2077.25	2038.59	2077.25	0.06	0.00
Layer 5	5604.27	5604.11	5603.94	0.33	Sand	451.06	471.43	2097.63	2118.00	2097.63	2118.00	0.02	0.00
Layer 6	5603.94	5603.78	5603.61	0.33	Sand-Slime	491.06	510.69	2137.63	2157.26	2137.63	2157.26	0.03	0.00
Layer 7	5603.61	5602.55	5601.48	2.13	Sand	642.19	773.69	2288.76	2420.26	2288.76	2420.26	0.08	0.00
Layer 8	5601.48	5598.45	5595.41	6.07	Sand-Slime	1022.14	1193.83	2781.34	3142.42	2781.34	3142.42	0.32	0.00
Layer 9	5595.41	5595.33	5595.24	0.17	Slime	1198.14	1202.45	3152.03	3151.04	3152.03	3161.65	0.01	0.00
Layer 10	5595.24	5594.18	5593.11	2.13	Sand-Slime	1262.70	1322.95	3211.29	3271.54	3288.35	3415.06	0.10	0.00
Layer 11	5593.11	5591.68	5590.24	2.87	Sand-Slime	1404.13	1485.31	3352.72	3433.90	3585.78	3577.42	0.13	0.01

Total Consolidtion of Profile at t_1, $\delta_{c\text{-}t1}$ (ft):	**1.03**
Total Consolidtion of Profile at t_2, $\delta_{c\text{-}t2}$ (ft):	**0.01**

Notes:

[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

3-8S

FINAL COVER

5620.45	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
4.25	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
1273.89	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION

5603.50	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5600.6	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013
5590.63	Water surface elevation at t_1 (ft amsl)	
5585.63	Water surface elevation at t_2 (ft amsl)	

3-8S

CONSOLIDATION SETTLEMENT

Soil Layer	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl) [1]	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Material Type [1]	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Effective Stress at Midpoint of Layer at t_2, $\sigma'_{i\text{-}mid2}$ (psf)	Effective Stress at Bottom of Layer at t_2, $\sigma'_{i\text{-}bott2}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Final Cover Placement and Dewatering, $\delta_{ci\text{-}t1}$ (ft)	Consolidtion of Layer from t_1 to t_2 due to Dewatering, $\delta_{ci\text{-}t2}$ (ft)
Layer 1	5608.70	5607.15	5605.59	3.11	Int. Cover	156.63	313.25	1430.52	1587.14	1430.52	1587.14	0.24	0.00
Layer 2	5605.59	5605.02	5604.44	1.15	Sand	384.25	455.25	1658.14	1729.14	1658.14	1729.14	0.05	0.00
Layer 3	5604.44	5604.28	5604.11	0.33	Sand-Slime	474.88	494.51	1748.77	1768.40	1748.77	1768.40	0.02	0.00
Layer 4	5604.11	5604.03	5603.95	0.16	Sand	504.39	514.27	1778.28	1788.15	1778.28	1788.15	0.01	0.00
Layer 5	5603.95	5603.54	5603.13	0.82	Sand-Slime	563.04	611.82	1836.93	1885.71	1836.93	1885.71	0.05	0.00
Layer 6	5603.13	5601.33	5599.52	3.61	Sand	834.69	990.80	2108.58	2331.45	2108.58	2331.45	0.10	0.00
Layer 7	5599.52	5599.36	5599.19	0.33	Sand-Slime	1000.13	1009.46	2351.08	2370.71	2351.08	2370.71	0.01	0.00
Layer 8	5599.19	5599.03	5598.86	0.33	Sand	1019.54	1029.62	2391.09	2411.46	2391.09	2411.46	0.01	0.00
Layer 9	5598.86	5596.89	5594.92	3.94	Sand-Slime	1141.06	1252.51	2645.83	2880.21	2645.83	2880.21	0.17	0.00
Layer 10	5594.92	5594.84	5594.76	0.16	Slime	1256.57	1260.63	2889.26	2898.31	2889.26	2898.31	0.01	0.00
Layer 11	5594.76	5594.60	5594.43	0.33	Sand-Slime	1269.96	1279.30	2917.94	2937.57	2917.94	2937.57	0.01	0.00
Layer 12	5594.43	5594.11	5593.78	0.65	Slime	1295.78	1312.27	2974.33	3011.10	2974.33	3011.10	0.03	0.00
Layer 13	5593.78	5593.62	5593.45	0.33	Sand-Slime	1321.60	1330.94	3030.73	3050.36	3030.73	3050.36	0.01	0.00
Layer 14	5593.45	5589.54	5585.63	7.82	Sand-Slime	1552.13	1773.32	3447.52	3668.72	3515.54	3492.75	0.33	0.01

Total Consolidtion of Profile at t_1, $\delta_{c\text{-}t1}$ (ft):	**1.06**
Total Consolidtion of Profile at t_2, $\delta_{c\text{-}t2}$ (ft):	**0.01**

Notes:

[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

ATTACHMENT F.2

CREEP SETTLEMENT CALCULATIONS

Notes

t_0 corresponds to beginning of final cover placement — Assumes 99% of consolidation due to existing stress conditions has taken place

t_1 corresponds to dewatering of the tailings to a level 5 feet above the liner

t_2 corresponds to completion of dewatering

SOIL PROPERTIES

TAILINGS

Specific Gravity, G_s		
2.70	Specific gravity of tailing sands, $G_{s\text{-}TSand}$	Based on lab testing performed on uranium tailings sands and presented in Keshian and Rager (1988)
2.80	Specific gravity of tailing sand-slimes, $G_{s\text{-}TS\text{-}S}$	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015)
2.86	Specific gravity of tailing slimes, $G_{s\text{-}TSlime}$	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015)
Fines Content		
18%	Fines content of tailings sands (%)	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015)
47%	Fines content of tailings sand-slimes (%)	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015)
71%	Fines content of tailings slimes (%)	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015)
Dry Unit Weight, γ_d		
97	In-situ dry unit weight of tailings sands at t_0, $\gamma_{d0\text{-}Tsand}$ (pcf)	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015)
88	In-situ dry unit weight of tailings sand-slimes at t_0, $\gamma_{d0\text{-}TS\text{-}S}$ (pcf)	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015)
78	In-situ dry unit weight of tailings slimes at t_0, $\gamma_{d0\text{-}Tslime}$ (pcf)	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015)
Saturated Unit Weight, γ_{sat}		
123	In-situ saturated unit weight of tailings sands at t_0, $\gamma_{sat0\text{-}Tsand}$ (pcf)	Calculated
119	In-situ saturated unit weight of tailings sand-slimes at t_0, $\gamma_{sat0\text{-}TS\text{-}S}$ (pcf)	Calculated
113	In-situ saturated unit weight of tailings slimes at t_0, $\gamma_{sat0\text{-}Tslime}$ (pcf)	Calculated
Moist Unit Weight, γ_m		
123	Moist unit weight of tailings sands, $\gamma_{m\text{-}Tsand}$ (pcf)	Calculated, assuming 100% degree of saturation (conservative estimate of loading from these layers)
119	Moist unit weight of tailings sand-slimes, $\gamma_{m\text{-}TS\text{-}S}$ (pcf)	Calculated, assuming 100% degree of saturation (conservative estimate of loading from these layers)
113	Moist unit weight of tailings slimes, $\gamma_{m\text{-}Tslime}$ (pcf)	Calculated, assuming 100% degree of saturation (conservative estimate of loading from these layers)
Void Ratio, e		
0.74	Void ratio of tailing sands at t_0, $e_{0\text{-}TSand}$	Calculated
0.99	Void ratio of tailing sand-slimes at t_0, $e_{0\text{-}TS\text{-}S}$	Calculated
1.29	Void ratio of tailing slimes at t_0, $e_{0\text{-}TSlime}$	Calculated
Saturated Water Content, w_{Sat}		
27%	Saturated water content of tailings sands at t_0, $w_{sat0\text{-}TSand}$ (%)	Calculated
35%	Saturated water content of tailings sand-slimes at t_0, $w_{sat0\text{-}TS\text{-}S}$ (%)	Calculated
45%	Saturated water content of tailings slimes at t_0, $w_{sat0\text{-}TSlime}$ (%)	Calculated
Water Content of Moist Tailings, $w_{m\text{-}T}$		
27%	Water content of moist tailings sands, $w_{m\text{-}TSand}$ (%)	Calculated, assuming 100% saturation (conservative value used to estimate loading from these layers, actual long-term water content will be lower)
35%	Water content of moist tailings sand-slimes, $w_{m\text{-}TS\text{-}S}$ (%)	Calculated, assuming 100% saturation (conservative value used to estimate loading from these layers, actual long-term water content will be lower)
45%	Water content of moist tailings slimes, $w_{m\text{-}TSlime}$ (%)	Calculated, assuming 100% saturation (conservative value used to estimate loading from these layers, actual long-term water content will be lower)
Compression Index, C_c		
0.12	Compression index of tailings sands, $C_{c\text{-}TSand}$	Based on lab testing performed on uranium tailings sands and presented in Keshian and Rager (1988)
0.24	Compression index of tailings sand-slimes, $C_{c\text{-}TS\text{-}S}$	Median value from lab testing of tailings sand-slimes samples obtained on-site (Tailings Data Analysis Report. MWH, 2015)
0.28	Compression index of tailings slimes, $C_{c\text{-}TSlime}$	Median value from lab testing of tailings slimes samples obtained on-site (Tailings Data Analysis Report. MWH, 2015)
Normalized Blow Count, N_{60}		
17	Normalized Blow Count for saturated tailings sands, $N_{60\text{-}TSand}$	
7	Normalized Blow Count for saturated tailings sand-slimes, $N_{60\text{-}TS\text{-}S}$	
4	Normalized Blow Count for saturated tailings slimes, $N_{60\text{-}Tslime}$	

23	Normalized Blow Count for unsaturated tailings sands, $N_{60\text{-}TSand}$	Blow counts for material types calculated using method presented in Guide to Cone Penetration Testing for Geotechnical Engineering, 5th Ed. (Robertson and Cabal, 2012).
14	Normalized Blow Count for unsaturated tailings sand-slimes, $N_{60\text{-}TS\text{-}S}$	
10	Normalized Blow Count for unsaturated tailings slimes, $N_{60\text{-}Tslime}$	
Other		
62.4	Unit Weight of Water, γ_W	
5.0	Height of water table above liner at t_1, $H_{sat\text{-}1}$ (ft)	Assumed for end of active maintenance
0.0	Height of water table above liner at t_2, $H_{sat\text{-}2}$ (ft)	
82.4	Atmospheric Pressure, P_a (kPa)	Calculated assuming elev=5600' amsl. http://www.engineeringtoolbox.com/air-altitude-pressure-d_462.html
1722.0	Atmospheric Pressure, P_a (psf)	Unit conversion calculation
5.2%	Long-term moisture content of tailings, $w_{tailings}$ (%)	From Attachment H - Radon Emanation Modeling including with this submittal
0.020	Ratio of Secondary Compression Index to Primary Compression Index, C_α/C_c	Estimated from laboratory results presented in MWH (2015b), upper bound average $C\alpha$ for sand-slime and slime tailings of 0.02

COVER SOIL

Specific Gravity, G_s		
2.61	Specific gravity of topsoil, $G_{s\text{-}Topsoil}$	From Attachment H - Radon Emanation Modeling including with this submittal
2.62	Specific gravity of rock mulch, $G_{s\text{-}mulch}$	From Attachment H - Radon Emanation Modeling including with this submittal
2.63	Specific gravity of cover soil, $G_{s\text{-}cover}$	From Attachment H - Radon Emanation Modeling including with this submittal
Unit Weight, γ		
118.0	Maximum dry unit weight of cover soil $\gamma_{cover\text{-}max}$ (pcf)	Average calculated from laboratory testing results (UWM, 2012)
100.7	Moist unit weight of cover soil at 80% relative compaction, $\gamma_{cover80}$ (pcf)	Calculated
107.0	Moist unit weight of cover soil at 85% relative compaction, $\gamma_{cover85}$ (pcf)	Calculated
119.6	Moist unit weight of cover soil at 95% relative compaction, $\gamma_{cover95}$ (pcf)	Calculated
127.5	Saturated unit weight of cover soil at 80% relative compaction, $\gamma_{cover80\text{-}sat}$ (pcf)	Calculated
100	Dry unit weight of topsoil layer at 85% relative compaction, $\gamma_{topsoil5}$ (pcf)	From Attachment H - Radon Emanation Modeling including with this submittal
105	Moist unit weight of topsoil layer at 85% relative compaction, $\gamma_{topsoil5}$ (pcf)	Calculated
106	Dry unit weight of rock mulch layer at 85% relative compaction, $\gamma_{mulch85}$ (pcf)	From Attachment H - Radon Emanation Modeling including with this submittal
110	Moist unit weight of rock mulch layer at 85% relative compaction, $\gamma_{mulch85}$ (pcf)	From Attachment H - Radon Emanation Modeling including with this submittal
Void Ratio, e		
0.74	Void Ratio of cover soil at 80% relative compaction, $e_{cover80}$	Calculated
0.64	Void Ratio of cover soil at 85% relative compaction, $e_{cover85}$	Calculated
0.46	Void Ratio of cover soil at 95% relative compaction, $e_{cover95}$	Calculated
0.61	Void Ratio of topsoil at 85% relative compaction, $e_{topsoil85}$	Calculated from porosity presented in Attachment H - Radon Emanation Modeling including with this submittal
0.54	Void Ratio of rock mulch at 85% relative compaction, $e_{mulch85}$	Calculated from porosity presented in Attachment H - Radon Emanation Modeling including with this submittal
Other		
6.7%	Long-term moisture content of cover soil, w_{cover} (%)	Estimated based on measured 15bar water content. (UWM, 2012)
5.2%	Long-term moisture content of topsoil, $w_{topsoil}$ (%)	From Attachment H - Radon Emanation Modeling including with this submittal
4.0%	Long-term moisture content of rock mulch, $w_{rockmulch}$ (%)	From Attachment H - Radon Emanation Modeling including with this submittal
0.14	Compression index of cover soil, $C_{c\text{-}cover}$	Calculated from empirical equation for soil types similar to cover material (as presented in Holtz and Kovacs, 1981. Page 341). $C_c = 0.30*(e_0-0.27)$

REFERENCES

Energy Fuels Resources (USA) Inc. (EFRI), 2012. Responses to Interrogatories – Round 1 for Reclamation Plan, Revision 5.0, March 2012. August 15.

Holtz, R.D. and Kovacs, W.D., 1981. An Introduction to Geotechnical Engineering. Prentice Hall, Inc. New Jersey

Keshian, B., and Rager, R. 1988. Geotechnical Properties of Hydraulically Placed Uranium Mill Tailings, in Hydraulically Fill Structures, Geotechnical Special Publication No. 21, Eds. Van Zyl, D., and Vick, S., ASCE, August.

MWH Americas, Inc. (MWH), 2015. White Mesa Mill Tailings Data Analysis Report. Prepared for Energy Fuels Resources (USA) Inc. April.

University of Wisconsin-Madison (UWM), Wisconsin Geotechnics Laboratory, 2012. Compaction and Hydraulic Properties of Soils from Banding, Utah. Geotechnics Report NO. 12-41 by C.H. Benson and X. Wang. July 24.

2W2

FINAL COVER

5625.87	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
4.00	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
2.02	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
1111.60	Additional Stress due to Final Cover Placement $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION

5613.10	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5607.7	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013).
5598.51	Water surface elevation at t_1 (ft amsl)	
5593.51	Water surface elevation at t_2 (ft amsl)	

2W2

CREEP SETTLEMENT

Soil Layer	Material Type [1]	Thickness of Layer at t_0, H (ft)	Elevation at Top of Layer at t_1, $z_{i\text{-top1}}$ (ft amsl)	Elevation at Midpoint of Layer at t_1, $z_{i\text{-mid1}}$ (ft amsl)	Elevation at Bottom of Layer at t_1, $z_{i\text{-bott1}}$ (ft amsl)	Thickness of Layer at t_1, H (ft)	Height above liner (ft)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-mid1}}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-bott1}}$ (psf)	Void Ratio at t_0, e_0	Void Ratio at t_1, e_1	Secondary Compression Index, C_α	Change in Void Ratio due to 1000 years of Creep, Δe	Final Void Ratio After 1,000 years, e_{final}	Settlement due to 1000 years of Creep, δ_{creep} (ft)
Erosion Protection Layer	Erosion Protection Layer		5624.78	5624.53	5624.28	0.50	31.27	NA	NA	NA	NA	NA	NA	NA	NA
Rooting Zone	Rooting Zone		5624.28	5622.53	5620.78	3.50	30.77	NA	NA	NA	NA	NA	NA	NA	NA
High-Compaction Layer	High-Compaction Layer		5620.78	5618.78	5616.78	4.00	27.27	NA	NA	NA	NA	NA	NA	NA	NA
Platform Fill	Platform Fill		5616.78	5615.77	5614.76	2.02	23.27	NA	NA	NA	NA	NA	NA	NA	NA
Layer 1	Int. Cover		5614.76	5613.32	5611.88	2.88	21.25	NA	NA	NA	NA	NA	NA	NA	NA
Layer 2	Sand-Slime		5611.88	5611.42	5610.97	0.91	18.37	NA	NA	NA	NA	NA	NA	NA	NA
Layer 3	Slime		5610.97	5610.89	5610.81	0.16	17.46	NA	NA	NA	NA	NA	NA	NA	NA
Layer 4	Sand		5610.81	5610.65	5610.50	0.31	17.30	NA	NA	NA	NA	NA	NA	NA	NA
Layer 5	Sand-Slime		5610.50	5610.42	5610.34	0.16	16.99	NA	NA	NA	NA	NA	NA	NA	NA
Layer 6	Slime		5610.34	5609.95	5609.57	0.77	16.83	NA	NA	NA	NA	NA	NA	NA	NA
Layer 7	Sand-Slime		5609.57	5609.49	5609.42	0.15	16.06	NA	NA	NA	NA	NA	NA	NA	NA
Layer 8	Slime		5609.42	5609.18	5608.95	0.46	15.91	NA	NA	NA	NA	NA	NA	NA	NA
Layer 9	Sand-Slime		5608.95	5608.71	5608.48	0.48	15.44	NA	NA	NA	NA	NA	NA	NA	NA
Layer 10	Slime		5608.48	5607.93	5607.39	1.09	14.97	NA	NA	NA	NA	NA	NA	NA	NA
Layer 11	Sand-Slime		5607.39	5607.23	5607.07	0.32	13.88	NA	NA	NA	NA	NA	NA	NA	NA
Layer 12	Slime		5607.07	5606.68	5606.29	0.78	13.56	NA	NA	NA	NA	NA	NA	NA	NA
Layer 13	Sand-Slime		5606.29	5605.97	5605.66	0.63	12.78	NA	NA	NA	NA	NA	NA	NA	NA
Layer 14	Slime		5605.66	5605.42	5605.19	0.47	12.15	NA	NA	NA	NA	NA	NA	NA	NA
Layer 15	Sand-Slime		5605.19	5605.03	5604.87	0.32	11.68	NA	NA	NA	NA	NA	NA	NA	NA
Layer 16	Slime		5604.87	5604.71	5604.56	0.32	11.36	NA	NA	NA	NA	NA	NA	NA	NA
Layer 17	Sand-Slime		5604.56	5604.40	5604.24	0.32	11.05	NA	NA	NA	NA	NA	NA	NA	NA
Layer 18	Slime		5604.24	5604.01	5603.77	0.47	10.73	NA	NA	NA	NA	NA	NA	NA	NA
Layer 19	Sand-Slime		5603.77	5603.61	5603.46	0.32	10.26	NA	NA	NA	NA	NA	NA	NA	NA
Layer 20	Slime		5603.46	5602.99	5602.52	0.94	9.95	NA	NA	NA	NA	NA	NA	NA	NA
Layer 21	Sand-Slime		5602.52	5602.44	5602.36	0.15	9.01	NA	NA	NA	NA	NA	NA	NA	NA
Layer 22	Slime		5602.36	5601.97	5601.58	0.79	8.85	NA	NA	NA	NA	NA	NA	NA	NA
Layer 23	Sand-Slime		5601.58	5601.34	5601.10	0.48	8.07	NA	NA	NA	NA	NA	NA	NA	NA
Layer 24	Slime		5601.10	5601.02	5600.95	0.15	7.59	NA	NA	NA	NA	NA	NA	NA	NA
Layer 25	Sand-Slime		5600.95	5600.87	5600.79	0.15	7.44	NA	NA	NA	NA	NA	NA	NA	NA
Layer 26	Slime		5600.79	5600.40	5600.01	0.79	7.28	NA	NA	NA	NA	NA	NA	NA	NA
Layer 27	Sand-Slime		5600.01	5599.62	5599.22	0.79	6.50	NA	NA	NA	NA	NA	NA	NA	NA
Layer 28	Slime		5599.22	5598.51	5597.80	1.42	5.71	1548.29	3096.58	1.29	1.19	0.006	0.023	1.17	0.015
Layer 29	Sand-Slime		5597.80	5597.73	5597.65	0.15	4.29	1552.82	3105.63	0.99	0.90	0.005	0.020	0.88	0.002
Layer 30	Slime		5597.65	5597.34	5597.02	0.63	4.14	1569.56	3139.11	1.29	1.19	0.006	0.023	1.17	0.007
Layer 31	Sand-Slime		5597.02	5596.70	5596.39	0.63	3.51	1588.23	3176.45	0.99	0.91	0.005	0.020	0.89	0.007
Layer 32	Slime		5596.39	5596.23	5596.08	0.31	2.88	1596.34	3192.68	1.29	1.20	0.006	0.023	1.17	0.003
Layer 33	Sand-Slime		5596.08	5595.76	5595.44	0.63	2.57	1615.01	3230.02	0.99	0.91	0.005	0.020	0.89	0.007
Layer 34	Sand-Slime		5595.44	5594.48	5593.51	1.93	1.93	1671.86	3343.73	0.99	0.91	0.005	0.020	0.89	0.020
														TOTAL:	**0.06**

Notes:

[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015

2W3

FINAL COVER		
5626.27	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
4.00	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
2.55	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
1164.98	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION		
5613.80	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5607.6	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013).
5597.75	Water surface elevation at t_1 (ft amsl)	
5592.75	Water surface elevation at t_2 (ft amsl)	

2W3

CREEP SETTLEMENT

Soil Layer	Material Type [1]	Elevation at Top of Layer at t_1, $z_{i\text{-top1}}$ (ft amsl)	Elevation at Midpoint of Layer at t_1, $z_{i\text{-mid1}}$ (ft amsl)	Elevation at Bottom of Layer at t_1, $z_{i\text{-bott1}}$ (ft amsl)	Thickness of Layer at t_1, H (ft)	Height above liner (ft)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-mid1}}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-bott1}}$ (psf)	Void Ratio at t_0, e_0	Void Ratio at t_1, e_1	Secondary Compression Index, C_α	Change in Void Ratio due to 1000 years of Creep, Δe	Final Void Ratio After 1,000 years, e_{final}	Settlement due to 1000 years of Creep, δ_{creep} (ft)
Erosion Protection Layer	Erosion Protection Layer	5625.12	5624.87	5624.62	0.50	32.37	NA	NA	NA	NA	NA	NA	NA	NA
Rooting Zone	Rooting Zone	5624.62	5622.87	5621.12	3.50	31.87	NA	NA	NA	NA	NA	NA	NA	NA
High-Compaction Layer	High-Compaction Layer	5621.12	5619.12	5617.12	4.00	28.37	NA	NA	NA	NA	NA	NA	NA	NA
Platform Fill	Platform Fill	5617.12	5615.85	5614.57	2.55	24.37	NA	NA	NA	NA	NA	NA	NA	NA
Layer 1	Int. Cover	5614.57	5613.13	5611.70	2.88	21.82	NA	NA	NA	NA	NA	NA	NA	NA
Layer 2	Sand-Slime	5611.70	5611.47	5611.24	0.45	18.95	NA	NA	NA	NA	NA	NA	NA	NA
Layer 3	Slime	5611.24	5611.17	5611.09	0.16	18.49	NA	NA	NA	NA	NA	NA	NA	NA
Layer 4	Sand-Slime	5611.09	5610.63	5610.17	0.91	18.34	NA	NA	NA	NA	NA	NA	NA	NA
Layer 5	Slime	5610.17	5610.02	5609.86	0.31	17.42	NA	NA	NA	NA	NA	NA	NA	NA
Layer 6	Sand-Slime	5609.86	5609.09	5608.31	1.55	17.11	NA	NA	NA	NA	NA	NA	NA	NA
Layer 7	Slime	5608.31	5608.23	5608.15	0.16	15.56	NA	NA	NA	NA	NA	NA	NA	NA
Layer 8	Sand-Slime	5608.15	5607.92	5607.68	0.47	15.40	NA	NA	NA	NA	NA	NA	NA	NA
Layer 9	Slime	5607.68	5607.61	5607.53	0.15	14.93	NA	NA	NA	NA	NA	NA	NA	NA
Layer 10	Sand-Slime	5607.53	5607.45	5607.37	0.16	14.78	NA	NA	NA	NA	NA	NA	NA	NA
Layer 11	Slime	5607.37	5607.21	5607.04	0.32	14.62	NA	NA	NA	NA	NA	NA	NA	NA
Layer 12	Sand-Slime	5607.04	5606.42	5605.80	1.24	14.29	NA	NA	NA	NA	NA	NA	NA	NA
Layer 13	Slime	5605.80	5605.65	5605.49	0.31	13.05	NA	NA	NA	NA	NA	NA	NA	NA
Layer 14	Sand-Slime	5605.49	5604.47	5603.45	2.05	12.74	NA	NA	NA	NA	NA	NA	NA	NA
Layer 15	Slime	5603.45	5602.82	5602.19	1.25	10.70	NA	NA	NA	NA	NA	NA	NA	NA
Layer 16	Sand-Slime	5602.19	5601.25	5600.31	1.89	9.44	NA	NA	NA	NA	NA	NA	NA	NA
Layer 17	Slime	5600.31	5600.15	5599.99	0.32	7.56	NA	NA	NA	NA	NA	NA	NA	NA
Layer 18	Sand-Slime	5599.99	5599.84	5599.68	0.31	7.24	NA	NA	NA	NA	NA	NA	NA	NA
Layer 19	Slime	5599.68	5598.82	5597.95	1.73	6.93	NA	NA	NA	NA	NA	NA	NA	NA
Layer 20	Sand-Slime	5597.95	5597.64	5597.33	0.62	5.20	3205.98	3230.29	0.99	0.90	0.005	0.020	0.88	0.006
Layer 21	Slime	5597.33	5597.17	5597.01	0.32	4.58	3238.66	3247.03	1.29	1.19	0.006	0.023	1.17	0.003
Layer 22	Sand-Slime	5597.01	5596.39	5595.76	1.26	4.26	3284.09	3321.14	0.99	0.90	0.005	0.020	0.88	0.013
Layer 23	Slime	5595.76	5595.44	5595.12	0.63	3.01	3337.88	3354.62	1.29	1.20	0.006	0.023	1.17	0.007
Layer 24	Sand-Slime	5595.12	5594.97	5594.81	0.32	2.37	3363.96	3373.29	0.99	0.91	0.005	0.020	0.89	0.003
Layer 25	Slime	5594.81	5594.57	5594.34	0.47	2.06	3385.72	3398.15	1.29	1.20	0.006	0.023	1.17	0.005
Layer 26	Sand-Slime	5594.34	5594.18	5594.02	0.32	1.59	3407.48	3416.81	0.99	0.91	0.005	0.020	0.89	0.003
Layer 27	Sand-Slime	5594.02	5593.38	5592.75	1.27	1.27	3454.15	3491.49	0.99	0.91	0.005	0.020	0.89	0.013
													TOTAL:	**0.05**

Notes:
[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

2W4-C

FINAL COVER

5626.19	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
4.00	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
1.95	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
1104.55	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION

5611.20	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5608.1	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013).
5593.51	Water surface elevation at t_1 (ft amsl)	
5588.51	Water surface elevation at t_2 (ft amsl)	

2W4-C

CREEP SETTLEMENT

Soil Layer	Material Type [1]	Elevation at Top of Layer at t_1, $z_{i\text{-top1}}$ (ft amsl)	Elevation at Midpoint of Layer at t_1, $z_{i\text{-mid1}}$ (ft amsl)	Elevation at Bottom of Layer at t_1, $z_{i\text{-bott1}}$ (ft amsl)	Thickness of Layer at t_1, H (ft)	Height above liner (ft)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-mid1}}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-bott1}}$ (psf)	Void Ratio at t_0, e_0	Void Ratio at t_1, e_1	Secondary Compression Index, C_α	Change in Void Ratio due to 1000 years of Creep, Δe	Final Void Ratio After 1,000 years, e_{final}	Settlement due to 1000 years of Creep, δ_{creep} (ft)
Erosion Protection Layer	Erosion Protection Layer	5624.90	5624.65	5624.40	0.50	36.39	NA	NA	NA	NA	NA	NA	NA	NA
Rooting Zone	Rooting Zone	5624.40	5622.65	5620.90	3.50	35.89	NA	NA	NA	NA	NA	NA	NA	NA
High-Compaction Layer	High-Compaction Layer	5620.90	5618.90	5616.90	4.00	32.39	NA	NA	NA	NA	NA	NA	NA	NA
Platform Fill	Platform Fill	5616.90	5615.92	5614.95	1.95	28.39	NA	NA	NA	NA	NA	NA	NA	NA
Layer 1	Int. Cover	5614.95	5613.50	5612.05	2.89	26.44	NA	NA	NA	NA	NA	NA	NA	NA
Layer 2	Sand	5612.05	5611.98	5611.90	0.15	23.54	NA	NA	NA	NA	NA	NA	NA	NA
Layer 3	Sand-Slime	5611.90	5610.36	5608.82	3.09	23.39	NA	NA	NA	NA	NA	NA	NA	NA
Layer 4	Slime	5608.82	5608.73	5608.65	0.16	20.31	NA	NA	NA	NA	NA	NA	NA	NA
Layer 5	Sand-Slime	5608.65	5607.48	5606.30	2.36	20.14	NA	NA	NA	NA	NA	NA	NA	NA
Layer 6	Slime	5606.30	5606.14	5605.99	0.31	17.79	NA	NA	NA	NA	NA	NA	NA	NA
Layer 7	Sand-Slime	5605.99	5605.83	5605.68	0.32	17.48	NA	NA	NA	NA	NA	NA	NA	NA
Layer 8	Slime	5605.68	5605.59	5605.51	0.16	17.17	NA	NA	NA	NA	NA	NA	NA	NA
Layer 9	Sand-Slime	5605.51	5604.73	5603.94	1.57	17.00	NA	NA	NA	NA	NA	NA	NA	NA
Layer 10	Slime	5603.94	5603.86	5603.79	0.15	15.43	NA	NA	NA	NA	NA	NA	NA	NA
Layer 11	Sand-Slime	5603.79	5603.63	5603.47	0.32	15.28	NA	NA	NA	NA	NA	NA	NA	NA
Layer 12	Slime	5603.47	5603.31	5603.15	0.32	14.96	NA	NA	NA	NA	NA	NA	NA	NA
Layer 13	Sand-Slime	5603.15	5601.35	5599.54	3.61	14.64	NA	NA	NA	NA	NA	NA	NA	NA
Layer 14	Slime	5599.54	5598.99	5598.44	1.10	11.03	NA	NA	NA	NA	NA	NA	NA	NA
Layer 15	Sand-Slime	5598.44	5598.04	5597.65	0.79	9.93	NA	NA	NA	NA	NA	NA	NA	NA
Layer 16	Slime	5597.65	5597.57	5597.50	0.15	9.14	NA	NA	NA	NA	NA	NA	NA	NA
Layer 17	Sand-Slime	5597.50	5597.26	5597.03	0.47	8.99	NA	NA	NA	NA	NA	NA	NA	NA
Layer 18	Slime	5597.03	5596.87	5596.71	0.32	8.52	NA	NA	NA	NA	NA	NA	NA	NA
Layer 19	Sand-Slime	5596.71	5596.32	5595.92	0.79	8.20	NA	NA	NA	NA	NA	NA	NA	NA
Layer 20	Slime	5595.92	5595.53	5595.14	0.79	7.41	NA	NA	NA	NA	NA	NA	NA	NA
Layer 21	Sand-Slime	5595.14	5594.82	5594.51	0.63	6.63	NA	NA	NA	NA	NA	NA	NA	NA
Layer 22	Slime	5594.51	5594.43	5594.35	0.15	6.00	NA	NA	NA	NA	NA	NA	NA	NA
Layer 23	Sand-Slime	5594.35	5594.19	5594.04	0.32	5.84	NA	NA	NA	NA	NA	NA	NA	NA
Layer 24	Slime	5594.04	5593.88	5593.72	0.32	5.53	NA	NA	NA	NA	NA	NA	NA	NA
Layer 25	Sand-Slime	5593.72	5591.67	5589.63	4.09	5.21	3825.33	3945.83	0.99	0.91	0.005	0.020	0.89	0.042
Layer 26	Sand-Slime	5589.63	5589.07	5588.51	1.12	1.12	3978.64	4011.45	0.99	0.91	0.005	0.020	0.89	0.011
													TOTAL:	**0.05**

Notes:
[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

2W5-C

FINAL COVER

5626.29	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
4.00	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
2.43	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
1152.89	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION

5604.20	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5604.2	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013).
5589.01	Water surface elevation at t_1 (ft amsl)	
5584.01	Water surface elevation at t_2 (ft amsl)	

2W5-C

CREEP SETTLEMENT

Soil Layer	Material Type [1]	Elevation at Top of Layer at t_1, $z_{i\text{-top}1}$ (ft amsl)	Elevation at Midpoint of Layer at t_1, $z_{i\text{-mid}1}$ (ft amsl)	Elevation at Bottom of Layer at t_1, $z_{i\text{-bott}1}$ (ft amsl)	Thickness of Layer at t_1, H (ft)	Height above liner (ft)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-mid}1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-bott}1}$ (psf)	Void Ratio at t_0, e_0	Void Ratio at t_1, e_1	Secondary Compression Index, C_α	Change in Void Ratio due to 1000 years of Creep, Δe	Final Void Ratio After 1,000 years, e_{final}	Settlement due to 1000 years of Creep, δ_{creep} (ft)
Erosion Protection Layer	Erosion Protection Layer	5625.03	5624.78	5624.53	0.50	41.02	NA	NA	NA	NA	NA	NA	NA	NA
Rooting Zone	Rooting Zone	5624.53	5622.78	5621.03	3.50	40.52	NA	NA	NA	NA	NA	NA	NA	NA
High-Compaction Layer	High-Compaction Layer	5621.03	5619.03	5617.03	4.00	37.02	NA	NA	NA	NA	NA	NA	NA	NA
Platform Fill	Platform Fill	5617.03	5615.82	5614.60	2.43	33.02	NA	NA	NA	NA	NA	NA	NA	NA
Layer 1	Int. Cover	5614.60	5613.16	5611.73	2.88	30.59	NA	NA	NA	NA	NA	NA	NA	NA
Layer 2	Sand-Slime	5611.73	5611.57	5611.42	0.30	27.72	NA	NA	NA	NA	NA	NA	NA	NA
Layer 3	Sand	5611.42	5611.10	5610.79	0.63	27.41	NA	NA	NA	NA	NA	NA	NA	NA
Layer 4	Sand-Slime	5610.79	5610.64	5610.49	0.30	26.78	NA	NA	NA	NA	NA	NA	NA	NA
Layer 5	Sand	5610.49	5610.17	5609.85	0.64	26.48	NA	NA	NA	NA	NA	NA	NA	NA
Layer 6	Sand-Slime	5609.85	5609.08	5608.30	1.55	25.84	NA	NA	NA	NA	NA	NA	NA	NA
Layer 7	Sand	5608.30	5608.06	5607.82	0.48	24.29	NA	NA	NA	NA	NA	NA	NA	NA
Layer 8	Sand-Slime	5607.82	5604.18	5600.53	7.29	23.81	NA	NA	NA	NA	NA	NA	NA	NA
Layer 9	Sand	5600.53	5600.45	5600.37	0.16	16.52	NA	NA	NA	NA	NA	NA	NA	NA
Layer 10	Sand-Slime	5600.37	5599.58	5598.79	1.58	16.36	NA	NA	NA	NA	NA	NA	NA	NA
Layer 11	Slime	5598.79	5598.63	5598.47	0.32	14.78	NA	NA	NA	NA	NA	NA	NA	NA
Layer 12	Sand-Slime	5598.47	5596.49	5594.51	3.96	14.46	NA	NA	NA	NA	NA	NA	NA	NA
Layer 13	Slime	5594.51	5594.12	5593.72	0.79	10.50	NA	NA	NA	NA	NA	NA	NA	NA
Layer 14	Sand-Slime	5593.72	5593.48	5593.25	0.47	9.71	NA	NA	NA	NA	NA	NA	NA	NA
Layer 15	Slime	5593.25	5593.17	5593.08	0.16	9.24	NA	NA	NA	NA	NA	NA	NA	NA
Layer 16	Sand-Slime	5593.08	5592.29	5591.50	1.58	9.07	NA	NA	NA	NA	NA	NA	NA	NA
Layer 17	Slime	5591.50	5591.34	5591.18	0.32	7.49	NA	NA	NA	NA	NA	NA	NA	NA
Layer 18	Sand-Slime	5591.18	5589.29	5587.39	3.79	7.17	4236.82	4375.75	0.99	0.92	0.005	0.020	0.90	0.039
Layer 19	Slime	5587.39	5587.23	5587.07	0.32	3.38	4384.12	4392.49	1.29	1.21	0.006	0.023	1.19	0.003
Layer 20	Sand	5587.07	5586.67	5586.27	0.80	3.06	4417.53	4442.57	0.74	0.70	0.002	0.010	0.69	0.005
Layer 21	Sand-Slime	5586.27	5586.11	5585.95	0.32	2.26	4451.90	4461.24	0.99	0.92	0.005	0.020	0.90	0.003
Layer 22	Sand	5585.95	5585.79	5585.63	0.32	1.94	4471.31	4481.39	0.74	0.70	0.002	0.010	0.69	0.002
Layer 23	Sand-Slime	5585.63	5584.82	5584.01	1.62	1.62	4528.63	4575.86	0.99	0.92	0.005	0.020	0.90	0.016
													TOTAL:	**0.07**

Notes:
[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

2W6-S

FINAL COVER

5625.41	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
4.00	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
1.56	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
1065.26	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION

5604.40	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5604.4	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013).
5588.59	Water surface elevation at t_1 (ft amsl)	
5583.59	Water surface elevation at t_2 (ft amsl)	

2W6-S

CREEP SETTLEMENT

Soil Layer	Material Type [1]	Elevation at Top of Layer at t_1, $z_{i\text{-}top1}$ (ft amsl)	Elevation at Midpoint of Layer at t_1, $z_{i\text{-}mid1}$ (ft amsl)	Elevation at Bottom of Layer at t_1, $z_{i\text{-}bott1}$ (ft amsl)	Thickness of Layer at t_1, H (ft)	Height above liner (ft)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Void Ratio at t_0, e_0	Void Ratio at t_1, e_1	Secondary Compression Index, C_α	Change in Void Ratio due to 1000 years of Creep, Δe	Final Void Ratio After 1,000 years, e_{final}	Settlement due to 1000 years of Creep, δ_{creep} (ft)
Erosion Protection Layer	Erosion Protection Layer	5624.12	5623.87	5623.62	0.50	40.53	NA	NA	NA	NA	NA	NA	NA	NA
Rooting Zone	Rooting Zone	5623.62	5621.87	5620.12	3.50	40.03	NA	NA	NA	NA	NA	NA	NA	NA
High-Compaction Layer	High-Compaction Layer	5620.12	5618.12	5616.12	4.00	36.53	NA	NA	NA	NA	NA	NA	NA	NA
Platform Fill	Platform Fill	5616.12	5615.34	5614.56	1.56	32.53	NA	NA	NA	NA	NA	NA	NA	NA
Layer 1	Int. Cover	5614.56	5613.11	5611.67	2.90	30.97	NA	NA	NA	NA	NA	NA	NA	NA
Layer 2	Sand-Slime	5611.67	5611.44	5611.21	0.45	28.08	NA	NA	NA	NA	NA	NA	NA	NA
Layer 3	Sand	5611.21	5611.13	5611.05	0.16	27.62	NA	NA	NA	NA	NA	NA	NA	NA
Layer 4	Sand-Slime	5611.05	5610.67	5610.28	0.77	27.46	NA	NA	NA	NA	NA	NA	NA	NA
Layer 5	Sand	5610.28	5610.04	5609.81	0.47	26.69	NA	NA	NA	NA	NA	NA	NA	NA
Layer 6	Sand-Slime	5609.81	5608.87	5607.94	1.87	26.22	NA	NA	NA	NA	NA	NA	NA	NA
Layer 7	Slime	5607.94	5607.78	5607.62	0.32	24.35	NA	NA	NA	NA	NA	NA	NA	NA
Layer 8	Sand	5607.62	5607.47	5607.31	0.31	24.03	NA	NA	NA	NA	NA	NA	NA	NA
Layer 9	Sand-Slime	5607.31	5606.60	5605.89	1.42	23.72	NA	NA	NA	NA	NA	NA	NA	NA
Layer 10	Slime	5605.89	5605.73	5605.57	0.32	22.30	NA	NA	NA	NA	NA	NA	NA	NA
Layer 11	Sand-Slime	5605.57	5605.33	5605.10	0.47	21.98	NA	NA	NA	NA	NA	NA	NA	NA
Layer 12	Slime	5605.10	5604.78	5604.46	0.64	21.51	NA	NA	NA	NA	NA	NA	NA	NA
Layer 13	Sand-Slime	5604.46	5604.15	5603.83	0.63	20.87	NA	NA	NA	NA	NA	NA	NA	NA
Layer 14	Slime	5603.83	5603.59	5603.35	0.48	20.24	NA	NA	NA	NA	NA	NA	NA	NA
Layer 15	Sand-Slime	5603.35	5603.27	5603.19	0.15	19.76	NA	NA	NA	NA	NA	NA	NA	NA
Layer 16	Slime	5603.19	5602.00	5600.81	2.38	19.60	NA	NA	NA	NA	NA	NA	NA	NA
Layer 17	Sand-Slime	5600.81	5600.57	5600.34	0.47	17.22	NA	NA	NA	NA	NA	NA	NA	NA
Layer 18	Slime	5600.34	5600.26	5600.17	0.16	16.75	NA	NA	NA	NA	NA	NA	NA	NA
Layer 19	Sand-Slime	5600.17	5600.10	5600.02	0.15	16.58	NA	NA	NA	NA	NA	NA	NA	NA
Layer 20	Slime	5600.02	5599.62	5599.23	0.79	16.43	NA	NA	NA	NA	NA	NA	NA	NA
Layer 21	Sand-Slime	5599.23	5598.67	5598.11	1.11	15.64	NA	NA	NA	NA	NA	NA	NA	NA
Layer 22	Slime	5598.11	5597.72	5597.32	0.79	14.52	NA	NA	NA	NA	NA	NA	NA	NA
Layer 23	Sand-Slime	5597.32	5596.53	5595.74	1.58	13.73	NA	NA	NA	NA	NA	NA	NA	NA
Layer 24	Slime	5595.74	5595.50	5595.26	0.47	12.15	NA	NA	NA	NA	NA	NA	NA	NA
Layer 25	Sand-Slime	5595.26	5595.10	5594.95	0.32	11.67	NA	NA	NA	NA	NA	NA	NA	NA
Layer 26	Slime	5594.95	5594.87	5594.79	0.15	11.36	NA	NA	NA	NA	NA	NA	NA	NA
Layer 27	Sand-Slime	5594.79	5592.42	5590.04	4.75	11.20	NA	NA	NA	NA	NA	NA	NA	NA
Layer 28	Slime	5590.04	5589.96	5589.88	0.16	6.45	NA	NA	NA	NA	NA	NA	NA	NA
Layer 29	Sand-Slime	5589.88	5588.45	5587.03	2.85	6.29	4212.55	4297.55	0.99	0.92	0.005	0.020	0.90	0.029
Layer 30	Sand	5587.03	5586.79	5586.55	0.48	3.44	4312.52	4327.48	0.74	0.70	0.002	0.010	0.69	0.003
Layer 31	Sand-Slime	5586.55	5585.07	5583.59	2.96	2.96	4414.03	4500.59	0.99	0.92	0.005	0.020	0.90	0.030
													TOTAL:	0.06

Notes:

[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

2W7-C

FINAL COVER

5626.65	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
4.00	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
-0.95	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
812.44	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION

5613.10	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5611.5	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013).
5595.40	Water surface elevation at t_1 (ft amsl)	
5590.40	Water surface elevation at t_2 (ft amsl)	

2W7-C

CREEP SETTLEMENT

Soil Layer	Material Type [1]	Elevation at Top of Layer at t_1, $z_{i\text{-}top1}$ (ft amsl)	Elevation at Midpoint of Layer at t_1, $z_{i\text{-}mid1}$ (ft amsl)	Elevation at Bottom of Layer at t_1, $z_{i\text{-}bott1}$ (ft amsl)	Thickness of Layer at t_1, H (ft)	Height above liner (ft)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Void Ratio at t_0, e_0	Void Ratio at t_1, e_1	Secondary Compression Index, C_α	Change in Void Ratio due to 1000 years of Creep, Δe	Final Void Ratio After 1,000 years, e_{final}	Settlement due to 1000 years of Creep, δ_{creep} (ft)
Erosion Protection Layer	Erosion Protection Layer	5625.48	5625.23	5624.98	0.50	35.08	NA	NA	NA	NA	NA	NA	NA	NA
Rooting Zone	Rooting Zone	5624.98	5623.23	5621.48	3.50	34.58	NA	NA	NA	NA	NA	NA	NA	NA
High-Compaction Layer	High-Compaction Layer	5621.48	5619.48	5617.48	4.00	31.08	NA	NA	NA	NA	NA	NA	NA	NA
Platform Fill	Platform Fill	5617.48	5617.95	5618.43	-0.95	27.08	NA	NA	NA	NA	NA	NA	NA	NA
Layer 1	Int. Cover	5618.43	5616.97	5615.51	2.92	28.03	NA	NA	NA	NA	NA	NA	NA	NA
Layer 2	Sand-Slime	5615.51	5614.27	5613.03	2.48	25.11	NA	NA	NA	NA	NA	NA	NA	NA
Layer 3	Slime	5613.03	5612.94	5612.86	0.16	22.63	NA	NA	NA	NA	NA	NA	NA	NA
Layer 4	Sand-Slime	5612.86	5612.00	5611.13	1.73	22.46	NA	NA	NA	NA	NA	NA	NA	NA
Layer 5	Slime	5611.13	5611.05	5610.97	0.16	20.73	NA	NA	NA	NA	NA	NA	NA	NA
Layer 6	Sand-Slime	5610.97	5610.26	5609.55	1.42	20.57	NA	NA	NA	NA	NA	NA	NA	NA
Layer 7	Slime	5609.55	5609.47	5609.38	0.16	19.15	NA	NA	NA	NA	NA	NA	NA	NA
Layer 8	Sand-Slime	5609.38	5609.31	5609.23	0.15	18.98	NA	NA	NA	NA	NA	NA	NA	NA
Layer 9	Slime	5609.23	5609.15	5609.07	0.16	18.83	NA	NA	NA	NA	NA	NA	NA	NA
Layer 10	Sand-Slime	5609.07	5605.59	5602.11	6.96	18.67	NA	NA	NA	NA	NA	NA	NA	NA
Layer 11	Slime	5602.11	5601.79	5601.47	0.64	11.71	NA	NA	NA	NA	NA	NA	NA	NA
Layer 12	Sand-Slime	5601.47	5601.39	5601.32	0.15	11.07	NA	NA	NA	NA	NA	NA	NA	NA
Layer 13	Slime	5601.32	5601.16	5601.00	0.32	10.92	NA	NA	NA	NA	NA	NA	NA	NA
Layer 14	Sand-Slime	5601.00	5600.37	5599.74	1.26	10.60	NA	NA	NA	NA	NA	NA	NA	NA
Layer 15	Slime	5599.74	5599.65	5599.57	0.16	9.34	NA	NA	NA	NA	NA	NA	NA	NA
Layer 16	Sand	5599.57	5599.49	5599.42	0.16	9.17	NA	NA	NA	NA	NA	NA	NA	NA
Layer 17	Sand-Slime	5599.42	5599.33	5599.25	0.16	9.02	NA	NA	NA	NA	NA	NA	NA	NA
Layer 18	Slime	5599.25	5598.94	5598.63	0.63	8.85	NA	NA	NA	NA	NA	NA	NA	NA
Layer 19	Sand-Slime	5598.63	5598.23	5597.84	0.79	8.23	NA	NA	NA	NA	NA	NA	NA	NA
Layer 20	Slime	5597.84	5597.36	5596.88	0.95	7.44	NA	NA	NA	NA	NA	NA	NA	NA
Layer 21	Sand-Slime	5596.88	5596.73	5596.57	0.31	6.48	NA	NA	NA	NA	NA	NA	NA	NA
Layer 22	Slime	5596.57	5596.49	5596.41	0.16	6.17	NA	NA	NA	NA	NA	NA	NA	NA
Layer 23	Sand-Slime	5596.41	5596.17	5595.94	0.47	6.01	NA	NA	NA	NA	NA	NA	NA	NA
Layer 24	Slime	5595.94	5595.86	5595.78	0.15	5.54	NA	NA	NA	NA	NA	NA	NA	NA
Layer 25	Sand-Slime	5595.78	5595.39	5594.99	0.79	5.38	3592.85	3626.66	0.99	0.91	0.005	0.020	0.89	0.008
Layer 26	Slime	5594.99	5594.68	5594.36	0.64	4.59	3643.40	3660.14	1.29	1.20	0.006	0.023	1.18	0.007
Layer 27	Sand-Slime	5594.36	5594.28	5594.20	0.15	3.96	3664.66	3669.19	0.99	0.91	0.005	0.020	0.89	0.002
Layer 28	Slime	5594.20	5593.96	5593.72	0.48	3.80	3681.87	3694.55	1.29	1.21	0.006	0.023	1.18	0.005
Layer 29	Sand-Slime	5593.72	5593.49	5593.25	0.47	3.32	3708.41	3722.27	0.99	0.92	0.005	0.020	0.90	0.005
Layer 30	Slime	5593.25	5593.17	5593.09	0.15	2.85	3726.33	3730.39	1.29	1.21	0.006	0.023	1.18	0.002
Layer 31	Sand-Slime	5593.09	5592.54	5591.98	1.11	2.69	3762.92	3795.44	0.99	0.92	0.005	0.020	0.90	0.011
Layer 32	Slime	5591.98	5591.75	5591.51	0.47	1.58	3807.87	3820.30	1.29	1.21	0.006	0.023	1.19	0.005
Layer 33	Sand-Slime	5591.51	5590.96	5590.40	1.11	1.11	3852.83	3885.36	0.99	0.92	0.005	0.020	0.90	0.011
													TOTAL:	0.06

Notes:

[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

2E1

FINAL COVER

5630.46	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
4.00	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
2.51	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
1160.95	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION

5610.80	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5610.8	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013).
5595.46	Water surface elevation at t_1 (ft amsl)	
5590.46	Water surface elevation at t_2 (ft amsl)	

2E1

CREEP SETTLEMENT

Soil Layer	Material Type [1]	Elevation at Top of Layer at t_1, $z_{i\text{-}top1}$ (ft amsl)	Elevation at Midpoint of Layer at t_1, $z_{i\text{-}mid1}$ (ft amsl)	Elevation at Bottom of Layer at t_1, $z_{i\text{-}bott1}$ (ft amsl)	Thickness of Layer at t_1, H (ft)	Height above liner (ft)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Void Ratio at t_0, e_0	Void Ratio at t_1, e_1	Secondary Compression Index, C_α	Change in Void Ratio due to 1000 years of Creep, Δe	Final Void Ratio After 1,000 years, e_{final}	Settlement due to 1000 years of Creep, δ_{creep} (ft)
Erosion Protection Layer	Erosion Protection Layer	5629.16	5628.91	5628.66	0.50	38.70	NA	NA	NA	NA	NA	NA	NA	NA
Rooting Zone	Rooting Zone	5628.66	5626.91	5625.16	3.50	38.20	NA	NA	NA	NA	NA	NA	NA	NA
High-Compaction Layer	High-Compaction Layer	5625.16	5623.16	5621.16	4.00	34.70	NA	NA	NA	NA	NA	NA	NA	NA
Platform Fill	Platform Fill	5621.16	5619.91	5618.65	2.51	30.70	NA	NA	NA	NA	NA	NA	NA	NA
Layer 1	Int. Cover	5618.65	5617.21	5615.76	2.89	28.19	NA	NA	NA	NA	NA	NA	NA	NA
Layer 2	Sand	5615.76	5615.45	5615.13	0.63	25.30	NA	NA	NA	NA	NA	NA	NA	NA
Layer 3	Sand-Slime	5615.13	5614.91	5614.68	0.46	24.67	NA	NA	NA	NA	NA	NA	NA	NA
Layer 4	Slime	5614.68	5614.52	5614.37	0.31	24.22	NA	NA	NA	NA	NA	NA	NA	NA
Layer 5	Sand-Slime	5614.37	5614.21	5614.06	0.31	23.91	NA	NA	NA	NA	NA	NA	NA	NA
Layer 6	Sand	5614.06	5613.66	5613.27	0.79	23.60	NA	NA	NA	NA	NA	NA	NA	NA
Layer 7	Sand-Slime	5613.27	5612.88	5612.49	0.78	22.81	NA	NA	NA	NA	NA	NA	NA	NA
Layer 8	Sand	5612.49	5612.33	5612.18	0.31	22.03	NA	NA	NA	NA	NA	NA	NA	NA
Layer 9	Sand-Slime	5612.18	5609.66	5607.14	5.04	21.72	NA	NA	NA	NA	NA	NA	NA	NA
Layer 10	Slime	5607.14	5607.05	5606.97	0.16	16.68	NA	NA	NA	NA	NA	NA	NA	NA
Layer 11	Sand-Slime	5606.97	5606.90	5606.82	0.15	16.51	NA	NA	NA	NA	NA	NA	NA	NA
Layer 12	Slime	5606.82	5606.74	5606.66	0.16	16.36	NA	NA	NA	NA	NA	NA	NA	NA
Layer 13	Sand-Slime	5606.66	5605.95	5605.24	1.41	16.20	NA	NA	NA	NA	NA	NA	NA	NA
Layer 14	Slime	5605.24	5605.16	5605.08	0.16	14.78	NA	NA	NA	NA	NA	NA	NA	NA
Layer 15	Sand-Slime	5605.08	5604.93	5604.77	0.31	14.62	NA	NA	NA	NA	NA	NA	NA	NA
Layer 16	Slime	5604.77	5604.69	5604.61	0.16	14.31	NA	NA	NA	NA	NA	NA	NA	NA
Layer 17	Sand-Slime	5604.61	5601.06	5597.52	7.09	14.15	NA	NA	NA	NA	NA	NA	NA	NA
Layer 18	Slime	5597.52	5597.36	5597.20	0.32	7.06	NA	NA	NA	NA	NA	NA	NA	NA
Layer 19	Sand-Slime	5597.20	5595.63	5594.05	3.15	6.74	3973.89	4089.75	0.99	0.91	0.005	0.020	0.89	0.032
Layer 20	Slime	5594.05	5593.89	5593.73	0.32	3.59	4098.12	4106.49	1.29	1.20	0.006	0.023	1.18	0.003
Layer 21	Sand-Slime	5593.73	5593.58	5593.43	0.31	3.27	4115.54	4124.60	0.99	0.91	0.005	0.020	0.89	0.003
Layer 22	Slime	5593.43	5593.27	5593.11	0.32	2.97	4132.97	4141.34	1.29	1.20	0.006	0.023	1.18	0.003
Layer 23	Sand-Slime	5593.11	5592.47	5591.84	1.27	2.65	4178.67	4216.01	0.99	0.91	0.005	0.020	0.89	0.013
Layer 24	Sand-Slime	5591.84	5591.15	5590.46	1.38	1.38	4256.46	4296.91	0.99	0.91	0.005	0.020	0.89	0.014
													TOTAL:	**0.07**

Notes:
[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

3-1S

FINAL COVER

5620.47	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
0.41	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
887.10	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION

5608.00	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5604.4	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013).
5595.59	Water surface elevation at t_1 (ft amsl)	
5590.59	Water surface elevation at t_2 (ft amsl)	

3-1S

CREEP SETTLEMENT

Soil Layer	Material Type [1]	Elevation at Top of Layer at t_1, $z_{i\text{-}top1}$ (ft amsl)	Elevation at Midpoint of Layer at t_1, $z_{i\text{-}mid1}$ (ft amsl)	Elevation at Bottom of Layer at t_1, $z_{i\text{-}bott1}$ (ft amsl)	Thickness of Layer at t_1, H (ft)	Height above liner (ft)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Void Ratio at t_0, e_0	Void Ratio at t_1, e_1	Secondary Compression Index, C_α	Change in Void Ratio due to 1000 years of Creep, Δe	Final Void Ratio After 1,000 years, e_{final}	Settlement due to 1000 years of Creep, δ_{creep} (ft)
Erosion Protection Layer	Erosion Protection Layer	5619.59	5619.34	5619.09	0.50	29.00	NA	NA	NA	NA	NA	NA	NA	NA
Rooting Zone	Rooting Zone	5619.09	5617.34	5615.59	3.50	28.50	NA	NA	NA	NA	NA	NA	NA	NA
High-Compaction Layer	High-Compaction Layer	5615.59	5613.84	5612.09	3.50	25.00	NA	NA	NA	NA	NA	NA	NA	NA
Platform Fill	Platform Fill	5612.09	5611.89	5611.68	0.41	21.50	NA	NA	NA	NA	NA	NA	NA	NA
Layer 1	Int. Cover	5611.68	5610.23	5608.77	2.91	21.09	NA	NA	NA	NA	NA	NA	NA	NA
Layer 2	Slime	5608.77	5608.08	5607.39	1.38	18.18	NA	NA	NA	NA	NA	NA	NA	NA
Layer 3	Sand-Slime	5607.39	5607.31	5607.23	0.16	16.80	NA	NA	NA	NA	NA	NA	NA	NA
Layer 4	Sand	5607.23	5605.95	5604.68	2.55	16.64	NA	NA	NA	NA	NA	NA	NA	NA
Layer 5	Sand-Slime	5604.68	5604.44	5604.20	0.48	14.09	NA	NA	NA	NA	NA	NA	NA	NA
Layer 6	Sand	5604.20	5603.96	5603.72	0.48	13.61	NA	NA	NA	NA	NA	NA	NA	NA
Layer 7	Sand-Slime	5603.72	5603.32	5602.93	0.79	13.13	NA	NA	NA	NA	NA	NA	NA	NA
Layer 8	Sand	5602.93	5602.69	5602.45	0.48	12.34	NA	NA	NA	NA	NA	NA	NA	NA
Layer 9	Sand-Slime	5602.45	5602.29	5602.13	0.32	11.86	NA	NA	NA	NA	NA	NA	NA	NA
Layer 10	Slime	5602.13	5602.05	5601.97	0.15	11.54	NA	NA	NA	NA	NA	NA	NA	NA
Layer 11	Sand-Slime	5601.97	5600.86	5599.76	2.22	11.38	NA	NA	NA	NA	NA	NA	NA	NA
Layer 12	Sand	5599.76	5599.68	5599.60	0.16	9.17	NA	NA	NA	NA	NA	NA	NA	NA
Layer 13	Sand-Slime	5599.60	5597.70	5595.80	3.80	9.01	NA	NA	NA	NA	NA	NA	NA	NA
Layer 14	Slime	5595.80	5595.73	5595.65	0.15	5.21	NA	NA	NA	NA	NA	NA	NA	NA
Layer 15	Sand-Slime	5595.65	5595.10	5594.54	1.11	5.06	2874.54	2907.07	0.99	0.91	0.005	0.020	0.89	0.011
Layer 16	Sand-Slime	5594.54	5592.57	5590.59	3.95	3.95	3022.76	3138.45	0.99	0.92	0.005	0.020	0.90	0.040
													TOTAL:	**0.05**

Notes:
[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

3-2C

FINAL COVER		
5621.51	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.19	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
1167.12	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION		
5605.30	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5602.7	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013).
5591.64	Water surface elevation at t_1 (ft amsl)	
5586.64	Water surface elevation at t_2 (ft amsl)	

3-2C

CREEP SETTLEMENT

Soil Layer	Material Type [1]	Elevation at Top of Layer at t_1, $z_{i\text{-top1}}$ (ft amsl)	Elevation at Midpoint of Layer at t_1, $z_{i\text{-mid1}}$ (ft amsl)	Elevation at Bottom of Layer at t_1, $z_{i\text{-bott1}}$ (ft amsl)	Thickness of Layer at t_1, H (ft)	Height above liner (ft)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-mid1}}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-bott1}}$ (psf)	Void Ratio at t_0, e_0	Void Ratio at t_1, e_1	Secondary Compression Index, C_α	Change in Void Ratio due to 1000 years of Creep, Δe	Final Void Ratio After 1,000 years, e_{final}	Settlement due to 1000 years of Creep, δ_{creep} (ft)
Erosion Protection Layer	Erosion Protection Layer	5620.32	5620.07	5619.82	0.50	33.68	NA	NA	NA	NA	NA	NA	NA	NA
Rooting Zone	Rooting Zone	5619.82	5618.07	5616.32	3.50	33.18	NA	NA	NA	NA	NA	NA	NA	NA
High-Compaction Layer	High-Compaction Layer	5616.32	5614.57	5612.82	3.50	29.68	NA	NA	NA	NA	NA	NA	NA	NA
Platform Fill	Platform Fill	5612.82	5611.23	5609.63	3.19	26.18	NA	NA	NA	NA	NA	NA	NA	NA
Layer 1	Int. Cover	5609.63	5608.19	5606.76	2.88	22.99	NA	NA	NA	NA	NA	NA	NA	NA
Layer 2	Sand	5606.76	5606.67	5606.59	0.16	20.12	NA	NA	NA	NA	NA	NA	NA	NA
Layer 3	Sand-Slime	5606.59	5606.52	5606.45	0.15	19.95	NA	NA	NA	NA	NA	NA	NA	NA
Layer 4	Slime	5606.45	5605.99	5605.53	0.92	19.81	NA	NA	NA	NA	NA	NA	NA	NA
Layer 5	Sand-Slime	5605.53	5605.14	5604.76	0.77	18.89	NA	NA	NA	NA	NA	NA	NA	NA
Layer 6	Slime	5604.76	5604.60	5604.45	0.31	18.12	NA	NA	NA	NA	NA	NA	NA	NA
Layer 7	Sand-Slime	5604.45	5604.30	5604.15	0.30	17.81	NA	NA	NA	NA	NA	NA	NA	NA
Layer 8	Slime	5604.15	5603.83	5603.52	0.62	17.51	NA	NA	NA	NA	NA	NA	NA	NA
Layer 9	Sand-Slime	5603.52	5600.22	5596.93	6.59	16.88	NA	NA	NA	NA	NA	NA	NA	NA
Layer 10	Slime	5596.93	5596.85	5596.78	0.15	10.29	NA	NA	NA	NA	NA	NA	NA	NA
Layer 11	Sand-Slime	5596.78	5596.54	5596.30	0.48	10.14	NA	NA	NA	NA	NA	NA	NA	NA
Layer 12	Slime	5596.30	5595.83	5595.36	0.94	9.66	NA	NA	NA	NA	NA	NA	NA	NA
Layer 13	Sand-Slime	5595.36	5594.65	5593.94	1.42	8.72	NA	NA	NA	NA	NA	NA	NA	NA
Layer 14	Slime	5593.94	5593.86	5593.79	0.15	7.30	NA	NA	NA	NA	NA	NA	NA	NA
Layer 15	Sand-Slime	5593.79	5593.24	5592.69	1.10	7.15	NA	NA	NA	NA	NA	NA	NA	NA
Layer 16	Slime	5592.69	5592.53	5592.37	0.32	6.05	NA	NA	NA	NA	NA	NA	NA	NA
Layer 17	Sand-Slime	5592.37	5591.98	5591.59	0.79	5.73	NA	NA	NA	NA	NA	NA	NA	NA
Layer 18	Slime	5591.59	5591.43	5591.27	0.32	4.95	3371.80	3380.17	1.29	1.19	0.006	0.023	1.17	0.003
Layer 19	Sand-Slime	5591.27	5591.03	5590.80	0.47	4.63	3394.03	3407.89	0.99	0.90	0.005	0.020	0.88	0.005
Layer 20	Slime	5590.80	5590.72	5590.65	0.15	4.16	3411.95	3416.00	1.29	1.19	0.006	0.023	1.17	0.002
Layer 21	Sand-Slime	5590.65	5590.49	5590.33	0.32	4.01	3425.34	3434.67	0.99	0.90	0.005	0.020	0.88	0.003
Layer 22	Sand-Slime	5590.33	5588.49	5586.64	3.69	3.69	3543.29	3651.91	0.99	0.91	0.005	0.020	0.89	0.038
													TOTAL:	**0.05**

Notes:
[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

3-3S

FINAL COVER

5620.49	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.36	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
1184.24	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION

5605.60	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5601.5	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013).
5582.14	Water surface elevation at t_1 (ft amsl)	
5577.14	Water surface elevation at t_2 (ft amsl)	

3-3S

CREEP SETTLEMENT

Soil Layer	Material Type [1]	Elevation at Top of Layer at t_1, $z_{i\text{-top1}}$ (ft amsl)	Elevation at Midpoint of Layer at t_1, $z_{i\text{-mid1}}$ (ft amsl)	Elevation at Bottom of Layer at t_1, $z_{i\text{-bott1}}$ (ft amsl)	Thickness of Layer at t_1, H (ft)	Height above liner (ft)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-mid1}}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-bott1}}$ (psf)	Void Ratio at t_0, e_0	Void Ratio at t_1, e_1	Secondary Compression Index, C_α	Change in Void Ratio due to 1000 years of Creep, Δe	Final Void Ratio After 1,000 years, e_{final}	Settlement due to 1000 years of Creep, δ_{creep} (ft)
Erosion Protection Layer	Erosion Protection Layer	5619.02	5618.77	5618.52	0.50	41.88	NA	NA	NA	NA	NA	NA	NA	NA
Rooting Zone	Rooting Zone	5618.52	5616.77	5615.02	3.50	41.38	NA	NA	NA	NA	NA	NA	NA	NA
High-Compaction Layer	High-Compaction Layer	5615.02	5613.27	5611.52	3.50	37.88	NA	NA	NA	NA	NA	NA	NA	NA
Platform Fill	Platform Fill	5611.52	5609.84	5608.16	3.36	34.38	NA	NA	NA	NA	NA	NA	NA	NA
Layer 1	Int. Cover	5608.16	5606.72	5605.29	2.88	31.02	NA	NA	NA	NA	NA	NA	NA	NA
Layer 2	Sand	5605.29	5604.89	5604.50	0.78	28.15	NA	NA	NA	NA	NA	NA	NA	NA
Layer 3	Sand-Slime	5604.50	5604.27	5604.04	0.47	27.36	NA	NA	NA	NA	NA	NA	NA	NA
Layer 4	Sand	5604.04	5603.33	5602.62	1.42	26.90	NA	NA	NA	NA	NA	NA	NA	NA
Layer 5	Sand-Slime	5602.62	5601.44	5600.27	2.34	25.48	NA	NA	NA	NA	NA	NA	NA	NA
Layer 6	Slime	5600.27	5600.12	5599.96	0.32	23.13	NA	NA	NA	NA	NA	NA	NA	NA
Layer 7	Sand-Slime	5599.96	5599.88	5599.80	0.15	22.82	NA	NA	NA	NA	NA	NA	NA	NA
Layer 8	Slime	5599.80	5599.65	5599.49	0.32	22.66	NA	NA	NA	NA	NA	NA	NA	NA
Layer 9	Sand-Slime	5599.49	5598.62	5597.76	1.73	22.35	NA	NA	NA	NA	NA	NA	NA	NA
Layer 10	Slime	5597.76	5597.36	5596.97	0.78	20.62	NA	NA	NA	NA	NA	NA	NA	NA
Layer 11	Sand-Slime	5596.97	5596.74	5596.50	0.47	19.83	NA	NA	NA	NA	NA	NA	NA	NA
Layer 12	Slime	5596.50	5596.43	5596.35	0.15	19.36	NA	NA	NA	NA	NA	NA	NA	NA
Layer 13	Sand-Slime	5596.35	5595.57	5594.78	1.57	19.21	NA	NA	NA	NA	NA	NA	NA	NA
Layer 14	Slime	5594.78	5594.70	5594.62	0.16	17.64	NA	NA	NA	NA	NA	NA	NA	NA
Layer 15	Sand-Slime	5594.62	5594.46	5594.30	0.32	17.48	NA	NA	NA	NA	NA	NA	NA	NA
Layer 16	Slime	5594.30	5593.99	5593.68	0.62	17.16	NA	NA	NA	NA	NA	NA	NA	NA
Layer 17	Sand-Slime	5593.68	5593.21	5592.73	0.95	16.54	NA	NA	NA	NA	NA	NA	NA	NA
Layer 18	Slime	5592.73	5592.42	5592.11	0.62	15.59	NA	NA	NA	NA	NA	NA	NA	NA
Layer 19	Sand-Slime	5592.11	5591.56	5591.01	1.10	14.97	NA	NA	NA	NA	NA	NA	NA	NA
Layer 20	Slime	5591.01	5590.93	5590.86	0.15	13.87	NA	NA	NA	NA	NA	NA	NA	NA
Layer 21	Sand-Slime	5590.86	5590.38	5589.91	0.95	13.72	NA	NA	NA	NA	NA	NA	NA	NA
Layer 22	Slime	5589.91	5589.83	5589.75	0.15	12.77	NA	NA	NA	NA	NA	NA	NA	NA
Layer 23	Sand-Slime	5589.75	5589.20	5588.65	1.10	12.61	NA	NA	NA	NA	NA	NA	NA	NA
Layer 24	Sand	5588.65	5588.49	5588.33	0.32	11.51	NA	NA	NA	NA	NA	NA	NA	NA
Layer 25	Sand-Slime	5588.33	5587.15	5585.97	2.36	11.19	NA	NA	NA	NA	NA	NA	NA	NA
Layer 26	Sand	5585.97	5585.73	5585.49	0.48	8.83	NA	NA	NA	NA	NA	NA	NA	NA
Layer 27	Sand-Slime	5585.49	5581.32	5577.14	8.35	8.35	4428.47	4674.84	0.99	0.90	0.005	0.020	0.88	0.086
													TOTAL:	**0.09**

Notes:

[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

3-4N

FINAL COVER

5623.36	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
7.16	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
1567.00	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION

5606.00	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5600.6	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013).
5583.71	Water surface elevation at t_1 (ft amsl)	
5578.71	Water surface elevation at t_2 (ft amsl)	

3-4N

CREEP SETTLEMENT

Soil Layer	Material Type [1]	Elevation at Top of Layer at t_1, $z_{i\text{-}top1}$ (ft amsl)	Elevation at Midpoint of Layer at t_1, $z_{i\text{-}mid1}$ (ft amsl)	Elevation at Bottom of Layer at t_1, $z_{i\text{-}bott1}$ (ft amsl)	Thickness of Layer at t_1, H (ft)	Height above liner (ft)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Void Ratio at t_0, e_0	Void Ratio at t_1, e_1	Secondary Compression Index, C_α	Change in Void Ratio due to 1000 years of Creep, Δe	Final Void Ratio After 1,000 years, e_{final}	Settlement due to 1000 years of Creep, δ_{creep} (ft)
Erosion Protection Layer	Erosion Protection Layer	5621.80	5621.55	5621.30	0.50	43.09	NA	NA	NA	NA	NA	NA	NA	NA
Rooting Zone	Rooting Zone	5621.30	5619.55	5617.80	3.50	42.59	NA	NA	NA	NA	NA	NA	NA	NA
High-Compaction Layer	High-Compaction Layer	5617.80	5616.05	5614.30	3.50	39.09	NA	NA	NA	NA	NA	NA	NA	NA
Platform Fill	Platform Fill	5614.30	5610.72	5607.14	7.16	35.59	NA	NA	NA	NA	NA	NA	NA	NA
Layer 1	Int. Cover	5607.14	5605.71	5604.29	2.86	28.43	NA	NA	NA	NA	NA	NA	NA	NA
Layer 2	Sand	5604.29	5603.35	5602.41	1.88	25.58	NA	NA	NA	NA	NA	NA	NA	NA
Layer 3	Sand-Slime	5602.41	5600.24	5598.07	4.33	23.70	NA	NA	NA	NA	NA	NA	NA	NA
Layer 4	Slime	5598.07	5597.29	5596.52	1.56	19.36	NA	NA	NA	NA	NA	NA	NA	NA
Layer 5	Sand-Slime	5596.52	5596.36	5596.20	0.31	17.81	NA	NA	NA	NA	NA	NA	NA	NA
Layer 6	Sand	5596.20	5595.88	5595.56	0.64	17.49	NA	NA	NA	NA	NA	NA	NA	NA
Layer 7	Slime	5595.56	5595.49	5595.41	0.15	16.85	NA	NA	NA	NA	NA	NA	NA	NA
Layer 8	Sand-Slime	5595.41	5595.25	5595.10	0.31	16.70	NA	NA	NA	NA	NA	NA	NA	NA
Layer 9	Sand	5595.10	5595.02	5594.94	0.16	16.39	NA	NA	NA	NA	NA	NA	NA	NA
Layer 10	Slime	5594.94	5594.86	5594.78	0.16	16.23	NA	NA	NA	NA	NA	NA	NA	NA
Layer 11	Sand-Slime	5594.78	5594.70	5594.63	0.15	16.07	NA	NA	NA	NA	NA	NA	NA	NA
Layer 12	Slime	5594.63	5594.24	5593.85	0.78	15.92	NA	NA	NA	NA	NA	NA	NA	NA
Layer 13	Sand-Slime	5593.85	5593.69	5593.53	0.31	15.14	NA	NA	NA	NA	NA	NA	NA	NA
Layer 14	Slime	5593.53	5593.38	5593.22	0.31	14.82	NA	NA	NA	NA	NA	NA	NA	NA
Layer 15	Sand-Slime	5593.22	5590.18	5587.14	6.08	14.51	NA	NA	NA	NA	NA	NA	NA	NA
Layer 16	Sand-Slime	5587.14	5582.92	5578.71	8.43	8.43	4510.59	4760.35	0.99	0.89	0.005	0.020	0.88	0.087
													TOTAL:	**0.09**

Notes:
[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

3-6N

FINAL COVER

5623.62	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
8.68	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
1720.10	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION

5604.20	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5599.3	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013).
5590.44	Water surface elevation at t_1 (ft amsl)	
5585.44	Water surface elevation at t_2 (ft amsl)	

3-6N

CREEP SETTLEMENT

Soil Layer	Material Type [1]	Elevation at Top of Layer at t_1, z_{i-top1} (ft amsl)	Elevation at Midpoint of Layer at t_1, z_{i-mid1} (ft amsl)	Elevation at Bottom of Layer at t_1, $z_{i-bott1}$ (ft amsl)	Thickness of Layer at t_1, H (ft)	Height above liner (ft)	Effective Stress at Midpoint of Layer at t_1, σ'_{i-mid1} (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i-bott1}$ (psf)	Void Ratio at t_0, e_0	Void Ratio at t_1, e_1	Secondary Compression Index, C_α	Change in Void Ratio due to 1000 years of Creep, Δe	Final Void Ratio After 1,000 years, e_{final}	Settlement due to 1000 years of Creep, δ_{creep} (ft)
Erosion Protection Layer	Erosion Protection Layer	5622.28	5622.03	5621.78	0.50	36.84	NA	NA	NA	NA	NA	NA	NA	NA
Rooting Zone	Rooting Zone	5621.78	5620.03	5618.28	3.50	36.34	NA	NA	NA	NA	NA	NA	NA	NA
High-Compaction Layer	High-Compaction Layer	5618.28	5616.53	5614.78	3.50	32.84	NA	NA	NA	NA	NA	NA	NA	NA
Platform Fill	Platform Fill	5614.78	5610.44	5606.10	8.68	29.34	NA	NA	NA	NA	NA	NA	NA	NA
Layer 1	Int. Cover	5606.10	5604.67	5603.25	2.85	20.66	NA	NA	NA	NA	NA	NA	NA	NA
Layer 2	Sand-Slime	5603.25	5603.18	5603.11	0.14	17.81	NA	NA	NA	NA	NA	NA	NA	NA
Layer 3	Sand	5603.11	5602.95	5602.79	0.31	17.67	NA	NA	NA	NA	NA	NA	NA	NA
Layer 4	Sand-Slime	5602.79	5602.64	5602.49	0.30	17.35	NA	NA	NA	NA	NA	NA	NA	NA
Layer 5	Slime	5602.49	5602.19	5601.90	0.60	17.05	NA	NA	NA	NA	NA	NA	NA	NA
Layer 6	Sand-Slime	5601.90	5601.52	5601.14	0.76	16.46	NA	NA	NA	NA	NA	NA	NA	NA
Layer 7	Slime	5601.14	5600.91	5600.67	0.46	15.70	NA	NA	NA	NA	NA	NA	NA	NA
Layer 8	Sand-Slime	5600.67	5600.45	5600.22	0.46	15.23	NA	NA	NA	NA	NA	NA	NA	NA
Layer 9	Sand	5600.22	5600.14	5600.06	0.15	14.78	NA	NA	NA	NA	NA	NA	NA	NA
Layer 10	Sand-Slime	5600.06	5599.91	5599.75	0.31	14.62	NA	NA	NA	NA	NA	NA	NA	NA
Layer 11	Slime	5599.75	5599.60	5599.44	0.31	14.31	NA	NA	NA	NA	NA	NA	NA	NA
Layer 12	Sand-Slime	5599.44	5599.29	5599.13	0.31	14.00	NA	NA	NA	NA	NA	NA	NA	NA
Layer 13	Slime	5599.13	5598.75	5598.36	0.77	13.69	NA	NA	NA	NA	NA	NA	NA	NA
Layer 14	Sand-Slime	5598.36	5598.20	5598.05	0.31	12.92	NA	NA	NA	NA	NA	NA	NA	NA
Layer 15	Slime	5598.05	5597.43	5596.81	1.24	12.61	NA	NA	NA	NA	NA	NA	NA	NA
Layer 16	Sand-Slime	5596.81	5596.66	5596.50	0.31	11.37	NA	NA	NA	NA	NA	NA	NA	NA
Layer 17	Slime	5596.50	5594.02	5591.54	4.96	11.06	NA	NA	NA	NA	NA	NA	NA	NA
Layer 18	Sand-Slime	5591.54	5590.61	5589.67	1.87	6.10	3584.42	3667.28	0.99	0.88	0.005	0.020	0.86	0.019
Layer 19	Slime	5589.67	5589.21	5588.74	0.94	4.23	3692.39	3717.50	1.29	1.17	0.006	0.023	1.15	0.010
Layer 20	Sand-Slime	5588.74	5587.09	5585.44	3.30	3.30	3815.37	3913.24	0.99	0.89	0.005	0.020	0.87	0.034
													TOTAL:	**0.06**

Notes:

[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

3-8N

FINAL COVER

5623.82	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
7.95	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
1646.57	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION

5604.90	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5600.3	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013).
5595.24	Water surface elevation at t_1 (ft amsl)	
5590.24	Water surface elevation at t_2 (ft amsl)	

3-8N

CREEP SETTLEMENT

Soil Layer	Material Type [1]	Elevation at Top of Layer at t_1, $z_{i\text{-}top1}$ (ft amsl)	Elevation at Midpoint of Layer at t_1, $z_{i\text{-}mid1}$ (ft amsl)	Elevation at Bottom of Layer at t_1, $z_{i\text{-}bott1}$ (ft amsl)	Thickness of Layer at t_1, H (ft)	Height above liner (ft)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Void Ratio at t_0, e_0	Void Ratio at t_1, e_1	Secondary Compression Index, C_α	Change in Void Ratio due to 1000 years of Creep, Δe	Final Void Ratio After 1,000 years, e_{final}	Settlement due to 1000 years of Creep, δ_{creep} (ft)
Erosion Protection Layer	Erosion Protection Layer	5622.79	5622.54	5622.29	0.50	32.55	NA	NA	NA	NA	NA	NA	NA	NA
Rooting Zone	Rooting Zone	5622.29	5620.54	5618.79	3.50	32.05	NA	NA	NA	NA	NA	NA	NA	NA
High-Compaction Layer	High-Compaction Layer	5618.79	5617.04	5615.29	3.50	28.55	NA	NA	NA	NA	NA	NA	NA	NA
Platform Fill	Platform Fill	5615.29	5611.31	5607.34	7.95	25.05	NA	NA	NA	NA	NA	NA	NA	NA
Layer 1	Int. Cover	5607.34	5605.91	5604.48	2.85	17.10	NA	NA	NA	NA	NA	NA	NA	NA
Layer 2	Slime	5604.48	5604.41	5604.34	0.14	14.24	NA	NA	NA	NA	NA	NA	NA	NA
Layer 3	Sand	5604.34	5604.26	5604.18	0.16	14.10	NA	NA	NA	NA	NA	NA	NA	NA
Layer 4	Sand-Slime	5604.18	5603.88	5603.58	0.59	13.94	NA	NA	NA	NA	NA	NA	NA	NA
Layer 5	Sand	5603.58	5603.43	5603.27	0.31	13.34	NA	NA	NA	NA	NA	NA	NA	NA
Layer 6	Sand-Slime	5603.27	5603.12	5602.97	0.30	13.03	NA	NA	NA	NA	NA	NA	NA	NA
Layer 7	Sand	5602.97	5601.94	5600.92	2.05	12.73	NA	NA	NA	NA	NA	NA	NA	NA
Layer 8	Sand-Slime	5600.92	5598.04	5595.17	5.75	10.68	NA	NA	NA	NA	NA	NA	NA	NA
Layer 9	Slime	5595.17	5595.09	5595.00	0.16	4.93	3152.03	3151.04	1.29	1.17	0.006	0.023	1.15	0.002
Layer 10	Sand-Slime	5595.00	5593.99	5592.98	2.03	4.76	3211.29	3271.54	0.99	0.89	0.005	0.020	0.87	0.021
Layer 11	Sand-Slime	5592.98	5591.61	5590.24	2.74	2.74	3352.72	3433.90	0.99	0.89	0.005	0.020	0.88	0.028
													TOTAL:	0.05

Notes:
[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

3-8S

FINAL COVER		
5620.45	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover deisgn grading plan AutoCAD file
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of Water Storage/Rooting Zone (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
3.50	Thickness of High Compaction Layer (ft)	From Appendix C - Radon Emanation Modeling (MWH, 2015)
4.25	Thickness of Random/Platform Fill on on top of existing interim cover (ft)	Calculated
1273.89	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)	Calculated

PROFILE INFORMATION		
5603.50	Water surface elevation during CPT investigation (ft amsl)	From on-site investigation (Tailings Data Analysis Report. MWH, 2015)
5600.6	Water surface elevation at t_0 (ft amsl)	Minimum of 5' below top of tailings or water surface elevation at time of CPT testing (2013).
5590.63	Water surface elevation at t_1 (ft amsl)	
5585.63	Water surface elevation at t_2 (ft amsl)	

3-8S

CREEP SETTLEMENT

Soil Layer	Material Type [1]	Elevation at Top of Layer at t_1, $z_{i\text{-top1}}$ (ft amsl)	Elevation at Midpoint of Layer at t_1, $z_{i\text{-mid1}}$ (ft amsl)	Elevation at Bottom of Layer at t_1, $z_{i\text{-bott1}}$ (ft amsl)	Thickness of Layer at t_1, H (ft)	Height above liner (ft)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-mid1}}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-bott1}}$ (psf)	Void Ratio at t_0, e_0	Void Ratio at t_1, e_1	Secondary Compression Index, C_α	Change in Void Ratio due to 1000 years of Creep, Δe	Final Void Ratio After 1,000 years, e_{final}	Settlement due to 1000 years of Creep, δ_{creep} (ft)
Erosion Protection Layer	Erosion Protection Layer	5619.39	5619.14	5618.89	0.50	33.76	NA	NA	NA	NA	NA	NA	NA	NA
Rooting Zone	Rooting Zone	5618.89	5617.14	5615.39	3.50	33.26	NA	NA	NA	NA	NA	NA	NA	NA
High-Compaction Layer	High-Compaction Layer	5615.39	5613.64	5611.89	3.50	29.76	NA	NA	NA	NA	NA	NA	NA	NA
Platform Fill	Platform Fill	5611.89	5609.76	5607.64	4.25	26.26	NA	NA	NA	NA	NA	NA	NA	NA
Layer 1	Int. Cover	5607.64	5606.20	5604.77	2.87	22.01	NA	NA	NA	NA	NA	NA	NA	NA
Layer 2	Sand	5604.77	5604.22	5603.67	1.10	19.14	NA	NA	NA	NA	NA	NA	NA	NA
Layer 3	Sand-Slime	5603.67	5603.52	5603.36	0.31	18.04	NA	NA	NA	NA	NA	NA	NA	NA
Layer 4	Sand	5603.36	5603.29	5603.21	0.15	17.73	NA	NA	NA	NA	NA	NA	NA	NA
Layer 5	Sand-Slime	5603.21	5602.82	5602.44	0.77	17.58	NA	NA	NA	NA	NA	NA	NA	NA
Layer 6	Sand	5602.44	5600.69	5598.93	3.51	16.81	NA	NA	NA	NA	NA	NA	NA	NA
Layer 7	Sand-Slime	5598.93	5598.77	5598.62	0.32	13.30	NA	NA	NA	NA	NA	NA	NA	NA
Layer 8	Sand	5598.62	5598.45	5598.29	0.32	12.99	NA	NA	NA	NA	NA	NA	NA	NA
Layer 9	Sand-Slime	5598.29	5596.41	5594.53	3.77	12.66	NA	NA	NA	NA	NA	NA	NA	NA
Layer 10	Slime	5594.53	5594.45	5594.37	0.15	8.90	NA	NA	NA	NA	NA	NA	NA	NA
Layer 11	Sand-Slime	5594.37	5594.22	5594.06	0.32	8.74	NA	NA	NA	NA	NA	NA	NA	NA
Layer 12	Slime	5594.06	5593.75	5593.44	0.62	8.43	NA	NA	NA	NA	NA	NA	NA	NA
Layer 13	Sand-Slime	5593.44	5593.28	5593.12	0.32	7.81	NA	NA	NA	NA	NA	NA	NA	NA
Layer 14	Sand-Slime	5593.12	5589.38	5585.63	7.49	7.49	3447.52	3668.72	0.99	0.90	0.005	0.020	0.88	0.077
													TOTAL:	**0.08**

Notes:
[1] From on-site investigation (Tailings Data Analysis Report. MWH, 2015)

ATTACHMENT F.3

SEISMIC SETTLEMENT CALCULATIONS

Notes

t_0 corresponds to beginning of final cover placement — Assumes 99% of consolidation due to existing stress conditions has taken place

t_1 corresponds to dewatering of the tailings to a level 5 feet above the liner

t_2 corresponds to completion of dewatering

SOIL PROPERTIES

TAILINGS

Specific Gravity, G_s		
2.70	Specific gravity of tailing sands, $G_{s\text{-TSand}}$	Based on testing performed on other uranium tailings and presented in Keshian and Rager (1988)
2.80	Specific gravity of tailing sand-slimes, $G_{s\text{-TS-S}}$	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015b)
2.86	Specific gravity of tailing slimes, $G_{s\text{-TSlime}}$	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015b)
Fines Content		
18%	Fines content of tailings sands (%)	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015b)
47%	Fines content of tailings sand-slimes (%)	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015b)
71%	Fines content of tailings slimes (%)	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015b)
Dry Unit Weight, γ_d		
97	In-situ dry unit weight of tailings sands at t_0, $\gamma_{d0\text{-Tsand}}$ (pcf)	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015b)
88	In-situ dry unit weight of tailings sand-slimes at t_0, $\gamma_{d0\text{-TS-S}}$ (pcf)	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015b)
78	In-situ dry unit weight of tailings slimes at t_0, $\gamma_{d0\text{-Tslime}}$ (pcf)	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015b)
Saturated Unit Weight, γ_{sat}		
123	In-situ saturated unit weight of tailings sands at t_0, $\gamma_{sat0\text{-Tsand}}$ (pcf)	Calculated
119	In-situ saturated unit weight of tailings sand-slimes at t_0, $\gamma_{sat0\text{-TS-S}}$ (pcf)	Calculated
113	In-situ saturated unit weight of tailings slimes at t_0, $\gamma_{sat0\text{-Tslime}}$ (pcf)	Calculated
Moist Unit Weight, γ_m		
103	Moist unit weight of tailings sands, $\gamma_{m\text{-Tsand}}$ (pcf)	Calculated, assuming long-term water content from laboratory testing (Tailings Data Analysis Report. MWH, 2015b)
93	Moist unit weight of tailings sand-slimes, $\gamma_{m\text{-TS-S}}$ (pcf)	Calculated, assuming long-term water content from laboratory testing (Tailings Data Analysis Report. MWH, 2015b)
83	Moist unit weight of tailings slimes, $\gamma_{m\text{-Tslime}}$ (pcf)	Calculated, assuming long-term water content from laboratory testing (Tailings Data Analysis Report. MWH, 2015b)
Void Ratio, e		
0.74	Void ratio of tailing sands at t_0, $e_{0\text{-TSand}}$	Calculated
0.99	Void ratio of tailing sand-slimes at t_0, $e_{0\text{-TS-S}}$	Calculated
1.29	Void ratio of tailing slimes at t_0, $e_{0\text{-TSlime}}$	Calculated
Saturated Water Content, w_{Sat}		
27%	Saturated water content of tailings sands at t_0, $w_{sat0\text{-TSand}}$ (%)	Calculated
35%	Saturated water content of tailings sand-slimes at t_0, $w_{sat0\text{-TS-S}}$ (%)	Calculated
45%	Saturated water content of tailings slimes at t_0, $w_{sat0\text{-TSlime}}$ (%)	Calculated
Water Content of Moist Tailings, $w_{m\text{-T}}$		
6%	Water content of moist tailings sands, $w_{m\text{-TSand}}$ (%)	From Attachment H - Radon Emanation Modeling including with this submittal
6%	Water content of moist tailings sand-slimes, $w_{m\text{-TS-S}}$ (%)	From Attachment H - Radon Emanation Modeling including with this submittal
6%	Water content of moist tailings slimes, $w_{m\text{-TSlime}}$ (%)	From Attachment H - Radon Emanation Modeling including with this submittal
Plasticity Index, PI		
0	Plasticity index of tailings sands, PI_{TSand}	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015b)
10	Plasticity index of tailings sand-slimes, $PI_{TS\text{-}S}$	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015b)
16	Plasticity index of tailings slimes, PI_{TSlime}	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015b)
Seismic Settlement Coefficients		
2.2	Coefficient "a" of Unsaturated Sand Tailings	From Stewart, et al (2004), page 86, Figure 6.5
5.0	Coefficient "a" of Saturated Sand Tailings	From Stewart, et al (2004), page 86, Figure 6.5
2.0	Coefficient "a" of Sand-Slime Tailings	From Stewart, et al (2004), page 89, Figure 6.7
2.0	Coefficient "a" of Slime Tailings	From Stewart, et al (2004), page 89, Figure 6.7
1.00	Coefficient "b" of Sand Tailings	From Stewart, et al (2004), page 86, Figure 6.5
0.65	Coefficient "b" of Sand-Slime Tailings	From Stewart, et al (2004), page 89, Figure 6.7
0.65	Coefficient "b" of Slime Tailings	From Stewart, et al (2004), page 89, Figure 6.7
0.01%	Strain threshold value of Sand Tailings, γtv	From Stewart, et al (2004), page 86, Figure 6.5
0.03%	Strain threshold value of Sand-Slime Tailings, γtv	From Stewart, et al (2004), page 89, Figure 6.7
0.03%	Strain threshold value of Slime Tailings, γtv	From Stewart, et al (2004), page 89, Figure 6.7
0.36	Coefficient "R" of Sand Tailings	From Stewart, et al (2004), page 86, for soils with non-plastic fines
0.34	Coefficient "R" of Sand-Slime Tailings	From Stewart, et al (2004), page 89, for soils with medium plasticity fines
0.34	Coefficient "R" of Slime Tailings	From Stewart, et al (2004), page 89, for soils with medium plasticity fines

Other		
5.0	Height of water table above liner at t_1, H_{sat-1} (ft)	Assumed for end of active maintenance
0.0	Height of water table above liner at t_2, H_{sat-2} (ft)	
6.0%	Long-term moisture content of tailings, $w_{tailings}$ (%)	From Attachment H - Radon Emanation Modeling including with this submittal
508	Shear Wave Velocity of Tailings, V_s (ft/sec)	Conservatively assumed to be the average of the shear wave velocities measured in Cell 2 tailings
COVER SOIL		
Specific Gravity, G_s		
2.61	Specific gravity of topsoil, $G_{s-Topsoil}$	From Attachment H - Radon Emanation Modeling including with this submittal
2.62	Specific gravity of rock mulch, $G_{s-mulch}$	From Attachment H - Radon Emanation Modeling including with this submittal
2.63	Specific gravity of cover soil, $G_{s-cover}$	From Attachment H - Radon Emanation Modeling including with this submittal
Unit Weight, γ		
118.0	Maximum dry unit weight of cover soil $\gamma_{cover-max}$ (pcf)	Average calculated from laboratory testing results (UWM, 2012)
100.7	Moist unit weight of cover soil at 80% relative compaction, $\gamma_{cover80}$ (pcf)	Calculated
107.0	Moist unit weight of cover soil at 85% relative compaction, $\gamma_{cover85}$ (pcf)	Calculated
119.6	Moist unit weight of cover soil at 95% relative compaction, $\gamma_{cover95}$ (pcf)	Calculated
100	Dry unit weight of topsoil layer at 85% relative compaction, $\gamma_{topsoil5}$ (pcf)	From Attachment H - Radon Emanation Modeling including with this submittal
105	Moist unit weight of topsoil layer at 85% relative compaction, $\gamma_{topsoil5}$ (pcf)	Calculated
106	Dry unit weight of rock mulch layer at 85% relative compaction, $\gamma_{mulch85}$ (pcf)	Calculated
110	Moist unit weight of rock mulch layer at 85% relative compaction, $\gamma_{mulch85}$ (pcf)	From Attachment H - Radon Emanation Modeling including with this submittal
Void Ratio, e		
0.74	Void Ratio of cover soil at 80% relative compaction, $e_{cover80}$	Calculated
0.64	Void Ratio of cover soil at 85% relative compaction, $e_{cover85}$	Calculated
0.46	Void Ratio of cover soil at 95% relative compaction, $e_{cover95}$	Calculated
0.61	Void Ratio of topsoil at 85% relative compaction, $e_{topsoil85}$	Calculated from porosity presented in Attachment H - Radon Emanation Modeling including with this submittal
0.54	Void Ratio of rock mulch at 85% relative compaction, $e_{mulch85}$	Calculated from porosity presented in Attachment H - Radon Emanation Modeling including with this submittal
Seismic Settlement Coefficients		
1.2	Coefficient "a" of Erosion Protection/Topsoil Cover	From Stewart, et al (2004), page 88, Figure 6.6
2.0	Coefficient "a" of General Cover Soil	From Stewart, et al (2004), page 89, Figure 6.7
0.65	Coefficient "a" of High-Compaction Layer	From Stewart, et al (2004), page 89, Figure 6.7
0.80	Coefficient "b" of Erosion Protection/Topsoil Cover	From Stewart, et al (2004), page 88, Figure 6.6
0.65	Coefficient "b" of General Cover Soil	From Stewart, et al (2004), page 89, Figure 6.7
0.75	Coefficient "b" of High-Compaction Layer	From Stewart, et al (2004), page 89, Figure 6.7
0.04%	Strain threshold value of Erosion Protection/Topsoil Cover, γtv	From Stewart, et al (2004), page 88, Figure 6.6
0.03%	Strain threshold value of General Cover Soil, γtv	From Stewart, et al (2004), page 89, Figure 6.7
0.02%	Strain threshold value of High-Compaction Layer, γtv	From Stewart, et al (2004), page 89, Figure 6.7
0.32	Coefficient "R" of Erosion Protection/Topsoil Cover	From Stewart, et al (2004), page 88, for soils with low plasticity fines
0.34	Coefficient "R" of General Cover Soil	From Stewart, et al (2004), page 89, for soils with medium plasticity fines
0.34	Coefficient "R" of High-Compaction Layer	From Stewart, et al (2004), page 89, for soils with medium plasticity fines
Other		
6.7%	Long-term moisture content of cover soil, w_{cover} (%)	Estimated based on measured 15bar water content. (UWM, 2012)
5.2%	Long-term moisture content of topsoil, $w_{topsoil}$ (%)	From Attachment H - Radon Emanation Modeling including with this submittal
4.0%	Long-term moisture content of rock mulch, $w_{rockmulch}$ (%)	From Attachment H - Radon Emanation Modeling including with this submittal
0.14	Compression index of cover soil, $C_{c-cover}$	Calculated from empirical equation presented in Holtz and Kovacs, 1981. Page 341. $C_c = 0.30*(e_0-0.27)$
51%	Fines content of cover soil (%)	Mean value from laboratory analyses presented in previous response to interrogatories (EFRI, 2012)
11	Plasticity Index of cover soil, PI	Weighted Average from 2010 and 2012 laboratory testing (laboratory results presented in EFRI, 2012)
508	Shear Wave Velocity of Cover Soil, V_s (ft/sec)	Conservatively assumed to be the average of the shear wave velocities measured in Cell 2 tailings
SEISMIC PARAMETERS		
0.15	Maximum horizontal acceleration at the ground surface, a_{max}/g	From Probabilistic Seismic Hazard Analysis (MWH, 2015a)
5.5	Magnitude of Design Event, M	From Probabilistic Seismic Hazard Analysis (MWH, 2015a)
20	Site-Source Distance, r (km)	From Probabilistic Seismic Hazard Analysis (MWH, 2015a)
1.00	Stress reduction factor, r_d	Conservatively assumed.
7.51	Equiv. Number of Uniform Strain Cycles, N	Calculated from Stewart, et al (2004), Equation 6.11, page 79, S parameter =0 since shallow soil and rock underlie the tailings (<20m) below tailings
594	Average shear wave velocity for cover, Vs (ft/s)	Conservatively estimated as upper bound average Vs for tailings in Cell 2 in October 2013 (Tailings Data Analysis Report. MWH, 2015b)
495	Average shear wave velocity for tailings (3' - 9.4'), Vs (ft/s)	Conservatively estimated as average Vs over depth range for tailings in Cell 2 in October 2013 (Tailings Data Analysis Report. MWH, 2015b)
460	Average shear wave velocity for tailings (9.4' - 14.4'), Vs (ft/s)	Conservatively estimated as average Vs over depth range for tailings in Cell 2 in October 2013 (Tailings Data Analysis Report. MWH, 2015b)
500	Average shear wave velocity for tailings (14.4' - 19.6'), Vs (ft/s)	Conservatively estimated as average Vs over depth range for tailings in Cell 2 in October 2013 (Tailings Data Analysis Report. MWH, 2015b)
538	Average shear wave velocity for tailings (19.6' - 24.7'), Vs (ft/s)	Conservatively estimated as average Vs over depth range for tailings in Cell 2 in October 2013 (Tailings Data Analysis Report. MWH, 2015b)
594	Average shear wave velocity for tailings (24.7' - liner), Vs (ft/s)	Conservatively estimated as average Vs over depth range for tailings in Cell 2 in October 2013 (Tailings Data Analysis Report. MWH, 2015b)
MISCELLANEOUS PARAMETERS		
62.4	Unit Weight of Water, γ_w	
82.4	Atmospheric Pressure, P_a (kPa)	Calculated assuming elev=5600' amsl. http://www.engineeringtoolbox.com/air-altitude-pressure-d_462.html
1722.0	Atmospheric Pressure, P_a (psf)	Unit conversion calculation

REFERENCES

Energy Fuels Resources (USA) Inc. (EFRI), 2012. Responses to Interrogatories – Round 1 for Reclamation Plan, Revision 5.0, March 2012. August 15.

Holtz, R.D. and Kovacs, W.D., 1981. An Introduction to Geotechnical Engineering. Prentice Hall, Inc. New Jersey

Keshian, B., and Rager, R. 1988. Geotechnical Properties of Hydraulically Placed Uranium Mill Tailings, in Hydraulically Fill Structures, Geotechnical Special Publication No. 21, Eds. Van Zyl, D., and Vick, S., ASCE, August

MWH Americas, Inc. (MWH), 2015a. White Mesa Mill Probabilistic Seismic Hazard Analysis Report. Prepared for Energy Fuels Resources (USA) Inc. April.

MWH Americas, Inc. (MWH), 2015b. White Mesa Mill Tailings Data Analysis Report. Prepared for Energy Fuels Resources (USA) Inc. April.

Stewart, J.P., D. Whang, M.Moyneur, and P.Duku, 2004. Seismic Compression of As-Compacted Fill Soils With Variable Levels of Fines Content and Fines Plasticity. CUREE Publication No.EDA-05. July.

Terzaghi, K., R. Peck, and G. Mesri, 1996. Soil Mechanics in Engineering Practice, Third Edition. John Wiley and Sons, Inc. New York

University of Wisconsin-Madison (UWM), Wisconsin Geotechnics Laboratory, 2012. Compaction and Hydraulic Properties of Soils from Banding, Utah. Geotechnics Report NO. 12-41 by C.H. Benson and X. Wang. July 24.

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W2

Data File: 13-52106_SP2W2-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Dat

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69

Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Parameter
5613.10	Water surface elevation during CPT investigation (ft amsl)
5607.57	Water surface elevation at t_0 (ft amsl)
5598.51	Water surface elevation at t_1 (ft amsl)
5593.51	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earth
7.51	Equiv. Number of Uniform Strain Cycles, N
5615.85	Ground Surface Elevation at time of CPT (ft amsl)
5625.87	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after plac
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
2.02	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1111.60	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5593.51	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)
Erosion Protection Layer	######	5625.62
Water Storage/Rooting Zone Layer	######	5623.62
High Compaction Layer	######	5619.87
Platform/Random Fill Layer	######	5616.86

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
0.164	5615.69	19.0	0.292	19.0	2.8	1.22	1.53%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0	1.70	32.317	449.21	37.57	2302	1.54%	1.4	51%	0.56	0.00	0.56	0
0.328	5615.52	27.6	0.767	27.6	3.0	1.32	2.78%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	46.937	652.42	54.55	1671	2.78%	1.7	51%	0.57	0.00	0.57	0
0.492	5615.36	63.0	1.250	63.0	2.6	1.13	1.98%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	107.100	######	124.42	2542	1.98%	1.5	51%	0.58	0.00	0.58	0
0.656	5615.19	130.6	1.407	130.6	1.2	0.53	1.08%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0	1.70	221.952	######	257.80	3950	1.08%	1.3	51%	0.59	0.00	0.59	0
0.820	5615.03	202.3	0.922	202.3	2.2	0.96	0.46%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0	1.70	343.859	######	399.40	4896	0.46%	0.9	51%	0.60	0.00	0.60	0
0.984	5614.87	189.1	1.391	189.0	4.1	1.77	0.74%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0	1.70	321.351	######	373.28	3813	0.74%	1.1	51%	0.61	0.00	0.61	0
1.148	5614.70	207.8	1.514	207.8	0.1	0.04	0.73%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0	1.70	353.311	######	410.35	3593	0.73%	1.1	51%	0.61	0.00	0.61	0
1.312	5614.54	81.3	1.745	81.3	0.7	0.29	2.15%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	138.142	######	160.45	1229	2.15%	1.6	51%	0.62	0.00	0.62	0
1.476	5614.37	52.5	1.382	52.5	-0.3	-0.14	2.63%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	89.284	######	103.69	705	2.64%	1.8	51%	0.63	0.00	0.63	0
1.640	5614.21	40.7	1.041	40.7	0.1	0.02	2.56%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0	1.70	69.241	962.45	80.42	492	2.56%	1.8	51%	0.64	0.00	0.64	0
1.804	5614.05	34.3	0.916	34.3	-0.7	-0.29	2.67%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0	1.70	58.310	810.51	67.72	376	2.68%	1.9	51%	0.65	0.00	0.65	0
1.968	5613.88	64.5	1.005	64.5	0.8	0.33	1.56%	Interim Cover	0.050	100.7	0.10	0.00	0.10	0	1.70	109.582	######	127.28	649	1.56%	1.6	51%	0.65	0.00	0.65	0
2.133	5613.72	88.7	1.082	88.7	0.0	0.00	1.22%	Interim Cover	0.050	100.7	0.11	0.00	0.11	0	1.70	150.858	######	175.21	825	1.22%	1.4	51%	0.66	0.00	0.66	0
2.297	5613.55	88.1	1.355	88.1	0.0	0.00	1.54%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	149.685	######	173.85	760	1.54%	1.5	51%	0.67	0.00	0.67	0
2.461	5613.39	81.2	1.017	81.2	0.2	0.08	1.25%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	138.091	######	160.39	655	1.25%	1.5	51%	0.68	0.00	0.68	0
2.625	5613.23	71.1	0.910	71.1	0.7	0.32	1.28%	Interim Cover	0.050	100.7	0.13	0.00	0.13	0	1.70	120.887	######	140.41	537	1.28%	1.5	51%	0.69	0.00	0.69	0
2.789	5613.06	61.0	0.753	61.0	-0.9	-0.37	1.24%	Interim Cover	0.050	100.7	0.14	0.00	0.14	1	1.70	103.632	######	120.35	437	1.24%	1.6	51%	0.70	0.00	0.70	0
2.953	5612.90	57.1	0.690	57.1	-0.9	-0.37	1.21%	Interim Cover	0.050	100.7	0.15	0.01	0.14	1	1.70	97.036	######	112.69	400	1.21%	1.6	51%	0.70	0.00	0.70	0
3.117	5612.73	50.5	0.655	50.5	-0.1	-0.05	1.30%	Interim Cover	0.050	100.7	0.16	0.01	0.15	1	1.70	85.782	######	99.63	346	1.30%	1.6	51%	0.71	0.00	0.71	0
3.281	5612.57	52.1	0.800	52.1	-0.1	-0.06	1.53%	Sand-Slime Tailings	0.059	119.0	0.17	0.02	0.15	1	1.70	88.604	######	102.91	346	1.54%	1.7	47%	0.72	0.00	0.72	0
3.445	5612.41	55.0	0.793	55.0	0.1	0.03	1.44%	Sand-Slime Tailings	0.059	119.0	0.18	0.02	0.15	1	1.70	93.449	######	108.54	354	1.45%	1.7	47%	0.73	0.00	0.73	0
3.609	5612.24	40.3	0.780	40.3	-1.0	-0.44	1.93%	Sand-Slime Tailings	0.059	119.0	0.19	0.03	0.16	1	1.70	68.544	952.76	79.60	252	1.94%	1.8	47%	0.74	0.00	0.74	0
3.773	5612.08	31.5	0.543	31.5	0.5	0.23	1.72%	Sand-Slime Tailings	0.059	119.0	0.20	0.03	0.16	1	1.70	53.584	744.82	62.24	191	1.73%	1.9	47%	0.75	0.00	0.75	0
3.937	5611.91	30.6	0.621	30.6	-0.2	-0.08	2.03%	Sand-Slime Tailings	0.059	119.0	0.21	0.04	0.17	1	1.70	52.088	724.02	60.49	180	2.04%	2.0	47%	0.76	0.00	0.76	0
4.101	5611.75	25.9	0.747	25.9	1.3	0.55	2.89%	Sand-Slime Tailings	0.059	119.0	0.22	0.04	0.17	1	1.70	43.962	611.07	51.07	148	2.91%	2.1	47%	0.77	0.00	0.77	0
4.265	5611.58	25.9	0.883	25.9	7.3	3.14	3.41%	Slime Tailings	0.057	113.1	0.22	0.05	0.18	1	1.70	43.979	611.31	51.17	145	3.44%	2.2	71%	0.78	0.00	0.78	0
4.429	5611.42	89.9	1.190	89.6	44.0	19.08	1.32%	Sand Tailings	0.062	123.5	0.23	0.05	0.18	1	1.70	152.354	######	177.49	491	1.33%	1.6	18%	0.79	0.00	0.79	0
4.593	5611.26	84.3	1.536	84.2	21.1	9.16	1.82%	Sand Tailings	0.062	123.5	0.25	0.06	0.19	1	1.70	143.140	######	166.51	448	1.83%	1.7	18%	0.80	0.00	0.80	0
4.757	5611.09	45.9	1.208	45.9	6.9	3.00	2.63%	Sand-Slime Tailings	0.059	119.0	0.25	0.06	0.19	1	1.70	78.030	######	90.71	238	2.64%	2.0	47%	0.81	0.00	0.81	0
4.921	5610.93	20.0	0.909	20.0	1.7	0.72	4.54%	Slime Tailings	0.057	113.1	0.26	0.07	0.20	1	1.70	34.051	473.31	39.57	101	4.60%	2.4	71%	0.82	0.00	0.82	0
5.085	5610.76	10.4	0.273	10.4	2.2	0.96	2.62%	Slime Tailings	0.057	113.1	0.27	0.07	0.20	1	1.70	17.697	245.99	20.58	51	2.69%	2.4	71%	0.83	0.00	0.83	0
5.249	5610.60	7.0	0.186	7.0	4.3	1.87	2.65%	Slime Tailings	0.057	113.1	0.28	0.08	0.20	1	1.70	11.866	164.94	13.83	33	2.77%	2.6	71%	0.84	0.00	0.84	0
5.413	5610.44	5.8	0.170	5.8	4.1	1.77	2.93%	Slime Tailings	0.057	113.1	0.29	0.08	0.21	1	1.70	9.809	136.35	11.44	26	3.09%	2.7	71%	0.85	0.00	0.85	0
5.577	5610.27	5.5	0.100	5.5	4.8	2.09	1.81%	Slime Tailings	0.057	113.1	0.30	0.09	0.21	1	1.70	9.367	130.20	10.94	25	1.91%	2.6	71%	0.86	0.00	0.86	0
5.741	5610.11	10.8	0.134	10.8	6.8	2.96	1.24%	Sand-Slime Tailings	0.059	119.0	0.31	0.09	0.22	1	1.70	18.360	255.20	21.41	48	1.27%	2.2	47%	0.87	0.00	0.87	0
5.905	5609.94	7.7	0.162	7.6	3.3	1.43	2.12%	Slime Tailings	0.057	113.1	0.32	0.10	0.22	1	1.70	12.971	180.30	15.11	33	2.21%	2.5	71%	0.88	0.00	0.88	0
6.069	5609.78	6.6	0.117	6.6	3.7	1.61	1.76%	Slime Tailings	0.057	113.1	0.33	0.10	0.23	1	1.70	11.254	156.43	13.12	28	1.85%	2.5	71%	0.89	0.00	0.89	0
6.234	5609.62	7.5	0.098	7.5	4.8	2.07	1.30%	Slime Tailings	0.057	113.1	0.34	0.11	0.23	1	1.70	12.767	177.46	14.89	31	1.36%	2.4	71%	0.89	0.00	0.89	0
6.398	5609.45	8.5	0.058	8.5	5.5	2.39	0.68%	Sand-Slime Tailings	0.059	119.0	0.35	0.11	0.23	1	1.70	14.399	200.15	16.79	35	0.71%	2.2	47%	0.90	0.00	0.90	0
6.562	5609.29	11.8	0.109	11.7	5.3	2.29	0.93%	Sand-Slime Tailings	0.059	119.0	0.36	0.12	0.24	1	1.70	19.941	277.18	23.23	48	0.96%	2.2	47%	0.91	0.00	0.91	0
6.726	5609.12	9.5	0.147	9.5	5.2	2.27	1.54%	Sand-Slime Tailings	0.059	119.0	0.37	0.12	0.24	1	1.70	16.150	224.49	18.82	38	1.60%	2.4	47%	0.92	0.00	0.92	0
6.890	5608.96	7.6	0.165	7.5	7.0	3.04	2.18%	Slime Tailings	0.057	113.1	0.38	0.13	0.25	1	1.70	12.801	177.93	14.95	29	2.29%	2.6	71%	0.93	0.00	0.93	0
7.054	5608.80	5.6	0.138	5.5	9.3	4.03	2.48%	Slime Tailings	0.057	113.1	0.39	0.13	0.25	1	1.70	9.350	129.97	10.97	20	2.67%	2.7	71%	0.94	0.00	0.94	0
7.218	5608.63	5.1	0.118	5.0	12.3	5.33	2.33%	Slime Tailings	0.057	113.1	0.40	0.14	0.26	1	1.70	8.483	117.91	10.00	18	2.53%	2.7	71%	0.95	0.00	0.95	0
7.382	5608.47	4.8	0.099	4.7	14.7	6.38	2.05%	Slime Tailings	0.057	113.1	0.41	0.14	0.26	1	1.70	8.058	112.01	9.54	17	2.24%	2.7	71%	0.96	0.00	0.96	0
7.546	5608.30	4.8	0.131	4.7	16.7	7.23	2.74%	Slime Tailings	0.057	113.1	0.41	0.15	0.26	1	1.70	7.956	110.59	9.45	16	3.00%	2.8	71%	0.97	0.00	0.97	0
7.710	5608.14	5.1	0.119	5.0	19.0	8.22	2.35%	Slime Tailings	0.057	113.1	0.42	0.15	0.27	1	1.70	8.415	116.97	10.01	17	2.56%	2.8	71%	0.98	0.00	0.98	0
7.874	5607.98	6.7	0.130	6.5	20.7	8.95	1.95%	Slime Tailings	0.057	113.1	0.43	0.16	0.27	1	1.70	11.118	154.54	13.17	23	2.08%	2.6	71%	0.99	0.00	0.99	0
8.038	5607.81	7.3	0.077	7.3	16.0	6.91	1.05%	Sand-Slime Tailings	0.059	119.0	0.44	0.16	0.28	1	1.70	12.325	171.32	14.51	25	1.11%	2.4	47%	1.00	0.00	1.00	0
8.202	5607.65	8.5	0.080	8.4	14.3	6.19	0.94%	Sand-Slime Tailings	0.059	119.0	0.45	0.17	0.28	1	1.70	14.297	198.73	16.78	28	0.99%	2.4	47%	1.01	0.00	1.01	0
8.366	5607.48	6.1	0.091	6.1	11.4	4.95	1.49%	Slime Tailings	0.057	113.1	0.46	0.18	0.29	1	1.70	10.285	142.96	12.09	20	1.61%	2.6	71%	1.02	0.00	1.02	0
8.530	5607.32	4.7	0.067	4.7	13.0	5.62	1.41%	Slime Tailings	0.057	113.1	0.47	0.18	0.29	1	1.70	7.922	110.12	9.36	15	1.57%	2.7	71%	1.03	0.00	1.03	0
8.694	5607.16	5.0	0.101	4.9	16.1	6.98	2.04%	Slime Tailings	0.057	113.1	0.48	0.19	0.29	1	1.70	8.245	114.61	9.77	15	2.26%	2.8	71%	1.04	0.00	1.04	0
8.858	5606.99	5.0	0.075	4.9	20.4	8.84	1.49%	Slime Tailings	0.057	113.1	0.49	0.19	0.30	1	1.70	8.364	116.26	9.97	15	1.65%	2.7	71%	1.05	0.00	1.05	0
9.022	5606.83	7.8	0.111	7.7	23.6	10.24	1.42%	Slime Tailings	0.057	113.1	0.50	0.20	0.30	1	1.70	13.022	181.01	15.42	24	1.52%	2.5	71%	1.05	0.00	1.05	0
9.186	5606.66	8.8	0.109	8.7	14.2	6.17	1.24%	Sand-Slime Tailings	0.059	119.0	0.51	0.20	0.31	1	1.70	14.739	204.87	17.29	27	1.32%	2.4	47%	1.06	0.00	1.06	0
9.350	5606.50	11.9	0.108	11.8	12.8	5.55	0.91%	Sand-Slime Tailings	0.059	119.0	0.52	0.21	0.31	1	1.70	20.043	278.60	23.44	36	0.95%	2.3	47%	1.07	0.00	1.07	0
9.514	5606.34	10.3	0.138	10.2	9.1	3.92	1.35%	Sand-Slime Tailings	0.059	119.0	0.53	0.21	0.32	1	1.70	17.340	241.03	20.25	31	1.42%	2.4	47%	1.08	0.00	1.08	0
9.678	5606.17	8.8	0.125	8.7	12.4	5.39	1.42%	Sand-Slime Tailings	0.059	119.0	0.54	0.22	0.32	1	1.70	14.858	206.53	17.41	26	1.51%	2.5	47%	1.09	0.00	1.09	0
9.842	5606.01	7.8	0.130	7.7	15.8	6.85	1.68%	Slime Tailings	0.057	113.1	0.55	0.22	0.33	1	1.70	13.022	181.01	15.32	22	1.80%	2.6	71%	1.10	0.00	1.10	0
10.006	5605.84	5.8	0.162	5.7	21.9	9.49	2.79%	Slime Tailings	0.057	113.1	0.56	0.23	0.33	1	1.70	9.656	134.22	11.48	16	3.08%	2.8	71%	1.11	0.00	1.11	0
10.170	5605.68	6.7	0.084	6.5	21.8	9.43	1.26%	Slime Tailings	0.057	113.1	0.57	0.23	0.33	1	1.70	11.101	154.30	13.16	18	1.38%	2.6	71%	1.12	0.00	1.12	0
10.335	5605.52	10.0	0.096	9.8	21.2	9.19	0.96%	Sand-Slime Tailings	0.059	119.0	0.58	0.24	0.34	1	1.70	16.728	232.52	19.69	28	1.02%	2.4	47%	1.13	0.00	1.13	0
10.499	5605.35	8.9	0.103	8.8	20.2	8.74	1.16%	Sand-Slime Tailings	0.059	119.0	0.59	0.24	0.34	1	1.70	14.892	207.00	17.54	24	1.24%	2.5	47%	1.14	0.00	1.14	0
10.663	5605.19	7.0	0.126	6.9	26.1	11.32	1.79%	Slime Tailings	0.057	113.1	0.59	0.25	0.35	1	1.70	11.662	162.10	13.87	18	1.96%	2.7	71%	1.15	0.00	1.15	0
10.827	5605.02	7.3	0.113	7.1	29.0	12.55	1.55%	Slime Tailings	0.057	113.1	0.60	0.25	0.35	1	1.70	12.087	168.01	14.40	19	1.69%	2.6	71%	1.16	0.00	1.16	0
10.991	5604.86	8.8	0.076	8.6	29.8	12.92	0.87%	Sand-Slime Tailings	0.059	119.0	0.61	0.26	0.36	1	1.70	14.586	202.75	17.31	23	0.93%	2.4	47%	1.17	0.00	1.17	0
11.155	5604.70	10.2	0.109	10.0	19.3	8.38	1.07%	Sand-Slime Tailings	0.059	119.0	0.62	0.26	0.36	1	1.70	17.068	237.25	20.06	26	1.14%	2.4	47%	1.18	0.00	1.18	0
11.319	5604.53	8.3	0.156	8.2	20.1	8.71	1.87%	Slime Tailings	0.057	113.1	0.63	0.27	0.37	1	1.70	13.940	193.77	16.44	21	2.03%	2.6	71%	1.19	0.00	1.19	0
11.483	5604.37	7.8	0.195	7.6	32.3	13.99	2.49%	Slime Tailings	0.057	113.1	0.64	0.27	0.37	1	1.70	12.971	180.30	15.46	19	2.71%	2.7	71%	1.20	0.00	1.20	0
11.647	5604.20	8.0	0.126	7.8	34.4	14.89	1.57%	Slime Tailings	0.057	113.1	0.65	0.28	0.37	1	1.70	13.311	185.02	15.88	20	1.70%	2.6	71%	1.21	0.00	1.21	0
11.811	5604.04	9.1	0.108	8.9	32.1	13.92	1.19%	Sand-Slime Tailings	0.059	119.0	0.66	0.28	0.38	1	1.70	15.045	209.13	17.87	22	1.29%	2.5	47%	1.22	0.00	1.22	0
11.975	5603.87	8.0	0.097	7.8	31.7	13.74	1.21%	Slime Tailings	0.057	113.1	0.67	0.29	0.38	1	1.70	13.311	185.02	15.85	19	1.31%	2.6	71%	1.23	0.00	1.23	0
12.139	5603.71	7.7	0.106	7.5	40.4	17.50	1.37%	Slime Tailings	0.057	113.1	0.68	0.29	0.39	1	1.70	12.682	176.28	15.23	18	1.51%	2.6	71%	1.24	0.00	1.24	0
12.303	5603.55	7.1	0.110	6.8	39.6	17.17	1.56%	Slime Tailings	0.057	113.1	0.69	0.30	0.39	1	1.70	11.543	160.45	13.88	16	1.72%	2.7	71%	1.25	0.00	1.25	0
12.467	5603.38	6.8	0.107	6.6	37.4	16.22	1.57%	Slime Tailings	0.057	113.1	0.70	0.30	0.40	1	1.70	11.169	155.25	13.43	15	1.75%	2.7	71%	1.26	0.00	1.26	0
12.631	5603.22	7.0	0.092	6.8	30.6	13.25	1.32%	Slime Tailings	0.057	113.1	0.71	0.31	0.40	1	1.70	11.543	160.45	13.78	16	1.47%	2.7	71%	1.26	0.00	1.26	0
12.795	5603.05	6.2	0.105	6.0	36.6	15.85	1.68%	Slime Tailings	0.057	113.1	0.72	0.31	0.41	1	1.70	10.324	143.50	12.41	14	1.90%	2.8	71%	1.27	0.00	1.27	0
12.959	5602.89	7.8	0.124	7.5	43.8	18.98	1.60%	Slime Tailings	0.057	113.1	0.73	0.32	0.41	1	1.70	12.733	176.99	15.33	17	1.76%	2.7	71%	1.28	0.00	1.28	0
13.123	5602.73	10.5	0.147	10.3	32.1	13.89	1.40%	Sand-Slime Tailings	0.059	119.0	0.74	0.32	0.41	1	1.70	17.493	243.15	20.71	24	1.51%	2.5	47%	1.29	0.00	1.29	0
13.287	5602.56	8.1	0.177	8.0	30.0	13.02	2.18%	Slime Tailings	0.057	113.1	0.75	0.33	0.42	1	1.70	13.515	187.86	16.07	18	2.39%	2.7	71%	1.30	0.00	1.30	0
13.451	5602.40	6.8	0.135	6.6	34.3	14.86	1.98%	Slime Tailings	0.057	113.1	0.75	0.33	0.42	1	1.70	11.237	156.19	13.47	14	2.22%	2.8	71%	1.31	0.00	1.31	0
13.615	5602.23	7.9	0.138	7.7	36.4	15.78	1.74%	Slime Tailings	0.057	113.1	0.76	0.34	0.43	1	1.70	13.133	182.55	15.72	17	1.92%	2.7	71%	1.32	0.00	1.32	0
13.779	5602.07	6.3	0.125	6.2	26.0	11.28	1.97%	Slime Tailings	0.057	113.1	0.77	0.34	0.43	1	1.70	10.489	145.80	12.50	13	2.25%	2.8	71%	1.33	0.00	1.33	0
13.943	5601.91	8.1	0.120	7.9	29.9	12.95	1.48%	Sand-Slime Tailings	0.059	119.0	0.78	0.35	0.43	1	1.70	13.431	186.69	15.87	17	1.65%	2.7	47%	1.34	0.00	1.34	0
14.107	5601.74	16.0	0.167	16.0	7.3	3.14	1.04%	Sand-Slime Tailings	0.059	119.0	0.79	0.35	0.44	1	1.63	26.112	362.96	30.41	35	1.09%	2.2	47%	1.35	0.00	1.35	0
14.271	5601.58	12.3	0.154	12.2	9.6	4.16	1.25%	Sand-Slime Tailings	0.059	119.0	0.80	0.36	0.44	1	1.66	20.342	282.76	23.74	26	1.34%	2.5	47%	1.36	0.00	1.36	0
14.436	5601.41	9.4	0.143	9.3	15.0	6.48	1.52%	Sand-Slime Tailings	0.059	119.0	0.81	0.36	0.45	1	1.67	15.535	215.93	18.13	20	1.67%	2.6	47%	1.37	0.00	1.37	0
14.600	5601.25	7.8	0.109	7.7	29.2	12.64	1.39%	Slime Tailings	0.057	113.1	0.82	0.37	0.45	1	1.66	12.673	176.16	15.07	16	1.55%	2.7	71%	1.38	0.00	1.38	0
14.764	5601.09	7.4	0.098	7.1	29.5	12.75	1.32%	Slime Tailings	0.057	113.1	0.83	0.37	0.46	1	1.65	12.474	173.39	15.11	15	1.47%	2.7	71%	1.39	0.00	1.39	0
14.928	5600.92	7.5	0.153	7.1	63.0	27.30	2.03%	Slime Tailings	0.057	113.1	0.84	0.38	0.46	1	1.63	12.151	168.91	15.25	15	2.29%	2.8	71%	1.40	0.00	1.40	0
15.092	5600.76	7.7	0.237	7.3	69.8	30.26	3.08%	Slime Tailings	0.057	113.1	0.85	0.39	0.46	1	1.62	11.780	163.74	14.50	15	3.46%	2.9	71%	1.41	0.00	1.41	0
15.256	5600.59	9.1	0.255	9.0	23.2	10.06	2.79%	Slime Tailings	0.057	113.1	0.86	0.39	0.47	1	1.64	14.867	206.65	17.89	19	3.08%	2.7	71%	1.42	0.00	1.42	0
15.420	5600.43	10.0	0.246	9.8	31.0	13.41	2.45%	Slime Tailings	0.057	113.1	0.87	0.40	0.47	1	1.60	15.709	218.35	18.60	19	2.69%	2.7	71%	1.42	0.00	1.42	0
15.584	5600.27	9.3	0.199	9.1	28.5	12.35	2.14%	Slime Tailings	0.057	113.1	0.88	0.40	0.48	1	1.59	14.475	201.20	17.14	18	2.36%	2.7	71%	1.43	0.00	1.43	0
15.748	5600.10	9.5	0.138	9.2	48.8	21.16	1.45%	Slime Tailings	0.057	113.1	0.89	0.41	0.48	1	1.58	14.476	201.21	17.37	18	1.60%	2.6	71%	1.44	0.00	1.44	0
15.912	5599.94	9.5	0.075	9.3	47.2	20.47	0.79%	Sand-Slime Tailings	0.059	119.0	0.90	0.41	0.49	1	1.56	14.461	201.01	17.33	18	0.87%	2.4	47%	1.45	0.00	1.45	0
16.076	5599.77	10.5	0.072	10.3	43.2	18.73	0.68%	Sand-Slime Tailings	0.059	119.0	0.91	0.42	0.49	1	1.55	15.931	221.53	19.00	20	0.76%	2.3	47%	1.46	0.00	1.46	0
16.240	5599.61	29.3	0.191	29.0	50.1	21.81	0.65%	Sand-Slime Tailings	0.059	119.0	0.92	0.43	0.50	1	1.41	41.329	574.48	48.52	57	0.67%	2.0	47%	1.47	0.00	1.47	0
16.404	5599.45	22.6	0.359	22.6	8.2	3.54	1.59%	Sand-Slime Tailings	0.059	119.0	0.93	0.43	0.50	1	1.45	32.779	455.63	38.16	43	1.65%	2.3	47%	1.48	0.00	1.48	0
16.568	5599.28	14.1	0.339	14.0	6.0	2.60	2.40%	Slime Tailings	0.057	113.1	0.94	0.43	0.51	1	1.50	21.048	292.57	24.60	26	2.56%	2.6	71%	1.49	0.00	1.49	0
16.732	5599.12	8.8	0.276	8.7	23.2	10.05	3.13%	Slime Tailings	0.057	113.1	0.95	0.44	0.51	1	1.51	13.104	182.14	15.47	16	3.50%	2.8	71%	1.50	0.00	1.50	0
16.896	5598.95	8.5	0.222	8.2	42.7	18.51	2.62%	Slime Tailings	0.057	113.1	0.96	0.44	0.51	1	1.52	12.846	171.60	14.80	14	2.96%	2.8	71%	1.51	0.00	1.51	0
17.060	5598.79	8.5	0.190	8.2	54.7	23.70	2.23%	Slime Tailings	0.057	113.1	0.96	0.45	0.52	1	1.50	12.718	176.79	14.93	15	2.53%	2.8	71%	1.52	0.00	1.52	0
17.224	5598.63	8.3	0.174	7.9	66.5	28.82	2.09%	Slime Tailings	0.057	113.1	0.97	0.45	0.52	1	1.48	11.717	162.87	14.32	14	2.37%	2.8	71%	1.53	0.00	1.53	0

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W2

Data File: 13-52106_SP2W2-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3 Field Data\2013 Field Investigation\Conetec Dat

Legend:
- Tailings Sands
- Tailings Sand-Slimes
- Tailings Slimes
- Interim Cover
- Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Parameter
5613.10	Water surface elevation during CPT investigation (ft a
5607.57	Water surface elevation at t_0 (ft amsl)
5598.51	Water surface elevation at t_1 (ft amsl)
5593.51	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earth
7.51	Equiv. Number of Uniform Strain Cycles, N

Value	Parameter
5615.85	Ground Surface Elevation at time of CPT (ft amsl)
5625.87	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after plac
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
2.02	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1111.60	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5593.51	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer	Total Stress at Midpoint of Layer	Equil Pore Pressure at Bottom of Layer	Equil Pore Pressure at Midpoint of Layer (tsf)	Effective Stress at Bottom of Layer	Effective Stress at Midpoint of Layer	Midpoint Depth at t_1, z_1	Shear Wave Velocity, V_s	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
Erosion Protection Layer	######	5625.62	5625.37	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014	0.08	508	1.7E-03	4.4E+02	3.0E-06	11	0.068	46696	0.00%	1.20	0.80	0.04%	0.000	0.32	0.133	0.778	0.00%	0.0000
Water Storage/Rooting Zone Layer	######	5623.62	5621.87	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121	0.69	508	1.7E-03	4.3E+02	2.8E-05	11	0.118	18930	0.00%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
High Compaction Layer	######	5619.87	5617.87	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334	1.83	508	1.9E-03	4.8E+02	6.8E-05	11	0.153	12419	0.01%	0.65	0.75	0.02%	0.000	0.34	0.079	0.765	0.00%	0.0000
Platform/Random Fill Layer	######	5616.86	5615.85	2.02	0.050	101	0.556	0.505	0.00	0.00	0.556	0.505	2.75	508	1.6E-03	4.0E+02	1.2E-04	11	0.170	10466	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000

2013 CPT Data from ConeTec / CPT Data Interpretations

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of CPT (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No
17.388	5598.46	9.6	0.196	9.2	57.7	25.02	2.05%	Slime Tailings	0.057	113.1	0.98	0.46	0.53	1
17.552	5598.30	8.9	0.209	8.4	74.2	32.14	2.35%	Slime Tailings	0.057	113.1	0.99	0.46	0.53	1
17.716	5598.13	9.1	0.199	8.7	67.5	29.25	2.19%	Slime Tailings	0.057	113.1	1.00	0.47	0.53	1
17.880	5597.97	9.1	0.170	8.7	60.5	26.22	1.88%	Slime Tailings	0.057	113.1	1.01	0.47	0.54	1
18.044	5597.81	9.4	0.142	9.0	57.5	24.92	1.52%	Sand-Slime Tailin	0.059	119.0	1.02	0.48	0.54	1
18.208	5597.64	8.7	0.209	8.3	57.7	25.02	2.41%	Slime Tailings	0.057	113.1	1.03	0.48	0.55	1
18.372	5597.48	10.0	0.260	9.5	72.0	31.20	2.61%	Slime Tailings	0.057	113.1	1.04	0.49	0.55	1
18.537	5597.31	10.6	0.320	10.3	54.3	23.51	3.02%	Slime Tailings	0.057	113.1	1.05	0.49	0.55	1
18.701	5597.15	12.3	0.297	12.1	37.1	16.09	2.42%	Slime Tailings	0.057	113.1	1.06	0.50	0.56	1
18.865	5596.99	17.2	0.199	17.1	20.4	8.85	1.16%	Sand-Slime Tailin	0.059	119.0	1.07	0.50	0.56	1
19.029	5596.82	16.8	0.219	16.7	20.1	8.71	1.31%	Sand-Slime Tailin	0.059	119.0	1.08	0.51	0.57	1
19.193	5596.66	15.5	0.212	15.4	19.4	8.42	1.37%	Sand-Slime Tailin	0.059	119.0	1.09	0.51	0.57	1
19.357	5596.49	11.9	0.188	11.8	28.4	12.32	1.58%	Sand-Slime Tailin	0.059	119.0	1.10	0.52	0.58	1
19.521	5596.33	10.5	0.213	10.3	42.0	18.18	2.02%	Slime Tailings	0.057	113.1	1.10	0.52	0.58	1
19.685	5596.17	10.7	0.236	10.3	60.5	26.21	2.21%	Slime Tailings	0.057	113.1	1.11	0.53	0.59	1
19.849	5596.00	13.4	0.216	13.1	40.2	17.42	1.62%	Sand-Slime Tailin	0.059	119.0	1.12	0.53	0.59	1
20.013	5595.84	12.8	0.185	12.6	40.5	17.54	1.44%	Sand-Slime Tailin	0.059	119.0	1.13	0.54	0.59	1
20.177	5595.67	14.7	0.185	14.4	48.7	21.12	1.26%	Sand-Slime Tailin	0.059	119.0	1.14	0.54	0.60	1
20.341	5595.51	13.5	0.185	13.4	28.8	12.46	1.37%	Sand-Slime Tailin	0.059	119.0	1.15	0.55	0.60	1
22.340	5593.51							Sand-Slime Tailin	0.059	119.0				

CPT Data Interpretations (continued) / Conditions at t_1

Depth at time of CPT (ft)	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
17.388	1.47	13.529	188.05	16.33	16	2.29%	2.8	71%	1.54	0.00	1.54	1
17.552	1.46	12.319	171.23	15.09	15	2.65%	2.8	71%	1.55	0.01	1.54	1
17.716	1.45	12.622	175.44	15.37	15	2.46%	2.8	71%	1.56	0.01	1.54	1
17.880	1.45	12.545	174.38	15.20	15	2.11%	2.8	71%	1.57	0.02	1.55	1
18.044	1.44	12.921	179.60	15.61	15	1.70%	2.7	47%	1.58	0.02	1.55	1
18.208	1.43	11.845	164.64	14.35	14	2.74%	2.9	71%	1.58	0.03	1.56	1
18.372	1.42	13.491	187.53	16.41	16	2.91%	2.8	71%	1.59	0.03	1.56	1
18.537	1.41	14.484	201.33	17.38	17	3.35%	2.8	71%	1.60	0.04	1.57	1
18.701	1.40	16.910	235.04	20.02	20	2.64%	2.7	71%	1.61	0.04	1.57	1
18.865	1.37	23.404	325.31	27.38	29	1.23%	2.4	47%	1.62	0.05	1.57	1
19.029	1.36	22.707	315.63	26.57	28	1.39%	2.4	47%	1.63	0.05	1.58	1
19.193	1.36	20.954	291.26	24.53	25	1.47%	2.5	47%	1.64	0.06	1.58	1
19.357	1.37	16.059	223.22	18.93	19	1.74%	2.6	47%	1.65	0.06	1.59	1
19.521	1.36	13.972	194.20	16.64	16	2.26%	2.8	71%	1.66	0.07	1.59	1
19.685	1.35	13.907	193.31	16.75	16	2.47%	2.8	71%	1.67	0.07	1.60	1
19.849	1.34	17.596	244.59	20.83	21	1.77%	2.6	47%	1.68	0.08	1.60	1
20.013	1.34	16.808	233.63	19.91	20	1.58%	2.6	47%	1.69	0.08	1.61	1
20.177	1.32	18.997	264.05	22.53	23	1.37%	2.5	47%	1.70	0.09	1.61	1
20.341	1.32	17.608	244.76	20.73	20	1.49%	2.6	47%	1.71	0.09	1.62	1
22.340									1.83	0.12	1.70	1

Liquefaction Triggering Analyses

Depth at time of CPT (ft)	Idriss & Boulanger (2008) Cyclic Stress Ratio r_d	C_σ	K_σ	K_a	CSR M=7.5, s'v=1atm	Cyclic Resistance Ratio Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Youd et al. (2001) Cyclic Stress Ratio r_d	D_r	f	K_σ	K_a	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No
17.388	0.90	0.05	0.97	1.0	0.050	35.77	52.10	0.080	1.58	0.94	0.23	0.80	1.10	1.0	0.037	4.41	72.07	0.115	4.56	3.07	2
17.552	0.90	0.05	0.97	1.0	0.051	35.34	50.44	0.078	1.54	0.94	0.22	0.80	1.10	1.0	0.038	4.99	75.30	0.120	4.70	3.12	2
17.716	0.89	0.05	0.97	1.0	0.051	35.44	50.81	0.078	1.55	0.94	0.23	0.80	1.10	1.0	0.038	4.77	73.31	0.117	4.53	3.04	2
17.880	0.89	0.05	0.97	1.0	0.051	35.38	50.59	0.078	1.54	0.93	0.23	0.80	1.10	1.0	0.038	4.50	68.48	0.110	4.22	2.88	2
18.044	0.89	0.05	0.97	1.0	0.051	35.77	51.38	0.079	1.55	0.93	0.23	0.80	1.10	1.0	0.038	4.03	62.94	0.103	3.92	2.74	2
18.208	0.89	0.05	0.97	1.0	0.051	35.09	49.44	0.077	1.51	0.93	0.22	0.80	1.10	1.0	0.038	5.27	75.69	0.120	4.53	3.02	2
18.372	0.89	0.05	0.97	1.0	0.051	35.80	52.21	0.080	1.56	0.93	0.23	0.80	1.09	1.0	0.038	4.95	81.19	0.130	4.83	3.20	2
18.537	0.89	0.05	0.97	1.0	0.051	36.14	53.52	0.081	1.59	0.93	0.24	0.80	1.09	1.0	0.039	5.08	88.30	0.144	5.31	3.45	2
18.701	0.89	0.05	0.97	1.0	0.051	37.06	57.08	0.085	1.66	0.93	0.26	0.80	1.09	1.0	0.039	4.13	82.75	0.133	4.84	3.25	2
18.865	0.89	0.06	0.97	1.0	0.051	39.91	67.29	0.096	1.89	0.93	0.30	0.80	1.09	1.0	0.039	2.32	63.52	0.104	3.75	2.82	2
19.029	0.88	0.06	0.97	1.0	0.051	39.62	66.19	0.095	1.86	0.93	0.30	0.80	1.09	1.0	0.039	2.50	66.55	0.107	3.83	2.85	2
19.193	0.88	0.06	0.97	1.0	0.051	38.90	63.43	0.092	1.79	0.93	0.29	0.80	1.08	1.0	0.039	2.72	66.83	0.108	3.80	2.80	2
19.357	0.88	0.05	0.97	1.0	0.051	36.94	55.88	0.083	1.63	0.93	0.25	0.80	1.08	1.0	0.039	3.56	67.47	0.109	3.79	2.71	2
19.521	0.88	0.05	0.97	1.0	0.051	35.88	52.52	0.080	1.56	0.93	0.24	0.80	1.08	1.0	0.040	4.40	73.27	0.117	4.03	2.79	2
19.685	0.88	0.05	0.97	1.0	0.051	35.92	52.66	0.080	1.56	0.93	0.24	0.80	1.08	1.0	0.040	4.57	76.54	0.122	4.17	2.86	2
19.849	0.88	0.05	0.97	1.0	0.051	37.61	58.44	0.086	1.67	0.93	0.26	0.80	1.08	1.0	0.040	3.36	70.06	0.112	3.80	2.74	2
20.013	0.88	0.05	0.97	1.0	0.052	37.29	57.20	0.085	1.65	0.93	0.26	0.80	1.08	1.0	0.040	3.31	65.95	0.107	3.58	2.61	2
20.177	0.87	0.05	0.97	1.0	0.052	38.20	60.73	0.089	1.72	0.93	0.27	0.80	1.08	1.0	0.040	2.84	63.94	0.104	3.47	2.59	2
20.341	0.87	0.05	0.97	1.0	0.052	37.57	58.30	0.086	1.66	0.93	0.26	0.80	1.07	1.0	0.040	3.15	65.23	0.106	3.49	2.58	2

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.347

Depth at time of CPT (ft)	Depth at t_1, z_1 m	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Maximum Shear Strain Modulus, G_{max} tsf	P = γ_{eff}*(G_{eff}/G_{max}) tsf	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
17.388	8.35	500	1.8E-03	4.4E+02	3.4E-04	16	0.478	5582	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.65%	0.0044
17.552	8.40	500	1.8E-03	4.4E+02	3.4E-04	16	0.478	5575	0.10%	2.00	0.65	0.03%	0.018	0.34	0.079	0.765	2.69%	0.0044
17.716	8.45	500	1.8E-03	4.4E+02	3.5E-04	16	0.478	5569	0.10%	2.00	0.65	0.03%	0.018	0.34	0.079	0.765	2.72%	0.0045
17.880	8.50	500	1.8E-03	4.4E+02	3.5E-04	16	0.478	5563	0.10%	2.00	0.65	0.03%	0.018	0.34	0.079	0.765	2.75%	0.0045
18.044	8.55	500	1.8E-03	4.6E+02	3.3E-04	10	0.227	6742	0.09%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.33%	0.0038
18.208	8.60	500	1.8E-03	4.4E+02	3.5E-04	16	0.479	5550	0.10%	2.00	0.65	0.03%	0.018	0.34	0.079	0.765	2.82%	0.0046
18.372	8.65	500	1.8E-03	4.4E+02	3.5E-04	16	0.479	5544	0.11%	2.00	0.65	0.03%	0.019	0.34	0.079	0.765	2.86%	0.0047
18.537	8.70	500	1.8E-03	4.4E+02	3.6E-04	16	0.479	5538	0.11%	2.00	0.65	0.03%	0.019	0.34	0.079	0.765	2.89%	0.0047
18.701	8.75	500	1.8E-03	4.4E+02	3.6E-04	16	0.479	5532	0.11%	2.00	0.65	0.03%	0.019	0.34	0.079	0.765	2.92%	0.0048
18.865	8.80	500	1.8E-03	4.6E+02	3.4E-04	10	0.228	6704	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.49%	0.0041
19.029	8.85	500	1.8E-03	4.6E+02	3.4E-04	10	0.228	6696	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.52%	0.0041
19.193	8.90	500	1.8E-03	4.6E+02	3.5E-04	10	0.228	6687	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.56%	0.0042
19.357	8.95	500	1.8E-03	4.6E+02	3.5E-04	10	0.229	6679	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.59%	0.0043
19.521	9.00	500	1.8E-03	4.4E+02	3.7E-04	16	0.480	5499	0.12%	2.00	0.65	0.03%	0.020	0.34	0.079	0.765	3.10%	0.0051
19.685	9.05	538	1.8E-03	5.1E+02	3.2E-04	16	0.480	5493	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.24%	0.0037
19.849	9.10	538	1.8E-03	5.3E+02	3.1E-04	10	0.229	6657	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.85%	0.0030
20.013	9.15	538	1.8E-03	5.3E+02	3.1E-04	10	0.229	6649	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.88%	0.0031
20.177	9.20	538	1.8E-03	5.3E+02	3.1E-04	10	0.229	6641	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.91%	0.0031
20.341	9.25	538	1.8E-03	5.3E+02	3.1E-04	10	0.230	6633	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.93%	0.0032
22.340	9.86	538	1.8E-03	5.3E+02	3.3E-04	10	0.233	6489	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.24%	0.0447

Extra layer added to analyze seismic settlement of tailings below the bottom of CPT investigation.

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W3

Data File: 13-52106_SP2W3-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)
- Max. Horiz. Acceleration, Amax/g: 0.15
- Earthquake Moment Magnitude, M: 5.5
- Magnitude Scaling Factor, MSF: 1.69

Youd, et al (2001)
- Max. Horiz. Acceleration, Amax/g: 0.15
- Earthquake Moment Magnitude, M: 5.5
- Magnitude Scaling Factor, MSF: 2.21

- 5613.80 Water surface elevation during CPT investigation (ft amsl)
- 5607.44 Water surface elevation at t_0 (ft amsl)
- 5597.74 Water surface elevation at t_1 (ft amsl)
- 5592.74 Water surface elevation at t_2 (ft amsl)
- 1.44 Scaling Factor for stress ration, r_m
- 0.47 Volumetric Strain Ratio for Site-Specific Design Earthquake
- 7.51 Equiv. Number of Uniform Strain Cycles, N

- 5615.72 Ground Surface Elevation at time of CPT (ft amsl)
- 5626.27 Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
- 0.50 Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement
- 3.50 Thickness of Water Storage/Rooting Zone (ft)
- 4.00 Thickness of High Compaction Layer (ft)
- 2.55 Thickness of Random/Platform Fill on on top of existing interim cover (ft)
- 1164.98 Additional Stress due to Final Cover Placement, $\Delta\sigma_{fc}$ (psf)
- 5592.74 Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer	Total Stress at Midpoint of Layer	Equil Pore Pressure at Bottom of Layer	Equil Pore Pressure at Midpoint of Layer (tsf)	Effective Stress at Bottom of Layer	Effective Stress at Midpoint of Layer
Erosion Protection Layer	######	5626.02	5625.77	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
Water Storage/Rooting Zone Layer	######	5624.02	5622.27	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5620.27	5618.27	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334
Platform/Random Fill Layer	######	5617	5615.72	2.55	0.050	101	0.582	0.518	0.00	0.00	0.582	0.518

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1 / Liquefaction Triggering Analyses – Idriss & Boulanger (2008)

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil. Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil. Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No	r_d	C_σ	K_σ	K_α	CSR M=7.5, s'v=1atm	Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS
0.164	5615.56	7.7	0.125	7.7	1.9	0.82	1.62%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0	1.70	13.124	182.42	15.27	935	1.62%	1.5	51%	0.59	0.00	0.59	0	1.00	0.05	1.02	1.0	0.059	35.68	50.94	0.078	1.33
0.328	5615.39	34.3	0.207	34.2	7.6	3.28	0.60%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	58.208	809.09	67.70	2074	0.60%	1.0	51%	0.60	0.00	0.60	0	1.00	0.08	1.03	1.0	0.060	54.08	121.78	0.183	3.08
0.492	5615.23	60.2	0.548	60.2	5.7	2.48	0.91%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	102.306	######	118.89	2429	0.91%	1.2	51%	0.61	0.00	0.61	0	1.00	0.12	1.04	1.0	0.060	72.04	190.94	0.778	12.90
0.656	5615.06	93.8	1.118	93.8	6.5	2.81	1.19%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0	1.70	159.409	######	185.22	2838	1.19%	1.3	51%	0.62	0.00	0.62	0	1.00	0.22	1.07	1.0	0.062	95.32	280.55	1.000	16.09
0.820	5614.90	158.1	1.774	158.0	7.2	3.13	1.12%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0	1.70	268.634	######	312.09	3826	1.12%	1.3	51%	0.62	0.00	0.62	0	1.00	0.30	1.10	1.0	0.063	139.84	451.93	1.000	15.77
0.984	5614.74	233.5	2.580	233.4	9.6	4.17	1.11%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0	1.70	396.814	######	460.99	4709	1.11%	1.3	51%	0.63	0.00	0.63	0	1.00	0.30	1.09	1.0	0.063	192.10	653.09	1.000	15.83
1.148	5614.57	321.1	3.237	321.1	4.7	2.05	1.01%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0	1.70	545.819	######	633.99	5551	1.01%	1.3	51%	0.64	0.00	0.64	0	1.00	0.30	1.09	1.0	0.063	252.81	886.80	1.000	15.89
1.312	5614.41	348.1	3.834	348.0	7.5	3.25	1.10%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	591.651	######	687.26	5266	1.10%	1.3	51%	0.65	0.00	0.65	0	1.00	0.30	1.08	1.0	0.063	271.50	958.76	1.000	15.94
1.476	5614.24	325.9	3.960	325.9	6.7	2.88	1.22%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	553.945	######	643.46	4382	1.22%	1.3	51%	0.66	0.00	0.66	0	1.00	0.30	1.08	1.0	0.063	256.13	899.58	1.000	16.00
1.640	5614.08	280.6	3.998	280.6	6.9	3.01	1.42%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0	1.70	477.020	######	554.12	3396	1.43%	1.4	51%	0.67	0.00	0.67	0	1.00	0.30	1.08	1.0	0.062	224.78	778.89	1.000	16.06
1.804	5613.92	244.2	3.918	244.1	3.6	1.54	1.60%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0	1.70	415.038	######	482.09	2686	1.61%	1.4	51%	0.67	0.00	0.67	0	1.00	0.30	1.07	1.0	0.062	199.50	681.58	1.000	16.11
1.968	5613.75	208.3	4.496	208.3	3.0	1.30	2.16%	Interim Cover	0.050	100.7	0.10	0.00	0.10	1	1.70	354.025	######	411.22	2132	2.16%	1.6	51%	0.68	0.00	0.68	0	1.00	0.30	1.07	1.0	0.062	174.63	585.84	1.000	16.18
2.133	5613.59	171.3	4.306	171.3	1.4	0.62	2.51%	Interim Cover	0.050	100.7	0.11	0.01	0.10	1	1.70	291.278	######	338.32	1699	2.51%	1.6	51%	0.69	0.00	0.69	0	1.00	0.30	1.07	1.0	0.062	149.05	487.37	1.000	16.25
2.297	5613.42	146.4	3.625	146.4	0.5	0.21	2.48%	Interim Cover	0.050	100.7	0.12	0.01	0.10	1	1.70	248.795	######	288.97	1407	2.48%	1.6	51%	0.70	0.00	0.70	0	1.00	0.30	1.06	1.0	0.061	131.73	420.69	1.000	16.32
2.461	5613.26	130.5	2.022	130.5	-0.0	-0.01	1.55%	Interim Cover	0.050	100.7	0.12	0.02	0.11	1	1.70	221.918	######	257.74	1218	1.55%	1.5	51%	0.71	0.00	0.71	0	1.00	0.30	1.06	1.0	0.061	120.77	378.52	1.000	16.38
2.625	5613.10	117.5	1.895	117.5	0.5	0.22	1.61%	Interim Cover	0.050	100.7	0.13	0.02	0.11	1	1.70	199.801	######	232.06	1065	1.61%	1.5	51%	0.71	0.00	0.71	0	1.00	0.30	1.06	1.0	0.061	111.76	343.82	1.000	16.45
2.789	5612.93	87.2	1.616	87.2	-0.2	-0.08	1.85%	Interim Cover	0.050	100.7	0.14	0.03	0.11	1	1.70	148.240	######	172.17	768	1.86%	1.6	51%	0.72	0.00	0.72	0	0.99	0.20	1.03	1.0	0.059	90.74	262.91	1.000	16.81
2.953	5612.77	56.6	1.213	56.6	-0.3	-0.11	2.14%	Interim Cover	0.050	100.7	0.15	0.03	0.12	1	1.70	96.186	######	111.71	484	2.15%	1.7	51%	0.73	0.00	0.73	0	0.99	0.12	1.02	1.0	0.059	69.52	181.23	0.556	9.50
3.117	5612.60	41.8	0.990	41.8	-0.7	-0.32	2.37%	Interim Cover	0.050	100.7	0.16	0.04	0.12	1	1.70	71.043	987.50	82.50	348	2.38%	1.8	51%	0.74	0.00	0.74	0	0.99	0.09	1.01	1.0	0.058	59.27	141.78	0.238	4.10
3.281	5612.44	29.4	0.781	29.4	-1.4	-0.59	2.66%	Sand-Slime Tailings	0.059	119.0	0.17	0.04	0.12	1	1.70	49.980	694.72	58.03	235	2.67%	2.0	47%	0.75	0.00	0.75	0	0.99	0.08	1.01	1.0	0.058	50.65	108.69	0.157	2.72
3.445	5612.28	24.9	0.524	24.9	-1.2	-0.53	2.10%	Sand-Slime Tailings	0.059	119.0	0.18	0.05	0.13	1	1.70	42.364	588.86	49.19	192	2.12%	1.9	47%	0.76	0.00	0.76	0	0.99	0.07	1.01	1.0	0.058	47.55	96.74	0.137	2.37
3.609	5612.11	21.4	0.387	21.4	-1.7	-0.72	1.81%	Sand-Slime Tailings	0.059	119.0	0.19	0.05	0.13	1	1.70	36.363	505.45	42.21	159	1.83%	2.0	47%	0.77	0.00	0.77	0	0.99	0.07	1.01	1.0	0.058	45.11	87.32	0.123	2.13
3.773	5611.95	13.1	0.327	13.2	-2.1	-0.91	2.49%	Slime Tailings	0.057	113.1	0.20	0.06	0.14	1	1.70	22.355	310.73	25.94	94	2.53%	2.2	71%	0.78	0.00	0.78	0	0.99	0.06	1.01	1.0	0.058	39.12	65.06	0.094	1.63
3.937	5611.78	9.9	0.171	10.0	-1.5	-0.64	1.72%	Sand-Slime Tailings	0.059	119.0	0.21	0.06	0.14	1	1.70	16.915	235.12	19.63	68	1.76%	2.2	47%	0.79	0.00	0.79	0	0.99	0.05	1.00	1.0	0.057	37.19	56.81	0.084	1.47
4.101	5611.62	9.9	0.106	9.9	1.7	0.74	1.07%	Sand-Slime Tailings	0.059	119.0	0.22	0.07	0.15	1	1.70	16.881	234.65	19.63	66	1.09%	2.1	47%	0.80	0.00	0.80	0	0.99	0.05	1.00	1.0	0.057	37.19	56.81	0.084	1.47
4.265	5611.45	13.3	0.031	13.3	3.7	1.60	0.23%	Sand-Slime Tailings	0.059	119.0	0.22	0.07	0.15	1	1.70	22.593	314.04	26.29	86	0.24%	1.6	47%	0.81	0.00	0.81	0	0.99	0.06	1.00	1.0	0.057	39.52	65.81	0.095	1.65
4.429	5611.29	10.7	0.042	10.7	2.1	0.90	0.39%	Sand-Slime Tailings	0.059	119.0	0.23	0.08	0.16	1	1.70	18.241	253.55	21.21	67	0.40%	1.8	47%	0.82	0.00	0.82	0	0.99	0.05	1.00	1.0	0.057	37.74	58.95	0.087	1.52
4.593	5611.13	8.5	0.048	8.4	6.1	2.62	0.57%	Sand-Slime Tailings	0.059	119.0	0.24	0.08	0.16	1	1.70	14.314	198.96	16.70	51	0.58%	2.0	47%	0.83	0.00	0.83	0	0.98	0.05	1.00	1.0	0.057	36.16	52.86	0.080	1.41
4.757	5610.96	7.9	0.031	7.8	13.0	5.65	0.39%	Sand-Slime Tailings	0.059	119.0	0.25	0.09	0.17	1	1.70	13.311	185.02	15.62	46	0.40%	2.0	47%	0.84	0.00	0.84	0	0.98	0.05	1.00	1.0	0.057	35.78	51.40	0.079	1.38
4.921	5610.80	7.2	0.093	7.1	20.3	8.78	1.30%	Slime Tailings	0.057	113.1	0.26	0.09	0.17	1	1.70	11.985	166.59	14.17	41	1.35%	2.3	71%	0.85	0.00	0.85	0	0.98	0.05	1.00	1.0	0.057	35.02	49.19	0.077	1.35
5.085	5610.63	7.1	0.130	7.0	25.9	11.21	1.82%	Slime Tailings	0.057	113.1	0.27	0.10	0.17	1	1.70	11.866	164.94	14.10	40	1.89%	2.4	71%	0.86	0.00	0.86	0	0.98	0.05	1.00	1.0	0.057	35.00	49.10	0.077	1.35
5.249	5610.47	8.4	0.108	8.2	23.7	10.28	1.29%	Sand-Slime Tailings	0.059	119.0	0.28	0.10	0.18	1	1.70	14.008	194.71	16.56	45	1.33%	2.3	47%	0.86	0.00	0.86	0	0.98	0.05	1.00	1.0	0.057	36.11	52.67	0.080	1.41
5.413	5610.31	18.2	0.125	18.1	15.6	6.76	0.69%	Sand-Slime Tailings	0.059	119.0	0.29	0.11	0.18	1	1.70	30.804	428.18	35.97	98	0.70%	1.8	47%	0.87	0.00	0.87	0	0.98	0.06	1.00	1.0	0.057	42.92	78.89	0.111	1.96
5.577	5610.14	20.7	0.144	20.7	2.2	0.94	0.69%	Sand-Slime Tailings	0.059	119.0	0.30	0.11	0.19	1	1.70	35.241	489.85	40.96	109	0.70%	1.8	47%	0.88	0.00	0.88	0	0.98	0.07	1.00	1.0	0.057	44.67	85.62	0.121	2.13
5.741	5609.98	20.9	0.185	20.9	1.2	0.52	0.89%	Sand-Slime Tailings	0.059	119.0	0.31	0.12	0.19	1	1.70	35.462	492.92	41.20	107	0.90%	1.9	47%	0.89	0.00	0.89	0	0.98	0.07	1.00	1.0	0.056	44.75	85.95	0.121	2.14
5.905	5609.81	17.0	0.216	17.0	-0.2	-0.07	1.27%	Sand-Slime Tailings	0.059	119.0	0.32	0.12	0.20	1	1.70	28.849	401.00	33.50	84	1.30%	2.0	47%	0.90	0.00	0.90	0	0.98	0.06	1.00	1.0	0.056	42.05	75.56	0.107	1.89
6.069	5609.65	16.4	0.222	16.4	0.0	0.01	1.35%	Sand-Slime Tailings	0.059	119.0	0.33	0.13	0.20	1	1.70	27.880	387.53	32.38	80	1.38%	2.1	47%	0.91	0.00	0.91	0	0.98	0.06	1.00	1.0	0.056	41.66	74.04	0.105	1.86
6.234	5609.49	12.5	0.167	12.5	0.5	0.23	1.33%	Sand-Slime Tailings	0.059	119.0	0.34	0.13	0.21	1	1.70	21.267	295.61	24.71	59	1.37%	2.2	47%	0.92	0.00	0.92	0	0.98	0.06	1.00	1.0	0.056	38.97	63.67	0.092	1.64
6.398	5609.32	11.4	0.156	11.4	5.1	2.22	1.37%	Sand-Slime Tailings	0.059	119.0	0.35	0.14	0.21	1	1.70	19.312	268.44	22.49	52	1.41%	2.2	47%	0.93	0.00	0.93	0	0.97	0.05	1.00	1.0	0.056	38.19	60.68	0.089	1.58
6.562	5609.16	8.9	0.092	8.8	14.8	6.41	1.03%	Sand-Slime Tailings	0.059	119.0	0.36	0.14	0.22	1	1.70	14.977	208.18	17.58	40	1.08%	2.3	47%	0.94	0.00	0.94	0	0.97	0.05	1.00	1.0	0.056	36.47	54.04	0.082	1.46
6.726	5608.99	7.1	0.054	7.0	16.9	7.31	0.76%	Sand-Slime Tailings	0.059	119.0	0.37	0.15	0.22	1	1.70	11.832	164.46	13.95	30	0.81%	2.3	47%	0.95	0.00	0.95	0	0.97	0.05	1.00	1.0	0.056	35.19	49.14	0.077	1.37
6.890	5608.83	6.9	0.094	6.8	23.9	10.34	1.36%	Slime Tailings	0.057	113.1	0.38	0.16	0.22	1	1.70	11.509	159.98	13.66	29	1.44%	2.4	71%	0.96	0.00	0.96	0	0.97	0.05	0.99	1.0	0.056	34.84	48.51	0.076	1.36
7.054	5608.67	6.6	0.021	6.4	33.6	14.56	0.32%	Sand-Slime Tailings	0.059	119.0	0.39	0.16	0.23	1	1.70	10.880	151.23	13.05	27	0.34%	2.2	47%	0.97	0.00	0.97	0	0.97	0.05	0.99	1.0	0.056	34.88	47.93	0.076	1.35
7.218	5608.50	8.6	0.044	8.4	29.9	12.94	0.51%	Sand-Slime Tailings	0.059	119.0	0.40	0.17	0.23	1	1.70	14.246	198.02	16.91	35	0.54%	2.1	47%	0.98	0.00	0.98	0	0.97	0.05	0.99	1.0	0.056	36.23	53.15	0.081	1.45
7.382	5608.34	6.9	0.052	6.7	30.0	13.02	0.75%	Sand-Slime Tailings	0.059	119.0	0.41	0.17	0.24	1	1.70	11.424	158.79	13.64	27	0.80%	2.3	47%	0.99	0.00	0.99	0	0.97	0.05	0.99	1.0	0.056	35.08	48.72	0.076	1.37
7.546	5608.17	6.5	0.057	6.3	35.9	15.54	0.88%	Slime Tailings	0.057	113.1	0.42	0.18	0.24	1	1.70	10.659	148.16	12.82	25	0.94%	2.4	71%	1.00	0.00	1.00	0	0.97	0.05	0.99	1.0	0.056	34.55	47.37	0.075	1.35
7.710	5608.01	7.0	0.066	6.9	29.2	12.65	0.94%	Sand-Slime Tailings	0.059	119.0	0.43	0.18	0.25	1	1.70	11.645	161.87	13.88	27	1.00%	2.4	47%	1.01	0.00	1.01	0	0.97	0.05	0.99	1.0	0.055	35.17	49.06	0.077	1.38
7.874	5607.85	6.7	0.068	6.5	36.4	15.76	1.02%	Slime Tailings	0.057	113.1	0.44	0.19	0.25	1	1.70	10.982	152.65	13.20	25	1.09%	2.4	71%	1.02	0.00	1.02	0	0.96	0.05	0.99	1.0	0.055	34.69	47.89	0.075	1.36
8.038	5607.68	7.0	0.101	6.8	40.5	17.55	1.44%	Slime Tailings	0.057	113.1	0.45	0.19	0.26	1	1.70	11.526	160.21	13.89	26	1.53%	2.5	71%	1.03	0.00	1.03	0	0.96	0.05	0.99	1.0	0.055	34.92	48.81	0.076	1.38
8.202	5607.52	7.2	0.053	7.0	32.9	14.27	0.74%	Sand-Slime Tailings	0.059	119.0	0.46	0.20	0.26	1	1.70	11.866	164.94	14.19	26	0.79%	2.3	47%	1.04	0.00	1.04	0	0.96	0.05	0.99	1.0	0.055	35.28	49.47	0.077	1.40
8.366	5607.35	8.3	0.060	8.1	33.6	14.56	0.72%	Sand-Slime Tailings	0.059	119.0	0.47	0.20	0.26	1	1.70	13.719	190.69	16.35	30	0.77%	2.3	47%	1.05	0.00	1.05	0	0.96	0.05	0.99	1.0	0.055	36.04	52.38	0.080	1.45
8.530	5607.19	8.4	0.039	8.2	29.3	12.71	0.47%	Sand-Slime Tailings	0.059	119.0	0.48	0.21	0.27	1	1.70	13.923	193.53	16.53	29	0.49%	2.2	47%	1.06	0.00	1.06	0	0.96	0.05	0.99	1.0	0.055	36.10	52.63	0.080	1.46
8.694	5607.03	9.0	0.046	8.9	16.0	6.93	0.51%	Sand-Slime Tailings	0.059	119.0	0.49	0.21	0.27	1	1.70	15.130	210.31	17.77	31	0.54%	2.2	47%	1.07	0.00	1.07	0	0.96	0.05	0.99	1.0	0.055	36.53	54.30	0.082	1.49
8.858	5606.86	8.9	0.043	8.8	19.3	8.37	0.48%	Sand-Slime Tailings	0.059	119.0	0.50	0.22	0.28	1	1.70	14.909	207.24	17.55	30	0.51%	2.2	47%	1.08	0.00	1.08	0	0.96	0.05	0.99	1.0	0.055	36.46	54.01	0.081	1.49
9.022	5606.70	9.0	0.081	8.9	11.3	4.91	0.90%	Sand-Slime Tailings	0.059	119.0	0.50	0.22	0.28	1	1.70	15.130	210.31	17.71	30	0.96%	2.3	47%	1.09	0.00	1.09	0	0.96	0.05	0.99	1.0	0.055	36.51	54.23	0.082	1.49
9.186	5606.53	10.5	0.074	10.5	12.7	5.50	0.70%	Sand-Slime Tailings	0.059	119.0	0.51	0.23	0.29	1	1.70	17.782	247.17	20.81	35	0.74%	2.2	47%	1.10	0.00	1.10	0	0.96	0.05	0.99	1.0	0.055	37.60	58.41	0.086	1.58
9.350	5606.37	8.8	0.087	8.8	6.6	2.84	0.98%	Sand-Slime Tailings	0.059	119.0	0.52	0.23	0.29	1	1.70	14.960	207.94	17.46	28	1.05%	2.4	47%	1.11	0.00	1.11	0	0.96	0.05	0.99	1.0	0.055	36.42	53.88	0.081	1.49
9.514	5606.21	6.8	0.122	6.7	23.8	10.30	1.78%	Slime Tailings	0.057	113.1	0.53	0.24	0.30	1	1.70	11.390	158.32	13.52	21	1.93%	2.6	71%	1.12	0.00	1.12	0	0.95	0.05	0.99	1.0	0.054	34.80	48.32	0.076	1.39
9.678	5606.04	8.3	0.124	8.0	40.2	17.44	1.50%	Slime Tailings	0.057	113.1	0.54	0.24	0.30	1	1.70	13.668	189.99	16.37	26	1.60%	2.5	71%	1.13	0.00	1.13	0	0.95	0.05	0.99	1.0	0.054	35.79	52.16	0.080	1.46
9.842	5605.88	13.0	0.032	12.8	32.9	14.24	0.25%	Sand-Slime Tailings	0.059	119.0	0.55	0.25	0.31	1	1.70	21.794	302.94	25.72	41	0.26%	2.0	47%	1.14	0.00	1.14	0	0.95	0.06	0.98	1.0	0.054	39.32	65.04	0.094	1.73
10.006	5605.71	14.0	0.141	13.9	7.1	3.09	1.01%	Sand-Slime Tailings	0.059	119.0	0.56	0.25	0.31	1	1.70	23.647	328.69	27.55	43	1.05%	2.2	47%	1.14	0.00	1.14	0	0.95	0.06	0.98	1.0	0.054	39.96	67.52	0.097	1.79
10.170	5605.55	8.3	0.114	8.2	6.4	2.78	1.38%	Sand-Slime Tailings	0.059	119.0	0.57	0.26	0.31	1	1.70	13.957	194.00	16.29	24	1.48%	2.5	47%	1.15	0.00	1.15	0	0.95	0.05	0.99	1.0	0.054	36.01	52.30	0.080	1.47
10.335	5605.39	8.7	0.102	8.7	10.1	4.39	1.17%	Sand-Slime Tailings	0.059	119.0	0.58	0.26	0.32	1	1.70	14.722	204.64	17.22	25	1.25%	2.4	47%	1.16	0.00	1.16	0	0.95	0.05	0.98	1.0	0.054	36.34	53.57	0.081	1.50
10.499	5605.22	23.1	0.120	23.1	9.6	4.17	0.52%	Sand-Slime Tailings	0.059	119.0	0.59	0.27	0.32	1	1.70	39.219	545.14	45.67	70	0.53%	1.9	47%	1.17	0.00	1.17	0	0.95	0.07	0.98	1.0	0.054	46.32	91.99	0.130	2.42
10.663	5605.06	24.0	0.124	23.9	8.7	3.75	0.52%	Sand-Slime Tailings	0.059	119.0	0.60	0.27	0.33	1	1.70	40.647	564.99	47.32	71	0.53%	1.9	47%	1.18	0.00	1.18	0	0.95	0.07	0.98	1.0	0.054	46.90	94.21	0.133	2.49
10.827	5604.89	25.3	0.175	25.3	8.6	3.72	0.69%	Sand-Slime Tailings	0.059	119.0	0.61	0.28	0.33	1	1.70	42.925	596.66	49.96	74	0.71%	1.9	47%	1.19	0.00	1.19	0	0.95	0.07	0.98	1.0	0.053	47.82	97.78	0.139	2.60
10.991	5604.73	28.0	0.202	28.0	8.4	3.62	0.72%	Sand-Slime Tailings	0.059	119.0	0.62	0.28	0.34	1	1.70	47.583	661.40	55.37	81	0.74%	1.9	47%	1.20	0.00	1.20	0	0.94	0.07	0.98	1.0	0.053	49.72	105.09	0.151	2.84
11.155	5604.57	24.5	0.216	24.4	7.8	3.38	0.88%	Sand-Slime Tailings	0.059	119.0	0.63	0.29	0.34	1	1.70	41.514	577.04	48.31	70	0.91%	2.0	47%	1.21	0.00	1.21	0	0.94	0.07	0.98	1.0	0.053	47.25	95.56	0.135	2.54
11.319	5604.40	20.2	0.227	20.2	7.1	3.09	1.12%	Sand-Slime Tailings	0.059	119.0	0.64	0.29	0.35	1	1.70	34.272	476.38	39.89	56	1.16%	2.1	47%	1.22	0.00	1.22	0	0.94	0.06	0.98	1.0	0.053	44.29	84.19	0.118	2.23
11.483	5604.24	17.7	0.281	17.6	7.2	3.11	1.59%	Sand-Slime Tailings	0.059	119.0	0.65	0.30	0.35	1	1.70	29.937	416.12	34.86	48	1.65%	2.3	47%	1.23	0.00	1.23	0	0.94	0.06	0.98	1.0	0.053	42.53	77.39	0.109	2.05
11.647	5604.07	17.7	0.326	17.7	8.6	3.74	1.84%	Sand-Slime Tailings	0.059	119.0	0.66	0.30	0.36	1	1.70	30.039	417.54	34.99	48	1.91%	2.3	47%	1.24	0.00	1.24	0	0.94	0.06	0.98	1.0	0.053	42.57	77.57	0.109	2.06
11.811	5603.91	20.4	0.539	20.3	13.1	5.69	2.65%	Sand-Slime Tailings	0.059	119.0	0.67	0.31	0.36	1	1.70	34.493	479.45	40.22	55	2.74%	2.4	47%	1.25	0.00	1.25	0	0.94	0.07	0.98	1.0	0.053	44.41	84.63	0.119	2.25
11.975	5603.75	17.7	0.579	17.6	13.2	5.71	3.27%	Slime Tailings	0.057	113.1	0.68	0.31	0.37	1	1.70	29.937	416.12	34.93	47	3.40%	2.5	71%	1.26	0.00	1.26	0	0.94	0.06	0.98	1.0	0.053	42.25	77.18	0.109	2.06
12.139	5603.58	11.5	0.499	11.4	15.5	6.73	4.33%	Slime Tailings	0.057	113.1	0.69	0.32	0.37	1	1.70	19.448	270.33	22.78	29	4.60%	2.7	71%	1.27	0.00	1.27	0	0.94	0.05	0.98	1.0	0.053	38.02	60.80	0.089	1.68
12.303	5603.42	10.9	0.321	10.7	30.3	13.15	2.94%	Slime Tailings	0.057	113.1	0.70	0.32	0.37	1	1.70	18.258	253.79	21.58	27	3.14%	2.7	71%	1.28	0.00	1.28	0	0.94	0.05	0.98	1.0	0.053	37.60	59.18	0.087	1.64
12.467	5603.25	10.3	0.339	10.0	56.2	24.35	3.28%	Slime Tailings	0.057	113.1	0.71	0.33	0.38	1	1.70	16.949	235.59	20.38	25	3.53%	2.7	71%	1.29	0.00	1.29	0	0.93	0.05	0.98	1.0	0.053	37.18	57.56	0.085	1.61
12.631	5603.09	8.7	0.195	8.6	16.5	7.14	2.25%	Slime Tailings	0.057	113.1	0.72	0.33	0.38	1	1.70	14.586	202.75	17.14	21	2.45%	2.7	71%	1.30	0.00	1.30	0	0.93	0.05	0.98	1.0	0.053	36.06	53.20	0.081	1.53
12.795	5602.92	9.5	0.203	9.3	29.1	12.59	2.13%	Slime Tailings	0.057	113.1	0.73	0.34	0.39	1	1.70	15.878	220.70	18.80	23	2.31%	2.6	71%	1.31	0.00	1.31	0	0.93	0.05	0.98	1.0	0.053	36.63	55.43	0.083	1.57
12.959	5602.76	8.1	0.206	7.9	33.3	14.44	2.53%	Slime Tailings	0.057	113.1	0.73	0.34	0.39	1	1.70	13.498	187.62	16.09	19	2.78%	2.8	71%	1.32	0.00	1.32	0	0.93	0.05	0.98	1.0	0.053	35.69	51.78	0.079	1.51
13.123	5602.60	7.2	0.183	6.9	46.1	19.99	2.54%	Slime Tailings	0.057	113.1	0.74	0.35	0.39	1	1.70	11.764	163.52	14.23	16	2.83%	2.8	71%	1.33	0.00	1.33	0	0.93	0.05	0.98	1.0	0.053	35.04	49.28	0.077	1.46
13.287	5602.43	10.7	0.106	10.4	37.6	16.29	0.99%	Sand-Slime Tailings	0.059	119.0	0.75	0.35	0.40	1	1.70	17.731	246.46	21.06	25	1.07%	2.4	47%	1.34	0.00	1.34	0	0.93	0.05	0.98	1.0	0.052	37.69	58.74	0.086	1.65
13.451	5602.27	16.7	0.102	16.7	10.8	4.70	0.61%	Sand-Slime Tailings	0.059	119.0	0.76	0.36	0.40	1	1.70	28.339	393.91	33.05	40	0.64%	2.1	47%	1.35	0.00	1.35	0	0.93	0.06	0.97	1.0	0.052	41.89	74.94	0.106	2.03
13.615	5602.10	17.2	0.121	17.1	10.8	4.69	0.70%	Sand-Slime Tailings	0.059	119.0	0.77	0.36	0.41	1	1.69	29.024	403.44	33.84	40	0.74%	2.2	47%	1.36	0.00	1.36	0	0.93	0.06	0.97	1.0	0.052	42.17	76.01	0.107	2.06
13.779	5601.94	17.2	0.165	17.1	13.8	5.99	0.96%	Sand-Slime Tailings	0.059	119.0	0.78	0.37	0.41	1	1.68	28.815	400.53	33.64	40	1.00%	2.2	47%	1.37	0.00	1.37	0	0.92	0.06	0.97	1.0	0.052	42.10	75.73	0.107	2.06
13.943	5601.78	17.7	0.203	17.6	15.3	6.65	1.15%	Sand-Slime Tailings	0.059	119.0	0.79	0.38	0.42	1	1.67	29.281	407.00	34.19	40	1.20%	2.3	47%	1.38	0.00	1.38	0	0.92	0.06	0.97	1.0	0.052	42.29	76.49	0.108	2.08
14.107	5601.61	19.0	0.286	18.9	16.8	7.30	1.50%	Sand-Slime Tailings	0.059	119.0	0.80	0.38	0.42	1	1.64	31.034	431.37	36.24	43	1.57%	2.3	47%	1.39	0.00	1.39	0	0.92	0.06	0.97	1.0	0.052	43.01	79.26	0.112	2.16
14.271	5601.45	18.8	0.300	18.7	17.6	7.62	1.59%	Sand-Slime Tailings	0.059	119.0	0.81	0.39	0.43	1	1.63	30.546	424.59	35.69	42	1.67%	2.3	47%	1.39	0.00	1.39	0	0.92	0.06	0.97	1.0	0.052	42.82	78.50	0.111	2.14
14.436	5601.28	21.0	0.318	20.9	18.2	7.88	1.51%	Sand-Slime Tailings	0.059	119.0	0.82	0.39	0.43	1	1.60	33.469	465.22	39.08	47	1.58%	2.3	47%	1.40	0.00	1.40	0	0.92	0.06	0.97	1.0	0.051	44.01	83.09	0.117	2.27
14.600	5601.12	18.5	0.163	18.5	9.1	3.93	0.88%	Sand-Slime Tailings	0.059	119.0	0.83	0.40	0.44	1	1.61	29.799	414.21	34.72	41	0.92%	2.2	47%	1.41	0.00	1.41	0	0.92	0.06	0.97	1.0	0.051	42.48	77.19	0.109	2.12
14.764	5600.96	15.4	0.117	15.4	3.3	1.43	0.76%	Sand-Slime Tailings	0.059	119.0	0.84	0.40	0.44	1	1.63	25.149	349.57	29.25	33	0.80%	2.3	47%	1.42	0.00	1.42	0	0.92	0.06	0.97	1.0	0.051	40.56	69.81	0.099	1.93
14.928	5600.79	12.2	0.162	12.2	9.3	4.03	1.32%	Sand-Slime Tailings	0.059	119.0	0.85	0.41	0.45	1	1.66	20.144	280.00	23.51	26	1.42%	2.5	47%	1.43	0.00	1.43	0	0.92	0.05	0.97	1.0	0.051	38.55	62.05	0.090	1.75
15.092	5600.63	11.5	0.194	11.3	27.6	11.96	1.69%	Sand-Slime Tailings	0.059	119.0	0.86	0.41	0.45	1	1.65	18.644	259.15	21.98	24	1.83%	2.6	47%	1.44	0.00	1.44	0	0.91	0.05	0.97	1.0	0.051	38.01	60.00	0.088	1.71
15.256	5600.46	10.0	0.206	9.9	14.5	6.29	2.06%	Slime Tailings	0.057	113.1	0.87	0.42	0.45	1	1.65	16.317	226.81	19.13	20	2.26%	2.7	71%	1.45	0.00	1.45	0	0.91	0.05	0.97	1.0	0.051	36.75	55.87	0.083	1.62
15.420	5600.30	8.6	0.137	8.4	31.8	13.77	1.60%	Slime Tailings	0.057	113.1	0.88	0.42	0.46	1	1.64	13.698	190.40	16.29	17	1.78%	2.7	71%	1.46	0.00	1.46	0	0.91	0.05	0.97	1.0	0.051	35.76	52.05	0.079	1.55
15.584	5600.14	9.3	0.108	9.1	29.9	12.95	1.16%	Sand-Slime Tailings	0.059	119.0	0.89	0.43	0.46	1	1.62	14.841	206.28	17.59	18	1.28%	2.6	47%	1.47	0.00	1.47	0	0.91	0.05	0.97	1.0	0.051	36.47	54.06	0.082	1.59
15.748	5599.97	8.4	0.114	8.2	29.4	12.75	1.36%	Sand-Slime Tailings	0.059	119.0	0.90	0.43	0.47	1	1.61	13.195	183.41	15.67	16	1.53%	2.7	47%	1.48	0.00	1.48	0	0.91	0.05	0.97	1.0	0.051	35.80	51.47	0.079	1.54
15.912	5599.81	7.3	0.150	7.0	43.6	18.89	2.07%	Slime Tailings	0.057	113.1	0.91	0.44	0.47	1	1.60	11.168	155.23	13.48	13	2.36%	2.8	71%	1.49	0.00	1.49	0	0.91	0.05	0.97	1.0	0.051	34.78	48.26	0.076	1.48
16.076	5599.64	6.8	0.155	6.5	59.5	25.76	2.27%	Slime Tailings	0.057	113.1	0.92	0.44	0.48	1	1.59	10.281	142.91	12.63	12	2.62%	2.9	71%	1.50	0.00	1.50	0	0.91	0.05	0.97	1.0	0.051	34.48	47.11	0.075	1.46
16.240	5599.48	6.4	0.150	6.0	55.9	24.23	2.36%	Slime Tailings	0.057	113.1	0.93	0.45	0.48	1	1.58	9.501	132.07	11.67	11	2.76%	2.9	71%	1.51	0.00	1.51	0	0.91	0.05	0.97	1.0	0.051	34.15	45.83	0.074	1.44
16.404	5599.32	6.2	0.155	5.8	62.4	27.06	2.49%	Slime Tailings	0.057	113.1	0.94	0.45	0.48	1	1.57	9.139	127.04	11.32	11	2.93%	3.0	71%	1.52	0.00	1.52	0	0.90	0.05	0.97	1.0	0.051	34.03	45.36	0.073	1.44
16.568	5599.15	6.4	0.156	6.0	61.6	26.67	2.43%	Slime Tailings	0.057	113.1	0.95	0.46	0.49	1	1.56	9.390	130.52	11.60	11	2.85%	2.9	71%	1.53	0.00	1.53	0	0.90	0.05	0.97	1.0	0.051	34.13	45.73	0.074	1.45
16.732	5598.99	6.5	0.127	6.1	59.1	25.59	1.96%	Slime Tailings	0.057	113.1	0.95	0.46	0.49	1	1.55	9.436	131.16	11.62	11	2.30%	2.9	71%	1.54	0.00	1.54	0	0.90	0.05	0.97	1.0	0.051	34.13	45.76	0.074	1.45
16.896	5598.82	6.4	0.116	6.1	51.0	22.11	1.81%	Slime Tailings	0.057	113.1	0.96	0.47	0.50	1	1.54	9.374	130.30	11.46	11	2.13%	2.9	71%	1.55	0.00	1.55	0	0.90	0.05	0.97	1.0	0.051	34.08	45.53	0.073	1.45
17.060	5598.66	5.5	0.121	5.1	60.9	26.40	2.22%	Slime Tailings	0.057	113.1	0.97	0.47	0.50	1	1.53	7.756	107.81	9.68	9	2.70%	3.0	71%	1.56	0.00	1.56	0	0.90	0.04	0.97	1.0	0.051	33.46	43.14	0.071	1.41
17.224	5598.50	5.3	0.143	4.9	60.8	26.34	2.71%	Slime Tailings	0.057	113.1	0.98	0.48	0.51	1	1.52	7.433	103.32	9.30	9	3.33%	3.1	71%	1.57	0.00	1.57	0	0.90	0.04	0.97	1.0	0.051	33.33	42.63	0.071	1.40

Liquefaction Triggering Analyses – Youd et al. (2001); Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.363

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W3

Data File: 13-52106_SP2W3-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Dat

Legend:
- Tailings Sands
- Tailings Sand-Slimes
- Tailings Slimes
- Interim Cover
- Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Parameter
5613.80	Water surface elevation during CPT investigation (ft
5607.44	Water surface elevation at t_0 (ft amsl)
5597.74	Water surface elevation at t_1 (ft amsl)
5592.74	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Ear
7.51	Equiv. Number of Uniform Strain Cycles, N

Value	Parameter
5615.72	Ground Surface Elevation at time of CPT (ft amsl)
5626.27	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after plac
3.50	Thickness of Water Storage/Rooting Zone Layer (ft)
4.00	Thickness of High Compaction Layer (ft)
2.55	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1164.98	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5592.74	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer	Total Stress at Midpoint of Layer	Equil Pore Pressure at Bottom of Layer	Equil Pore Pressure at Midpoint of Layer (tsf)	Effective Stress at Bottom of Layer	Effective Stress at Midpoint of Layer	Midpoint Depth at t_1, z_1	Shear Wave Velocity, V_s	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
Erosion Protection Layer	######	5626.02	5625.77	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014	0.08	508	1.7E-03	4.4E+02	3.0E-06	11	0.068	46696	0.00%	1.20	0.80	0.04%	0.000	0.32	0.133	0.778	0.00%	0.0000
Water Storage/Rooting Zone Layer	######	5624.02	5622.27	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121	0.69	508	1.7E-03	4.3E+02	2.8E-05	11	0.118	18930	0.00%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
High Compaction Layer	######	5620.27	5618.27	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334	1.83	508	1.9E-03	4.8E+02	6.8E-05	11	0.153	12419	0.01%	0.65	0.75	0.02%	0.000	0.34	0.079	0.765	0.00%	0.0000
Platform/Random Fill Layer	######	5617	5615.72	2.55	0.050	101	0.582	0.518	0.00	0.00	0.582	0.518	2.83	508	1.6E-03	4.0E+02	1.3E-04	11	0.172	10354	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
17.388	5598.33	5.4	0.167	5.0	60.4	26.17	3.09%	Slime Tailings	0.057	113.1	0.99	0.48	0.51	1	1.51	7.567	105.17	9.45	9	3.79%	3.1	71%	1.57	0.00	1.57	0
17.552	5598.17	8.1	0.153	7.8	49.8	21.59	1.90%	Slime Tailings	0.057	113.1	1.00	0.49	0.51	1	1.50	11.622	161.55	14.04	14	2.16%	2.8	71%	1.58	0.00	1.58	0
17.716	5598.00	12.1	0.146	11.9	23.4	10.13	1.21%	Sand-Slime Tailing	0.059	119.0	1.01	0.49	0.52	1	1.49	17.713	246.21	20.82	21	1.32%	2.5	47%	1.59	0.00	1.59	0
17.880	5597.84	14.1	0.132	14.0	21.9	9.47	0.94%	Sand-Slime Tailing	0.059	119.0	1.02	0.50	0.52	1	1.46	20.417	283.79	23.94	25	1.01%	2.4	47%	1.60	0.00	1.60	0
18.044	5597.68	14.0	0.074	13.9	17.3	7.51	0.53%	Sand-Slime Tailing	0.059	119.0	1.03	0.50	0.53	1	1.45	20.197	280.74	23.64	25	0.57%	2.3	47%	1.61	0.00	1.61	1
18.208	5597.51	11.8	0.070	11.7	17.2	7.43	0.59%	Sand-Slime Tailing	0.059	119.0	1.04	0.51	0.53	1	1.46	16.985	236.10	19.91	20	0.65%	2.4	47%	1.62	0.01	1.62	1
18.372	5597.35	9.1	0.178	8.9	23.4	10.12	1.96%	Slime Tailings	0.057	113.1	1.05	0.51	0.54	1	1.45	12.930	179.72	15.26	15	2.22%	2.8	71%	1.63	0.01	1.62	1
18.537	5597.18	6.8	0.214	6.6	44.6	19.31	3.12%	Slime Tailings	0.057	113.1	1.06	0.52	0.54	1	1.44	9.455	131.43	11.45	11	3.70%	3.0	71%	1.64	0.02	1.62	1
18.701	5597.02	12.2	0.207	12.1	17.2	7.44	1.70%	Sand-Slime Tailing	0.059	119.0	1.07	0.52	0.55	1	1.43	17.226	239.45	20.19	20	1.87%	2.6	47%	1.65	0.02	1.63	1
18.865	5596.86	12.4	0.172	12.2	21.3	9.23	1.39%	Sand-Slime Tailing	0.059	119.0	1.08	0.53	0.55	1	1.42	17.382	241.62	20.41	21	1.52%	2.6	47%	1.66	0.03	1.63	1
19.029	5596.69	14.4	0.138	14.3	22.3	9.64	0.96%	Sand-Slime Tailing	0.059	119.0	1.09	0.53	0.55	1	1.40	20.001	278.01	23.46	24	1.04%	2.4	47%	1.67	0.03	1.64	1
19.193	5596.53	15.7	0.130	15.6	20.8	8.99	0.83%	Sand-Slime Tailing	0.059	119.0	1.10	0.54	0.56	1	1.39	21.538	299.38	25.22	26	0.89%	2.4	47%	1.68	0.04	1.64	1
19.357	5596.36	16.7	0.123	16.5	23.1	9.99	0.74%	Sand-Slime Tailing	0.059	119.0	1.11	0.54	0.56	1	1.37	22.650	314.83	26.54	28	0.79%	2.3	47%	1.69	0.04	1.65	1
19.521	5596.20	16.7	0.112	16.5	24.3	10.52	0.67%	Sand-Slime Tailing	0.059	119.0	1.12	0.55	0.57	1	1.36	22.519	313.02	26.39	27	0.72%	2.3	47%	1.70	0.05	1.65	1
19.685	5596.04	16.2	0.142	16.1	26.1	11.31	0.88%	Sand-Slime Tailing	0.059	119.0	1.13	0.55	0.57	1	1.36	21.815	303.23	25.59	26	0.94%	2.4	47%	1.71	0.05	1.66	1
19.849	5595.87	13.7	0.203	13.5	30.3	13.14	1.48%	Sand-Slime Tailing	0.059	119.0	1.14	0.56	0.58	1	1.36	18.424	256.09	21.70	22	1.62%	2.6	47%	1.72	0.06	1.66	1
20.013	5595.71	9.9	0.190	9.6	41.6	18.02	1.92%	Slime Tailings	0.057	113.1	1.15	0.56	0.58	1	1.36	13.071	181.68	15.59	15	2.18%	2.8	71%	1.73	0.06	1.67	1
20.177	5595.54	8.7	0.172	8.3	65.6	28.43	1.98%	Slime Tailings	0.057	113.1	1.16	0.57	0.59	1	1.35	11.187	155.51	13.64	13	2.28%	2.8	71%	1.74	0.07	1.67	1
20.341	5595.38	8.9	0.207	8.5	67.9	29.41	2.32%	Slime Tailings	0.057	113.1	1.16	0.57	0.59	1	1.34	11.394	158.38	13.90	13	2.67%	2.9	71%	1.75	0.07	1.67	1
20.505	5595.22	9.3	0.168	8.9	65.7	28.45	1.81%	Slime Tailings	0.057	113.1	1.17	0.58	0.59	1	1.34	11.840	164.57	14.39	14	2.08%	2.8	71%	1.76	0.08	1.68	1
20.669	5595.05	12.9	0.090	12.6	43.1	18.67	0.70%	Sand-Slime Tailing	0.059	119.0	1.18	0.58	0.60	1	1.33	16.762	232.99	19.88	20	0.77%	2.4	47%	1.77	0.08	1.68	1
20.833	5594.89	13.2	0.156	13.1	27.5	11.92	1.18%	Sand-Slime Tailing	0.059	119.0	1.19	0.59	0.60	1	1.32	17.242	239.67	20.29	20	1.30%	2.5	47%	1.78	0.09	1.69	1
20.997	5594.72	9.7	0.180	9.2	68.8	29.83	1.86%	Slime Tailings	0.057	113.1	1.20	0.60	0.61	1	1.31	12.134	168.66	14.75	14	2.13%	2.8	71%	1.79	0.09	1.69	1
21.161	5594.56	9.1	0.158	8.5	91.2	39.53	1.73%	Slime Tailings	0.057	113.1	1.21	0.60	0.61	1	1.31	11.155	155.05	13.82	13	2.00%	2.8	71%	1.79	0.10	1.70	1
21.325	5594.39	9.1	0.173	8.5	87.2	37.78	1.90%	Slime Tailings	0.057	113.1	1.22	0.61	0.62	1	1.30	11.096	154.23	13.71	13	2.20%	2.8	71%	1.80	0.10	1.70	1
21.489	5594.23	10.0	0.173	9.4	103.1	44.66	1.73%	Sand-Slime Tailing	0.059	119.0	1.23	0.61	0.62	1	1.29	12.116	168.41	15.04	14	1.97%	2.8	47%	1.81	0.11	1.70	1
21.653	5594.07	11.1	0.173	10.5	102.2	44.29	1.56%	Sand-Slime Tailing	0.059	119.0	1.24	0.62	0.63	1	1.28	13.420	186.53	16.54	16	1.76%	2.7	47%	1.82	0.11	1.71	1
22.980	5592.74							Sand-Slime Tailing	0.059	119.0													1.90	0.14	1.77	1

Liquefaction Triggering Analyses

Idriss & Boulanger (2008): Cyclic Stress Ratio (r_d, C_σ, K_σ, K_α, CSR M=7.5, σ'v=1atm); Cyclic Resistance Ratio (Δqc_{1n}, qc_{1n-cs}, (CRR) M=7.5, σ'v=1atm); FoS. Youd et al. (2001): Cyclic Stress Ratio (r_d, D_r, f, K_σ, K_α, CSR M=7.5, σ'v=1atm); Kc, qc_{1n-cs}, (CRR) M=7.5, σ'v=1atm; FoS.

Depth at time of CPT (ft)	I&B r_d	C_σ	K_σ	K_α	CSR	Δqc_{1n}	qc_{1n-cs}	(CRR)	FoS	Youd r_d	D_r	f	K_σ	K_α	CSR	Kc	qc_{1n-cs}	(CRR)	FoS	Avg FoS	Liquefiable? 1=Yes 2=No
17.388	0.90	0.04	0.97	1.0	0.050	33.38	42.83	0.071	1.41	0.93	0.18	0.80	1.11	1.0	0.037	8.01	75.70	0.120	4.93	3.17	2
17.552	0.90	0.05	0.97	1.0	0.050	34.98	49.02	0.077	1.52	0.93	0.22	0.80	1.11	1.0	0.037	4.80	67.46	0.109	4.42	2.97	2
17.716	0.89	0.05	0.97	1.0	0.050	37.61	58.43	0.086	1.72	0.93	0.26	0.80	1.11	1.0	0.037	2.91	60.54	0.101	4.06	2.89	2
17.880	0.89	0.06	0.97	1.0	0.050	38.70	62.64	0.091	1.82	0.93	0.28	0.80	1.10	1.0	0.037	2.34	56.01	0.096	3.85	2.84	2
18.044	0.89	0.05	0.97	1.0	0.050	38.59	62.23	0.090	1.81	0.93	0.28	0.80	1.10	1.0	0.037	1.94	45.86	0.088	3.49	2.65	2
18.208	0.89	0.05	0.97	1.0	0.050	37.28	57.19	0.085	1.70	0.93	0.26	0.80	1.10	1.0	0.038	2.31	46.04	0.088	3.46	2.58	2
18.372	0.89	0.05	0.97	1.0	0.050	35.40	50.66	0.078	1.56	0.93	0.23	0.80	1.10	1.0	0.038	4.60	70.24	0.112	4.35	2.95	2
18.537	0.89	0.05	0.97	1.0	0.050	34.07	45.52	0.073	1.46	0.93	0.20	0.80	1.10	1.0	0.038	7.03	80.43	0.128	4.92	3.19	2
18.701	0.89	0.05	0.97	1.0	0.050	37.38	57.57	0.085	1.70	0.93	0.26	0.80	1.10	1.0	0.038	3.49	70.44	0.113	4.27	2.98	2
18.865	0.89	0.05	0.97	1.0	0.050	37.46	57.87	0.086	1.70	0.93	0.26	0.80	1.09	1.0	0.038	3.17	64.62	0.105	3.94	2.82	2
19.029	0.88	0.05	0.96	1.0	0.050	38.53	61.98	0.090	1.79	0.93	0.28	0.80	1.09	1.0	0.038	2.42	56.88	0.097	3.60	2.70	2
19.193	0.88	0.06	0.96	1.0	0.050	39.15	64.37	0.093	1.84	0.93	0.29	0.80	1.09	1.0	0.039	2.17	54.73	0.095	3.49	2.67	2
19.357	0.88	0.06	0.96	1.0	0.050	39.61	66.14	0.095	1.88	0.93	0.30	0.80	1.09	1.0	0.039	2.00	53.20	0.094	3.41	2.65	2
19.521	0.88	0.06	0.96	1.0	0.050	39.56	65.95	0.095	1.88	0.93	0.30	0.80	1.09	1.0	0.039	1.95	51.52	0.093	3.33	2.60	2
19.685	0.88	0.06	0.96	1.0	0.051	39.28	64.87	0.093	1.85	0.93	0.29	0.80	1.08	1.0	0.039	2.20	56.30	0.097	3.44	2.64	2
19.849	0.88	0.05	0.96	1.0	0.051	37.91	59.61	0.087	1.73	0.93	0.27	0.80	1.08	1.0	0.039	3.13	67.89	0.109	3.85	2.79	2
20.013	0.88	0.05	0.97	1.0	0.051	35.52	51.11	0.079	1.54	0.93	0.23	0.80	1.08	1.0	0.039	4.55	71.01	0.113	3.96	2.75	2
20.177	0.87	0.05	0.97	1.0	0.051	34.84	48.47	0.076	1.49	0.92	0.21	0.80	1.08	1.0	0.039	5.13	70.00	0.112	3.88	2.68	2
20.341	0.87	0.05	0.97	1.0	0.051	34.93	48.82	0.076	1.50	0.92	0.22	0.80	1.08	1.0	0.039	5.43	75.40	0.120	4.12	2.81	2
20.505	0.87	0.05	0.97	1.0	0.051	35.10	49.49	0.077	1.51	0.92	0.22	0.80	1.08	1.0	0.039	4.75	68.35	0.110	3.74	2.62	2
20.669	0.87	0.05	0.96	1.0	0.051	37.27	57.16	0.085	1.66	0.92	0.26	0.80	1.08	1.0	0.040	2.50	49.68	0.091	3.09	2.37	2
20.833	0.87	0.05	0.97	1.0	0.051	37.42	57.71	0.085	1.67	0.92	0.26	0.80	1.07	1.0	0.040	3.02	61.18	0.101	3.39	2.53	2
20.997	0.87	0.05	0.97	1.0	0.051	35.22	49.97	0.077	1.51	0.92	0.22	0.80	1.07	1.0	0.040	4.73	69.77	0.112	3.70	2.61	2
21.161	0.87	0.05	0.97	1.0	0.051	34.90	48.72	0.076	1.49	0.92	0.21	0.80	1.07	1.0	0.040	4.84	66.95	0.108	3.55	2.52	2
21.325	0.87	0.05	0.97	1.0	0.051	34.86	48.57	0.076	1.48	0.91	0.21	0.80	1.07	1.0	0.040	5.08	69.61	0.111	3.64	2.56	2
21.489	0.86	0.05	0.97	1.0	0.051	35.58	50.61	0.078	1.52	0.91	0.22	0.80	1.07	1.0	0.040	4.53	68.09	0.109	3.54	2.53	2
21.653	0.86	0.05	0.97	1.0	0.051	36.10	52.64	0.080	1.56	0.91	0.23	0.80	1.07	1.0	0.040	4.02	66.55	0.107	3.45	2.50	2

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.363

Depth at time of CPT (ft)	Depth at t_1, z_1 m	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Maximum Shear Strain Modulus, G_{max} tsf	P = γ_{eff}*(G_{eff}/G_{max}) tsf	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
17.388	8.52	500	1.8E-03	4.4E+02	3.5E-04	16	0.479	5525	0.10%	2.00	0.65	0.03%	0.018	0.34	0.079	0.765	2.77%	0.0045
17.552	8.57	500	1.8E-03	4.4E+02	3.5E-04	16	0.479	5512	0.10%	2.00	0.65	0.03%	0.018	0.34	0.079	0.765	2.79%	0.0046
17.716	8.62	500	1.8E-03	4.6E+02	3.4E-04	10	0.229	6670	0.09%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.37%	0.0039
17.880	8.67	500	1.8E-03	4.6E+02	3.4E-04	10	0.229	6653	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.40%	0.0039
18.044	8.72	500	1.8E-03	4.6E+02	3.4E-04	10	0.229	6640	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.43%	0.0040
18.208	8.77	500	1.8E-03	4.6E+02	3.4E-04	10	0.230	6632	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.46%	0.0040
18.372	8.82	500	1.8E-03	4.4E+02	3.6E-04	16	0.481	5461	0.11%	2.00	0.65	0.03%	0.019	0.34	0.079	0.765	2.96%	0.0049
18.537	8.87	500	1.8E-03	4.4E+02	3.6E-04	16	0.481	5455	0.11%	2.00	0.65	0.03%	0.020	0.34	0.079	0.765	2.99%	0.0049
18.701	8.92	500	1.8E-03	4.6E+02	3.4E-04	10	0.230	6610	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.56%	0.0042
18.865	8.97	500	1.8E-03	4.6E+02	3.5E-04	10	0.230	6603	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.59%	0.0043
19.029	9.02	500	1.8E-03	4.6E+02	3.5E-04	10	0.230	6595	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.63%	0.0043
19.193	9.07	500	1.8E-03	4.6E+02	3.5E-04	10	0.230	6587	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.66%	0.0044
19.357	9.12	500	1.8E-03	4.6E+02	3.6E-04	10	0.231	6579	0.10%	2.00	0.65	0.03%	0.018	0.34	0.079	0.765	2.69%	0.0044
19.521	9.17	500	1.8E-03	4.6E+02	3.6E-04	10	0.231	6572	0.10%	2.00	0.65	0.03%	0.018	0.34	0.079	0.765	2.73%	0.0045
19.685	9.22	538	1.8E-03	5.3E+02	3.1E-04	10	0.231	6564	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.91%	0.0031
19.849	9.27	538	1.8E-03	5.3E+02	3.1E-04	10	0.231	6556	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.94%	0.0032
20.013	9.32	538	1.8E-03	5.1E+02	3.3E-04	16	0.482	5399	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.38%	0.0039
20.177	9.37	538	1.8E-03	5.1E+02	3.3E-04	16	0.482	5394	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.41%	0.0039
20.341	9.42	538	1.8E-03	5.1E+02	3.4E-04	16	0.483	5388	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.43%	0.0040
20.505	9.47	538	1.8E-03	5.1E+02	3.4E-04	16	0.483	5383	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.46%	0.0040
20.669	9.52	538	1.8E-03	5.3E+02	3.2E-04	10	0.232	6522	0.08%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.06%	0.0034
20.833	9.57	538	1.8E-03	5.3E+02	3.2E-04	10	0.232	6514	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.09%	0.0034
20.997	9.62	538	1.8E-03	5.1E+02	3.4E-04	16	0.483	5365	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.54%	0.0042
21.161	9.67	538	1.8E-03	5.1E+02	3.4E-04	16	0.483	5360	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.57%	0.0042
21.325	9.72	538	1.8E-03	5.1E+02	3.5E-04	16	0.483	5354	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.60%	0.0043
21.489	9.77	538	1.8E-03	5.3E+02	3.3E-04	10	0.233	6487	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.19%	0.0036
21.653	9.82	538	1.8E-03	5.3E+02	3.3E-04	10	0.233	6480	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.22%	0.0036
22.980	10.22	538	1.8E-03	5.3E+02	3.5E-04	10	0.235	6391	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.43%	0.0322

Extra layer added to analyze seismic settlement of tailings below the bottom of CPT investigation.

Energy Fuels Resources (USA) Inc.
White Mesa Mill
Seismic Settlement Analyses

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W4-C

Data File: 13-52106_SP2W4-C-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Dat

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Parameter
5611.20	Water surface elevation during CPT investigation (ft amsl)
5607.96	Water surface elevation at t_0 (ft amsl)
5593.50	Water surface elevation at t_1 (ft amsl)
5588.50	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earthquake
7.51	Equiv. Number of Uniform Strain Cycles, N
5616.24	Ground Surface Elevation at time of CPT (ft amsl)
5626.19	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
1.95	Thickness of Random/Platform Fill on top of existing interim cover (ft)
1104.55	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5588.50	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom Layer	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer	Total Stress at Midpoint of Layer	Equil Pore Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer	Effective Stress at Bottom of Layer	Effective Stress at Midpoint of Layer	Midpoint Depth at t_1, z_1	Shear Wave Velocity, V_s	Soil Density, ρ (tcf)	Max Shear Modulus, G_{max} (tsf)	$P = \gamma_{eff}*(G_{eff}/G_{max})$	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
Erosion Protection Layer	5626.19	5625.94	5625.69	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014	0.08	508	1.7E-03	4.4E+02	3.0E-06	11	0.068	46696	0.00%	1.20	0.80	0.04%	0.000	0.32	0.133	0.778	0.00%	0.0000
Water Storage/Rooting Zone Layer	5625.69	5623.94	5622.19	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121	0.69	508	1.7E-03	4.3E+02	2.8E-05	11	0.118	18930	0.00%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
High Compaction Layer	5622.19	5620.19	5618.19	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334	1.83	508	1.9E-03	4.8E+02	6.8E-05	11	0.153	12419	0.01%	0.65	0.75	0.02%	0.000	0.34	0.079	0.765	0.00%	0.0000
Platform/Random Fill Layer	5618.19	5617.22	5616.24	1.95	0.050	101	0.552	0.503	0.00	0.00	0.552	0.503	2.74	508	1.6E-03	4.0E+02	1.2E-04	11	0.170	10482	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000

2013 CPT Data from ConeTec / CPT Data Interpretations

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %
0.164	5616.08	20.1	0.057	20.0	8.1	3.50	0.28%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0	1.70	34.068	473.55	39.67	2431	0.28%	0.7	51%
0.328	5615.91	44.3	0.080	44.3	3.0	1.28	0.18%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	75.242	1045.86	87.43	2679	0.18%	0.5	51%
0.492	5615.75	56.7	0.160	56.7	4.6	1.97	0.28%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	96.373	1339.58	111.99	2287	0.28%	0.7	51%
0.656	5615.58	59.2	0.227	59.2	1.6	0.69	0.38%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0	1.70	100.708	1399.84	116.99	1792	0.38%	0.8	51%
0.820	5615.42	57.7	0.368	57.7	1.8	0.79	0.64%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0	1.70	98.107	1363.69	113.97	1396	0.64%	1.1	51%
0.984	5615.26	76.8	0.959	76.8	3.0	1.30	1.25%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0	1.70	130.509	1814.08	151.62	1548	1.25%	1.3	51%
1.148	5615.09	85.7	0.894	85.6	3.7	1.58	1.04%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0	1.70	145.571	2023.44	169.12	1480	1.04%	1.3	51%
1.312	5614.93	82.5	0.999	82.4	17.4	7.54	1.21%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	140.046	1946.64	162.87	1247	1.21%	1.4	51%
1.476	5614.76	93.6	0.450	93.6	0.8	0.34	0.48%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	159.120	2211.77	184.82	1258	0.48%	1.0	51%
1.640	5614.60	40.2	0.533	40.2	-0.8	-0.35	1.33%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0	1.70	68.306	949.45	79.32	485	1.33%	1.6	51%
1.804	5614.44	69.8	0.650	69.8	3.2	1.40	0.93%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0	1.70	118.609	1648.67	137.80	767	0.93%	1.3	51%
1.968	5614.27	139.8	1.194	139.8	6.7	2.90	0.85%	Interim Cover	0.050	100.7	0.10	0.00	0.10	0	1.70	237.575	3302.29	276.01	1409	0.85%	1.2	51%
2.133	5614.11	222.3	2.152	222.2	6.7	2.90	0.97%	Interim Cover	0.050	100.7	0.11	0.00	0.11	0	1.70	377.791	5251.29	438.86	2069	0.97%	1.2	51%
2.297	5613.94	246.8	3.608	246.8	4.8	2.07	1.46%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	419.082	5825.24	486.80	2133	1.46%	1.4	51%
2.461	5613.78	219.5	4.267	219.4	6.7	2.90	1.94%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.67	365.913	5086.19	425.07	1770	1.95%	1.5	51%
2.625	5613.62	178.9	4.079	179.0	-0.1	-0.03	2.28%	Interim Cover	0.050	100.7	0.13	0.00	0.13	0	1.64	293.386	4078.06	340.75	1353	2.28%	1.6	51%
2.789	5613.45	149.3	2.666	149.3	0.3	0.12	1.79%	Interim Cover	0.050	100.7	0.14	0.00	0.14	0	1.61	240.810	3347.26	279.69	1062	1.79%	1.5	51%
2.953	5613.29	132.8	2.041	132.8	-0.3	-0.15	1.54%	Interim Cover	0.050	100.7	0.15	0.00	0.15	0	1.61	213.554	2968.40	248.03	892	1.54%	1.5	51%
3.117	5613.12	92.1	1.817	92.1	2.6	1.12	1.97%	Interim Cover	0.050	100.7	0.16	0.00	0.16	0	1.70	156.604	2176.80	181.92	586	1.98%	1.7	51%
3.281	5612.96	80.8	1.379	80.8	2.1	0.89	1.71%	Sand Tailings	0.051	102.8	0.17	0.00	0.17	0	1.70	137.326	1908.83	159.52	487	1.71%	1.7	18%
3.445	5612.80	68.7	1.150	68.7	0.4	0.18	1.67%	Sand-Slime Tailin	0.047	93.3	0.17	0.00	0.17	0	1.70	116.722	1622.44	135.57	396	1.68%	1.7	47%
3.609	5612.63	56.4	0.959	56.4	-0.5	-0.20	1.70%	Sand-Slime Tailin	0.047	93.3	0.18	0.00	0.18	0	1.70	95.897	1332.97	111.37	311	1.71%	1.8	47%
3.773	5612.47	53.4	0.881	53.4	-0.6	-0.27	1.65%	Sand-Slime Tailin	0.047	93.3	0.19	0.00	0.19	0	1.70	90.797	1262.08	105.45	283	1.66%	1.8	47%
3.937	5612.30	48.2	0.768	48.2	-0.6	-0.27	1.59%	Sand-Slime Tailin	0.047	93.3	0.20	0.00	0.20	0	1.70	81.991	1139.67	95.22	245	1.60%	1.8	47%
4.101	5612.14	42.9	0.667	42.9	-0.7	-0.29	1.56%	Sand-Slime Tailin	0.047	93.3	0.20	0.00	0.20	0	1.70	72.879	1013.02	84.64	209	1.56%	1.8	47%
4.265	5611.97	37.5	0.582	37.5	-0.0	-0.01	1.55%	Sand-Slime Tailin	0.047	93.3	0.21	0.00	0.21	0	1.70	63.767	886.36	74.06	177	1.56%	1.9	47%
4.429	5611.81	34.9	0.521	35.0	-0.6	-0.25	1.49%	Sand-Slime Tailin	0.047	93.3	0.22	0.00	0.22	0	1.70	59.415	825.87	69.00	159	1.50%	1.9	47%
4.593	5611.65	33.0	0.469	33.0	-0.6	-0.26	1.42%	Sand-Slime Tailin	0.047	93.3	0.23	0.00	0.23	0	1.70	56.049	779.08	65.09	144	1.43%	1.9	47%
4.757	5611.48	30.9	0.492	30.9	-0.7	-0.32	1.59%	Sand-Slime Tailin	0.047	93.3	0.23	0.00	0.23	0	1.70	52.462	729.22	60.92	131	1.61%	2.0	47%
4.921	5611.32	29.7	0.432	29.7	-1.3	-0.55	1.45%	Sand-Slime Tailin	0.047	93.3	0.24	0.00	0.24	0	1.70	50.490	701.81	58.63	122	1.47%	2.0	47%
5.085	5611.15	26.8	0.410	26.8	-1.5	-0.67	1.53%	Sand-Slime Tailin	0.059	119.0	0.25	0.00	0.25	1	1.70	45.594	633.76	52.94	106	1.54%	2.0	47%
5.249	5610.99	24.8	0.386	24.8	-0.4	-0.16	1.56%	Sand-Slime Tailin	0.059	119.0	0.26	0.01	0.25	1	1.70	42.143	585.79	48.94	96	1.57%	2.1	47%
5.413	5610.83	26.0	0.371	26.0	-0.4	-0.17	1.43%	Sand-Slime Tailin	0.059	119.0	0.27	0.01	0.26	1	1.70	44.200	614.38	51.33	99	1.44%	2.0	47%
5.577	5610.66	24.7	0.321	24.7	-0.3	-0.13	1.30%	Sand-Slime Tailin	0.059	119.0	0.28	0.02	0.26	1	1.70	41.922	582.72	48.69	92	1.32%	2.0	47%
5.741	5610.50	27.7	0.310	27.7	-0.3	-0.13	1.12%	Sand-Slime Tailin	0.059	119.0	0.29	0.02	0.27	1	1.70	47.022	653.61	54.61	102	1.13%	1.9	47%
5.905	5610.33	28.1	0.321	28.1	-0.4	-0.16	1.14%	Sand-Slime Tailin	0.059	119.0	0.30	0.03	0.27	1	1.70	47.770	664.00	55.48	102	1.15%	1.9	47%
6.069	5610.17	23.8	0.368	23.8	-0.4	-0.17	1.54%	Sand-Slime Tailin	0.059	119.0	0.31	0.03	0.28	1	1.70	40.511	563.10	47.05	85	1.56%	2.1	47%
6.234	5610.01	18.4	0.319	18.4	-0.5	-0.20	1.73%	Sand-Slime Tailin	0.059	119.0	0.32	0.04	0.28	1	1.70	31.297	435.03	36.34	64	1.76%	2.2	47%
6.398	5609.84	20.4	0.332	20.5	-0.3	-0.14	1.62%	Sand-Slime Tailin	0.059	119.0	0.33	0.04	0.29	1	1.70	34.765	483.23	40.37	70	1.65%	2.2	47%
6.562	5609.68	17.3	0.407	17.3	-0.4	-0.16	2.35%	Sand-Slime Tailin	0.059	119.0	0.34	0.05	0.29	1	1.70	29.461	409.51	34.21	58	2.40%	2.3	47%
6.726	5609.51	11.3	0.330	11.4	-0.5	-0.20	2.91%	Slime Tailings	0.057	113.1	0.35	0.05	0.30	1	1.70	19.295	268.20	22.40	37	3.00%	2.5	71%
6.890	5609.35	13.4	0.217	13.4	1.7	0.72	1.62%	Sand-Slime Tailin	0.059	119.0	0.36	0.06	0.30	1	1.70	22.763	316.41	26.46	43	1.66%	2.3	47%
7.054	5609.19	20.5	0.195	20.5	1.9	0.83	0.95%	Sand-Slime Tailin	0.059	119.0	0.37	0.06	0.31	1	1.70	34.782	483.47	40.42	66	0.97%	2.0	47%
7.218	5609.02	20.5	0.217	20.5	0.3	0.14	1.06%	Sand-Slime Tailin	0.059	119.0	0.38	0.07	0.31	1	1.70	34.782	483.47	40.40	65	1.08%	2.1	47%
7.382	5608.86	18.7	0.284	18.7	-0.3	-0.14	1.52%	Sand-Slime Tailin	0.059	119.0	0.39	0.07	0.31	1	1.70	31.756	441.41	36.88	58	1.55%	2.2	47%
7.546	5608.69	13.6	0.275	13.6	-0.3	-0.14	2.03%	Sand-Slime Tailin	0.059	119.0	0.40	0.08	0.32	1	1.70	23.086	320.90	26.81	41	2.09%	2.4	47%
7.710	5608.53	17.2	0.252	17.2	0.6	0.24	1.46%	Sand-Slime Tailin	0.059	119.0	0.41	0.08	0.32	1	1.70	29.257	406.67	33.99	52	1.50%	2.2	47%
7.874	5608.37	19.5	0.259	19.5	0.3	0.14	1.33%	Sand-Slime Tailin	0.059	119.0	0.42	0.09	0.33	1	1.70	33.184	461.26	38.55	58	1.36%	2.2	47%
8.038	5608.20	17.5	0.270	17.5	-0.4	-0.19	1.54%	Sand-Slime Tailin	0.059	119.0	0.43	0.09	0.33	1	1.70	29.716	413.05	34.51	51	1.58%	2.3	47%
8.202	5608.04	20.8	0.275	20.8	-0.3	-0.15	1.32%	Sand-Slime Tailin	0.059	119.0	0.44	0.10	0.34	1	1.70	35.343	491.27	41.04	60	1.35%	2.2	47%
8.366	5607.87	29.7	0.344	29.7	-0.3	-0.13	1.16%	Sand-Slime Tailin	0.059	119.0	0.45	0.10	0.34	1	1.70	50.524	702.28	58.68	85	1.18%	2.0	47%
8.530	5607.71	27.7	0.473	27.7	-0.4	-0.17	1.71%	Sand-Slime Tailin	0.059	119.0	0.46	0.11	0.35	1	1.70	47.056	654.08	54.65	78	1.74%	2.1	47%
8.694	5607.55	17.5	0.350	17.5	-0.4	-0.18	2.00%	Sand-Slime Tailin	0.059	119.0	0.47	0.11	0.36	1	1.70	29.733	413.29	34.53	48	2.06%	2.4	47%
8.858	5607.38	14.1	0.266	14.1	0.3	0.13	1.88%	Sand-Slime Tailin	0.059	119.0	0.48	0.12	0.36	1	1.70	23.987	333.42	27.86	38	1.95%	2.4	47%
9.022	5607.22	12.6	0.246	12.4	27.0	11.71	1.96%	Sand-Slime Tailin	0.059	119.0	0.49	0.12	0.36	1	1.70	21.080	293.01	24.48	33	2.04%	2.5	47%
9.186	5607.05	14.1	0.209	14.0	21.8	9.43	1.48%	Sand-Slime Tailin	0.059	119.0	0.50	0.13	0.37	1	1.70	23.783	330.58	27.89	37	1.53%	2.4	47%
9.350	5606.89	11.2	0.245	11.2	5.5	2.40	2.18%	Slime Tailings	0.057	113.1	0.50	0.13	0.37	1	1.70	19.023	264.42	22.16	29	2.29%	2.6	71%
9.514	5606.73	8.4	0.166	8.3	7.5	3.23	1.98%	Slime Tailings	0.057	113.1	0.51	0.14	0.37	1	1.70	14.144	196.60	16.52	21	2.11%	2.6	71%
9.678	5606.56	9.2	0.101	9.1	11.5	4.97	1.10%	Sand-Slime Tailin	0.059	119.0	0.52	0.14	0.38	1	1.70	15.470	215.03	18.11	23	1.17%	2.5	47%
9.842	5606.40	8.9	0.136	8.8	15.6	6.74	1.53%	Sand-Slime Tailin	0.059	119.0	0.53	0.15	0.38	1	1.70	14.926	207.47	17.53	22	1.63%	2.6	47%
10.006	5606.23	7.4	0.138	7.3	21.3	9.25	1.87%	Slime Tailings	0.057	113.1	0.54	0.15	0.39	1	1.70	12.325	171.32	14.58	18	2.02%	2.7	71%
10.170	5606.07	10.2	0.164	10.2	-1.3	-0.56	1.60%	Sand-Slime Tailin	0.059	119.0	0.55	0.16	0.39	1	1.70	17.408	241.97	20.20	25	1.69%	2.5	47%
10.335	5605.91	11.2	0.177	11.1	9.8	4.26	1.58%	Sand-Slime Tailin	0.059	119.0	0.56	0.16	0.40	1	1.70	18.921	263.00	22.10	27	1.66%	2.5	47%
10.499	5605.74	10.6	0.158	10.5	14.1	6.11	1.49%	Sand-Slime Tailin	0.059	119.0	0.57	0.17	0.40	1	1.70	17.833	247.88	20.89	25	1.58%	2.5	47%
10.663	5605.58	11.5	0.125	11.4	10.9	4.70	1.09%	Sand-Slime Tailin	0.059	119.0	0.58	0.18	0.41	1	1.70	19.380	269.38	22.69	27	1.15%	2.4	47%
10.827	5605.41	11.2	0.137	11.1	7.2	3.12	1.22%	Sand-Slime Tailin	0.059	119.0	0.59	0.18	0.41	1	1.70	18.938	263.24	22.08	26	1.29%	2.5	47%
10.991	5605.25	11.3	0.128	11.2	15.6	6.78	1.13%	Sand-Slime Tailin	0.059	119.0	0.60	0.19	0.41	1	1.70	19.057	264.89	22.33	26	1.19%	2.4	47%
11.155	5605.09	12.7	0.188	12.6	14.5	6.28	1.48%	Sand-Slime Tailin	0.059	119.0	0.61	0.19	0.42	1	1.70	21.437	297.97	25.08	29	1.56%	2.5	47%
11.319	5604.92	10.6	0.193	10.5	12.0	5.18	1.82%	Sand-Slime Tailin	0.059	119.0	0.62	0.20	0.42	1	1.70	17.867	248.35	20.90	23	1.94%	2.6	47%
11.483	5604.76	10.1	0.128	10.0	15.4	6.66	1.27%	Sand-Slime Tailin	0.059	119.0	0.63	0.20	0.43	1	1.70	17.000	236.30	19.93	22	1.35%	2.5	47%
11.647	5604.59	9.6	0.155	9.5	10.4	4.52	1.62%	Sand-Slime Tailin	0.059	119.0	0.64	0.21	0.43	1	1.70	16.150	224.49	18.89	21	1.74%	2.6	47%
11.811	5604.43	7.6	0.132	7.4	26.7	11.58	1.74%	Slime Tailings	0.057	113.1	0.65	0.21	0.44	1	1.70	12.549	174.44	14.90	16	1.90%	2.7	71%
11.975	5604.27	7.8	0.081	7.7	21.2	9.18	1.04%	Sand-Slime Tailin	0.059	119.0	0.66	0.22	0.44	1	1.68	12.874	179.08	15.22	16	1.14%	2.6	47%
12.139	5604.10	8.6	0.080	8.5	21.2	9.20	0.93%	Sand-Slime Tailin	0.059	119.0	0.67	0.22	0.45	1	1.67	14.147	196.65	16.69	18	1.01%	2.5	47%
12.303	5603.94	7.4	0.144	7.2	28.9	12.53	1.95%	Slime Tailings	0.057	113.1	0.68	0.23	0.45	1	1.66	11.958	166.22	14.24	15	2.14%	2.8	71%
12.467	5603.77	6.6	0.098	6.4	31.0	13.42	1.48%	Slime Tailings	0.057	113.1	0.69	0.23	0.46	1	1.64	10.508	146.06	12.57	13	1.66%	2.8	71%
12.631	5603.61	10.5	0.114	10.4	20.4	8.82	1.08%	Sand-Slime Tailin	0.059	119.0	0.70	0.24	0.46	1	1.63	16.984	236.07	19.97	21	1.17%	2.5	47%
12.795	5603.44	13.7	0.097	13.6	15.2	6.59	0.71%	Sand-Slime Tailin	0.059	119.0	0.71	0.24	0.47	1	1.59	21.664	301.16	25.34	28	0.75%	2.3	47%
12.959	5603.28	16.5	0.105	16.4	9.8	4.23	0.64%	Sand-Slime Tailin	0.059	119.0	0.72	0.25	0.47	1	1.55	25.544	355.07	29.78	34	0.67%	2.2	47%
13.123	5603.12	21.7	0.122	21.7	9.2	4.00	0.56%	Sand-Slime Tailin	0.059	119.0	0.73	0.25	0.48	1	1.51	32.623	453.45	37.99	44	0.58%	2.1	47%
13.287	5602.95	18.8	0.157	18.7	5.8	2.52	0.84%	Sand-Slime Tailin	0.059	119.0	0.74	0.26	0.48	1	1.52	28.407	394.86	33.06	38	0.87%	2.2	47%
13.451	5602.79	19.3	0.227	19.2	9.2	4.00	1.18%	Sand-Slime Tailin	0.059	119.0	0.75	0.26	0.48	1	1.50	28.942	402.30	33.72	38	1.22%	2.3	47%
13.615	5602.62	15.8	0.262	15.7	7.7	3.33	1.66%	Sand-Slime Tailin	0.059	119.0	0.76	0.27	0.49	1	1.52	23.933	332.67	27.88	31	1.74%	2.5	47%
13.779	5602.46	12.7	0.218	12.6	16.1	6.99	1.72%	Sand-Slime Tailin	0.059	119.0	0.77	0.27	0.49	1	1.54	19.381	269.39	22.59	24	1.83%	2.6	47%
13.943	5602.30	10.1	0.175	9.9	22.6	9.81	1.74%	Sand-Slime Tailin	0.059	119.0	0.78	0.28	0.50	1	1.54	15.263	212.15	17.98	19	1.88%	2.7	47%
14.107	5602.13	9.1	0.134	8.8	44.4	19.24	1.48%	Sand-Slime Tailin	0.059	119.0	0.79	0.28	0.50	1	1.52	13.415	186.46	16.07	16	1.61%	2.7	47%
14.271	5601.97	13.3	0.135	13.2	23.4	10.14	1.01%	Sand-Slime Tailin	0.059	119.0	0.80	0.29	0.51	1	1.50	19.817	275.45	23.27	25	1.08%	2.4	47%
14.436	5601.80	11.8	0.101	11.7	21.6	9.37	0.86%	Sand-Slime Tailin	0.059	119.0	0.81	0.29	0.51	1	1.51	17.534	243.76	20.60	22	0.92%	2.4	47%
14.600	5601.64	11.3	0.117	11.2	20.4	8.83	1.03%	Sand-Slime Tailin	0.059	119.0	0.81	0.30	0.52	1	1.49	16.742	232.71	19.67	20	1.11%	2.5	47%
14.764	5601.48	10.3	0.048	10.1	26.4	11.43	0.47%	Sand-Slime Tailin	0.059	119.0	0.82	0.30	0.52	1	1.48	15.025	208.85	17.65	18	0.51%	2.4	47%
14.928	5601.31	10.3	0.125	10.2	18.2	7.88	1.21%	Sand-Slime Tailin	0.059	119.0	0.83	0.31	0.52	1	1.47	15.024	208.83	17.86	18	1.32%	2.6	47%
15.092	5601.15	9.7	0.124	9.5	36.6	15.86	1.28%	Sand-Slime Tailin	0.059	119.0	0.84	0.31	0.53	1	1.46	13.810	191.97	16.43	17	1.40%	2.6	47%
15.256	5600.98	10.1	0.123	10.0	14.9	6.47	1.22%	Sand-Slime Tailin	0.059	119.0	0.85	0.32	0.53	1	1.46	14.660	203.78	17.42	17	1.32%	2.6	47%
15.420	5600.82	8.8	0.119	8.6	32.5	14.09	1.36%	Sand-Slime Tailin	0.059	119.0	0.86	0.32	0.54	1	1.44	12.356	171.74	14.69	15	1.50%	2.7	47%
15.584	5600.66	9.0	0.113	8.9	23.2	10.04	1.26%	Sand-Slime Tailin	0.059	119.0	0.87	0.33	0.54	1	1.44	12.749	177.21	15.21	15	1.38%	2.7	47%
15.748	5600.49	9.1	0.138	8.8	60.7	26.31	1.52%	Sand-Slime Tailin	0.059	119.0	0.88	0.33	0.55	1	1.43	12.476	173.42	14.83	15	1.66%	2.7	47%
15.912	5600.33	8.8	0.135	8.4	58.5	25.37	1.54%	Sand-Slime Tailin	0.059	119.0	0.89	0.34	0.55	1	1.41	11.857	164.82	14.07	14	1.72%	2.7	47%
16.076	5600.16	8.0	0.083	7.6	54.0	23.40	1.04%	Sand-Slime Tailin	0.059	119.0	0.90	0.34	0.56	1	1.40	10.699	148.72	12.98	13	1.15%	2.7	47%
16.240	5600.00	7.6	0.060	7.2	48.7	21.11	0.79%	Sand-Slime Tailin	0.059	119.0	0.91	0.35	0.56	1	1.40	10.115	140.59	12.19	12	0.88%	2.7	47%
16.404	5599.84	7.2	0.093	6.8	64.6	27.99	1.29%	Slime Tailings	0.057	113.1	0.92	0.35	0.57	1	1.38	9.446	131.31	11.42	11	1.44%	2.8	71%
16.568	5599.67	7.1	0.134	6.7	52.5	22.70	1.75%	Slime Tailings	0.057	113.1	0.93	0.36	0.57	1	1.38	9.446	131.30	11.42	11	1.95%	2.8	71%
16.732	5599.51	6.9	0.131	6.6	54.4	23.55	1.89%	Slime Tailings	0.057	113.1	0.94	0.36	0.58	1	1.37	9.064	125.99	11.07	10	2.10%	2.9	71%
16.896	5599.34	8.8	0.147	8.5	39.7	17.21	1.67%	Slime Tailings	0.057	113.1	0.95	0.37	0.58	1	1.37	11.631	161.68	13.92	14	1.85%	2.8	71%
17.060	5599.18	7.0	0.190	6.6	39.7	17.19	2.71%	Slime Tailings	0.057	113.1	0.96	0.37	0.59	1	1.36	9.153	127.22	11.02	10	3.05%	3.0	71%
17.224	5599.02	6.5	0.176	6.2	52.9	22.94	2.70%	Slime Tailings	0.057	113.1	0.97	0.38	0.59	1	1.35	8.333	115.83	10.20	9	3.18%	3.0	71%

Conditions at t_1 / Liquefaction Triggering Analyses

Depth at time of CPT (ft)	Total Stress at t_1 (tsf)	Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No	Idriss & Boulanger (2008): r_d	C_σ	K_σ	K_α	CSR	Δq_{c1N}	q_{c1N-cs}	CRR	FoS	Youd et al. (2001): r_d	D_r	f	K_σ	K_α	CSR	K_c	q_{c1N-cs}	(CRR)	FoS	Avg FoS	Liquefiable? 1=Yes 2=No
0.164	0.56	0.00	0.56	0	1.00	0.06	1.03	1.0	0.059	44.24	83.91	0.118	1.99	0.98	0.36	0.80	2.53	1.0	0.017	1.00	39.67	0.083	201.04	101.51	2
0.328	0.57	0.00	0.57	0	1.00	0.10	1.04	1.0	0.060	61.00	148.43	0.264	4.40	0.98	0.54	0.73	2.91	1.0	0.015	1.00	87.43	0.142	172.13	88.26	2
0.492	0.58	0.00	0.58	0	1.00	0.12	1.05	1.0	0.061	69.62	181.61	0.563	9.30	0.98	0.61	0.69	2.96	1.0	0.015	1.00	111.99	0.211	170.09	89.70	2
0.656	0.59	0.00	0.59	0	1.00	0.12	1.05	1.0	0.061	71.37	188.36	0.707	11.68	0.98	0.62	0.69	2.77	1.0	0.016	1.00	116.99	0.229	138.70	75.19	2
0.820	0.59	0.00	0.59	0	1.00	0.12	1.04	1.0	0.061	70.32	184.28	0.614	10.17	0.97	0.62	0.69	2.55	1.0	0.017	1.00	113.97	0.218	105.56	57.86	2
0.984	0.60	0.00	0.60	0	1.00	0.16	1.06	1.0	0.061	83.53	235.14	1.000	16.35	0.97	0.71	0.64	2.76	1.0	0.016	1.00	151.62	0.404	163.38	89.86	2
1.148	0.61	0.00	0.61	0	1.00	0.19	1.07	1.0	0.062	89.67	258.79	1.000	16.23	0.97	0.75	0.62	2.76	1.0	0.016	1.00	169.12	1.000	346.66	181.45	2
1.312	0.62	0.00	0.62	0	1.00	0.18	1.06	1.0	0.061	87.48	250.35	1.000	16.33	0.97	0.74	0.63	2.57	1.0	0.017	1.00	162.87	1.000	303.45	159.89	2
1.476	0.63	0.00	0.63	0	1.00	0.22	1.07	1.0	0.062	95.18	280.00	1.000	16.16	0.97	0.78	0.61	2.61	1.0	0.016	1.00	184.82	1.000	269.84	143.00	2
1.640	0.63	0.00	0.63	0	1.00	0.09	1.03	1.0	0.059	58.16	137.48	0.224	3.78	0.97	0.51	0.74	1.83	1.0	0.023	1.00	79.32	0.126	30.71	17.24	2
1.804	0.64	0.00	0.64	0	1.00	0.14	1.04	1.0	0.060	78.68	216.47	1.000	16.60	0.97	0.68	0.66	2.14	1.0	0.020	1.00	137.80	0.323	71.44	44.02	2
1.968	0.65	0.00	0.65	0	1.00	0.30	1.08	1.0	0.063	127.18	403.19	1.000	15.98	0.97	0.96	0.60	2.37	1.0	0.018	1.00	276.01	1.000	202.62	109.30	2
2.133	0.66	0.00	0.66	0	1.00	0.30	1.08	1.0	0.062	184.33	623.20	1.000	16.05	0.97	1.21	0.60	2.30	1.0	0.019	1.00	438.86	1.000	187.10	101.57	2
2.297	0.67	0.00	0.67	0	1.00	0.30	1.08	1.0	0.062	201.15	687.95	1.000	16.11	0.97	1.27	0.60	2.23	1.0	0.019	1.00	486.80	1.000	173.81	94.96	2
2.461	0.68	0.00	0.68	0	1.00	0.30	1.07	1.0	0.062	179.49	604.56	1.000	16.18	0.97	1.19	0.60	2.17	1.0	0.020	1.00	425.07	1.000	162.28	89.23	2
2.625	0.68	0.00	0.68	0	1.00	0.30	1.07	1.0	0.062	149.90	490.65	1.000	16.25	0.97	1.07	0.60	2.12	1.0	0.020	1.00	340.75	1.000	152.20	84.23	2
2.789	0.69	0.00	0.69	0	0.99	0.30	1.07	1.0	0.061	128.47	408.16	1.000	16.32	0.97	0.97	0.60	2.07	1.0	0.021	1.00	279.69	1.000	143.30	79.81	2
2.953	0.70	0.00	0.70	0	0.99	0.30	1.06	1.0	0.061	117.36	365.39	1.000	16.39	0.97	0.91	0.60	2.02	1.0	0.021	1.00	248.03	1.000	135.40	75.89	2
3.117	0.71	0.00	0.71	0	0.99	0.22	1.04	1.0	0.060	94.16	276.08	1.000	16.72	0.97	0.78	0.61	1.94	1.0	0.022	1.02	185.13	1.000	128.32	72.52	2
3.281	0.72	0.00	0.72	0	0.99	0.17	1.03	1.0	0.059	62.87	222.39	1.000	16.90	0.97	0.73	0.64	1.82	1.0	0.023	1.00	160.07	1.000	121.83	69.36	2
3.445	0.73	0.00	0.73	0	0.99	0.14	1.02	1.0	0.059	77.85	213.42	1.000	16.93	0.97	0.67	0.66	1.71	1.0	0.025	1.03	139.61	0.333	38.80	27.92	2
3.609	0.73	0.00	0.73	0	0.99	0.12	1.02	1.0	0.058	69.36	180.73	0.548	9.39	0.97	0.61	0.70	1.61	1.0	0.027	1.07	119.35	0.238	26.57	17.98	2
3.773	0.74	0.00	0.74	0	0.99	0.11	1.02	1.0	0.058	67.28	172.73	0.437	7.51	0.97	0.59	0.70	1.57	1.0	0.027	1.08	113.95	0.218	23.31	15.41	2
3.937	0.75	0.00	0.75	0	0.99	0.10	1.01	1.0	0.058	63.20	158.92	0.319	5.50	0.97	0.56	0.72	1.52	1.0	0.028	1.10	104.52	0.186	19.17	12.34	2
4.101	0.76	0.00	0.76	0	0.99	0.09	1.01	1.0	0.058	59.98	144.62	0.249	4.31	0.97	0.53	0.73	1.47	1.0	0.028	1.12	95.05	0.160	15.85	10.08	2
4.265	0.76	0.00	0.76	0	0.99	0.09	1.01	1.0	0.058	56.28	130.34	0.204	3.54	0.97	0.50	0.75	1.42	1.0	0.030	1.16	85.99	0.139	13.30	8.42	2
4.429	0.77	0.00	0.77	0	0.99	0.08	1.01	1.0	0.058	54.50	123.50	0.187	3.26	0.97	0.48	0.76	1.39	1.0	0.031	1.18	81.21	0.130	11.98	7.62	2
4.593	0.78	0.00	0.78	0	0.98	0.08	1.01	1.0	0.057	53.13	118.22	0.176	3.06	0.97	0.47	0.77	1.36	1.0	0.031	1.19	77.39	0.123	10.98	7.02	2
4.757	0.79	0.00	0.79	0	0.98	0.08	1.01	1.0	0.057	51.67	112.59	0.165	2.87	0.97	0.45	0.77	1.34	1.0	0.032	1.26	76.65	0.122	10.52	6.70	2
4.921	0.79	0.00	0.79	0	0.98	0.08	1.01	1.0	0.057	50.86	109.49	0.159	2.78	0.97	0.44	0.78	1.32	1.0	0.032	1.25	73.30	0.117	9.75	6.27	2
5.085	0.80	0.00	0.80	0	0.98	0.07	1.00	1.0	0.057	48.87	101.80	0.146	2.55	0.96	0.42	0.79	1.30	1.0	0.033	1.32	70.05	0.112	9.05	5.80	2
5.249	0.81	0.00	0.81	0	0.98	0.07	1.00	1.0	0.057	47.47	96.41	0.137	2.40	0.96	0.40	0.80	1.28	1.0	0.033	1.38	67.39	0.108	8.62	5.51	2
5.413	0.82	0.00	0.82	0	0.98	0.07	1.00	1.0	0.057	48.30	99.63	0.142	2.50	0.96	0.41	0.79	1.28	1.0	0.033	1.32	68.00	0.109	8.53	5.51	2
5.577	0.83	0.00	0.83	0	0.98	0.07	1.00	1.0	0.057	47.38	96.06	0.136	2.40	0.96	0.40	0.80	1.27	1.0	0.033	1.32	64.25	0.105	8.03	5.21	2
5.741	0.84	0.00	0.84	0	0.98	0.07	1.00	1.0	0.057	49.45	104.06	0.149	2.64	0.96	0.43	0.79	1.28	1.0	0.033	1.23	67.08	0.108	8.15	5.39	2
5.905	0.85	0.00	0.85	0	0.98	0.07	1.00	1.0	0.057	49.76	105.24	0.151	2.68	0.96	0.43	0.78	1.28	1.0	0.033	1.23	68.51	0.110	8.15	5.41	2
6.069	0.86	0.00	0.86	0	0.98	0.07	1.00	1.0	0.056	46.80	93.85	0.133	2.35	0.96	0.40	0.80	1.25	1.0	0.034	1.44	67.86	0.109	7.96	5.15	2
6.234	0.87	0.00	0.87	0	0.97	0.06	1.00	1.0	0.056	43.05	79.39	0.112	1.98	0.96	0.35	0.80	1.25	1.0	0.034	1.71	62.22	0.102	7.35	4.67	2
6.398	0.88	0.00	0.88	0	0.97	0.07	1.00	1.0	0.056	44.46	84.83	0.119	2.12	0.96	0.37	0.80	1.25	1.0	0.034	1.60	64.41	0.105	7.41	4.77	2
6.562	0.89	0.00	0.89	0	0.97	0.06	1.00	1.0	0.056	42.30	76.51	0.108	1.92	0.96	0.34	0.80	1.24	1.0	0.034	2.08	71.05	0.113	7.88	4.90	2
6.726	0.90	0.00	0.90	0	0.97	0.05	1.00	1.0	0.056	37.89	60.29	0.088	1.57	0.96	0.28	0.80	1.24	1.0	0.034	3.02	67.71	0.109	7.47	4.52	2
6.890	0.91	0.00	0.91	0	0.97	0.06	1.00	1.0	0.056	39.58	66.04	0.095	1.69	0.96	0.30	0.80	1.23	1.0	0.034	2.05	54.36	0.095	6.42	4.05	2
7.054	0.92	0.00	0.92	0	0.97	0.07	1.00	1.0	0.056	44.48	84.90	0.119	2.14	0.96	0.37	0.80	1.23	1.0	0.034	1.36	55.14	0.096	6.36	4.25	2
7.218	0.93	0.00	0.93	0	0.97	0.07	0.99	1.0	0.056	44.47	84.87	0.119	2.14	0.96	0.37	0.80	1.23	1.0	0.034	1.42	57.29	0.097	6.40	4.27	2
7.382	0.94	0.00	0.94	0	0.97	0.06	0.99	1.0	0.056	43.24	80.11	0.113	2.03	0.96	0.35	0.80	1.22	1.0	0.035	1.70	62.74	0.103	6.66	4.34	2
7.546	0.95	0.00	0.95	0	0.97	0.06	0.99	1.0	0.056	39.70	66.51	0.095	1.72	0.96	0.30	0.80	1.22	1.0	0.035	2.35	63.11	0.103	6.59	4.15	2
7.710	0.96	0.00	0.96	0	0.97	0.06	0.99	1.0	0.055	42.22	76.21	0.108	1.94	0.96	0.34	0.80	1.22	1.0	0.035	1.78	60.41	0.101	6.32	4.13	2
7.874	0.97	0.00	0.97	0	0.96	0.06	0.99	1.0	0.055	43.82	82.37	0.116	2.09	0.96	0.36	0.80	1.21	1.0	0.035	1.61	62.11	0.102	6.34	4.22	2
8.038	0.98	0.00	0.98	0	0.96	0.06	0.99	1.0	0.055	42.40	76.91	0.108	1.96	0.96	0.34	0.80	1.21	1.0	0.035	1.83	63.24	0.104	6.33	4.15	2
8.202	0.99	0.00	0.99	0	0.96	0.07	0.99	1.0	0.055	44.70	85.74	0.121	2.19	0.96	0.37	0.80	1.21	1.0	0.035	1.58	64.94	0.105	6.36	4.28	2
8.366	1.00	0.00	1.00	0	0.96	0.08	0.99	1.0	0.055	50.88	109.56	0.159	2.89	0.96	0.44	0.78	1.23	1.0	0.034	1.31	76.88	0.122	7.28	5.09	2
8.530	1.01	0.00	1.01	0	0.96	0.07	0.99	1.0	0.055	49.47	104.12	0.149	2.72	0.96	0.43	0.79	1.21	1.0	0.035	1.55	84.64	0.136	8.02	5.37	2
8.694	1.02	0.00	1.02	0	0.96	0.06	0.99	1.0	0.055	42.41	76.94	0.109	1.98	0.96	0.34	0.80	1.20	1.0	0.035	2.13	73.60	0.117	6.79	4.38	2
8.858	1.03	0.00	1.03	0	0.96	0.06	0.99	1.0	0.055	40.07	67.94	0.097	1.77	0.96	0.30	0.80	1.19	1.0	0.035	2.38	66.42	0.107	6.14	3.96	2
9.022	1.04	0.00	1.04	0	0.96	0.06	0.99	1.0	0.055	39.01	63.82	0.092	1.68	0.96	0.29	0.80	1.19	1.0	0.035	2.64	65.56	0.106	6.01	3.85	2
9.186	1.05	0.00	1.05	0	0.96	0.06	0.99	1.0	0.055	40.08	67.97	0.097	1.78	0.96	0.30	0.80	1.19	1.0	0.035	2.17	60.39	0.100	5.62	3.70	2
9.350	1.06	0.00	1.06	0	0.96	0.05	0.99	1.0	0.055	37.81	59.97	0.088	1.61	0.95	0.27	0.80	1.18	1.0	0.036	3.06	67.79	0.109	6.02	3.82	2
9.514	1.07	0.00	1.07	0	0.95	0.05	0.99	1.0	0.055	35.84	52.36	0.080	1.46	0.95	0.23	0.80	1.18	1.0	0.036	3.62	59.80	0.100	5.46	3.46	2
9.678	1.08	0.00	1.08	0	0.95	0.05	0.99	1.0	0.054	36.65	54.76	0.082	1.51	0.95	0.25	0.80	1.18	1.0	0.036	2.64	47.72	0.090	4.85	3.18	2
9.842	1.09	0.00	1.09	0	0.95	0.05	0.99	1.0	0.054	36.45	53.98	0.081	1.50	0.95	0.24	0.80	1.18	1.0	0.036	3.14	55.03	0.095	5.10	3.30	2
10.006	1.09	0.00	1.09	0	0.95	0.05	0.99	1.0	0.054	35.16	49.74	0.077	1.42	0.95	0.22	0.80	1.17	1.0	0.036	3.97	57.82	0.098	5.18	3.30	2
10.170	1.10	0.00	1.10	0	0.95	0.05	0.99	1.0	0.054	37.39	57.59	0.085	1.57	0.95	0.26	0.80	1.17	1.0	0.036	2.94	59.41	0.100	5.20	3.39	2
10.335	1.11	0.00	1.11	0	0.95	0.05	0.99	1.0	0.054	38.05	60.15	0.088	1.63	0.95	0.27	0.80	1.17	1.0	0.036	2.77	61.13	0.101	5.23	3.43	2
10.499	1.12	0.00	1.12	0	0.95	0.05	0.99	1.0	0.054	37.63	58.51	0.086	1.60	0.95	0.26	0.80	1.16	1.0	0.036	2.83	59.12	0.099	5.07	3.33	2
10.663	1.13	0.00	1.13	0	0.95	0.05	0.99	1.0	0.054	38.24	60.89	0.089	1.65	0.95	0.27	0.80	1.16	1.0	0.036	2.35	53.28	0.094	4.75	3.20	2
10.827	1.14	0.00	1.14	0	0.95	0.05	0.98	1.0	0.054	38.05	60.13	0.088	1.64	0.95	0.27	0.80	1.16	1.0	0.036	2.54	56.01	0.096	4.81	3.22	2
10.991	1.15	0.00	1.15	0	0.94	0.05	0.98	1.0	0.054	38.13	60.46	0.088	1.64	0.95	0.27	0.80	1.16	1.0	0.036	2.43	54.27	0.095	4.69	3.17	2
11.155	1.16	0.00	1.16	0	0.94	0.06	0.98	1.0	0.054	39.10	64.17	0.093	1.73	0.95	0.29	0.80	1.15	1.0	0.036	2.56	64.20	0.105	5.12	3.42	2
11.319	1.17	0.00	1.17	0	0.94	0.05	0.98	1.0	0.054	37.63	58.53	0.086	1.61	0.95	0.26	0.80	1.15	1.0	0.036	3.23	67.57	0.109	5.26	3.43	2
11.483	1.18	0.00	1.18	0	0.94	0.05	0.98	1.0	0.053	37.29	57.23	0.085	1.59	0.95	0.26	0.80	1.15	1.0	0.036	2.87	57.19	0.097	4.66	3.12	2
11.647	1.19	0.00	1.19	0	0.94	0.05	0.98	1.0	0.053	36.93	55.81	0.083	1.56	0.95	0.25	0.80	1.15	1.0	0.037	3.35	63.33	0.104	4.91	3.24	2
11.811	1.20	0.00	1.20	0	0.94	0.05	0.98	1.0	0.053	35.28	50.18	0.078	1.46	0.95	0.22	0.80	1.14	1.0	0.037	4.16	62.05	0.102	4.80	3.13	2
11.975	1.21	0.00	1.21	0	0.94	0.05	0.98	1.0	0.053	35.64	50.86	0.078	1.47	0.95	0.23	0.80	1.14	1.0	0.037	3.31	50.40	0.092	4.27	2.87	2
12.139	1.22	0.00	1.22	0	0.94	0.05	0.98	1.0	0.053	36.15	52.84	0.080	1.51	0.95	0.24	0.80	1.14	1.0	0.037	2.95	49.28	0.091	4.19	2.85	2
12.303	1.23	0.00	1.23	0	0.94	0.05	0.98	1.0	0.053	35.05	49.28	0.077	1.45	0.95	0.22	0.80	1.14	1.0	0.037	4.55	64.75	0.105	4.80	3.12	2
12.467	1.24	0.00	1.24	0	0.93	0.05	0.98	1.0	0.053	34.47	47.04	0.075	1.41	0.95	0.20	0.80	1.14	1.0	0.037	4.48	56.35	0.097	4.37	2.89	2
12.631	1.25	0.00	1.25	0	0.93	0.05	0.98	1.0	0.053	37.30	57.27	0.085	1.61	0.95	0.26	0.80	1.13	1.0	0.037	2.75	54.84	0.095	4.27	2.94	2
12.795	1.26	0.00	1.26	0	0.93	0.06	0.98	1.0	0.053	39.19	64.53	0.093	1.76	0.95	0.29	0.80	1.13	1.0	0.037	1.95	49.33	0.091	4.04	2.90	2
12.959	1.27	0.00	1.27	0	0.93	0.06	0.98	1.0	0.053	40.75	70.52	0.100	1.91	0.95	0.32	0.80	1.13	1.0	0.037	1.68	50.08	0.092	4.03	2.97	2
13.123	1.28	0.00	1.28	0	0.93	0.06	0.97	1.0	0.052	43.63	81.62	0.115	2.19	0.95	0.36	0.80	1.13	1.0	0.037	1.41	53.48	0.094	4.10	3.15	2
13.287	1.29	0.00	1.29	0	0.93	0.06	0.98	1.0	0.052	41.90	74.95	0.106	2.02	0.95	0.33	0.80	1.12	1.0	0.037	1.72	56.89	0.097	4.19	3.11	2
13.451	1.30	0.00	1.30	0	0.93	0.06	0.97	1.0	0.052	42.13	75.84	0.107	2.05	0.95	0.34	0.80	1.12	1.0	0.037	1.93	65.17	0.106	4.52	3.28	2
13.615	1.31	0.00	1.31	0	0.93	0.06	0.98	1.0	0.052	40.08	67.96	0.097	1.86	0.95	0.30	0.80	1.12	1.0	0.037	2.58	72.05	0.115	4.86	3.36	2
13.779	1.32	0.00	1.32	0	0.92	0.05	0.98	1.0	0.052	38.26	60.95	0.089	1.70	0.94	0.28	0.80	1.12	1.0	0.037	3.08	69.87	0.112	4.69	3.19	2
13.943	1.33	0.00	1.33	0	0.92	0.05	0.98	1.0	0.052	36.61	54.59	0.082	1.57	0.94	0.24	0.80	1.12	1.0	0.037	3.70	66.52	0.107	4.46	3.02	2
14.107	1.34	0.00	1.34	0	0.92	0.05	0.98	1.0	0.052	35.94	52.01	0.079	1.52	0.94	0.23	0.80	1.11	1.0	0.037	3.76	60.46	0.101	4.14	2.83	2
14.271	1.35	0.00	1.35	0	0.92	0.05	0.98	1.0	0.052	38.46	61.73	0.090	1.73	0.94	0.28	0.80	1.11	1.0	0.037	2.41	56.17	0.096	3.94	2.84	2
14.436	1.36	0.00	1.36	0	0.92	0.05	0.98	1.0	0.052	37.53	58.13	0.086	1.65	0.94	0.26	0.80	1.11	1.0	0.037	2.50	51.42	0.093	3.75	2.70	2
14.600	1.37	0.00	1.37	0	0.92	0.05	0.98	1.0	0.052	37.20	56.86	0.084	1.63	0.94	0.26	0.80	1.11	1.0	0.038	2.79	54.80	0.095	3.83	2.73	2
14.764	1.38	0.00	1.38	0	0.92	0.05	0.98	1.0	0.052	36.52	54.25	0.082	1.58	0.94	0.24	0.80	1.11	1.0	0.038	2.29	40.67	0.084	3.34	2.46	2
14.928	1.39	0.00	1.39	0	0.92	0.05	0.98	1.0	0.052	36.49	54.13	0.082	1.58	0.94	0.24	0.80	1.10	1.0	0.038	3.25	57.31	0.098	3.85	2.71	2
15.092	1.40	0.00	1.40	0	0.91	0.05	0.98	1.0	0.052	36.06	52.49	0.080	1.55	0.94	0.23	0.80	1.10	1.0	0.038	3.52	57.87	0.098	3.84	2.69	2
15.256	1.41	0.00	1.41	0	0.91	0.05	0.98	1.0	0.051	36.25	53.22	0.081	1.57	0.94	0.24	0.80	1.10	1.0	0.038	3.37	57.25	0.097	3.78	2.67	2
15.420	1.42	0.00	1.42	0	0.91	0.05	0.98	1.0	0.051	35.45	50.14	0.078	1.51	0.94	0.22	0.80	1.10	1.0	0.038	3.95	58.10	0.098	3.78	2.65	2
15.584	1.43	0.00	1.43	0	0.91	0.05	0.98	1.0	0.051	35.54	50.46	0.078	1.52	0.94	0.22	0.80	1.10	1.0	0.038	3.94	58.84	0.099	3.78	2.65	2
15.748	1.43	0.00	1.43	0	0.91	0.05	0.97	1.0	0.051	35.60	50.72	0.078	1.53	0.94	0.22	0.80	1.09	1.0	0.038	4.07	61.49	0.102	3.85	2.69	2
15.912	1.44	0.00	1.44	0	0.91	0.05	0.97	1.0	0.051	35.34	49.71	0.077	1.51	0.94	0.22	0.80	1.09	1.0	0.038	4.27	61.31	0.101	3.81	2.66	2
16.076	1.45	0.00	1.45	0	0.91	0.05	0.98	1.0	0.051	34.85	47.83	0.075	1.48	0.94	0.21	0.80	1.09	1.0	0.038	3.97	51.55	0.093	3.46	2.47	2
16.240	1.46	0.00	1.46	0	0.91	0.05	0.97	1.0	0.051	34.78	47.54	0.075	1.47	0.94	0.21	0.80	1.09	1.0	0.038	4.05	51.70	0.093	3.43	2.45	2
16.404	1.47	0.00	1.47	0	0.90	0.05	0.98	1.0	0.051	34.13	45.75	0.074	1.44	0.94	0.20	0.80	1.09	1.0	0.038	4.74	55.05	0.096	3.51	2.47	2
16.568	1.48	0.00	1.48	0	0.90	0.05	0.97	1.0	0.051	34.35	46.60	0.074	1.46	0.94	0.20	0.80	1.09	1.0	0.038	5.14	62.91	0.103	3.76	2.61	2
16.732	1.49	0.00	1.49	0	0.90	0.05	0.97	1.0	0.051	33.94	45.01	0.073	1.43	0.94	0.19	0.80	1.08	1.0	0.038	5.74	63.53	0.104	3.76	2.60	2
16.896	1.50	0.00	1.50	0	0.90	0.05	0.97	1.0	0.051	34.93	48.85	0.076	1.51	0.94	0.22	0.80	1.08	1.0	0.038	4.57	63.62	0.104	3.74	2.62	2
17.060	1.51	0.00	1.51	0	0.90	0.05	0.97	1.0	0.051	33.93	44.95	0.073	1.44	0.94	0.19	0.80	1.08	1.0	0.038	6.70	73.85	0.117	4.20	2.82	2
17.224	1.52	0.00	1.52	0	0.90	0.05	0.97	1.0	0.051	33.64	43.83	0.072	1.42	0.94	0.18	0.80	1.08	1.0	0.038	7.10	72.42	0.115	4.09	2.76	2

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.425

Depth at t_1, z_1 m	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Maximum Shear Strain Modulus, G_{max} tsf	$P = \gamma_{eff}*(G_{eff}/G_{max})$ tsf	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
3.08	594	1.6E-03	5.5E+02	9.9E-05	11	0.175	10022	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.13	594	1.6E-03	5.5E+02	1.0E-04	11	0.176	9961	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.18	594	1.6E-03	5.5E+02	1.0E-04	11	0.176	9902	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.23	594	1.6E-03	5.5E+02	1.0E-04	11	0.177	9844	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.28	594	1.6E-03	5.5E+02	1.0E-04	11	0.178	9786	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.33	594	1.6E-03	5.5E+02	1.1E-04	11	0.178	9730	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.38	594	1.6E-03	5.5E+02	1.1E-04	11	0.179	9676	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.43	594	1.6E-03	5.5E+02	1.1E-04	11	0.179	9622	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.48	594	1.6E-03	5.5E+02	1.1E-04	11	0.180	9569	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.53	594	1.6E-03	5.5E+02	1.1E-04	11	0.181	9517	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.58	594	1.6E-03	5.5E+02	1.1E-04	11	0.181	9466	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.63	594	1.6E-03	5.5E+02	1.2E-04	11	0.182	9416	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.68	594	1.6E-03	5.5E+02	1.2E-04	11	0.182	9367	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.73	594	1.6E-03	5.5E+02	1.2E-04	11	0.183	9318	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.78	594	1.6E-03	5.5E+02	1.2E-04	11	0.184	9271	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.83	594	1.6E-03	5.5E+02	1.2E-04	11	0.184	9224	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.88	594	1.6E-03	5.5E+02	1.2E-04	11	0.185	9179	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.93	594	1.6E-03	5.5E+02	1.2E-04	11	0.185	9133	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.98	495	1.6E-03	3.8E+02	1.8E-04	11	0.186	9089	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
4.03	495	1.6E-03	3.9E+02	1.8E-04	0	0.191	11691	0.04%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.03%	0.0000
4.08	495	1.4E-03	3.5E+02	2.0E-04	10	0.187	9244	0.04%	2.00	0.65	0.03%	0.004	0.34	0.079	0.765	0.59%	0.0010
4.13	495	1.4E-03	3.5E+02	2.0E-04	10	0.188	9204	0.04%	2.00	0.65	0.03%	0.004	0.34	0.079	0.765	0.62%	0.0010
4.18	495	1.4E-03	3.5E+02	2.0E-04	10	0.188	9165	0.04%	2.00	0.65	0.03%	0.004	0.34	0.079	0.765	0.66%	0.0011
4.23	495	1.4E-03	3.5E+02	2.1E-04	10	0.189	9126	0.04%	2.00	0.65	0.03%	0.005	0.34	0.079	0.765	0.70%	0.0011
4.28	495	1.4E-03	3.5E+02	2.1E-04	10	0.189	9087	0.04%	2.00	0.65	0.03%	0.005	0.34	0.079	0.765	0.73%	0.0012
4.33	495	1.4E-03	3.5E+02	2.1E-04	10	0.190	9050	0.04%	2.00	0.65	0.03%	0.005	0.34	0.079	0.765	0.77%	0.0013
4.38	495	1.4E-03	3.5E+02	2.1E-04	10	0.190	9012	0.04%	2.00	0.65	0.03%	0.005	0.34	0.079	0.765	0.80%	0.0013
4.43	495	1.4E-03	3.5E+02	2.1E-04	10	0.191	8975	0.04%	2.00	0.65	0.03%	0.005	0.34	0.079	0.765	0.83%	0.0014
4.48	495	1.4E-03	3.5E+02	2.2E-04	10	0.191	8939	0.04%	2.00	0.65	0.03%	0.006	0.34	0.079	0.765	0.87%	0.0014
4.53	495	1.4E-03	3.5E+02	2.2E-04	10	0.192	8903	0.04%	2.00	0.65	0.03%	0.006	0.34	0.079	0.765	0.90%	0.0015
4.58	495	1.8E-03	4.5E+02	1.7E-04	10	0.192	8858	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
4.63	495	1.8E-03	4.5E+02	1.8E-04	10	0.193	8814	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
4.68	495	1.8E-03	4.5E+02	1.8E-04	10	0.193	8771	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
4.73	495	1.8E-03	4.5E+02	1.8E-04	10	0.194	8728	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
4.78	495	1.8E-03	4.5E+02	1.8E-04	10	0.195	8686	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
4.83	495	1.8E-03	4.5E+02	1.8E-04	10	0.195	8645	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.02%	0.0000
4.88	495	1.8E-03	4.5E+02	1.9E-04	10	0.196	8604	0.03%	2.00	0.65	0.03%	0.001	0.34	0.079	0.765	0.12%	0.0002
4.93	495	1.8E-03	4.5E+02	1.9E-04	10	0.196	8564	0.03%	2.00	0.65	0.03%	0.001	0.34	0.079	0.765	0.18%	0.0003
4.98	495	1.8E-03	4.5E+02	1.9E-04	10	0.197	8524	0.03%	2.00	0.65	0.03%	0.002	0.34	0.079	0.765	0.24%	0.0004
5.03	495	1.8E-03	4.5E+02	1.9E-04	10	0.197	8486	0.03%	2.00	0.65	0.03%	0.002	0.34	0.079	0.765	0.29%	0.0005
5.08	495	1.8E-03	4.3E+02	2.0E-04	16	0.450	6952	0.04%	2.00	0.65	0.03%	0.005	0.34	0.079	0.765	0.78%	0.0013
5.13	495	1.8E-03	4.5E+02	2.0E-04	10	0.198	8412	0.03%	2.00	0.65	0.03%	0.002	0.34	0.079	0.765	0.37%	0.0006
5.18	495	1.8E-03	4.5E+02	2.0E-04	10	0.199	8375	0.03%	2.00	0.65	0.03%	0.003	0.34	0.079	0.765	0.41%	0.0007
5.23	495	1.8E-03	4.5E+02	2.0E-04	10	0.200	8338	0.03%	2.00	0.65	0.03%	0.003	0.34	0.079	0.765	0.45%	0.0007
5.28	495	1.8E-03	4.5E+02	2.0E-04	10	0.200	8302	0.04%	2.00	0.65	0.03%	0.003	0.34	0.079	0.765	0.49%	0.0008
5.33	495	1.8E-03	4.5E+02	2.0E-04	10	0.201	8266	0.04%	2.00	0.65	0.03%	0.003	0.34	0.079	0.765	0.53%	0.0009
5.38	495	1.8E-03	4.5E+02	2.1E-04	10	0.201	8232	0.04%	2.00	0.65	0.03%	0.004	0.34	0.079	0.765	0.56%	0.0009
5.43	495	1.8E-03	4.5E+02	2.1E-04	10	0.202	8197	0.04%	2.00	0.65	0.03%	0.004	0.34	0.079	0.765	0.60%	0.0010
5.48	495	1.8E-03	4.5E+02	2.1E-04	10	0.202	8163	0.04%	2.00	0.65	0.03%	0.004	0.34	0.079	0.765	0.63%	0.0010
5.53	495	1.8E-03	4.5E+02	2.1E-04	10	0.203	8130	0.04%	2.00	0.65	0.03%	0.004	0.34	0.079	0.765	0.66%	0.0011
5.58	495	1.8E-03	4.5E+02	2.2E-04	10	0.203	8097	0.04%	2.00	0.65	0.03%	0.005	0.34	0.079	0.765	0.70%	0.0011
5.63	495	1.8E-03	4.5E+02	2.2E-04	10	0.204	8064	0.04%	2.00	0.65	0.03%	0.005	0.34	0.079	0.765	0.73%	0.0012
5.68	495	1.8E-03	4.5E+02	2.2E-04	10	0.204	8032	0.04%	2.00	0.65	0.03%	0.005	0.34	0.079	0.765	0.76%	0.0012
5.73	495	1.8E-03	4.5E+02	2.2E-04	10	0.205	8000	0.04%	2.00	0.65	0.03%	0.005	0.34	0.079	0.765	0.79%	0.0013
5.78	495	1.8E-03	4.5E+02	2.2E-04	10	0.205	7969	0.04%	2.00	0.65	0.03%	0.005	0.34	0.079	0.765	0.82%	0.0014
5.83	495	1.8E-03	4.5E+02	2.3E-04	10	0.206	7938	0.04%	2.00	0.65	0.03%	0.006	0.34	0.079	0.765	0.85%	0.0014
5.88	460	1.8E-03	3.7E+02	2.8E-04	16	0.458	6510	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.95%	0.0032
5.93	460	1.8E-03	3.7E+02	2.8E-04	16	0.458	6487	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.98%	0.0033
5.98	460	1.8E-03	3.9E+02	2.7E-04	10	0.207	7851	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.57%	0.0026
6.03	460	1.8E-03	3.9E+02	2.7E-04	10	0.208	7821	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.61%	0.0026
6.08	460	1.8E-03	3.7E+02	2.9E-04	16	0.460	6416	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.09%	0.0034
6.13	460	1.8E-03	3.9E+02	2.8E-04	10	0.208	7765	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.67%	0.0027
6.18	460	1.8E-03	3.9E+02	2.8E-04	10	0.209	7737	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.71%	0.0028
6.23	460	1.8E-03	3.9E+02	2.8E-04	10	0.209	7709	0.07%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.74%	0.0029
6.28	460	1.8E-03	3.9E+02	2.8E-04	10	0.210	7681	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.78%	0.0029
6.33	460	1.8E-03	3.9E+02	2.9E-04	10	0.210	7654	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.82%	0.0030
6.38	460	1.8E-03	3.9E+02	2.9E-04	10	0.211	7627	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.85%	0.0030
6.43	460	1.8E-03	3.9E+02	2.9E-04	10	0.211	7601	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.89%	0.0031
6.48	460	1.8E-03	3.9E+02	2.9E-04	10	0.212	7574	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.92%	0.0032
6.53	460	1.8E-03	3.9E+02	2.9E-04	10	0.212	7548	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.96%	0.0032
6.58	460	1.8E-03	3.9E+02	3.0E-04	10	0.213	7523	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.99%	0.0033
6.63	460	1.8E-03	3.7E+02	3.2E-04	16	0.464	6175	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.50%	0.0041
6.68	460	1.8E-03	3.9E+02	3.0E-04	10	0.213	7473	0.08%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.06%	0.0034
6.73	460	1.8E-03	3.9E+02	3.0E-04	10	0.214	7449	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.10%	0.0034
6.78	460	1.8E-03	3.7E+02	3.2E-04	16	0.466	6115	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.61%	0.0043
6.83	460	1.8E-03	3.7E+02	3.3E-04	16	0.466	6096	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.65%	0.0043
6.88	460	1.8E-03	3.9E+02	3.1E-04	10	0.215	7378	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.20%	0.0036
6.93	460	1.8E-03	3.9E+02	3.1E-04	10	0.215	7354	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.24%	0.0037
6.98	460	1.8E-03	3.9E+02	3.2E-04	10	0.216	7331	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.28%	0.0037
7.03	460	1.8E-03	3.9E+02	3.2E-04	10	0.216	7308	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.31%	0.0038
7.08	460	1.8E-03	3.9E+02	3.2E-04	10	0.217	7285	0.09%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.35%	0.0039
7.13	460	1.8E-03	3.9E+02	3.2E-04	10	0.217	7262	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.39%	0.0039
7.18	460	1.8E-03	3.9E+02	3.3E-04	10	0.218	7239	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.43%	0.0040
7.23	460	1.8E-03	3.9E+02	3.3E-04	10	0.218	7217	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.46%	0.0040
7.28	460	1.8E-03	3.9E+02	3.3E-04	10	0.218	7195	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.50%	0.0041
7.33	460	1.8E-03	3.9E+02	3.3E-04	10	0.219	7173	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.54%	0.0042
7.38	460	1.8E-03	3.9E+02	3.4E-04	10	0.219	7152	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.58%	0.0042
7.43	460	1.8E-03	3.9E+02	3.4E-04	10	0.220	7130	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.61%	0.0043
7.48	500	1.8E-03	4.6E+02	2.9E-04	10	0.220	7109	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.71%	0.0028
7.53	500	1.8E-03	4.6E+02	2.9E-04	10	0.220	7088	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.73%	0.0028
7.58	500	1.8E-03	4.6E+02	2.9E-04	10	0.221	7067	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.76%	0.0029
7.63	500	1.8E-03	4.6E+02	2.9E-04	10	0.221	7047	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.79%	0.0029
7.68	500	1.8E-03	4.6E+02	3.0E-04	10	0.222	7027	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.82%	0.0030
7.73	500	1.8E-03	4.6E+02	3.0E-04	10	0.222	7006	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.84%	0.0030
7.78	500	1.8E-03	4.6E+02	3.0E-04	10	0.222	6987	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.87%	0.0031
7.83	500	1.8E-03	4.6E+02	3.0E-04	10	0.223	6967	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.90%	0.0031
7.88	500	1.8E-03	4.6E+02	3.0E-04	10	0.223	6947	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.93%	0.0032
7.93	500	1.8E-03	4.6E+02	3.1E-04	10	0.223	6928	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.96%	0.0032
7.98	500	1.8E-03	4.6E+02	3.1E-04	10	0.224	6909	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.99%	0.0033
8.03	500	1.8E-03	4.4E+02	3.3E-04	16	0.475	5678	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.45%	0.0040
8.08	500	1.8E-03	4.4E+02	3.3E-04	16	0.476	5663	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.48%	0.0041
8.13	500	1.8E-03	4.4E+02	3.3E-04	16	0.476	5649	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.51%	0.0041
8.18	500	1.8E-03	4.4E+02	3.3E-04	16	0.476	5634	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.54%	0.0042
8.23	500	1.8E-03	4.4E+02	3.4E-04	16	0.477	5620	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.57%	0.0042
8.28	500	1.8E-03	4.4E+02	3.4E-04	16	0.477	5606	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.60%	0.0043

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W4-C

Data File: 13-52106_SP2W4-C-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)
Max. Horiz. Acceleration, Amax/g: 0.15
Earthquake Moment Magnitude, M: 5.5
Magnitude Scaling Factor, MSF: 1.69

Youd, et al (2001)
Max. Horiz. Acceleration, Amax/g: 0.15
Earthquake Moment Magnitude, M: 5.5
Magnitude Scaling Factor, MSF: 2.21

5611.20 Water surface elevation during CPT investigation (ft amsl)
5607.96 Water surface elevation at t_0 (ft amsl)
5593.50 Water surface elevation at t_1 (ft amsl)
5588.50 Water surface elevation at t_2 (ft amsl)
1.44 Scaling Factor for stress ratio, r_m
0.47 Volumetric Strain Ratio for Site-Specific Design Earthquake
7.51 Equiv. Number of Uniform Strain Cycles, N

5616.24 Ground Surface Elevation at time of CPT (ft amsl)
5626.19 Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50 Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement
3.50 Thickness of Water Storage/Rooting Zone (ft)
4.00 Thickness of High Compaction Layer (ft)
1.95 Thickness of Random/Platform Fill on top of existing interim cover (ft)
1104.55 Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5588.50 Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer	Total Stress at Midpoint of Layer	Equil Pore Pressure at Bottom of Layer	Equil Pore Pressure Midpoint of Layer (tsf)	Effective Stress at Bottom of Layer	Effective Stress at Midpoint of Layer	Midpoint Depth at t_1, z_1	Shear Wave Velocity, V_s	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_c (%)	Incremental Consolidation (ft)
Erosion Protection Layer	5626.19	5625.94	5625.69	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014	0.08	508	1.7E-03	4.4E+02	3.0E-06	11	0.068	46696	0.00%	1.20	0.80	0.04%	0.000	0.32	0.133	0.778	0.00%	0.0000
Water Storage/Rooting Zone Layer	5625.69	5623.94	5622.19	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121	0.69	508	1.7E-03	4.3E+02	2.8E-05	11	0.118	18930	0.00%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
High Compaction Layer	5622.19	5620.19	5618.19	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334	1.83	508	1.9E-03	4.8E+02	6.8E-05	11	0.153	12419	0.01%	0.65	0.75	0.02%	0.000	0.34	0.079	0.765	0.00%	0.0000
Platform/Random Fill Layer	5618.19	5617.22	5616.24	1.95	0.050	101	0.552	0.503	0.00	0.00	0.552	0.503	2.74	508	1.6E-03	4.0E+02	1.2E-04	11	0.170	10482	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000

2013 CPT Data from ConeTec / CPT Data Interpretations

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of CPT (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %
17.388	5598.85	7.9	0.164	7.7	33.1	14.33	2.07%	Slime Tailings	0.057	113.1	0.98	0.39	0.59	1	1.34	10.339	143.72	12.33	12	2.36%	2.9	71%
17.552	5598.69	11.4	0.123	11.3	9.0	3.89	1.08%	Sand-Slime Tailin	0.059	119.0	0.99	0.39	0.60	1	1.33	15.075	209.54	17.60	17	1.19%	2.6	47%
17.716	5598.52	11.9	0.100	11.9	9.2	3.97	0.84%	Sand-Slime Tailin	0.059	119.0	1.00	0.40	0.60	1	1.32	15.752	218.95	18.38	18	0.91%	2.5	47%
17.880	5598.36	13.3	0.080	13.2	10.8	4.68	0.60%	Sand-Slime Tailin	0.059	119.0	1.01	0.40	0.61	1	1.32	17.409	241.99	20.32	20	0.65%	2.4	47%
18.044	5598.20	11.4	0.112	11.3	11.6	5.01	0.98%	Sand-Slime Tailin	0.059	119.0	1.02	0.41	0.61	1	1.31	14.805	205.79	17.31	17	1.08%	2.6	47%
18.208	5598.03	9.8	0.153	9.6	32.4	14.04	1.56%	Sand-Slime Tailin	0.059	119.0	1.03	0.41	0.61	1	1.30	12.479	173.46	14.80	14	1.75%	2.7	47%
18.372	5597.87	8.7	0.140	8.4	48.2	20.90	1.61%	Slime Tailings	0.057	113.1	1.03	0.42	0.62	1	1.29	10.848	150.78	13.05	12	1.83%	2.8	71%
18.537	5597.70	13.2	0.140	13.0	34.0	14.71	1.06%	Sand-Slime Tailin	0.059	119.0	1.04	0.42	0.62	1	1.29	16.691	232.01	19.70	19	1.15%	2.5	47%
18.701	5597.54	16.6	0.192	16.5	16.7	7.23	1.15%	Sand-Slime Tailin	0.059	119.0	1.05	0.43	0.63	1	1.27	21.007	292.00	24.55	25	1.23%	2.5	47%
18.865	5597.38	18.6	0.304	18.5	20.3	8.79	1.64%	Sand-Slime Tailin	0.059	119.0	1.06	0.43	0.63	1	1.26	23.192	322.37	27.12	28	1.74%	2.5	47%
19.029	5597.21	12.1	0.344	12.0	21.5	9.30	2.85%	Slime Tailings	0.057	113.1	1.07	0.44	0.64	1	1.27	15.124	210.23	17.76	17	3.12%	2.8	71%
19.193	5597.05	10.5	0.228	10.4	14.6	6.31	2.17%	Slime Tailings	0.057	113.1	1.08	0.44	0.64	1	1.26	13.121	182.38	15.37	15	2.42%	2.8	71%
19.357	5596.88	14.9	0.247	14.8	23.9	10.36	1.66%	Sand-Slime Tailin	0.059	119.0	1.09	0.45	0.65	1	1.25	18.446	256.39	21.64	21	1.79%	2.6	47%
19.521	5596.72	13.9	0.205	13.8	21.2	9.20	1.47%	Sand-Slime Tailin	0.059	119.0	1.10	0.45	0.65	1	1.25	17.183	238.84	20.15	20	1.60%	2.6	47%
19.685	5596.56	13.2	0.218	13.1	22.9	9.93	1.65%	Sand-Slime Tailin	0.059	119.0	1.11	0.46	0.66	1	1.24	16.221	225.47	19.05	19	1.80%	2.7	47%
19.849	5596.39	13.5	0.200	13.2	37.2	16.11	1.49%	Sand-Slime Tailin	0.059	119.0	1.12	0.46	0.66	1	1.23	16.280	226.29	19.24	19	1.62%	2.6	47%
20.013	5596.23	12.3	0.225	12.1	40.5	17.56	1.82%	Sand-Slime Tailin	0.059	119.0	1.13	0.47	0.66	1	1.22	14.794	205.64	17.54	17	2.01%	2.7	47%
20.177	5596.06	11.2	0.272	11.1	13.6	5.88	2.44%	Slime Tailings	0.057	113.1	1.14	0.47	0.67	1	1.22	13.492	187.53	15.79	15	2.72%	2.8	71%
20.341	5595.90	8.2	0.252	7.9	49.1	21.27	3.08%	Slime Tailings	0.057	113.1	1.15	0.48	0.67	1	1.21	9.557	132.85	11.53	10	3.58%	3.0	71%
20.505	5595.74	9.4	0.193	9.0	75.9	32.90	2.05%	Slime Tailings	0.057	113.1	1.16	0.48	0.68	1	1.21	10.815	150.33	13.23	12	2.33%	2.9	71%
20.669	5595.57	9.3	0.202	9.0	52.0	22.51	2.18%	Slime Tailings	0.057	113.1	1.17	0.49	0.68	1	1.20	10.763	149.61	12.95	12	2.49%	2.9	71%
20.833	5595.41	8.3	0.219	7.8	73.7	31.95	2.64%	Slime Tailings	0.057	113.1	1.18	0.49	0.69	1	1.20	9.349	129.95	11.50	10	3.08%	3.0	71%
20.997	5595.24	12.0	0.180	11.6	62.5	27.06	1.50%	Sand-Slime Tailin	0.059	119.0	1.19	0.50	0.69	1	1.19	13.843	192.42	16.62	16	1.66%	2.7	47%
21.161	5595.08	19.0	0.205	19.0	5.5	2.37	1.08%	Sand-Slime Tailin	0.059	119.0	1.20	0.50	0.69	1	1.17	22.300	309.97	25.95	26	1.15%	2.4	47%
21.325	5594.91	17.5	0.316	17.4	19.7	8.54	1.80%	Sand-Slime Tailin	0.059	119.0	1.21	0.51	0.70	1	1.17	20.385	283.36	23.84	23	1.94%	2.6	47%
21.489	5594.75	17.3	0.420	17.1	33.3	14.41	2.43%	Sand-Slime Tailin	0.059	119.0	1.22	0.51	0.70	1	1.17	19.921	276.90	23.42	23	2.62%	2.7	47%
21.653	5594.59	15.7	0.502	15.4	48.2	20.90	3.21%	Slime Tailings	0.057	113.1	1.23	0.52	0.71	1	1.17	17.885	248.60	21.18	20	3.48%	2.8	71%
21.817	5594.42	15.8	0.368	15.7	17.6	7.63	2.33%	Sand-Slime Tailin	0.059	119.0	1.24	0.52	0.71	1	1.16	18.175	252.63	21.26	20	2.53%	2.7	47%
21.981	5594.26	15.2	0.338	15.1	19.9	8.62	2.23%	Sand-Slime Tailin	0.059	119.0	1.25	0.53	0.72	1	1.15	17.362	241.33	20.33	19	2.43%	2.7	47%
22.145	5594.09	12.0	0.255	11.8	32.8	14.22	2.12%	Slime Tailings	0.057	113.1	1.25	0.53	0.72	1	1.15	13.551	188.36	16.01	15	2.37%	2.8	71%
22.309	5593.93	8.6	0.140	8.2	71.6	31.03	1.62%	Slime Tailings	0.057	113.1	1.26	0.54	0.73	1	1.14	9.341	129.83	11.44	10	1.90%	2.9	71%
22.473	5593.77	9.5	0.099	9.0	82.5	35.75	1.04%	Sand-Slime Tailin	0.059	119.0	1.27	0.54	0.73	1	1.14	10.238	142.31	12.57	11	1.20%	2.7	47%
22.638	5593.60	10.4	0.096	9.8	94.2	40.81	0.93%	Sand-Slime Tailin	0.059	119.0	1.28	0.55	0.73	1	1.13	11.059	153.72	13.62	12	1.06%	2.7	47%
22.802	5593.44	9.9	0.099	9.3	99.2	43.00	1.00%	Sand-Slime Tailin	0.059	119.0	1.29	0.55	0.74	1	1.13	10.431	144.98	12.92	12	1.15%	2.7	47%
22.966	5593.27	10.2	0.107	9.5	106.1	45.99	1.05%	Sand-Slime Tailin	0.059	119.0	1.30	0.56	0.74	1	1.12	10.660	148.17	13.24	12	1.21%	2.7	47%
23.130	5593.11	10.7	0.153	10.0	111.1	48.14	1.44%	Sand-Slime Tailin	0.059	119.0	1.31	0.56	0.75	1	1.12	11.110	154.43	13.80	12	1.64%	2.8	47%
23.294	5592.95	12.8	0.177	12.1	112.8	48.88	1.39%	Sand-Slime Tailin	0.059	119.0	1.32	0.57	0.75	1	1.11	13.388	186.09	16.46	15	1.55%	2.7	47%
23.458	5592.78	14.7	0.172	14.3	63.4	27.46	1.17%	Sand-Slime Tailin	0.059	119.0	1.33	0.57	0.76	1	1.10	15.787	219.45	18.84	18	1.29%	2.6	47%
23.622	5592.62	13.1	0.169	12.7	73.0	31.63	1.29%	Sand-Slime Tailin	0.059	119.0	1.34	0.58	0.76	1	1.10	13.909	193.34	16.74	15	1.44%	2.7	47%
23.786	5592.45	13.9	0.141	13.4	84.0	36.41	1.02%	Sand-Slime Tailin	0.059	119.0	1.35	0.58	0.77	1	1.09	14.609	203.07	17.63	16	1.13%	2.6	47%
23.950	5592.29	12.4	0.180	12.0	69.1	29.93	1.45%	Sand-Slime Tailin	0.059	119.0	1.36	0.59	0.77	1	1.09	13.081	181.83	15.74	14	1.62%	2.7	47%
24.114	5592.13	12.8	0.188	11.8	149.2	64.65	1.47%	Sand-Slime Tailin	0.059	119.0	1.37	0.60	0.78	1	1.08	12.814	178.11	16.06	15	1.65%	2.7	47%
24.278	5591.96	13.0	0.159	12.1	152.5	66.07	1.22%	Sand-Slime Tailin	0.059	119.0	1.38	0.60	0.78	1	1.08	13.024	181.04	16.32	15	1.37%	2.7	47%
24.442	5591.80	13.9	0.175	13.0	152.5	66.07	1.26%	Sand-Slime Tailin	0.059	119.0	1.39	0.61	0.79	1	1.07	13.931	193.64	17.37	16	1.40%	2.6	47%
24.606	5591.63	14.2	0.192	13.3	152.9	66.26	1.35%	Sand-Slime Tailin	0.059	119.0	1.40	0.61	0.79	1	1.07	14.198	197.35	17.68	16	1.50%	2.7	47%
24.770	5591.47	13.7	0.186	12.8	151.0	65.42	1.36%	Sand-Slime Tailin	0.059	119.0	1.41	0.62	0.80	1	1.06	13.601	189.06	16.96	15	1.51%	2.7	47%
24.934	5591.31	12.8	0.197	12.0	120.3	52.12	1.54%	Sand-Slime Tailin	0.059	119.0	1.42	0.62	0.80	1	1.06	12.734	177.01	15.71	14	1.74%	2.7	47%
25.098	5591.14	11.7	0.209	10.9	127.8	55.38	1.79%	Sand-Slime Tailin	0.059	119.0	1.43	0.63	0.80	1	1.05	11.464	159.35	14.29	13	2.04%	2.8	47%
25.262	5590.98	11.2	0.195	10.6	97.8	42.36	1.74%	Sand-Slime Tailin	0.059	119.0	1.44	0.63	0.81	1	1.05	11.150	154.99	13.69	12	1.99%	2.8	47%
25.426	5590.81	11.4	0.160	10.8	101.4	43.94	1.41%	Sand-Slime Tailin	0.059	119.0	1.45	0.64	0.81	1	1.05	11.236	156.18	13.82	12	1.61%	2.8	47%
25.590	5590.65	11.2	0.149	10.6	105.8	45.83	1.33%	Sand-Slime Tailin	0.059	119.0	1.46	0.64	0.82	1	1.04	10.978	152.60	13.55	12	1.53%	2.8	47%
25.754	5590.49	11.6	0.159	11.1	86.4	37.44	1.37%	Sand-Slime Tailin	0.059	119.0	1.47	0.65	0.82	1	1.04	11.458	159.27	13.96	12	1.57%	2.8	47%
25.918	5590.32	11.7	0.182	11.0	108.2	46.89	1.56%	Sand-Slime Tailin	0.059	119.0	1.48	0.65	0.83	1	1.03	11.356	157.85	14.00	12	1.78%	2.8	47%
26.082	5590.16	11.7	0.204	11.1	102.1	44.24	1.74%	Sand-Slime Tailin	0.059	119.0	1.49	0.66	0.83	1	1.03	11.368	158.02	13.96	12	2.00%	2.8	47%
26.246	5589.99	11.8	0.197	11.1	100.4	43.51	1.67%	Sand-Slime Tailin	0.059	119.0	1.50	0.66	0.84	1	1.02	11.391	158.33	13.97	12	1.92%	2.8	47%
26.410	5589.83	11.4	0.197	10.8	88.6	38.40	1.73%	Sand-Slime Tailin	0.059	119.0	1.51	0.67	0.84	1	1.02	11.016	153.12	13.45	12	2.00%	2.8	47%
26.574	5589.67	10.5	0.197	10.0	88.3	38.26	1.87%	Sand-Slime Tailin	0.059	119.0	1.52	0.67	0.85	1	1.01	10.127	140.77	12.41	11	2.18%	2.9	47%
27.740	5588.50							Sand-Slime Tailin	0.059	119.0												

Conditions at t_1 / Liquefaction Triggering Analyses

Idriss & Boulanger (2008) (columns r_d through FoS after "Saturated"); Youd et al. (2001) (second set of r_d through FoS).

Depth at time of CPT (ft)	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No	I&B r_d	C_σ	K_σ	K_α	CSR M=7.5, s'v=1atm	Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Youd r_d	D_r	f	K_σ	K_α	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No
17.388	1.53	0.00	1.53	0	0.90	0.05	0.97	1.0	0.050	34.38	46.71	0.074	1.47	0.94	0.20	0.80	1.08	1.0	0.038	5.52	68.04	0.109	3.85	2.66	2
17.552	1.54	0.00	1.54	0	0.90	0.05	0.97	1.0	0.050	36.47	54.07	0.082	1.62	0.94	0.24	0.80	1.08	1.0	0.038	3.19	56.15	0.096	3.38	2.50	2
17.716	1.55	0.00	1.55	0	0.89	0.05	0.97	1.0	0.050	36.75	55.13	0.083	1.65	0.94	0.25	0.80	1.07	1.0	0.038	2.79	51.35	0.093	3.22	2.43	2
17.880	1.56	0.00	1.56	0	0.89	0.05	0.97	1.0	0.050	37.43	57.75	0.085	1.71	0.94	0.26	0.80	1.07	1.0	0.038	2.30	46.76	0.089	3.07	2.39	2
18.044	1.57	0.00	1.57	0	0.89	0.05	0.97	1.0	0.050	36.37	53.68	0.081	1.62	0.93	0.24	0.80	1.07	1.0	0.038	3.13	54.15	0.095	3.25	2.43	2
18.208	1.58	0.00	1.58	0	0.89	0.05	0.97	1.0	0.050	35.49	50.29	0.078	1.56	0.93	0.22	0.80	1.07	1.0	0.039	4.29	63.44	0.104	3.53	2.54	2
18.372	1.59	0.00	1.59	0	0.89	0.05	0.97	1.0	0.050	34.63	47.68	0.075	1.51	0.93	0.21	0.80	1.07	1.0	0.039	4.81	62.72	0.103	3.48	2.49	2
18.537	1.60	0.00	1.60	0	0.89	0.05	0.97	1.0	0.050	37.21	56.91	0.085	1.70	0.93	0.26	0.80	1.07	1.0	0.039	2.92	57.59	0.098	3.28	2.49	2
18.701	1.61	0.00	1.61	0	0.89	0.06	0.97	1.0	0.049	38.91	63.46	0.092	1.85	0.93	0.29	0.80	1.07	1.0	0.039	2.55	62.56	0.103	3.42	2.64	2
18.865	1.62	0.00	1.62	0	0.89	0.06	0.96	1.0	0.049	39.81	66.93	0.096	1.94	0.93	0.30	0.80	1.06	1.0	0.039	2.76	74.88	0.119	3.94	2.94	2
19.029	1.63	0.00	1.63	0	0.88	0.05	0.97	1.0	0.049	36.27	54.04	0.081	1.65	0.93	0.24	0.80	1.06	1.0	0.039	4.91	87.26	0.142	4.66	3.15	2
19.193	1.63	0.00	1.63	0	0.88	0.05	0.97	1.0	0.049	35.44	50.81	0.078	1.58	0.93	0.23	0.80	1.06	1.0	0.039	4.83	74.31	0.118	3.86	2.72	2
19.357	1.64	0.00	1.64	0	0.88	0.05	0.97	1.0	0.049	37.89	59.53	0.087	1.78	0.93	0.27	0.80	1.06	1.0	0.039	3.31	71.69	0.114	3.71	2.74	2
19.521	1.65	0.00	1.65	0	0.88	0.05	0.97	1.0	0.049	37.37	57.52	0.085	1.73	0.93	0.26	0.80	1.06	1.0	0.039	3.32	66.95	0.108	3.48	2.61	2
19.685	1.66	0.00	1.66	0	0.88	0.05	0.97	1.0	0.049	36.98	56.03	0.084	1.70	0.93	0.25	0.80	1.06	1.0	0.039	3.65	69.51	0.111	3.56	2.63	2
19.849	1.67	0.00	1.67	0	0.88	0.05	0.97	1.0	0.049	37.05	56.29	0.084	1.71	0.93	0.25	0.80	1.05	1.0	0.039	3.47	66.72	0.108	3.42	2.57	2
20.013	1.68	0.00	1.68	0	0.88	0.05	0.97	1.0	0.049	36.45	54.00	0.081	1.66	0.93	0.24	0.80	1.05	1.0	0.039	4.08	71.55	0.114	3.60	2.63	2
20.177	1.69	0.00	1.69	0	0.87	0.05	0.97	1.0	0.049	35.59	51.38	0.079	1.61	0.93	0.23	0.80	1.05	1.0	0.039	5.03	79.45	0.127	3.98	2.80	2
20.341	1.70	0.00	1.70	0	0.87	0.05	0.97	1.0	0.049	34.10	45.64	0.073	1.50	0.93	0.20	0.80	1.05	1.0	0.039	7.03	81.06	0.130	4.05	2.78	2
20.505	1.71	0.00	1.71	0	0.87	0.05	0.97	1.0	0.049	34.69	47.92	0.076	1.55	0.93	0.21	0.80	1.05	1.0	0.039	5.35	70.73	0.113	3.52	2.53	2
20.669	1.72	0.00	1.72	0	0.87	0.05	0.97	1.0	0.049	34.60	47.55	0.075	1.54	0.92	0.21	0.80	1.05	1.0	0.039	5.58	72.33	0.115	3.57	2.56	2
20.833	1.73	0.00	1.73	0	0.87	0.05	0.97	1.0	0.049	34.09	45.59	0.073	1.51	0.92	0.20	0.80	1.05	1.0	0.039	6.64	76.37	0.121	3.75	2.63	2
20.997	1.74	0.00	1.74	0	0.87	0.05	0.96	1.0	0.048	36.13	52.75	0.080	1.66	0.92	0.24	0.80	1.05	1.0	0.039	3.93	65.36	0.106	3.25	2.45	2
21.161	1.75	0.00	1.75	0	0.87	0.06	0.96	1.0	0.048	39.40	65.35	0.094	1.95	0.92	0.29	0.80	1.04	1.0	0.039	2.42	62.89	0.103	3.15	2.55	2
21.325	1.76	0.00	1.76	0	0.87	0.05	0.96	1.0	0.048	38.66	62.51	0.091	1.89	0.92	0.28	0.80	1.04	1.0	0.039	3.25	77.41	0.123	3.74	2.81	2
21.489	1.77	0.00	1.77	0	0.86	0.05	0.96	1.0	0.048	38.51	61.93	0.090	1.88	0.92	0.28	0.80	1.04	1.0	0.039	3.80	88.94	0.145	4.40	3.14	2
21.653	1.78	0.00	1.78	0	0.86	0.05	0.96	1.0	0.048	37.46	58.64	0.086	1.80	0.92	0.27	0.80	1.04	1.0	0.039	4.68	99.17	0.171	5.14	3.47	2
21.817	1.79	0.00	1.79	0	0.86	0.05	0.96	1.0	0.048	37.76	59.01	0.087	1.81	0.92	0.27	0.80	1.04	1.0	0.039	4.01	85.19	0.137	4.12	2.96	2
21.981	1.80	0.00	1.80	0	0.86	0.05	0.96	1.0	0.048	37.43	57.76	0.085	1.79	0.91	0.26	0.80	1.04	1.0	0.039	4.06	82.51	0.132	3.94	2.86	2
22.145	1.81	0.00	1.81	0	0.86	0.05	0.96	1.0	0.048	35.66	51.68	0.079	1.65	0.91	0.23	0.80	1.04	1.0	0.039	4.75	76.11	0.121	3.59	2.62	2
22.309	1.82	0.00	1.82	0	0.86	0.05	0.97	1.0	0.048	34.07	45.51	0.073	1.53	0.91	0.20	0.80	1.03	1.0	0.039	5.55	63.50	0.104	3.07	2.30	2
22.473	1.83	0.00	1.83	0	0.86	0.05	0.96	1.0	0.048	34.71	47.28	0.075	1.57	0.91	0.20	0.80	1.03	1.0	0.039	4.33	54.47	0.095	2.79	2.18	2
22.638	1.84	0.00	1.84	0	0.85	0.05	0.96	1.0	0.048	35.08	48.70	0.076	1.60	0.91	0.21	0.80	1.03	1.0	0.039	3.88	52.88	0.094	2.74	2.17	2
22.802	1.85	0.00	1.84	1	0.85	0.05	0.96	1.0	0.048	34.83	47.76	0.075	1.58	0.91	0.21	0.80	1.03	1.0	0.039	4.18	54.08	0.095	2.75	2.17	2
22.966	1.86	0.01	1.85	1	0.85	0.05	0.96	1.0	0.048	34.95	48.19	0.076	1.59	0.91	0.21	0.80	1.03	1.0	0.039	4.18	55.34	0.096	2.76	2.18	2
23.130	1.87	0.01	1.85	1	0.85	0.05	0.96	1.0	0.048	35.14	48.94	0.076	1.60	0.90	0.21	0.80	1.03	1.0	0.039	4.56	63.00	0.103	2.96	2.28	2
23.294	1.88	0.02	1.86	1	0.85	0.05	0.96	1.0	0.048	36.07	52.53	0.080	1.68	0.90	0.23	0.80	1.03	1.0	0.039	3.91	64.31	0.105	2.98	2.33	2
23.458	1.88	0.02	1.86	1	0.85	0.05	0.96	1.0	0.048	36.91	55.75	0.083	1.75	0.90	0.25	0.80	1.03	1.0	0.039	3.27	61.70	0.102	2.87	2.31	2
23.622	1.89	0.03	1.87	1	0.85	0.05	0.96	1.0	0.048	36.17	52.91	0.080	1.68	0.90	0.24	0.80	1.02	1.0	0.039	3.75	62.77	0.103	2.89	2.28	2
23.786	1.90	0.03	1.87	1	0.85	0.05	0.96	1.0	0.048	36.49	54.12	0.082	1.71	0.90	0.24	0.80	1.02	1.0	0.039	3.27	57.67	0.098	2.72	2.21	2
23.950	1.91	0.04	1.88	1	0.84	0.05	0.96	1.0	0.048	35.82	51.56	0.079	1.65	0.90	0.23	0.80	1.02	1.0	0.040	4.14	65.19	0.106	2.92	2.29	2
24.114	1.92	0.04	1.88	1	0.84	0.05	0.96	1.0	0.048	35.93	51.99	0.079	1.66	0.90	0.23	0.80	1.02	1.0	0.040	4.11	66.05	0.107	2.93	2.29	2
24.278	1.93	0.05	1.89	1	0.84	0.05	0.96	1.0	0.048	36.03	52.34	0.080	1.67	0.90	0.23	0.80	1.02	1.0	0.040	3.76	61.39	0.102	2.76	2.21	2
24.442	1.94	0.05	1.89	1	0.84	0.05	0.96	1.0	0.048	36.39	53.76	0.081	1.69	0.89	0.24	0.80	1.02	1.0	0.040	3.62	62.94	0.103	2.79	2.24	2
24.606	1.95	0.06	1.89	1	0.84	0.05	0.96	1.0	0.048	36.50	54.18	0.082	1.70	0.89	0.24	0.80	1.02	1.0	0.040	3.68	65.11	0.106	2.84	2.27	2
24.770	1.96	0.06	1.90	1	0.84	0.05	0.96	1.0	0.048	36.25	53.21	0.081	1.68	0.89	0.24	0.80	1.02	1.0	0.040	3.82	64.78	0.105	2.81	2.24	2
24.934	1.97	0.07	1.90	1	0.84	0.05	0.96	1.0	0.048	35.81	51.53	0.079	1.64	0.89	0.23	0.80	1.01	1.0	0.040	4.29	67.41	0.108	2.87	2.26	2
25.098	1.98	0.07	1.91	1	0.83	0.05	0.96	1.0	0.048	35.31	49.61	0.077	1.60	0.89	0.22	0.80	1.01	1.0	0.040	4.93	70.46	0.113	2.96	2.28	2
25.262	1.99	0.08	1.91	1	0.83	0.05	0.96	1.0	0.048	35.10	48.80	0.076	1.58	0.89	0.21	0.80	1.01	1.0	0.040	5.04	69.04	0.111	2.89	2.24	2
25.426	2.00	0.08	1.92	1	0.83	0.05	0.96	1.0	0.048	35.15	48.97	0.077	1.59	0.89	0.21	0.80	1.01	1.0	0.040	4.60	63.56	0.104	2.70	2.14	2
25.590	2.01	0.09	1.92	1	0.83	0.05	0.96	1.0	0.048	35.05	48.60	0.076	1.58	0.88	0.21	0.80	1.01	1.0	0.040	4.58	62.02	0.102	2.63	2.11	2
25.754	2.02	0.09	1.93	1	0.83	0.05	0.96	1.0	0.048	35.20	49.15	0.077	1.59	0.88	0.22	0.80	1.01	1.0	0.040	4.53	63.18	0.103	2.65	2.12	2
25.918	2.03	0.10	1.93	1	0.83	0.05	0.96	1.0	0.048	35.21	49.21	0.077	1.59	0.88	0.22	0.80	1.01	1.0	0.041	4.76	66.63	0.108	2.74	2.16	2
26.082	2.04	0.10	1.94	1	0.83	0.05	0.96	1.0	0.048	35.20	49.16	0.077	1.59	0.88	0.22	0.80	1.01	1.0	0.041	5.00	69.81	0.112	2.82	2.20	2
26.246	2.05	0.11	1.94	1	0.82	0.05	0.96	1.0	0.048	35.20	49.18	0.077	1.58	0.88	0.22	0.80	1.01	1.0	0.041	4.92	68.75	0.110	2.77	2.18	2
26.410	2.06	0.11	1.95	1	0.82	0.05	0.96	1.0	0.048	35.02	48.47	0.076	1.57	0.88	0.21	0.80	1.00	1.0	0.041	5.15	69.27	0.111	2.77	2.17	2
26.574	2.07	0.12	1.95	1	0.82	0.05	0.96	1.0	0.048	34.65	47.07	0.075	1.54	0.88	0.20	0.80	1.00	1.0	0.041	5.67	70.40	0.112	2.79	2.16	2
27.740	2.14	0.14	2.00	1																					

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.425

Depth at t_1, z_1 m	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Maximum Shear Strain Modulus, G_{max} tsf	P = γ_{eff}*(G_{eff}/G_{max}) tsf	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_c (%)	Incremental Consolidation (ft)
8.33	500	1.8E-03	4.4E+02	3.4E-04	16	0.477	5592	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.62%	0.0043
8.38	500	1.8E-03	4.6E+02	3.2E-04	10	0.227	6768	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.20%	0.0036
8.43	500	1.8E-03	4.6E+02	3.3E-04	10	0.227	6750	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.23%	0.0037
8.48	500	1.8E-03	4.6E+02	3.3E-04	10	0.227	6732	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.26%	0.0037
8.53	500	1.8E-03	4.6E+02	3.3E-04	10	0.228	6715	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.29%	0.0038
8.58	500	1.8E-03	4.6E+02	3.3E-04	10	0.228	6698	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.32%	0.0038
8.63	500	1.8E-03	4.4E+02	3.5E-04	16	0.480	5507	0.10%	2.00	0.65	0.03%	0.018	0.34	0.079	0.765	2.81%	0.0046
8.68	500	1.8E-03	4.6E+02	3.4E-04	10	0.229	6664	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.38%	0.0039
8.73	500	1.8E-03	4.6E+02	3.4E-04	10	0.229	6648	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.41%	0.0039
8.78	500	1.8E-03	4.6E+02	3.4E-04	10	0.230	6631	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.43%	0.0040
8.83	500	1.8E-03	4.4E+02	3.6E-04	16	0.481	5453	0.11%	2.00	0.65	0.03%	0.019	0.34	0.079	0.765	2.93%	0.0048
8.88	500	1.8E-03	4.4E+02	3.6E-04	16	0.481	5440	0.11%	2.00	0.65	0.03%	0.019	0.34	0.079	0.765	2.96%	0.0048
8.93	500	1.8E-03	4.6E+02	3.5E-04	10	0.231	6583	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.52%	0.0041
8.98	500	1.8E-03	4.6E+02	3.5E-04	10	0.231	6567	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.55%	0.0042
9.03	538	1.8E-03	5.3E+02	3.0E-04	10	0.231	6551	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.77%	0.0029
9.08	538	1.8E-03	5.3E+02	3.1E-04	10	0.232	6535	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.80%	0.0029
9.13	538	1.8E-03	5.3E+02	3.1E-04	10	0.232	6520	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.82%	0.0030
9.18	538	1.8E-03	5.1E+02	3.2E-04	16	0.483	5363	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.25%	0.0037
9.23	538	1.8E-03	5.1E+02	3.3E-04	16	0.484	5351	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.27%	0.0037
9.28	538	1.8E-03	5.1E+02	3.3E-04	16	0.484	5339	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.30%	0.0038
9.33	538	1.8E-03	5.1E+02	3.3E-04	16	0.484	5327	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.32%	0.0038
9.38	538	1.8E-03	5.1E+02	3.3E-04	16	0.485	5315	0.09%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.34%	0.0038
9.43	538	1.8E-03	5.3E+02	3.2E-04	10	0.234	6432	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.95%	0.0032
9.48	538	1.8E-03	5.3E+02	3.2E-04	10	0.234	6417	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.98%	0.0032
9.53	538	1.8E-03	5.3E+02	3.2E-04	10	0.235	6402	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.00%	0.0033
9.58	538	1.8E-03	5.3E+02	3.2E-04	10	0.235	6387	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.02%	0.0033
9.63	538	1.8E-03	5.1E+02	3.4E-04	16	0.486	5255	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.46%	0.0040
9.68	538	1.8E-03	5.3E+02	3.3E-04	10	0.236	6359	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.07%	0.0034
9.73	538	1.8E-03	5.3E+02	3.3E-04	10	0.236	6345	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.09%	0.0034
9.78	538	1.8E-03	5.1E+02	3.5E-04	16	0.487	5221	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.53%	0.0042
9.83	538	1.8E-03	5.1E+02	3.5E-04	16	0.487	5210	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.55%	0.0042
9.88	538	1.8E-03	5.3E+02	3.3E-04	10	0.237	6304	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.16%	0.0035
9.93	538	1.8E-03	5.3E+02	3.3E-04	10	0.237	6290	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.18%	0.0036
9.98	538	1.8E-03	5.3E+02	3.4E-04	10	0.237	6279	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.20%	0.0036
10.03	538	1.8E-03	5.3E+02	3.4E-04	10	0.237	6272	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.23%	0.0037
10.08	538	1.8E-03	5.3E+02	3.4E-04	10	0.238	6266	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.26%	0.0037
10.13	538	1.8E-03	5.3E+02	3.4E-04	10	0.238	6259	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.28%	0.0037
10.18	538	1.8E-03	5.3E+02	3.4E-04	10	0.238	6253	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.31%	0.0038
10.23	538	1.8E-03	5.3E+02	3.5E-04	10	0.238	6246	0.09%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.34%	0.0038
10.28	538	1.8E-03	5.3E+02	3.5E-04	10	0.238	6240	0.09%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.36%	0.0039
10.33	538	1.8E-03	5.3E+02	3.5E-04	10	0.238	6233	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.39%	0.0039
10.38	538	1.8E-03	5.3E+02	3.5E-04	10	0.239	6227	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.42%	0.0040
10.43	538	1.8E-03	5.3E+02	3.5E-04	10	0.239	6221	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.45%	0.0040
10.48	538	1.8E-03	5.3E+02	3.5E-04	10	0.239	6214	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.47%	0.0041
10.53	538	1.8E-03	5.3E+02	3.6E-04	10	0.239	6208	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.50%	0.0041
10.58	594	1.8E-03	6.5E+02	2.9E-04	10	0.239	6202	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.52%	0.0025
10.63	594	1.8E-03	6.5E+02	3.0E-04	10	0.239	6195	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.54%	0.0025
10.68	594	1.8E-03	6.5E+02	3.0E-04	10	0.239	6189	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.56%	0.0026
10.73	594	1.8E-03	6.5E+02	3.0E-04	10	0.240	6183	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.58%	0.0026
10.78	594	1.8E-03	6.5E+02	3.0E-04	10	0.240	6177	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.60%	0.0026
10.83	594	1.8E-03	6.5E+02	3.0E-04	10	0.240	6171	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.62%	0.0027
10.88	594	1.8E-03	6.5E+02	3.0E-04	10	0.240	6164	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.64%	0.0027
10.93	594	1.8E-03	6.5E+02	3.0E-04	10	0.240	6158	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.66%	0.0027
10.98	594	1.8E-03	6.5E+02	3.1E-04	10	0.240	6152	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.68%	0.0028
11.03	594	1.8E-03	6.5E+02	3.1E-04	10	0.240	6146	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.70%	0.0028
11.08	594	1.8E-03	6.5E+02	3.1E-04	10	0.241	6140	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.72%	0.0028
11.13	594	1.8E-03	6.5E+02	3.1E-04	10	0.241	6134	0.07%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.74%	0.0029
11.49	594	1.8E-03	6.5E+02	3.2E-04	10	0.242	6068	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.87%	0.0218

Extra layer added to analyze seismic settlement of tailings below the bottom of CPT investigation.

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W5-C

Data File: 13-52106_SP2W5-C-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Dat

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)
Max. Horiz. Acceleration, Amax/g: 0.15
Earthquake Moment Magnitude, M: 5.5
Magnitude Scaling Factor, MSF: 1.69

Youd, et al (2001)
Max. Horiz. Acceleration, Amax/g: 0.15
Earthquake Moment Magnitude, M: 5.5
Magnitude Scaling Factor, MSF: 2.21

5604.20 Water surface elevation during CPT investigation (ft
5604.20 Water surface elevation at t_0 (ft amsl)
5589.01 Water surface elevation at t_1 (ft amsl)
5584.01 Water surface elevation at t_2 (ft amsl)
1.44 Scaling Factor for stress ration, r_m
0.47 Volumetric Strain Ratio for Site-Specific Design Eart
7.51 Equiv. Number of Uniform Strain Cycles, N

5615.86 Ground Surface Elevation at time of CPT (ft amsl)
5626.28 Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50 Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after plac
3.50 Thickness of Water Storage/Rooting Zone (ft)
4.00 Thickness of High Compaction Layer (ft)
2.42 Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1151.89 Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5584.01 Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer	Total Stress at Midpoint of Layer	Equil Pore Pressure at Bottom of Layer	Equil Pore Pressure at Midpoint of Layer (tsf)	Effective Stress at Bottom of Layer	Effective Stress at Midpoint of Layer	Midpoint Depth at t_1, z_1	Shear Wave Velocity, V_s	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
Erosion Protection Layer	######	5626.03	5625.78	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014	0.08	508	1.7E-03	4.4E+02	3.0E-06	11	0.068	46696	0.00%	1.20	0.80	0.04%	0.000	0.32	0.133	0.778	0.00%	0.0000
Water Storage/Rooting Zone Layer	######	5624.03	5622.28	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121	0.69	508	1.7E-03	4.3E+02	2.8E-05	11	0.118	18930	0.00%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
High Compaction Layer	######	5620.28	5618.28	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334	1.83	508	1.9E-03	4.8E+02	6.8E-05	11	0.153	12419	0.01%	0.65	0.75	0.02%	0.000	0.34	0.079	0.765	0.00%	0.0000
Platform/Random Fill Layer	######	5617.07	5615.86	2.42	0.050	101	0.576	0.515	0.00	0.00	0.576	0.515	2.81	508	1.6E-03	4.0E+02	1.2E-04	11	0.171	10381	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
0.164	5615.70	4.8	0.029	4.8	1.1	0.49	0.60%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0	1.70	8.143	113.19	9.47	580	0.61%	1.2	51%	0.58	0.00	0.58	0
0.328	5615.53	11.7	0.170	11.6	8.2	3.56	1.46%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	19.737	274.34	23.02	705	1.46%	1.5	51%	0.59	0.00	0.59	0
0.492	5615.37	34.1	0.408	34.1	8.9	3.84	1.20%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	57.885	804.60	67.34	1375	1.20%	1.3	51%	0.60	0.00	0.60	0
0.656	5615.20	51.6	0.661	51.6	1.4	0.59	1.28%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0	1.70	87.686	1218.84	101.86	1560	1.28%	1.4	51%	0.61	0.00	0.61	0
0.820	5615.04	73.2	1.112	73.1	6.6	2.84	1.52%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0	1.70	124.304	1727.83	144.45	1770	1.52%	1.4	51%	0.62	0.00	0.62	0
0.984	5614.88	89.2	1.392	89.2	-0.9	-0.37	1.56%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0	1.70	151.606	2107.32	176.07	1798	1.56%	1.4	51%	0.63	0.00	0.63	0
1.148	5614.71	116.0	1.613	115.8	37.9	16.43	1.39%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0	1.70	196.792	2735.41	229.03	2005	1.39%	1.4	51%	0.63	0.00	0.63	0
1.312	5614.55	135.8	1.481	135.7	12.6	5.44	1.09%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	230.724	3207.06	268.13	2054	1.09%	1.3	51%	0.64	0.00	0.64	0
1.476	5614.38	141.1	2.556	141.0	16.3	7.07	1.81%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	239.717	3332.07	278.62	1897	1.81%	1.5	51%	0.65	0.00	0.65	0
1.640	5614.22	158.3	2.323	158.2	7.6	3.31	1.47%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0	1.70	268.974	3738.74	312.49	1915	1.47%	1.4	51%	0.66	0.00	0.66	0
1.804	5614.06	219.1	2.632	219.1	7.2	3.12	1.20%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0	1.70	372.453	5177.10	432.67	2410	1.20%	1.3	51%	0.67	0.00	0.67	0
1.968	5613.89	216.1	2.814	216.0	10.4	4.50	1.30%	Interim Cover	0.050	100.7	0.10	0.00	0.10	0	1.70	367.251	5104.79	426.67	2179	1.30%	1.3	51%	0.68	0.00	0.68	0
2.133	5613.73	184.6	2.875	184.5	8.4	3.65	1.56%	Interim Cover	0.050	100.7	0.11	0.00	0.11	0	1.70	313.718	4360.68	364.47	1718	1.56%	1.4	51%	0.68	0.00	0.68	0
2.297	5613.56	191.7	3.125	191.7	11.1	4.81	1.63%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	325.524	4524.79	378.21	1657	1.63%	1.5	51%	0.69	0.00	0.69	0
2.461	5613.40	166.4	3.732	166.3	8.8	3.82	2.24%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.67	277.345	3855.09	322.23	1342	2.24%	1.6	51%	0.70	0.00	0.70	0
2.625	5613.24	152.8	3.596	152.7	5.5	2.40	2.35%	Interim Cover	0.050	100.7	0.13	0.00	0.13	0	1.64	250.398	3480.54	290.89	1155	2.36%	1.6	51%	0.71	0.00	0.71	0
2.789	5613.07	141.7	3.046	141.7	2.9	1.26	2.15%	Interim Cover	0.050	100.7	0.14	0.00	0.14	0	1.61	228.613	3177.71	265.55	1008	2.15%	1.6	51%	0.72	0.00	0.72	0
2.953	5612.91	135.3	2.327	135.3	3.0	1.28	1.72%	Interim Cover	0.050	100.7	0.15	0.00	0.15	0	1.60	216.180	3004.91	251.11	909	1.72%	1.5	51%	0.72	0.00	0.72	0
3.117	5612.74	130.1	2.548	130.1	2.3	0.98	1.96%	Interim Cover	0.050	100.7	0.16	0.00	0.16	0	1.60	208.503	2898.19	242.19	828	1.96%	1.6	51%	0.73	0.00	0.73	0
3.281	5612.58	111.7	2.753	111.7	2.9	1.27	2.46%	Sand-Slime Tailin	0.047	93.3	0.16	0.00	0.16	0	1.67	186.121	2587.09	216.20	678	2.47%	1.7	47%	0.74	0.00	0.74	0
3.445	5612.42	108.0	2.637	108.0	2.3	1.00	2.44%	Sand-Slime Tailin	0.047	93.3	0.17	0.00	0.17	0	1.67	180.028	2502.39	209.12	626	2.45%	1.7	47%	0.75	0.00	0.75	0
3.609	5612.25	115.0	1.758	115.0	1.5	0.66	1.53%	Sand Tailings	0.051	102.8	0.18	0.00	0.18	0	1.62	186.160	2587.62	216.23	635	1.53%	1.6	18%	0.76	0.00	0.76	0
3.773	5612.09	130.6	2.562	130.6	2.0	0.88	1.96%	Sand Tailings	0.051	102.8	0.19	0.00	0.19	0	1.54	201.640	2802.79	234.22	690	1.96%	1.6	18%	0.77	0.00	0.77	0
3.937	5611.92	134.1	2.416	134.1	2.0	0.88	1.80%	Sand Tailings	0.051	102.8	0.20	0.00	0.20	0	1.52	203.635	2830.52	236.53	678	1.80%	1.6	18%	0.77	0.00	0.77	0
4.101	5611.76	107.5	2.141	107.5	1.8	0.76	1.99%	Sand Tailings	0.051	102.8	0.21	0.00	0.21	0	1.60	172.196	2393.53	200.02	521	2.00%	1.7	18%	0.78	0.00	0.78	0
4.265	5611.59	96.2	1.939	96.1	5.9	2.54	2.02%	Sand-Slime Tailin	0.047	93.3	0.21	0.00	0.21	0	1.64	157.282	2186.22	182.74	449	2.02%	1.7	47%	0.79	0.00	0.79	0
4.429	5611.43	67.8	1.878	67.8	0.9	0.39	2.77%	Sand-Slime Tailin	0.047	93.3	0.22	0.00	0.22	0	1.70	115.175	1600.93	133.78	305	2.78%	1.9	47%	0.80	0.00	0.80	0
4.593	5611.27	82.0	1.346	81.9	5.5	2.36	1.64%	Sand Tailings	0.051	102.8	0.23	0.00	0.23	0	1.67	136.924	1903.24	159.09	356	1.65%	1.7	18%	0.81	0.00	0.81	0
4.757	5611.10	80.0	1.313	80.0	1.7	0.75	1.64%	Sand Tailings	0.051	102.8	0.24	0.00	0.24	0	1.66	133.066	1849.61	154.57	335	1.65%	1.7	18%	0.81	0.00	0.81	0
4.921	5610.94	93.3	1.401	93.3	3.1	1.33	1.50%	Sand Tailings	0.051	102.8	0.25	0.00	0.25	0	1.59	147.935	2056.29	171.85	377	1.51%	1.7	18%	0.82	0.00	0.82	0
5.085	5610.77	97.4	1.343	97.4	3.2	1.40	1.38%	Sand Tailings	0.051	102.8	0.26	0.00	0.26	0	1.56	151.462	2105.33	175.95	381	1.38%	1.6	18%	0.83	0.00	0.83	0
5.249	5610.61	63.5	1.284	63.5	0.9	0.40	2.02%	Sand-Slime Tailin	0.047	93.3	0.26	0.00	0.26	0	1.70	107.951	1500.52	125.39	241	2.03%	1.9	47%	0.84	0.00	0.84	0
5.413	5610.45	54.2	0.816	54.2	-0.6	-0.24	1.51%	Sand-Slime Tailin	0.047	93.3	0.27	0.00	0.27	0	1.70	92.072	1279.80	106.93	199	1.51%	1.8	47%	0.85	0.00	0.85	0
5.577	5610.28	38.7	0.729	38.7	-0.7	-0.30	1.88%	Sand-Slime Tailin	0.047	93.3	0.28	0.00	0.28	0	1.70	65.841	915.19	76.46	138	1.90%	2.0	47%	0.85	0.00	0.85	0
5.741	5610.12	35.6	0.520	35.6	0.1	0.04	1.46%	Sand-Slime Tailin	0.047	93.3	0.29	0.00	0.29	0	1.70	60.520	841.23	70.29	124	1.47%	2.0	47%	0.86	0.00	0.86	0
5.905	5609.95	32.6	0.386	32.6	-0.6	-0.28	1.18%	Sand-Slime Tailin	0.047	93.3	0.29	0.00	0.29	0	1.70	55.420	770.34	64.36	110	1.19%	1.9	47%	0.87	0.00	0.87	0
6.069	5609.79	31.4	0.323	31.4	-0.6	-0.25	1.03%	Sand-Slime Tailin	0.047	93.3	0.30	0.00	0.30	0	1.70	53.346	741.51	61.95	103	1.04%	1.9	47%	0.88	0.00	0.88	0
6.234	5609.63	27.6	0.437	27.6	-0.4	-0.19	1.59%	Sand-Slime Tailin	0.047	93.3	0.31	0.00	0.31	0	1.70	46.852	651.24	54.41	88	1.60%	2.1	47%	0.88	0.00	0.88	0
6.398	5609.46	19.4	0.406	19.4	-0.6	-0.24	2.09%	Sand-Slime Tailin	0.047	93.3	0.32	0.00	0.32	0	1.70	32.963	458.19	38.28	60	2.13%	2.3	47%	0.89	0.00	0.89	0
6.562	5609.30	22.0	0.353	22.0	0.9	0.39	1.60%	Sand-Slime Tailin	0.047	93.3	0.32	0.00	0.32	0	1.70	37.400	519.86	43.45	67	1.63%	2.2	47%	0.90	0.00	0.90	0
6.726	5609.13	32.3	0.314	32.3	1.2	0.51	0.97%	Sand-Slime Tailin	0.047	93.3	0.33	0.00	0.33	0	1.70	54.961	763.96	63.85	97	0.98%	1.9	47%	0.91	0.00	0.91	0
6.890	5608.97	36.5	0.296	36.5	0.3	0.11	0.81%	Sand Tailings	0.051	102.8	0.34	0.00	0.34	0	1.70	61.932	860.85	71.93	106	0.82%	1.8	18%	0.92	0.00	0.92	0
7.054	5608.81	37.5	0.279	37.5	0.2	0.10	0.74%	Sand Tailings	0.051	102.8	0.35	0.00	0.35	0	1.67	62.634	870.61	72.75	107	0.75%	1.8	18%	0.92	0.00	0.92	0
7.218	5608.64	38.6	0.335	38.6	0.2	0.10	0.87%	Sand Tailings	0.051	102.8	0.36	0.00	0.36	0	1.64	63.426	881.62	73.67	107	0.88%	1.9	18%	0.93	0.00	0.93	0
7.382	5608.48	38.6	0.379	38.6	0.0	0.02	0.98%	Sand-Slime Tailin	0.047	93.3	0.36	0.00	0.36	0	1.63	62.785	872.71	72.92	105	0.99%	1.9	47%	0.94	0.00	0.94	0
7.546	5608.31	38.2	0.414	38.2	-0.4	-0.19	1.08%	Sand-Slime Tailin	0.047	93.3	0.37	0.00	0.37	0	1.61	61.540	855.40	71.47	102	1.10%	1.9	47%	0.95	0.00	0.95	0
7.710	5608.15	37.4	0.416	37.4	-0.5	-0.20	1.11%	Sand-Slime Tailin	0.047	93.3	0.38	0.00	0.38	0	1.60	59.889	832.45	69.55	97	1.12%	2.0	47%	0.96	0.00	0.96	0
7.874	5607.99	36.6	0.415	36.6	-0.5	-0.20	1.13%	Sand-Slime Tailin	0.047	93.3	0.39	0.00	0.39	0	1.59	58.233	809.43	67.63	94	1.15%	2.0	47%	0.96	0.00	0.96	0
8.038	5607.82	34.6	0.402	34.6	-0.5	-0.22	1.16%	Sand-Slime Tailin	0.047	93.3	0.40	0.00	0.40	0	1.59	54.871	762.70	63.72	87	1.18%	2.0	47%	0.97	0.00	0.97	0
8.202	5607.66	33.4	0.283	33.5	-0.5	-0.20	0.85%	Sand-Slime Tailin	0.047	93.3	0.40	0.00	0.40	0	1.58	52.769	733.49	61.28	82	0.86%	1.9	47%	0.98	0.00	0.98	0
8.366	5607.49	34.9	0.300	34.9	-0.5	-0.22	0.86%	Sand-Slime Tailin	0.047	93.3	0.41	0.00	0.41	0	1.55	54.238	753.90	62.99	84	0.87%	1.9	47%	0.99	0.00	0.99	0
8.530	5607.33	35.7	0.323	35.7	1.0	0.45	0.91%	Sand-Slime Tailin	0.047	93.3	0.42	0.00	0.42	0	1.53	54.753	761.06	63.60	84	0.92%	1.9	47%	0.99	0.00	0.99	0
8.694	5607.17	37.7	0.356	37.7	0.3	0.14	0.95%	Sand-Slime Tailin	0.047	93.3	0.43	0.00	0.43	0	1.51	56.872	790.53	66.06	87	0.96%	1.9	47%	1.00	0.00	1.00	0
8.858	5607.00	39.5	0.390	39.5	0.3	0.12	0.99%	Sand-Slime Tailin	0.047	93.3	0.43	0.00	0.43	0	1.49	58.703	815.97	68.18	90	1.00%	1.9	47%	1.01	0.00	1.01	0
9.022	5606.84	40.6	0.422	40.6	0.3	0.12	1.04%	Sand-Slime Tailin	0.047	93.3	0.44	0.00	0.44	0	1.47	59.660	829.28	69.29	91	1.05%	2.0	47%	1.02	0.00	1.02	0
9.186	5606.67	38.9	0.458	38.9	0.2	0.10	1.18%	Sand-Slime Tailin	0.047	93.3	0.45	0.00	0.45	0	1.46	57.008	792.41	66.21	86	1.19%	2.0	47%	1.02	0.00	1.02	0
9.350	5606.51	35.6	0.461	35.6	0.2	0.10	1.30%	Sand-Slime Tailin	0.047	93.3	0.46	0.00	0.46	0	1.47	52.127	724.56	60.54	77	1.31%	2.1	47%	1.03	0.00	1.03	0
9.514	5606.35	32.5	0.457	32.5	-0.1	-0.05	1.41%	Sand-Slime Tailin	0.047	93.3	0.46	0.00	0.46	0	1.47	47.683	662.79	55.38	69	1.43%	2.1	47%	1.04	0.00	1.04	0
9.678	5606.18	26.9	0.454	26.9	-0.5	-0.21	1.69%	Sand-Slime Tailin	0.047	93.3	0.47	0.00	0.47	0	1.48	39.847	553.87	46.27	56	1.72%	2.3	47%	1.05	0.00	1.05	0
9.842	5606.02	18.0	0.256	18.0	-0.5	-0.21	1.42%	Sand-Slime Tailin	0.047	93.3	0.48	0.00	0.48	0	1.52	27.373	380.49	31.79	37	1.46%	2.4	47%	1.06	0.00	1.06	0
10.006	5605.85	15.0	0.216	15.1	-0.5	-0.21	1.44%	Sand-Slime Tailin	0.047	93.3	0.49	0.00	0.49	0	1.53	23.015	319.91	26.73	30	1.48%	2.4	47%	1.06	0.00	1.06	0
10.170	5605.69	15.7	0.118	15.7	0.9	0.39	0.75%	Sand-Slime Tailin	0.047	93.3	0.49	0.00	0.49	0	1.51	23.659	328.86	27.49	31	0.78%	2.3	47%	1.07	0.00	1.07	0
10.335	5605.53	12.4	0.142	12.4	0.4	0.18	1.15%	Sand-Slime Tailin	0.047	93.3	0.50	0.00	0.50	0	1.52	18.795	261.25	21.83	24	1.20%	2.5	47%	1.08	0.00	1.08	0
10.499	5605.36	10.8	0.099	10.7	4.9	2.13	0.92%	Sand-Slime Tailin	0.047	93.3	0.51	0.00	0.51	0	1.51	16.147	224.44	18.81	20	0.97%	2.5	47%	1.09	0.00	1.09	0
10.663	5605.20	14.4	0.173	14.4	9.8	4.23	1.20%	Sand-Slime Tailin	0.047	93.3	0.52	0.00	0.52	0	1.47	21.120	293.57	24.63	27	1.24%	2.4	47%	1.09	0.00	1.09	0
10.827	5605.03	12.7	0.151	12.7	5.4	2.33	1.19%	Sand-Slime Tailin	0.047	93.3	0.53	0.00	0.53	0	1.47	18.646	259.18	21.71	23	1.24%	2.5	47%	1.10	0.00	1.10	0
10.991	5604.87	19.4	0.189	19.4	5.3	2.31	0.97%	Sand-Slime Tailin	0.047	93.3	0.53	0.00	0.53	0	1.41	27.383	380.62	31.86	35	1.00%	2.3	47%	1.11	0.00	1.11	0
11.155	5604.71	14.8	0.188	14.8	2.4	1.02	1.27%	Sand-Slime Tailin	0.047	93.3	0.54	0.00	0.54	0	1.42	21.005	291.97	24.42	26	1.32%	2.4	47%	1.12	0.00	1.12	0
11.319	5604.54	12.2	0.105	12.1	2.4	1.02	0.86%	Sand-Slime Tailin	0.047	93.3	0.55	0.00	0.55	0	1.42	17.280	240.19	20.09	21	0.90%	2.4	47%	1.12	0.00	1.12	0
11.483	5604.38	10.1	0.138	10.1	3.1	1.34	1.37%	Sand-Slime Tailin	0.047	93.3	0.56	0.00	0.56	0	1.41	14.151	196.70	16.47	17	1.45%	2.6	47%	1.13	0.00	1.13	0
11.647	5604.21	14.6	0.228	14.6	2.1	0.91	1.56%	Sand-Slime Tailin	0.047	93.3	0.56	0.00	0.56	0	1.38	20.144	280.00	23.42	25	1.63%	2.5	47%	1.14	0.00	1.14	0
11.811	5604.05	12.5	0.140	12.5	3.1	1.35	1.12%	Sand-Slime Tailin	0.059	119.0	0.57	0.00	0.57	1	1.38	17.237	239.60	20.05	21	1.18%	2.5	47%	1.15	0.00	1.15	0
11.975	5603.89	12.6	0.058	12.6	2.8	1.22	0.46%	Sand-Slime Tailin	0.059	119.0	0.58	0.01	0.57	1	1.37	17.307	240.56	20.13	21	0.48%	2.3	47%	1.16	0.00	1.16	0
12.139	5603.72	13.5	0.096	13.4	5.0	2.18	0.71%	Sand-Slime Tailin	0.059	119.0	0.59	0.01	0.58	1	1.36	18.315	254.58	21.32	22	0.75%	2.4	47%	1.17	0.00	1.17	0
12.303	5603.56	11.6	0.118	11.5	11.0	4.78	1.02%	Sand-Slime Tailin	0.059	119.0	0.60	0.02	0.58	1	1.36	15.638	217.37	18.27	19	1.07%	2.5	47%	1.18	0.00	1.18	0
12.467	5603.39	11.3	0.166	11.2	12.8	5.56	1.47%	Sand-Slime Tailin	0.059	119.0	0.61	0.03	0.59	1	1.35	15.110	210.03	17.67	18	1.56%	2.6	47%	1.19	0.00	1.19	0
12.631	5603.23	11.0	0.151	10.9	12.5	5.42	1.38%	Sand-Slime Tailin	0.059	119.0	0.62	0.03	0.59	1	1.34	14.588	202.77	17.06	17	1.46%	2.6	47%	1.20	0.00	1.20	0
12.795	5603.06	18.2	0.083	18.2	2.6	1.13	0.46%	Sand-Slime Tailin	0.059	119.0	0.63	0.04	0.60	1	1.31	23.841	331.39	27.71	29	0.47%	2.2	47%	1.21	0.00	1.21	0
12.959	5602.90	20.3	0.069	20.3	0.7	0.29	0.34%	Sand-Slime Tailin	0.059	119.0	0.64	0.04	0.60	1	1.30	26.297	365.53	30.55	33	0.35%	2.1	47%	1.22	0.00	1.22	0
13.123	5602.74	21.3	0.128	21.3	-0.0	-0.01	0.60%	Sand-Slime Tailin	0.059	119.0	0.65	0.05	0.61	1	1.29	27.402	380.89	31.83	34	0.62%	2.2	47%	1.23	0.00	1.23	0
13.287	5602.57	22.1	0.250	22.1	2.2	0.94	1.13%	Sand-Slime Tailin	0.059	119.0	0.66	0.05	0.61	1	1.28	28.264	392.88	32.85	35	1.16%	2.3	47%	1.24	0.00	1.24	0
13.451	5602.41	17.9	0.288	17.9	3.9	1.69	1.61%	Sand-Slime Tailin	0.059	119.0	0.67	0.06	0.61	1	1.29	22.955	319.07	26.70	28	1.67%	2.5	47%	1.25	0.00	1.25	0
13.615	5602.24	16.1	0.193	16.1	8.8	3.83	1.20%	Sand-Slime Tailin	0.059	119.0	0.68	0.06	0.62	1	1.28	20.647	287.00	24.06	25	1.25%	2.5	47%	1.26	0.00	1.26	0
13.779	5602.08	19.4	0.123	19.3	9.7	4.21	0.63%	Sand-Slime Tailin	0.059	119.0	0.69	0.07	0.62	1	1.27	24.473	340.18	28.51	30	0.66%	2.2	47%	1.27	0.00	1.27	0
13.943	5601.92	25.1	0.130	25.1	8.8	3.83	0.52%	Sand-Slime Tailin	0.059	119.0	0.70	0.07	0.63	1	1.24	31.169	433.25	36.28	39	0.53%	2.1	47%	1.28	0.00	1.28	0
14.107	5601.75	25.6	0.219	25.6	8.3	3.58	0.85%	Sand-Slime Tailin	0.059	119.0	0.71	0.08	0.63	1	1.24	31.630	439.66	36.81	39	0.88%	2.2	47%	1.29	0.00	1.29	0
14.271	5601.59	25.3	0.206	25.3	14.8	6.43	0.81%	Sand-Slime Tailin	0.059	119.0	0.72	0.08	0.64	1	1.23	31.101	432.30	36.25	39	0.84%	2.2	47%	1.30	0.00	1.30	0
14.436	5601.42	28.0	0.355	27.9	15.7	6.79	1.27%	Sand-Slime Tailin	0.059	119.0	0.73	0.09	0.64	1	1.22	33.991	472.48	39.62	42	1.30%	2.3	47%	1.31	0.00	1.31	0
14.600	5601.26	21.9	0.337	21.8	19.3	8.38	1.54%	Sand-Slime Tailin	0.059	119.0	0.74	0.09	0.65	1	1.23	26.771	372.11	31.26	33	1.59%	2.4	47%	1.32	0.00	1.32	0
14.764	5601.10	27.4	0.402	27.2	33.6	14.56	1.47%	Sand-Slime Tailin	0.059	119.0	0.75	0.10	0.65	1	1.21	32.863	456.79	38.46	41	1.51%	2.3	47%	1.32	0.00	1.32	0
14.928	5600.93	49.6	0.629	49.5	20.9	9.05	1.27%	Sand Tailings	0.062	123.5	0.76	0.10	0.66	1	1.17	57.889	804.66	67.41	74	1.29%	2.1	18%	1.33	0.00	1.33	0
15.092	5600.77	29.2	0.705	29.1	11.9	5.15	2.41%	Sand-Slime Tailin	0.059	119.0	0.77	0.11	0.66	1	1.19	34.821	484.01	40.55	43	2.48%	2.4	47%	1.34	0.00	1.34	0
15.256	5600.60	26.1	0.521	26.1	10.3	4.48	1.99%	Sand-Slime Tailin	0.059	119.0	0.78	0.11	0.67	1	1.20	31.170	433.26	36.29	38	2.05%	2.4	47%	1.35	0.00	1.35	0
15.420	5600.44	21.1	0.398	21.0	25.4	11.00	1.88%	Sand-Slime Tailin	0.059	119.0	0.79	0.12	0.67	1	1.20	25.169	349.85	29.45	30	1.96%	2.5	47%	1.36	0.00	1.36	0
15.584	5600.28	18.2	0.232	17.9	47.5	20.56	1.28%	Sand-Slime Tailin	0.059	119.0	0.80	0.12	0.68	1	1.20	21.442	298.05	25.32	26	1.34%	2.5	47%	1.37	0.00	1.37	0
15.748	5600.11	17.7	0.358	17.4	55.7	24.12	2.02%	Sand-Slime Tailin	0.059	119.0	0.81	0.13	0.68	1	1.20	20.745	288.36	24.58	25	2.12%	2.6	47%	1.38	0.00	1.38	0
15.912	5599.95	15.1	0.207	14.6	74.8	32.40	1.37%	Sand-Slime Tailin	0.059	119.0	0.82	0.13	0.68	1	1.20	17.473	242.88	20.94	21	1.45%	2.6	47%	1.39	0.00	1.39	0
16.076	5599.78	20.3	0.257	19.8	68.4	29.65	1.27%	Sand-Slime Tailin	0.059	119.0	0.83	0.14	0.69	1	1.18	23.370	324.85	27.73	28	1.32%	2.4	47%	1.40	0.00	1.40	0
16.240	5599.62	21.4	0.347	21.2	43.6	18.89	1.62%	Sand-Slime Tailin	0.059	119.0	0.84	0.14	0.69	1	1.17	24.772	344.33	29.14	30	1.68%	2.5	47%	1.41	0.00	1.41	0
16.404	5599.46	16.6	0.322	16.3	49.4	21.39	1.94%	Sand-Slime Tailin	0.059	119.0	0.85	0.15	0.70	1	1.17	19.179	266.59	22.70	23	2.04%	2.6	47%	1.42	0.00	1.42	0
16.568	5599.29	13.3	0.286	12.8	72.0	31.18	2.16%	Sand-Slime Tailin	0.059	119.0	0.86	0.15	0.70	1	1.17	15.003	208.55	18.04	18	2.31%	2.7	47%	1.43	0.00	1.43	0
16.732	5599.13	10.2	0.232	9.8	68.1	29.53	2.28%	Slime Tailings	0.057	113.1	0.87	0.16	0.71	1	1.17	11.379	158.16	13.79	13	2.49%	2.9	71%	1.44	0.00	1.44	0
16.896	5598.96	9.5	0.302	9.0	80.2	34.74	3.18%	Slime Tailings	0.057	113.1	0.88	0.16	0.71	1	1.16	10.433	145.02	12.79	12	3.51%	3.0	71%	1.45	0.00	1.45	0
17.060	5598.80	16.7	0.143	16.2	83.4	36.16	0.86%	Sand-Slime Tailin	0.059	119.0	0.88	0.17	0.72	1	1.15	18.672	259.55	22.38	22	0.90%	2.4	47%	1.46	0.00	1.46	0
17.224	5598.64	29.8	0.265	29.6	24.9	10.78	0.89%	Sand-Slime Tailin	0.059	119.0	0.89	0.17	0.72	1	1.13	33.458	465.06	39.06	40	0.92%	2.2	47%	1.47	0.00	1.47	0

Liquefaction Triggering Analyses

Depth at time of CPT (ft)	Idriss & Boulanger (2008) Cyclic Stress Ratio r_d	C_σ	K_σ	K_α	CSR M=7.5, s'v=1atm	Cyclic Resistance Ratio Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Youd et al. (2001) Cyclic Stress Ratio r_d	D_r	f	K_σ	K_α	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No
0.164	1.00	0.04	1.02	1.0	0.059	33.64	43.12	0.071	1.21	0.98	0.18	0.80	2.53	1.0	0.017	1.00	9.47	0.058	4.26	2.74	2
0.328	1.00	0.05	1.02	1.0	0.059	38.40	61.43	0.089	1.52	0.97	0.28	0.80	2.20	1.0	0.019	1.00	23.02	0.069	4.34	2.93	2
0.492	1.00	0.08	1.03	1.0	0.060	53.95	121.29	0.182	3.06	0.97	0.47	0.76	2.32	1.0	0.019	1.00	67.34	0.108	6.40	4.73	2
0.656	1.00	0.11	1.04	1.0	0.060	66.07	167.92	0.388	6.46	0.97	0.58	0.71	2.59	1.0	0.017	1.00	101.86	0.178	11.62	9.04	2
0.820	1.00	0.15	1.05	1.0	0.061	81.01	225.47	1.000	16.46	0.97	0.69	0.65	2.87	1.0	0.015	1.00	144.45	0.360	23.84	20.15	2
0.984	1.00	0.20	1.07	1.0	0.062	92.11	268.18	1.000	16.24	0.97	0.77	0.62	2.98	1.0	0.014	1.00	176.07	1.000	62.26	39.25	2
1.148	1.00	0.30	1.09	1.0	0.063	110.69	339.72	1.000	15.84	0.97	0.87	0.60	2.95	1.0	0.015	1.00	229.03	1.000	54.71	35.28	2
1.312	1.00	0.30	1.09	1.0	0.063	124.41	392.54	1.000	15.90	0.97	0.95	0.60	2.79	1.0	0.015	1.00	268.13	1.000	65.11	40.50	2
1.476	1.00	0.30	1.08	1.0	0.063	128.10	406.71	1.000	15.95	0.97	0.96	0.60	2.66	1.0	0.016	1.00	278.62	1.000	62.14	39.05	2
1.640	1.00	0.30	1.08	1.0	0.062	139.98	452.47	1.000	16.01	0.97	1.02	0.60	2.55	1.0	0.017	1.00	312.49	1.000	243.22	129.62	2
1.804	1.00	0.30	1.08	1.0	0.062	182.16	614.83	1.000	16.07	0.97	1.20	0.60	2.46	1.0	0.017	1.00	432.67	1.000	221.20	118.63	2
1.968	1.00	0.30	1.07	1.0	0.062	180.05	606.72	1.000	16.13	0.97	1.19	0.60	2.37	1.0	0.018	1.00	426.67	1.000	202.84	109.49	2
2.133	1.00	0.30	1.07	1.0	0.062	158.22	522.69	1.000	16.20	0.97	1.10	0.60	2.30	1.0	0.019	1.00	364.47	1.000	187.31	101.76	2
2.297	1.00	0.30	1.07	1.0	0.061	163.05	541.26	1.000	16.27	0.97	1.12	0.60	2.23	1.0	0.019	1.00	378.21	1.000	174.00	95.14	2
2.461	1.00	0.30	1.06	1.0	0.061	143.40	465.63	1.000	16.34	0.97	1.04	0.60	2.17	1.0	0.020	1.00	322.23	1.000	162.47	89.40	2
2.625	1.00	0.30	1.06	1.0	0.061	132.40	423.29	1.000	16.41	0.97	0.98	0.60	2.12	1.0	0.020	1.00	290.50	1.000	152.37	84.39	2
2.789	0.99	0.30	1.06	1.0	0.061	123.51	389.07	1.000	16.48	0.97	0.94	0.60	2.07	1.0	0.021	1.00	265.55	1.000	143.47	79.97	2
2.953	0.99	0.30	1.05	1.0	0.060	118.44	369.56	1.000	16.55	0.97	0.91	0.60	2.02	1.0	0.021	1.00	251.11	1.000	135.55	76.05	2
3.117	0.99	0.30	1.05	1.0	0.060	115.31	357.50	1.000	16.62	0.97	0.90	0.60	1.98	1.0	0.022	1.00	242.19	1.000	128.47	72.54	2
3.281	0.99	0.30	1.05	1.0	0.060	106.13	322.33	1.000	16.68	0.97	0.85	0.60	1.94	1.0	0.022	1.06	229.38	1.000	122.54	69.61	2
3.445	0.99	0.29	1.04	1.0	0.060	103.64	312.76	1.000	16.76	0.97	0.83	0.60	1.90	1.0	0.022	1.07	223.18	1.000	117.15	66.95	2
3.609	0.99	0.30	1.04	1.0	0.059	77.37	293.60	1.000	16.81	0.97	0.85	0.60	1.87	1.0	0.023	1.00	216.23	1.000	111.72	64.27	2
3.773	0.99	0.30	1.04	1.0	0.059	81.97	316.18	1.000	16.88	0.97	0.88	0.60	1.83	1.0	0.023	1.00	234.22	1.000	106.79	61.83	2
3.937	0.99	0.30	1.03	1.0	0.059	82.56	319.09	1.000	16.95	0.97	0.89	0.60	1.80	1.0	0.024	1.00	236.53	1.000	102.27	59.61	2
4.101	0.99	0.26	1.03	1.0	0.059	73.22	273.24	1.000	17.08	0.97	0.82	0.60	1.77	1.0	0.024	1.04	207.11	1.000	98.12	57.60	2
4.265	0.99	0.22	1.02	1.0	0.058	94.39	277.14	1.000	17.21	0.97	0.78	0.61	1.72	1.0	0.025	1.06	193.46	1.000	94.64	55.92	2
4.429	0.99	0.14	1.01	1.0	0.058	77.22	211.00	1.000	17.36	0.97	0.67	0.67	1.57	1.0	0.027	1.22	163.57	1.000	91.41	54.38	2
4.593	0.98	0.17	1.01	1.0	0.058	62.76	221.86	1.000	17.36	0.96	0.73	0.64	1.62	1.0	0.026	1.04	165.68	1.000	88.09	52.73	2
4.757	0.98	0.17	1.01	1.0	0.057	61.60	216.17	1.000	17.42	0.96	0.72	0.64	1.59	1.0	0.027	1.05	162.43	1.000	85.00	51.21	2
4.921	0.98	0.20	1.01	1.0	0.057	66.02	237.88	1.000	17.44	0.96	0.76	0.62	1.61	1.0	0.026	1.01	173.52	1.000	82.13	49.78	2
5.085	0.98	0.20	1.01	1.0	0.057	67.07	243.02	1.000	17.49	0.96	0.77	0.62	1.59	1.0	0.027	1.00	175.95	1.000	79.44	48.47	2
5.249	0.98	0.13	1.00	1.0	0.057	74.28	199.67	1.000	17.57	0.96	0.65	0.68	1.47	1.0	0.029	1.17	146.26	0.371	28.62	23.10	2
5.413	0.98	0.11	1.00	1.0	0.057	67.80	174.73	0.460	8.11	0.96	0.60	0.70	1.41	1.0	0.030	1.13	120.33	0.242	18.15	13.13	2
5.577	0.98	0.09	1.00	1.0	0.057	57.12	133.58	0.213	3.75	0.96	0.50	0.75	1.33	1.0	0.032	1.30	99.66	0.172	12.55	8.15	2
5.741	0.98	0.08	1.00	1.0	0.057	54.95	125.25	0.191	3.38	0.96	0.48	0.76	1.31	1.0	0.032	1.25	87.61	0.143	10.13	6.75	2
5.905	0.98	0.08	1.00	1.0	0.056	52.87	117.23	0.174	3.08	0.96	0.46	0.77	1.28	1.0	0.033	1.22	78.38	0.125	8.64	5.86	2
6.069	0.98	0.08	1.00	1.0	0.056	52.03	113.98	0.167	2.97	0.96	0.45	0.77	1.27	1.0	0.033	1.20	74.27	0.118	7.97	5.47	2
6.234	0.98	0.07	1.00	1.0	0.056	49.38	103.79	0.149	2.65	0.96	0.43	0.79	1.24	1.0	0.034	1.43	77.86	0.124	8.16	5.40	2
6.398	0.97	0.06	1.00	1.0	0.056	43.73	82.00	0.115	2.05	0.96	0.36	0.80	1.22	1.0	0.035	1.92	73.58	0.117	7.52	4.79	2
6.562	0.97	0.07	1.00	1.0	0.056	45.54	88.99	0.125	2.24	0.96	0.38	0.80	1.22	1.0	0.035	1.62	70.38	0.112	7.06	4.65	2
6.726	0.97	0.08	1.00	1.0	0.056	52.69	116.54	0.172	3.08	0.96	0.46	0.77	1.25	1.0	0.034	1.21	76.95	0.122	7.51	5.29	2
6.890	0.97	0.09	0.99	1.0	0.056	40.48	112.41	0.164	2.94	0.96	0.49	0.76	1.26	1.0	0.034	1.13	81.47	0.130	7.80	5.37	2
7.054	0.97	0.09	0.99	1.0	0.056	40.69	113.44	0.166	2.98	0.96	0.49	0.75	1.25	1.0	0.034	1.11	81.07	0.130	7.57	5.28	2
7.218	0.97	0.09	0.99	1.0	0.056	40.92	114.59	0.169	3.03	0.96	0.50	0.75	1.24	1.0	0.034	1.15	84.37	0.136	7.75	5.39	2
7.382	0.97	0.09	0.99	1.0	0.056	55.88	128.80	0.200	3.60	0.96	0.49	0.75	1.24	1.0	0.034	1.18	86.12	0.139	7.79	5.70	2
7.546	0.97	0.08	0.99	1.0	0.055	55.37	126.84	0.195	3.52	0.96	0.49	0.76	1.23	1.0	0.034	1.22	87.14	0.142	7.75	5.63	2
7.710	0.97	0.08	0.99	1.0	0.055	54.69	124.25	0.189	3.41	0.96	0.48	0.76	1.22	1.0	0.035	1.24	86.34	0.140	7.51	5.46	2
7.874	0.96	0.08	0.99	1.0	0.055	54.02	121.65	0.183	3.31	0.96	0.47	0.76	1.21	1.0	0.035	1.26	85.43	0.138	7.26	5.29	2
8.038	0.96	0.08	0.99	1.0	0.055	52.65	116.37	0.172	3.12	0.96	0.46	0.77	1.20	1.0	0.035	1.30	83.14	0.133	6.89	5.01	2
8.202	0.96	0.08	0.99	1.0	0.055	51.79	113.08	0.166	3.01	0.96	0.45	0.77	1.19	1.0	0.036	1.23	75.08	0.119	6.05	4.53	2
8.366	0.96	0.08	0.99	1.0	0.055	52.39	115.38	0.170	3.09	0.96	0.46	0.77	1.19	1.0	0.036	1.22	76.88	0.122	6.08	4.59	2
8.530	0.96	0.08	0.99	1.0	0.055	52.61	116.21	0.172	3.13	0.96	0.46	0.77	1.18	1.0	0.036	1.23	78.46	0.125	6.11	4.62	2
8.694	0.96	0.08	0.99	1.0	0.055	53.47	119.53	0.179	3.26	0.96	0.47	0.77	1.18	1.0	0.036	1.23	81.42	0.130	6.25	4.75	2
8.858	0.96	0.08	0.99	1.0	0.055	54.21	122.40	0.185	3.38	0.96	0.48	0.76	1.18	1.0	0.036	1.23	84.20	0.136	6.39	4.89	2
9.022	0.96	0.08	0.99	1.0	0.055	54.60	123.90	0.188	3.45	0.95	0.48	0.76	1.17	1.0	0.036	1.25	86.34	0.140	6.49	4.97	2
9.186	0.96	0.08	0.99	1.0	0.055	53.52	119.74	0.179	3.28	0.95	0.47	0.77	1.17	1.0	0.036	1.31	86.94	0.141	6.44	4.86	2
9.350	0.96	0.08	0.99	1.0	0.054	51.54	112.08	0.164	3.01	0.95	0.45	0.78	1.15	1.0	0.036	1.41	85.30	0.138	6.18	4.59	2
9.514	0.95	0.07	0.99	1.0	0.054	49.72	105.10	0.151	2.78	0.95	0.43	0.79	1.14	1.0	0.037	1.52	84.00	0.135	5.96	4.37	2
9.678	0.95	0.07	0.99	1.0	0.054	46.53	92.81	0.131	2.41	0.95	0.39	0.80	1.13	1.0	0.037	1.81	83.75	0.135	5.85	4.13	2
9.842	0.95	0.06	0.99	1.0	0.054	41.45	73.24	0.104	1.91	0.95	0.33	0.80	1.12	1.0	0.037	2.15	68.25	0.110	4.69	3.30	2
10.006	0.95	0.06	0.99	1.0	0.054	39.67	66.40	0.095	1.75	0.95	0.30	0.80	1.12	1.0	0.037	2.45	65.38	0.106	4.46	3.11	2
10.170	0.95	0.06	0.99	1.0	0.054	39.94	67.43	0.096	1.78	0.95	0.30	0.80	1.12	1.0	0.038	1.86	51.18	0.092	3.84	2.81	2
10.335	0.95	0.05	0.99	1.0	0.054	37.96	59.79	0.088	1.62	0.95	0.27	0.80	1.11	1.0	0.038	2.60	56.78	0.097	3.96	2.79	2
10.499	0.95	0.05	0.99	1.0	0.054	36.90	55.70	0.083	1.54	0.95	0.25	0.80	1.11	1.0	0.038	2.67	50.18	0.092	3.69	2.62	2
10.663	0.95	0.05	0.99	1.0	0.054	38.94	63.57	0.092	1.70	0.95	0.29	0.80	1.11	1.0	0.038	2.43	59.84	0.100	3.97	2.83	2
10.827	0.95	0.05	0.99	1.0	0.054	37.92	59.63	0.087	1.62	0.95	0.27	0.80	1.10	1.0	0.038	2.67	57.90	0.098	3.84	2.73	2
10.991	0.94	0.06	0.98	1.0	0.054	41.47	73.33	0.104	1.93	0.95	0.33	0.80	1.10	1.0	0.038	1.87	59.57	0.100	3.84	2.89	2
11.155	0.94	0.06	0.99	1.0	0.054	38.87	63.29	0.092	1.70	0.95	0.29	0.80	1.10	1.0	0.038	2.53	61.68	0.102	3.87	2.79	2
11.319	0.94	0.05	0.99	1.0	0.054	37.35	57.44	0.085	1.58	0.95	0.26	0.80	1.09	1.0	0.038	2.51	50.41	0.092	3.45	2.52	2
11.483	0.94	0.05	0.99	1.0	0.054	36.08	52.54	0.080	1.49	0.95	0.23	0.80	1.09	1.0	0.038	3.51	57.77	0.098	3.63	2.56	2
11.647	0.94	0.05	0.98	1.0	0.053	38.51	61.93	0.090	1.68	0.95	0.28	0.80	1.09	1.0	0.038	2.87	67.29	0.108	3.96	2.82	2
11.811	0.94	0.05	0.98	1.0	0.053	37.33	57.39	0.085	1.59	0.95	0.26	0.80	1.09	1.0	0.038	2.80	56.18	0.096	3.50	2.54	2
11.975	0.94	0.05	0.98	1.0	0.053	37.36	57.49	0.085	1.60	0.95	0.26	0.80	1.08	1.0	0.039	2.05	41.26	0.084	3.03	2.31	2
12.139	0.94	0.05	0.98	1.0	0.053	37.78	59.10	0.087	1.63	0.95	0.27	0.80	1.08	1.0	0.039	2.26	48.23	0.090	3.22	2.42	2
12.303	0.94	0.05	0.98	1.0	0.053	36.71	54.98	0.082	1.55	0.95	0.25	0.80	1.08	1.0	0.039	2.90	53.04	0.094	3.32	2.44	2
12.467	0.93	0.05	0.98	1.0	0.053	36.50	54.18	0.082	1.54	0.95	0.24	0.80	1.08	1.0	0.039	3.47	61.35	0.101	3.57	2.55	2
12.631	0.93	0.05	0.98	1.0	0.053	36.29	53.35	0.081	1.52	0.95	0.24	0.80	1.08	1.0	0.039	3.47	59.22	0.099	3.46	2.49	2
12.795	0.93	0.06	0.98	1.0	0.053	40.02	67.74	0.097	1.83	0.95	0.30	0.80	1.08	1.0	0.039	1.65	45.66	0.088	3.05	2.44	2
12.959	0.93	0.06	0.98	1.0	0.053	41.02	71.56	0.102	1.93	0.95	0.32	0.80	1.07	1.0	0.039	1.46	44.47	0.087	2.99	2.46	2
13.123	0.93	0.06	0.98	1.0	0.053	41.46	73.29	0.104	1.97	0.95	0.33	0.80	1.07	1.0	0.039	1.63	51.99	0.093	3.18	2.57	2
13.287	0.93	0.06	0.98	1.0	0.052	41.82	74.67	0.106	2.01	0.94	0.33	0.80	1.07	1.0	0.039	1.99	65.50	0.106	3.60	2.80	2
13.451	0.93	0.06	0.98	1.0	0.052	39.66	66.36	0.095	1.81	0.94	0.30	0.80	1.07	1.0	0.039	2.69	71.93	0.115	3.85	2.83	2
13.615	0.93	0.06	0.98	1.0	0.052	38.74	62.80	0.091	1.74	0.94	0.28	0.80	1.07	1.0	0.039	2.56	61.51	0.102	3.39	2.57	2
13.779	0.92	0.06	0.98	1.0	0.052	40.30	68.82	0.098	1.88	0.94	0.31	0.80	1.07	1.0	0.039	1.79	51.10	0.092	3.06	2.47	2
13.943	0.92	0.06	0.98	1.0	0.052	43.03	79.31	0.112	2.15	0.94	0.35	0.80	1.06	1.0	0.039	1.47	53.16	0.094	3.09	2.62	2
14.107	0.92	0.06	0.97	1.0	0.052	43.21	80.02	0.113	2.17	0.94	0.35	0.80	1.06	1.0	0.039	1.68	62.01	0.102	3.34	2.75	2
14.271	0.92	0.06	0.97	1.0	0.052	43.02	79.27	0.112	2.15	0.94	0.35	0.80	1.06	1.0	0.039	1.67	60.69	0.101	3.27	2.71	2
14.436	0.92	0.06	0.97	1.0	0.052	44.20	83.81	0.118	2.28	0.94	0.36	0.80	1.06	1.0	0.039	1.87	74.22	0.118	3.81	3.04	2
14.600	0.92	0.06	0.97	1.0	0.052	41.27	72.53	0.103	1.99	0.94	0.32	0.80	1.06	1.0	0.039	2.38	74.56	0.119	3.80	2.89	2
14.764	0.92	0.06	0.97	1.0	0.052	43.79	82.25	0.116	2.25	0.94	0.36	0.80	1.06	1.0	0.039	2.04	78.35	0.125	3.97	3.11	2
14.928	0.92	0.08	0.96	1.0	0.051	39.32	106.73	0.154	3.02	0.94	0.47	0.76	1.07	1.0	0.039	1.42	95.65	0.161	5.10	4.06	2
15.092	0.91	0.07	0.97	1.0	0.051	44.52	85.07	0.120	2.33	0.94	0.37	0.80	1.05	1.0	0.039	2.51	101.61	0.178	5.57	3.95	2
15.256	0.91	0.06	0.97	1.0	0.051	43.03	79.32	0.112	2.18	0.94	0.35	0.80	1.05	1.0	0.039	2.45	88.96	0.145	4.54	3.36	2
15.420	0.91	0.06	0.97	1.0	0.051	40.63	70.08	0.100	1.94	0.94	0.31	0.80	1.05	1.0	0.039	2.75	81.14	0.130	4.02	2.98	2
15.584	0.91	0.06	0.97	1.0	0.051	39.18	64.50	0.093	1.81	0.94	0.29	0.80	1.05	1.0	0.039	2.58	65.28	0.106	3.26	2.54	2
15.748	0.91	0.06	0.97	1.0	0.051	38.92	63.50	0.092	1.79	0.94	0.29	0.80	1.05	1.0	0.039	3.25	79.94	0.128	3.90	2.85	2
15.912	0.91	0.05	0.97	1.0	0.051	37.65	58.59	0.086	1.69	0.94	0.26	0.80	1.05	1.0	0.040	3.07	64.37	0.105	3.18	2.44	2
16.076	0.91	0.06	0.97	1.0	0.051	40.03	67.75	0.097	1.90	0.94	0.30	0.80	1.05	1.0	0.040	2.42	67.01	0.108	3.26	2.58	2
16.240	0.91	0.06	0.97	1.0	0.051	40.52	69.66	0.099	1.95	0.94	0.31	0.80	1.04	1.0	0.040	2.60	75.89	0.121	3.62	2.78	2
16.404	0.90	0.05	0.97	1.0	0.051	38.26	60.96	0.089	1.75	0.94	0.28	0.80	1.04	1.0	0.040	3.39	77.02	0.122	3.65	2.70	2
16.568	0.90	0.05	0.97	1.0	0.051	36.63	54.66	0.082	1.62	0.94	0.25	0.80	1.04	1.0	0.040	4.22	76.04	0.121	3.58	2.60	2
16.732	0.90	0.05	0.98	1.0	0.051	34.89	48.68	0.076	1.50	0.94	0.21	0.80	1.04	1.0	0.040	5.25	72.36	0.115	3.40	2.45	2
16.896	0.90	0.05	0.98	1.0	0.051	34.54	47.33	0.075	1.48	0.94	0.21	0.80	1.04	1.0	0.040	6.40	81.87	0.131	3.84	2.66	2
17.060	0.90	0.05	0.97	1.0	0.051	38.15	60.54	0.088	1.75	0.94	0.27	0.80	1.04	1.0	0.040	2.43	54.50	0.095	2.77	2.26	2
17.224	0.90	0.05	0.97	1.0	0.050	44.00	83.06	0.117	2.33	0.94	0.36	0.80	1.04	1.0	0.040	1.69	66.07	0.107	3.09	2.71	2

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.494

Depth at time of CPT (ft)	Depth at t_1, z_1 m	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Maximum Shear Strain Modulus, G_{max} tsf	P = γ_{eff}*(G_{eff}/G_{max}) tsf	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
0.164	3.23	594	1.6E-03	5.5E+02	1.0E-04	11	0.177	9851	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.328	3.28	594	1.6E-03	5.5E+02	1.0E-04	11	0.178	9794	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.492	3.33	594	1.6E-03	5.5E+02	1.1E-04	11	0.178	9738	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.656	3.38	594	1.6E-03	5.5E+02	1.1E-04	11	0.179	9683	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.820	3.43	594	1.6E-03	5.5E+02	1.1E-04	11	0.179	9629	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.984	3.48	594	1.6E-03	5.5E+02	1.1E-04	11	0.180	9576	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.148	3.53	594	1.6E-03	5.5E+02	1.1E-04	11	0.181	9524	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.312	3.58	594	1.6E-03	5.5E+02	1.1E-04	11	0.181	9473	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.476	3.63	594	1.6E-03	5.5E+02	1.1E-04	11	0.182	9423	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.640	3.68	594	1.6E-03	5.5E+02	1.2E-04	11	0.182	9373	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.804	3.73	594	1.6E-03	5.5E+02	1.2E-04	11	0.183	9325	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.968	3.78	594	1.6E-03	5.5E+02	1.2E-04	11	0.184	9277	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.133	3.83	594	1.6E-03	5.5E+02	1.2E-04	11	0.184	9231	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.297	3.88	594	1.6E-03	5.5E+02	1.2E-04	11	0.185	9185	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.461	3.93	594	1.6E-03	5.5E+02	1.2E-04	11	0.185	9139	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.625	3.98	594	1.6E-03	5.5E+02	1.3E-04	11	0.186	9095	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.789	4.03	594	1.6E-03	5.5E+02	1.3E-04	11	0.186	9051	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.953	4.08	594	1.6E-03	5.5E+02	1.3E-04	11	0.187	9008	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.117	4.13	495	1.6E-03	3.8E+02	1.9E-04	11	0.187	8966	0.03%	2.00	0.65	0.03%	0.001	0.34	0.079	0.765	0.21%	0.0003
3.281	4.18	495	1.4E-03	3.5E+02	2.0E-04	10	0.188	9165	0.04%	2.00	0.65	0.03%	0.004	0.34	0.079	0.765	0.66%	0.0011
3.445	4.23	495	1.4E-03	3.5E+02	2.1E-04	10	0.189	9126	0.04%	2.00	0.65	0.03%	0.005	0.34	0.079	0.765	0.70%	0.0011
3.609	4.28	495	1.6E-03	3.9E+02	1.9E-04	0	0.193	11440	0.04%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.04%	0.0001
3.773	4.33	495	1.6E-03	3.9E+02	1.9E-04	0	0.194	11388	0.04%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.04%	0.0001
3.937	4.38	495	1.6E-03	3.9E+02	1.9E-04	0	0.194	11337	0.04%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.05%	0.0001
4.101	4.43	495	1.6E-03	3.9E+02	1.9E-04	0	0.195	11287	0.04%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.05%	0.0001
4.265	4.48	495	1.4E-03	3.5E+02	2.2E-04	10	0.191	8925	0.04%	2.00	0.65	0.03%	0.006	0.34	0.079	0.765	0.88%	0.0014
4.429	4.53	495	1.4E-03	3.5E+02	2.2E-04	10	0.192	8889	0.04%	2.00	0.65	0.03%	0.006	0.34	0.079	0.765	0.91%	0.0015
4.593	4.58	495	1.6E-03	3.9E+02	2.0E-04	0	0.196	11149	0.05%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.06%	0.0001
4.757	4.63	495	1.6E-03	3.9E+02	2.0E-04	0	0.196	11102	0.05%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.06%	0.0001
4.921	4.68	495	1.6E-03	3.9E+02	2.1E-04	0	0.197	11055	0.05%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.07%	0.0001
5.085	4.73	495	1.6E-03	3.9E+02	2.1E-04	0	0.197	11009	0.05%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.07%	0.0001
5.249	4.78	495	1.4E-03	3.5E+02	2.3E-04	10	0.194	8704	0.05%	2.00	0.65	0.03%	0.007	0.34	0.079	0.765	1.09%	0.0018
5.413	4.83	495	1.4E-03	3.5E+02	2.3E-04	10	0.195	8672	0.05%	2.00	0.65	0.03%	0.007	0.34	0.079	0.765	1.12%	0.0018
5.577	4.88	495	1.4E-03	3.5E+02	2.3E-04	10	0.195	8639	0.05%	2.00	0.65	0.03%	0.008	0.34	0.079	0.765	1.15%	0.0019
5.741	4.93	495	1.4E-03	3.5E+02	2.4E-04	10	0.196	8608	0.05%	2.00	0.65	0.03%	0.008	0.34	0.079	0.765	1.19%	0.0019
5.905	4.98	495	1.4E-03	3.5E+02	2.4E-04	10	0.196	8576	0.05%	2.00	0.65	0.03%	0.008	0.34	0.079	0.765	1.22%	0.0020
6.069	5.03	495	1.4E-03	3.5E+02	2.4E-04	10	0.197	8545	0.05%	2.00	0.65	0.03%	0.008	0.34	0.079	0.765	1.25%	0.0020
6.234	5.08	495	1.4E-03	3.5E+02	2.4E-04	10	0.197	8514	0.05%	2.00	0.65	0.03%	0.008	0.34	0.079	0.765	1.28%	0.0021
6.398	5.13	495	1.4E-03	3.5E+02	2.5E-04	10	0.197	8484	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.31%	0.0022
6.562	5.18	495	1.4E-03	3.5E+02	2.5E-04	10	0.198	8454	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.34%	0.0022
6.726	5.23	495	1.4E-03	3.5E+02	2.5E-04	10	0.198	8424	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.38%	0.0023
6.890	5.28	495	1.6E-03	3.9E+02	2.3E-04	0	0.202	10578	0.06%	2.20	1.00	0.03%	0.001	0.34	0.079	0.765	0.11%	0.0002
7.054	5.33	495	1.6E-03	3.9E+02	2.3E-04	0	0.202	10539	0.06%	2.20	1.00	0.03%	0.001	0.34	0.079	0.765	0.11%	0.0002
7.218	5.38	495	1.6E-03	3.9E+02	2.3E-04	0	0.203	10500	0.06%	2.20	1.00	0.03%	0.001	0.34	0.079	0.765	0.12%	0.0002
7.382	5.43	495	1.4E-03	3.5E+02	2.6E-04	10	0.200	8301	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.51%	0.0025
7.546	5.48	495	1.4E-03	3.5E+02	2.6E-04	10	0.201	8273	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.54%	0.0025
7.710	5.53	495	1.4E-03	3.5E+02	2.6E-04	10	0.201	8245	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.57%	0.0026
7.874	5.58	495	1.4E-03	3.5E+02	2.6E-04	10	0.201	8218	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.61%	0.0026
8.038	5.63	495	1.4E-03	3.5E+02	2.7E-04	10	0.202	8191	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.64%	0.0027
8.202	5.68	495	1.4E-03	3.5E+02	2.7E-04	10	0.202	8165	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.67%	0.0027
8.366	5.73	495	1.4E-03	3.5E+02	2.7E-04	10	0.203	8138	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.70%	0.0028
8.530	5.78	495	1.4E-03	3.5E+02	2.7E-04	10	0.203	8112	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.73%	0.0028
8.694	5.83	495	1.4E-03	3.5E+02	2.8E-04	10	0.203	8086	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.76%	0.0029
8.858	5.88	495	1.4E-03	3.5E+02	2.8E-04	10	0.204	8061	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.80%	0.0029
9.022	5.93	495	1.4E-03	3.5E+02	2.8E-04	10	0.204	8036	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.83%	0.0030
9.186	5.98	495	1.4E-03	3.5E+02	2.8E-04	10	0.204	8011	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.86%	0.0030
9.350	6.03	460	1.4E-03	3.1E+02	3.3E-04	10	0.205	7986	0.10%	2.00	0.65	0.03%	0.018	0.34	0.079	0.765	2.83%	0.0046
9.514	6.08	460	1.4E-03	3.1E+02	3.3E-04	10	0.205	7962	0.11%	2.00	0.65	0.03%	0.019	0.34	0.079	0.765	2.87%	0.0047
9.678	6.13	460	1.4E-03	3.1E+02	3.3E-04	10	0.206	7938	0.11%	2.00	0.65	0.03%	0.019	0.34	0.079	0.765	2.91%	0.0048
9.842	6.18	460	1.4E-03	3.1E+02	3.4E-04	10	0.206	7914	0.11%	2.00	0.65	0.03%	0.019	0.34	0.079	0.765	2.96%	0.0049
10.006	6.23	460	1.4E-03	3.1E+02	3.4E-04	10	0.206	7890	0.11%	2.00	0.65	0.03%	0.020	0.34	0.079	0.765	3.00%	0.0049
10.170	6.28	460	1.4E-03	3.1E+02	3.4E-04	10	0.207	7867	0.11%	2.00	0.65	0.03%	0.020	0.34	0.079	0.765	3.05%	0.0050
10.335	6.33	460	1.4E-03	3.1E+02	3.4E-04	10	0.207	7843	0.12%	2.00	0.65	0.03%	0.020	0.34	0.079	0.765	3.09%	0.0051
10.499	6.38	460	1.4E-03	3.1E+02	3.5E-04	10	0.208	7820	0.12%	2.00	0.65	0.03%	0.021	0.34	0.079	0.765	3.14%	0.0051
10.663	6.43	460	1.4E-03	3.1E+02	3.5E-04	10	0.208	7798	0.12%	2.00	0.65	0.03%	0.021	0.34	0.079	0.765	3.18%	0.0052
10.827	6.48	460	1.4E-03	3.1E+02	3.5E-04	10	0.208	7775	0.12%	2.00	0.65	0.03%	0.021	0.34	0.079	0.765	3.23%	0.0053
10.991	6.53	460	1.4E-03	3.1E+02	3.5E-04	10	0.209	7753	0.12%	2.00	0.65	0.03%	0.021	0.34	0.079	0.765	3.27%	0.0054
11.155	6.58	460	1.4E-03	3.1E+02	3.6E-04	10	0.209	7731	0.12%	2.00	0.65	0.03%	0.022	0.34	0.079	0.765	3.32%	0.0054
11.319	6.63	460	1.4E-03	3.1E+02	3.6E-04	10	0.209	7709	0.13%	2.00	0.65	0.03%	0.022	0.34	0.079	0.765	3.37%	0.0055
11.483	6.68	460	1.4E-03	3.1E+02	3.6E-04	10	0.210	7687	0.13%	2.00	0.65	0.03%	0.022	0.34	0.079	0.765	3.41%	0.0056
11.647	6.73	460	1.4E-03	3.1E+02	3.6E-04	10	0.210	7666	0.13%	2.00	0.65	0.03%	0.023	0.34	0.079	0.765	3.46%	0.0057
11.811	6.78	460	1.8E-03	3.9E+02	2.9E-04	10	0.211	7639	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.84%	0.0030
11.975	6.83	460	1.8E-03	3.9E+02	2.9E-04	10	0.211	7612	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.87%	0.0031
12.139	6.88	460	1.8E-03	3.9E+02	2.9E-04	10	0.211	7586	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.91%	0.0031
12.303	6.93	460	1.8E-03	3.9E+02	2.9E-04	10	0.212	7560	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.94%	0.0032
12.467	6.98	460	1.8E-03	3.9E+02	3.0E-04	10	0.212	7534	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.98%	0.0032
12.631	7.03	460	1.8E-03	3.9E+02	3.0E-04	10	0.213	7508	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.01%	0.0033
12.795	7.08	460	1.8E-03	3.9E+02	3.0E-04	10	0.213	7483	0.08%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.05%	0.0034
12.959	7.13	460	1.8E-03	3.9E+02	3.0E-04	10	0.214	7458	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.09%	0.0034
13.123	7.18	460	1.8E-03	3.9E+02	3.1E-04	10	0.214	7433	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.12%	0.0035
13.287	7.23	460	1.8E-03	3.9E+02	3.1E-04	10	0.214	7409	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.16%	0.0035
13.451	7.28	460	1.8E-03	3.9E+02	3.1E-04	10	0.215	7385	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.19%	0.0036
13.615	7.33	460	1.8E-03	3.9E+02	3.1E-04	10	0.215	7361	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.23%	0.0037
13.779	7.38	460	1.8E-03	3.9E+02	3.2E-04	10	0.216	7338	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.27%	0.0037
13.943	7.43	460	1.8E-03	3.9E+02	3.2E-04	10	0.216	7314	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.30%	0.0038
14.107	7.48	460	1.8E-03	3.9E+02	3.2E-04	10	0.217	7291	0.09%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.34%	0.0038
14.271	7.53	460	1.8E-03	3.9E+02	3.2E-04	10	0.217	7268	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.38%	0.0039
14.436	7.58	460	1.8E-03	3.9E+02	3.3E-04	10	0.217	7246	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.42%	0.0040
14.600	7.63	500	1.8E-03	4.6E+02	2.8E-04	10	0.218	7223	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.56%	0.0026
14.764	7.68	500	1.8E-03	4.6E+02	2.8E-04	10	0.218	7201	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.59%	0.0026
14.928	7.73	500	1.9E-03	4.8E+02	2.7E-04	0	0.220	9065	0.08%	2.20	1.00	0.03%	0.001	0.34	0.079	0.765	0.17%	0.0003
15.092	7.78	500	1.8E-03	4.6E+02	2.8E-04	10	0.219	7157	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.64%	0.0027
15.256	7.83	500	1.8E-03	4.6E+02	2.9E-04	10	0.219	7136	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.67%	0.0027
15.420	7.88	500	1.8E-03	4.6E+02	2.9E-04	10	0.220	7114	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.70%	0.0028
15.584	7.93	500	1.8E-03	4.6E+02	2.9E-04	10	0.220	7093	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.73%	0.0028
15.748	7.98	500	1.8E-03	4.6E+02	2.9E-04	10	0.221	7073	0.07%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.75%	0.0029
15.912	8.03	500	1.8E-03	4.6E+02	2.9E-04	10	0.221	7052	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.78%	0.0029
16.076	8.08	500	1.8E-03	4.6E+02	3.0E-04	10	0.221	7032	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.81%	0.0030
16.240	8.13	500	1.8E-03	4.6E+02	3.0E-04	10	0.222	7011	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.84%	0.0030
16.404	8.18	500	1.8E-03	4.6E+02	3.0E-04	10	0.222	6991	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.87%	0.0031
16.568	8.23	500	1.8E-03	4.6E+02	3.0E-04	10	0.223	6972	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.89%	0.0031
16.732	8.28	500	1.8E-03	4.4E+02	3.2E-04	16	0.474	5729	0.09%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.36%	0.0039
16.896	8.33	500	1.8E-03	4.4E+02	3.2E-04	16	0.475	5714	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.39%	0.0039
17.060	8.38	500	1.8E-03	4.6E+02	3.1E-04	10	0.224	6915	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.98%	0.0032
17.224	8.43	500	1.8E-03	4.6E+02	3.1E-04	10	0.224	6896	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.00%	0.0033

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W5-C

Data File: 13-52106_SP2W5-C-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

5604.20	Water surface elevation during CPT investigation (ft amsl)
5604.20	Water surface elevation at t_1 (ft amsl)
5589.01	Water surface elevation at t_2 (ft amsl)
5584.01	Water surface elevation at t_3 (ft amsl)
1.44	Scaling Factor for stress ratio, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Eart
7.51	Equiv. Number of Uniform Strain Cycles, N

5615.86	Ground Surface Elevation at time of CPT (ft amsl)
5626.28	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after plac
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
2.42	Thickness of Random/Platform Fill on top of existing interim cover (ft)
1151.89	Additional Stress due to Final Cover Placement, $\Delta\sigma_{vc}$ (psf)
5584.01	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer	Total Stress at Midpoint of Layer	Equil Pore Pressure at Bottom of Layer	Equil Pore Pressure at Midpoint of Layer (tsf)	Effective Stress at Bottom of Layer	Effective Stress at Midpoint of Layer	Midpoint Depth at t_1, z_1	Shear Wave Velocity, V_s	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
Erosion Protection Layer	######	5626.03	5625.78	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014	0.08	508	1.7E-03	4.4E+02	3.0E-06	11	0.068	46696	0.00%	1.20	0.80	0.04%	0.000	0.32	0.133	0.778	0.00%	0.0000
Water Storage/Rooting Zone Layer	######	5624.03	5622.28	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121	0.69	508	1.7E-03	4.3E+02	2.8E-05	11	0.118	18930	0.00%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
High Compaction Layer	######	5620.28	5618.28	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334	1.83	508	1.9E-03	4.8E+02	8.6E-05	11	0.153	12419	0.01%	0.65	0.75	0.02%	0.000	0.34	0.079	0.765	0.00%	0.0000
Platform/Random Fill Layer	######	5617.07	5615.86	2.42	0.050	101	0.576	0.515	0.00	0.00	0.576	0.515	2.81	508	1.6E-03	4.0E+02	1.2E-04	11	0.171	10381	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of CPT (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
17.388	5598.47	19.1	0.394	19.0	18.5	8.03	2.06%	Sand-Slime Tailin	0.059	119.0	0.90	0.18	0.73	1	1.14	21.615	300.45	25.26	25	2.16%	2.6	47%	1.48	0.00	1.48	0
17.552	5598.31	15.7	0.311	15.6	23.1	10.01	1.98%	Sand-Slime Tailin	0.059	119.0	0.91	0.18	0.73	1	1.14	17.686	245.84	20.73	20	2.10%	2.7	47%	1.49	0.00	1.49	0
17.716	5598.14	13.9	0.260	13.8	26.1	11.33	1.86%	Sand-Slime Tailin	0.059	119.0	0.92	0.19	0.73	1	1.13	15.596	216.78	18.33	18	2.00%	2.7	47%	1.50	0.00	1.50	0
17.880	5597.98	18.8	0.179	18.5	52.4	22.70	0.95%	Sand-Slime Tailin	0.059	119.0	0.93	0.19	0.74	1	1.12	20.761	288.58	24.54	24	1.00%	2.4	47%	1.51	0.00	1.51	0
18.044	5597.82	39.1	0.438	39.0	24.3	10.53	1.12%	Sand-Slime Tailin	0.059	119.0	0.94	0.20	0.74	1	1.10	42.754	594.28	49.85	51	1.15%	2.2	47%	1.52	0.00	1.52	0
18.208	5597.65	18.6	0.428	18.6	11.8	5.10	2.30%	Sand-Slime Tailin	0.059	119.0	0.95	0.20	0.75	1	1.11	20.630	286.76	24.06	24	2.42%	2.6	47%	1.53	0.00	1.53	0
18.372	5597.49	12.8	0.269	12.7	14.8	6.43	2.10%	Sand-Slime Tailin	0.059	119.0	0.96	0.21	0.75	1	1.11	14.096	195.93	16.49	16	2.27%	2.8	47%	1.54	0.00	1.54	0
18.537	5597.32	17.7	0.255	17.5	38.1	16.51	1.44%	Sand-Slime Tailin	0.059	119.0	0.97	0.21	0.76	1	1.10	19.280	267.99	22.70	22	1.52%	2.5	47%	1.55	0.00	1.55	0
18.701	5597.16	15.7	0.298	15.5	35.1	15.21	1.90%	Sand-Slime Tailin	0.059	119.0	0.98	0.22	0.76	1	1.10	17.040	236.85	20.07	19	2.02%	2.7	47%	1.56	0.00	1.56	0
18.865	5597.00	16.1	0.307	15.8	50.1	21.72	1.90%	Sand-Slime Tailin	0.059	119.0	0.99	0.22	0.77	1	1.09	17.309	240.60	20.50	20	2.03%	2.7	47%	1.57	0.00	1.57	0
19.029	5596.83	26.6	0.234	26.5	23.1	10.00	0.88%	Sand-Slime Tailin	0.059	119.0	1.00	0.23	0.77	1	1.08	28.588	397.38	33.38	33	0.91%	2.3	47%	1.58	0.00	1.58	0
19.193	5596.67	29.7	0.205	29.7	9.5	4.12	0.69%	Sand-Slime Tailin	0.059	119.0	1.01	0.24	0.78	1	1.07	31.852	442.74	37.07	37	0.71%	2.2	47%	1.59	0.00	1.59	0
19.357	5596.50	31.2	0.166	31.2	6.0	2.60	0.53%	Sand-Slime Tailin	0.059	119.0	1.02	0.24	0.78	1	1.07	33.332	463.32	38.76	39	0.55%	2.1	47%	1.60	0.00	1.60	0
19.521	5596.34	30.6	0.174	30.6	5.8	2.51	0.57%	Sand-Slime Tailin	0.059	119.0	1.03	0.25	0.79	1	1.06	32.529	452.15	37.83	38	0.59%	2.1	47%	1.61	0.00	1.61	0
19.685	5596.18	30.2	0.251	30.2	5.6	2.43	0.83%	Sand-Slime Tailin	0.059	119.0	1.04	0.25	0.79	1	1.06	32.002	444.83	37.21	37	0.86%	2.2	47%	1.62	0.00	1.62	0
19.849	5596.01	25.2	0.236	25.2	6.5	2.83	0.93%	Sand-Slime Tailin	0.059	119.0	1.05	0.26	0.80	1	1.06	26.686	370.94	31.04	30	0.98%	2.3	47%	1.63	0.00	1.63	0
20.013	5595.85	19.0	0.220	19.0	7.3	3.16	1.16%	Sand-Slime Tailin	0.059	119.0	1.06	0.26	0.80	1	1.06	20.060	278.83	23.35	22	1.23%	2.5	47%	1.64	0.00	1.64	0
20.177	5595.68	29.6	0.210	29.5	8.7	3.79	0.71%	Sand-Slime Tailin	0.059	119.0	1.07	0.27	0.80	1	1.05	30.959	430.33	36.02	35	0.74%	2.2	47%	1.65	0.00	1.65	0
20.341	5595.52	30.3	0.241	30.2	8.7	3.77	0.80%	Sand-Slime Tailin	0.059	119.0	1.08	0.27	0.81	1	1.04	31.560	438.68	36.72	36	0.83%	2.2	47%	1.66	0.00	1.66	0
20.505	5595.36	30.4	0.302	30.3	9.5	4.11	0.99%	Sand-Slime Tailin	0.059	119.0	1.09	0.28	0.81	1	1.04	31.508	437.97	36.67	36	1.03%	2.3	47%	1.67	0.00	1.67	0
20.669	5595.19	31.3	0.368	31.3	10.8	4.68	1.17%	Sand-Slime Tailin	0.059	119.0	1.10	0.28	0.82	1	1.04	32.371	449.96	37.68	37	1.22%	2.3	47%	1.68	0.00	1.68	0
20.833	5595.03	30.5	0.484	30.4	10.9	4.74	1.59%	Sand-Slime Tailin	0.059	119.0	1.11	0.29	0.82	1	1.03	31.396	436.41	36.55	36	1.65%	2.4	47%	1.69	0.00	1.69	0
20.997	5594.86	26.1	0.582	26.0	10.9	4.74	2.23%	Sand-Slime Tailin	0.059	119.0	1.12	0.29	0.83	1	1.03	26.780	372.24	31.18	30	2.33%	2.5	47%	1.69	0.00	1.69	0
21.161	5594.70	20.1	0.593	20.1	11.7	5.06	2.95%	Slime Tailings	0.057	113.1	1.13	0.30	0.83	1	1.03	20.583	286.10	23.99	23	3.12%	2.7	71%	1.70	0.00	1.70	0
21.325	5594.53	18.4	0.531	18.3	20.6	8.93	2.89%	Slime Tailings	0.057	113.1	1.14	0.30	0.84	1	1.02	18.692	259.82	21.86	21	3.08%	2.7	71%	1.71	0.00	1.71	0
21.489	5594.37	17.0	0.447	16.8	29.0	12.56	2.63%	Slime Tailings	0.057	113.1	1.15	0.31	0.84	1	1.02	17.124	238.03	20.10	19	2.82%	2.8	71%	1.72	0.00	1.72	0
21.653	5594.21	14.2	0.424	14.0	29.7	12.89	2.99%	Slime Tailings	0.057	113.1	1.16	0.31	0.84	1	1.02	14.215	197.59	16.73	15	3.25%	2.9	71%	1.73	0.00	1.73	0
21.817	5594.04	16.9	0.422	16.5	68.7	29.77	2.50%	Slime Tailings	0.057	113.1	1.17	0.32	0.85	1	1.01	16.669	231.70	19.86	19	2.68%	2.8	71%	1.74	0.00	1.74	0
21.981	5593.88	21.8	0.335	21.7	23.7	10.26	1.54%	Sand-Slime Tailin	0.059	119.0	1.18	0.32	0.85	1	1.01	21.800	303.01	25.49	24	1.62%	2.5	47%	1.75	0.00	1.75	0
22.145	5593.71	21.8	0.428	21.7	22.3	9.65	1.96%	Sand-Slime Tailin	0.059	119.0	1.18	0.33	0.86	1	1.00	21.771	302.62	25.45	24	2.07%	2.6	47%	1.76	0.00	1.76	0
22.309	5593.55	17.7	0.439	17.6	19.7	8.53	2.48%	Sand-Slime Tailin	0.059	119.0	1.19	0.33	0.86	1	1.00	17.547	243.90	20.52	19	2.66%	2.7	47%	1.77	0.00	1.77	0
22.473	5593.39	16.8	0.471	16.6	34.2	14.81	2.80%	Slime Tailings	0.057	113.1	1.20	0.34	0.87	1	0.99	16.546	229.99	19.46	18	3.01%	2.8	71%	1.78	0.00	1.78	0
22.638	5593.22	19.3	0.376	19.1	34.2	14.81	1.95%	Sand-Slime Tailin	0.059	119.0	1.21	0.34	0.87	1	0.99	18.876	262.38	22.17	21	2.08%	2.6	47%	1.79	0.00	1.79	0
22.802	5593.06	15.1	0.327	14.7	65.1	28.22	2.17%	Sand-Slime Tailin	0.059	119.0	1.22	0.35	0.88	1	0.99	14.455	200.93	17.25	16	2.36%	2.8	47%	1.80	0.00	1.80	0
22.966	5592.89	12.6	0.218	11.9	111.5	48.31	1.73%	Sand-Slime Tailin	0.059	119.0	1.23	0.35	0.88	1	0.98	11.703	162.67	14.39	13	1.92%	2.8	47%	1.81	0.00	1.81	0
23.130	5592.73	12.0	0.226	11.4	106.7	46.22	1.88%	Sand-Slime Tailin	0.059	119.0	1.24	0.36	0.89	1	0.98	11.107	154.39	13.66	12	2.10%	2.8	47%	1.82	0.00	1.82	0
23.294	5592.57	14.5	0.334	13.6	154.3	66.85	2.30%	Sand-Slime Tailin	0.059	119.0	1.25	0.36	0.89	1	0.97	13.235	183.97	16.46	15	2.51%	2.8	47%	1.83	0.00	1.83	0
23.458	5592.40	17.3	0.173	16.5	120.2	52.09	1.00%	Sand-Slime Tailin	0.059	119.0	1.26	0.37	0.89	1	0.97	16.025	222.75	19.46	18	1.08%	2.5	47%	1.84	0.00	1.84	0
23.622	5592.24	26.9	0.267	26.6	51.3	22.22	0.99%	Sand-Slime Tailin	0.059	119.0	1.27	0.37	0.90	1	0.97	25.759	358.04	30.28	29	1.04%	2.4	47%	1.85	0.00	1.85	0
23.786	5592.07	18.3	0.357	17.9	69.4	30.09	1.95%	Sand-Slime Tailin	0.059	119.0	1.28	0.38	0.90	1	0.96	17.187	238.90	20.45	19	2.10%	2.7	47%	1.86	0.00	1.86	0
23.950	5591.91	13.8	0.283	13.3	90.4	39.18	2.05%	Sand-Slime Tailin	0.059	119.0	1.29	0.38	0.91	1	0.96	12.716	176.76	15.40	14	2.26%	2.8	47%	1.87	0.00	1.87	0
24.114	5591.75	10.3	0.189	10.0	60.4	26.18	1.83%	Sand-Slime Tailin	0.059	119.0	1.30	0.39	0.91	1	0.96	9.514	132.24	11.47	10	2.09%	2.9	47%	1.88	0.00	1.88	0
24.278	5591.58	10.0	0.219	9.3	112.2	48.61	2.19%	Slime Tailings	0.057	113.1	1.31	0.39	0.92	1	0.95	8.871	123.30	11.08	9	2.51%	3.0	71%	1.89	0.00	1.89	0
24.442	5591.42	14.0	0.326	13.2	122.0	52.86	2.33%	Slime Tailings	0.057	113.1	1.32	0.40	0.92	1	0.95	12.529	174.15	15.39	14	2.58%	2.8	71%	1.90	0.00	1.90	0
24.606	5591.25	14.1	0.236	13.7	63.7	27.60	1.67%	Sand-Slime Tailin	0.059	119.0	1.33	0.40	0.93	1	0.94	12.962	180.17	15.49	14	1.85%	2.8	47%	1.91	0.00	1.91	0
24.770	5591.09	23.3	0.448	22.8	72.8	31.55	1.92%	Sand-Slime Tailin	0.059	119.0	1.34	0.41	0.93	1	0.94	21.533	299.31	25.51	24	2.04%	2.6	47%	1.92	0.00	1.92	0
24.934	5590.93	29.6	0.313	29.2	58.1	25.19	1.06%	Sand-Slime Tailin	0.059	119.0	1.35	0.41	0.94	1	0.94	27.544	382.86	32.39	30	1.11%	2.4	47%	1.93	0.00	1.93	0
25.098	5590.76	38.5	0.429	38.5	11.6	5.02	1.11%	Sand-Slime Tailin	0.059	119.0	1.36	0.42	0.94	1	0.94	36.269	504.14	42.20	40	1.15%	2.3	47%	1.94	0.00	1.94	0
25.262	5590.60	30.5	0.493	30.4	9.2	3.99	1.62%	Sand-Slime Tailin	0.059	119.0	1.37	0.42	0.94	1	0.94	28.493	396.05	33.16	31	1.69%	2.5	47%	1.94	0.00	1.94	0
25.426	5590.43	25.9	0.457	25.8	10.7	4.64	1.77%	Sand-Slime Tailin	0.059	119.0	1.38	0.43	0.95	1	0.93	23.999	333.59	27.95	26	1.87%	2.5	47%	1.95	0.00	1.95	0
25.590	5590.27	23.2	0.409	23.0	38.5	16.67	1.76%	Sand-Slime Tailin	0.059	119.0	1.39	0.43	0.95	1	0.93	21.279	295.77	24.97	23	1.87%	2.6	47%	1.96	0.00	1.96	0
25.754	5590.11	23.9	0.457	23.6	50.5	21.90	1.91%	Sand-Slime Tailin	0.059	119.0	1.40	0.44	0.96	1	0.92	21.735	302.12	25.58	23	2.03%	2.6	47%	1.97	0.00	1.97	0
25.918	5589.94	23.4	0.409	22.9	85.5	37.03	1.75%	Sand-Slime Tailin	0.059	119.0	1.41	0.44	0.96	1	0.92	21.004	291.95	24.96	23	1.86%	2.6	47%	1.98	0.00	1.98	0
26.082	5589.78	26.8	0.466	26.4	63.1	27.33	1.74%	Sand-Slime Tailin	0.059	119.0	1.42	0.45	0.97	1	0.92	24.200	336.38	28.53	26	1.84%	2.5	47%	1.99	0.00	1.99	0
26.246	5589.61	24.8	0.467	24.4	58.0	25.13	1.89%	Sand-Slime Tailin	0.059	119.0	1.43	0.46	0.97	1	0.91	22.278	309.67	26.26	24	2.00%	2.6	47%	2.00	0.00	2.00	0
26.410	5589.45	27.9	0.443	27.7	46.7	20.25	1.59%	Sand-Slime Tailin	0.059	119.0	1.44	0.46	0.98	1	0.91	25.216	350.50	29.60	27	1.67%	2.5	47%	2.01	0.00	2.01	0
26.574	5589.29	21.4	0.459	21.2	34.8	15.06	2.15%	Sand-Slime Tailin	0.059	119.0	1.45	0.47	0.98	1	0.90	19.114	265.68	22.43	20	2.30%	2.7	47%	2.02	0.00	2.02	0
26.739	5589.12	22.9	0.449	22.4	91.9	39.81	1.96%	Sand-Slime Tailin	0.059	119.0	1.46	0.47	0.99	1	0.90	20.162	280.25	24.02	22	2.09%	2.6	47%	2.03	0.00	2.03	0
26.903	5588.96	23.7	0.369	23.3	57.9	25.11	1.56%	Sand-Slime Tailin	0.059	119.0	1.47	0.48	0.99	1	0.90	20.966	291.42	24.73	22	1.66%	2.6	47%	2.04	0.00	2.04	1
27.067	5588.79	17.9	0.322	17.4	76.8	33.26	1.80%	Sand-Slime Tailin	0.059	119.0	1.48	0.48	1.00	1	0.89	15.524	215.78	18.53	16	1.96%	2.7	47%	2.05	0.01	2.05	1
27.231	5588.63	17.2	0.221	16.6	101.5	44.00	1.29%	Sand-Slime Tailin	0.059	119.0	1.49	0.49	1.00	1	0.89	14.729	204.74	17.76	16	1.41%	2.7	47%	2.06	0.01	2.05	1
27.395	5588.47	17.3	0.221	16.7	96.1	41.66	1.28%	Sand-Slime Tailin	0.059	119.0	1.50	0.49	1.00	1	0.89	14.791	205.60	17.80	16	1.40%	2.7	47%	2.07	0.02	2.05	1
27.559	5588.30	17.1	0.300	16.3	130.8	56.69	1.75%	Sand-Slime Tailin	0.059	119.0	1.51	0.50	1.01	1	0.88	14.394	200.07	17.55	15	1.92%	2.7	47%	2.08	0.02	2.06	1
27.723	5588.14	24.2	0.427	23.2	165.1	71.55	1.76%	Sand-Slime Tailin	0.059	119.0	1.52	0.50	1.01	1	0.88	20.498	284.93	24.87	22	1.88%	2.6	47%	2.09	0.03	2.06	1
27.887	5587.97	31.6	0.511	31.4	40.1	17.37	1.62%	Sand-Slime Tailin	0.059	119.0	1.53	0.51	1.02	1	0.89	27.813	386.60	32.56	30	1.70%	2.5	47%	2.10	0.03	2.07	1
28.051	5587.81	29.9	0.506	29.4	77.3	33.50	1.69%	Sand-Slime Tailin	0.059	119.0	1.53	0.51	1.02	1	0.88	25.927	360.38	30.61	28	1.79%	2.5	47%	2.11	0.04	2.07	1
28.215	5587.65	34.1	0.485	33.8	56.5	24.47	1.42%	Sand-Slime Tailin	0.059	119.0	1.54	0.52	1.03	1	0.88	29.829	414.63	35.01	32	1.49%	2.4	47%	2.12	0.04	2.08	1
28.379	5587.48	23.6	0.376	23.3	54.2	23.50	1.59%	Sand-Slime Tailin	0.059	119.0	1.55	0.52	1.03	1	0.87	20.248	281.45	23.86	21	1.71%	2.6	47%	2.13	0.05	2.08	1
28.543	5587.32	20.0	0.587	19.3	110.3	47.80	2.94%	Slime Tailings	0.057	113.1	1.56	0.53	1.04	1	0.86	16.699	232.11	20.09	18	3.18%	2.8	71%	2.14	0.05	2.09	1
28.707	5587.15	20.3	0.625	19.3	175.0	75.82	3.07%	Slime Tailings	0.057	113.1	1.57	0.53	1.04	1	0.86	16.595	230.67	20.37	18	3.33%	2.8	71%	2.15	0.06	2.09	1
28.871	5586.99	70.9	0.744	70.3	91.2	39.52	1.05%	Sand Tailings	0.062	123.5	1.58	0.54	1.05	1	0.90	63.004	875.75	73.77	66	1.07%	2.1	18%	2.16	0.06	2.10	1
29.035	5586.82	72.6	0.686	72.2	66.2	28.68	0.94%	Sand Tailings	0.062	123.5	1.59	0.54	1.05	1	0.89	64.601	897.96	75.46	68	0.97%	2.0	18%	2.17	0.07	2.10	1
29.199	5586.66	79.5	1.181	79.4	15.5	6.72	1.49%	Sand Tailings	0.062	123.5	1.60	0.55	1.06	1	0.90	71.104	988.34	82.68	74	1.52%	2.1	18%	2.18	0.07	2.11	1
29.363	5586.50	113.4	1.549	113.4	8.3	3.58	1.37%	Sand Tailings	0.062	123.5	1.61	0.55	1.06	1	0.91	103.022	1432.01	119.71	105	1.39%	2.0	18%	2.19	0.08	2.11	1
29.527	5586.33	133.5	2.246	133.4	9.1	3.95	1.68%	Sand Tailings	0.062	123.5	1.62	0.56	1.07	1	0.91	122.058	1696.61	141.82	124	1.70%	2.0	18%	2.20	0.08	2.12	1
29.691	5586.17	134.1	3.012	134.1	-0.7	-0.28	2.25%	Sand-Slime Tailin	0.059	119.0	1.63	0.56	1.07	1	0.91	122.449	1702.04	142.21	124	2.27%	2.1	47%	2.21	0.09	2.12	1
29.855	5586.00	114.2	2.896	114.0	26.4	11.45	2.54%	Sand-Slime Tailin	0.059	119.0	1.64	0.57	1.08	1	0.90	102.984	1431.48	119.78	105	2.57%	2.2	47%	2.22	0.09	2.13	1
30.019	5585.84	179.1	2.896	178.1	160.2	69.40	1.62%	Sand Tailings	0.062	123.5	1.65	0.57	1.08	1	0.93	164.913	2292.29	192.61	164	1.63%	1.9	18%	2.23	0.10	2.13	1
30.183	5585.68	217.4	2.896	217.3	26.4	11.43	1.33%	Sand Tailings	0.062	123.5	1.66	0.58	1.09	1	0.94	203.425	2827.61	236.45	199	1.34%	1.8	18%	2.24	0.10	2.14	1
31.850	5584.01							Sand Tailings	0.062	123.5													2.34	0.13	2.21	1

Liquefaction Triggering Analyses

Depth at time of CPT (ft)	I&B r_d	I&B C_σ	I&B K_σ	I&B K_α	I&B CSR (M=7.5, σ'v=1atm)	Δqc_{1n}	$qc_{1n\text{-}cs}$	I&B (CRR) (M=7.5, σ'v=1atm)	I&B FoS	Youd r_d	Youd D_r	Youd f	Youd K_σ	Youd K_α	Youd CSR (M=7.5, σ'v=1atm)	Kc	$qc_{1n\text{-}cs}$	Youd (CRR) (M=7.5, σ'v=1atm)	Youd FoS	Avg FoS	Liquefiable? 1=Yes 2=No
17.388	0.90	0.06	0.97	1.0	0.050	39.16	64.42	0.093	1.85	0.94	0.29	0.80	1.03	1.0	0.040	3.26	82.40	0.132	3.80	2.82	2
17.552	0.90	0.05	0.97	1.0	0.050	37.57	58.30	0.086	1.71	0.93	0.26	0.80	1.03	1.0	0.040	3.70	76.68	0.122	3.49	2.60	2
17.716	0.89	0.05	0.97	1.0	0.050	36.73	55.06	0.083	1.64	0.93	0.26	0.80	1.03	1.0	0.040	3.94	72.19	0.115	3.27	2.46	2
17.880	0.89	0.06	0.97	1.0	0.050	38.91	63.45	0.092	1.83	0.93	0.29	0.80	1.03	1.0	0.040	2.38	58.47	0.099	2.79	2.31	2
18.044	0.89	0.07	0.96	1.0	0.049	47.78	97.63	0.139	2.80	0.93	0.41	0.80	1.03	1.0	0.040	1.61	80.28	0.128	3.60	3.20	2
18.208	0.89	0.06	0.97	1.0	0.050	38.74	62.79	0.091	1.83	0.93	0.28	0.80	1.03	1.0	0.040	3.58	86.19	0.140	3.90	2.86	2
18.372	0.89	0.05	0.97	1.0	0.050	36.09	52.58	0.080	1.60	0.93	0.23	0.80	1.03	1.0	0.040	4.51	74.42	0.118	3.29	2.45	2
18.537	0.89	0.05	0.97	1.0	0.050	38.26	60.96	0.089	1.79	0.93	0.28	0.80	1.03	1.0	0.040	3.02	68.48	0.110	3.03	2.41	2
18.701	0.89	0.05	0.97	1.0	0.050	37.34	57.41	0.085	1.71	0.93	0.26	0.80	1.02	1.0	0.040	3.74	75.13	0.119	3.28	2.50	2
18.865	0.89	0.05	0.97	1.0	0.050	37.49	57.99	0.086	1.73	0.93	0.26	0.80	1.02	1.0	0.040	3.70	75.79	0.120	3.29	2.51	2
19.029	0.88	0.06	0.96	1.0	0.049	42.01	75.39	0.106	2.16	0.93	0.33	0.80	1.02	1.0	0.040	1.88	62.88	0.103	2.80	2.48	2
19.193	0.88	0.06	0.96	1.0	0.049	43.30	80.37	0.113	2.31	0.93	0.35	0.80	1.02	1.0	0.040	1.63	60.40	0.100	2.71	2.51	2
19.357	0.88	0.06	0.96	1.0	0.049	43.90	82.66	0.116	2.38	0.93	0.36	0.80	1.02	1.0	0.040	1.48	57.35	0.096	2.62	2.50	2
19.521	0.88	0.06	0.96	1.0	0.049	43.57	81.39	0.115	2.34	0.93	0.36	0.80	1.02	1.0	0.040	1.53	57.77	0.098	2.62	2.48	2
19.685	0.88	0.06	0.96	1.0	0.049	43.35	80.56	0.113	2.32	0.93	0.35	0.80	1.02	1.0	0.040	1.73	64.49	0.105	2.79	2.56	2
19.849	0.88	0.06	0.96	1.0	0.049	41.19	72.23	0.102	2.10	0.93	0.32	0.80	1.02	1.0	0.040	2.03	63.17	0.103	2.74	2.42	2
20.013	0.88	0.05	0.96	1.0	0.049	38.49	61.85	0.090	1.84	0.93	0.28	0.80	1.02	1.0	0.040	2.72	63.54	0.104	2.74	2.29	2
20.177	0.87	0.06	0.96	1.0	0.049	42.94	78.96	0.111	2.29	0.93	0.35	0.80	1.01	1.0	0.040	1.68	60.65	0.101	2.64	2.47	2
20.341	0.87	0.06	0.96	1.0	0.048	43.18	79.90	0.112	2.31	0.92	0.35	0.80	1.01	1.0	0.040	1.73	63.52	0.104	2.71	2.52	2
20.505	0.87	0.06	0.96	1.0	0.048	43.16	79.83	0.112	2.33	0.92	0.35	0.80	1.01	1.0	0.040	1.88	68.85	0.110	2.87	2.60	2
20.669	0.87	0.06	0.96	1.0	0.048	43.52	81.19	0.114	2.37	0.92	0.35	0.80	1.01	1.0	0.040	1.97	74.32	0.118	3.06	2.72	2
20.833	0.87	0.06	0.96	1.0	0.048	43.12	79.67	0.112	2.33	0.92	0.35	0.80	1.01	1.0	0.040	2.30	83.89	0.135	3.48	2.90	2
20.997	0.87	0.06	0.96	1.0	0.048	41.24	72.42	0.103	2.13	0.92	0.32	0.80	1.01	1.0	0.040	3.01	93.89	0.157	4.03	3.08	2
21.161	0.87	0.06	0.96	1.0	0.048	38.44	62.44	0.091	1.88	0.92	0.28	0.80	1.01	1.0	0.040	4.14	99.39	0.171	4.39	3.13	2
21.325	0.87	0.05	0.96	1.0	0.048	37.70	59.56	0.087	1.81	0.92	0.27	0.80	1.01	1.0	0.040	4.37	95.63	0.161	4.12	2.96	2
21.489	0.86	0.05	0.96	1.0	0.048	37.09	57.19	0.085	1.76	0.91	0.26	0.80	1.01	1.0	0.040	4.44	89.28	0.146	3.72	2.74	2
21.653	0.86	0.05	0.96	1.0	0.048	35.91	52.64	0.080	1.66	0.91	0.24	0.80	1.00	1.0	0.040	5.36	89.70	0.147	3.73	2.70	2
21.817	0.86	0.05	0.96	1.0	0.048	37.01	56.87	0.084	1.76	0.91	0.26	0.80	1.00	1.0	0.040	4.38	86.93	0.141	3.56	2.66	2
21.981	0.86	0.06	0.96	1.0	0.048	39.24	64.73	0.093	1.95	0.91	0.29	0.80	1.00	1.0	0.040	2.93	74.56	0.119	2.98	2.47	2
22.145	0.86	0.06	0.96	1.0	0.048	39.23	64.67	0.093	1.95	0.91	0.29	0.80	1.00	1.0	0.040	3.28	83.48	0.134	3.36	2.66	2
22.309	0.86	0.05	0.96	1.0	0.048	37.50	58.02	0.086	1.80	0.91	0.26	0.80	1.00	1.0	0.040	4.28	87.80	0.143	3.57	2.68	2
22.473	0.86	0.05	0.96	1.0	0.048	36.87	56.33	0.084	1.76	0.91	0.25	0.80	1.00	1.0	0.040	4.70	91.53	0.151	3.76	2.76	2
22.638	0.85	0.05	0.96	1.0	0.047	38.08	60.25	0.088	1.86	0.90	0.27	0.80	1.00	1.0	0.040	3.63	80.39	0.128	3.18	2.52	2
22.802	0.85	0.05	0.96	1.0	0.047	36.35	53.61	0.081	1.71	0.90	0.24	0.80	1.00	1.0	0.040	4.57	78.92	0.126	3.10	2.40	2
22.966	0.85	0.05	0.96	1.0	0.047	35.35	49.73	0.077	1.63	0.90	0.22	0.80	1.00	1.0	0.040	4.76	68.44	0.110	2.70	2.16	2
23.130	0.85	0.05	0.96	1.0	0.047	35.09	48.75	0.076	1.61	0.90	0.21	0.80	0.99	1.0	0.040	5.13	70.08	0.112	2.74	2.18	2
23.294	0.85	0.05	0.96	1.0	0.047	36.08	52.54	0.080	1.69	0.90	0.23	0.80	0.99	1.0	0.040	4.87	80.16	0.128	3.12	2.41	2
23.458	0.85	0.05	0.96	1.0	0.047	37.13	56.58	0.084	1.79	0.90	0.25	0.80	0.99	1.0	0.040	3.02	58.77	0.099	2.40	2.10	2
23.622	0.85	0.06	0.95	1.0	0.047	40.92	71.20	0.101	2.16	0.90	0.32	0.80	0.99	1.0	0.040	2.17	65.84	0.107	2.58	2.37	2
23.786	0.85	0.05	0.96	1.0	0.047	37.47	57.92	0.086	1.83	0.90	0.26	0.80	0.99	1.0	0.040	3.87	79.22	0.126	3.05	2.44	2
23.950	0.84	0.05	0.96	1.0	0.047	35.70	51.10	0.079	1.67	0.89	0.23	0.80	0.99	1.0	0.040	4.89	75.23	0.120	2.88	2.27	2
24.114	0.84	0.05	0.96	1.0	0.047	34.32	45.79	0.074	1.57	0.89	0.20	0.80	0.99	1.0	0.040	5.85	67.03	0.108	2.59	2.08	2
24.278	0.84	0.05	0.96	1.0	0.047	33.95	45.02	0.073	1.55	0.89	0.19	0.80	0.99	1.0	0.040	6.45	71.42	0.114	2.72	2.14	2
24.442	0.84	0.05	0.96	1.0	0.047	35.45	50.84	0.078	1.68	0.89	0.23	0.80	0.99	1.0	0.040	5.19	79.86	0.127	3.03	2.36	2
24.606	0.84	0.05	0.96	1.0	0.047	35.73	51.22	0.079	1.69	0.89	0.23	0.80	0.99	1.0	0.040	4.48	69.42	0.111	2.64	2.16	2
24.770	0.84	0.06	0.96	1.0	0.046	39.25	64.75	0.093	2.02	0.89	0.29	0.80	0.98	1.0	0.040	3.30	84.25	0.136	3.21	2.61	2
24.934	0.84	0.06	0.95	1.0	0.046	41.66	74.05	0.105	2.28	0.89	0.33	0.80	0.98	1.0	0.040	2.15	69.61	0.111	2.62	2.45	2
25.098	0.83	0.07	0.95	1.0	0.046	45.10	87.31	0.123	2.69	0.88	0.38	0.80	0.98	1.0	0.040	1.86	78.30	0.125	2.93	2.81	2
25.262	0.83	0.06	0.95	1.0	0.046	41.93	75.08	0.106	2.32	0.88	0.33	0.80	0.98	1.0	0.040	2.55	84.46	0.136	3.18	2.75	2
25.426	0.83	0.06	0.95	1.0	0.046	40.10	68.05	0.097	2.12	0.88	0.31	0.80	0.98	1.0	0.040	2.99	83.54	0.134	3.13	2.63	2
25.590	0.83	0.06	0.95	1.0	0.046	39.06	64.03	0.092	2.02	0.88	0.29	0.80	0.98	1.0	0.040	3.23	80.75	0.129	3.00	2.51	2
25.754	0.83	0.06	0.95	1.0	0.046	39.27	64.86	0.093	2.04	0.88	0.29	0.80	0.98	1.0	0.040	3.31	84.64	0.136	3.16	2.60	2
25.918	0.83	0.06	0.95	1.0	0.046	39.06	64.02	0.092	2.03	0.88	0.29	0.80	0.98	1.0	0.040	3.23	80.65	0.129	2.97	2.50	2
26.082	0.83	0.06	0.95	1.0	0.046	40.31	68.83	0.098	2.16	0.88	0.31	0.80	0.98	1.0	0.040	2.94	83.82	0.135	3.10	2.63	2
26.246	0.82	0.06	0.95	1.0	0.045	39.51	65.77	0.094	2.08	0.88	0.30	0.80	0.98	1.0	0.040	3.24	84.96	0.137	3.14	2.61	2
26.410	0.82	0.06	0.95	1.0	0.045	40.68	70.28	0.100	2.21	0.87	0.31	0.80	0.98	1.0	0.040	2.75	81.34	0.130	2.97	2.59	2
26.574	0.82	0.05	0.95	1.0	0.045	38.17	60.59	0.089	1.96	0.87	0.26	0.80	0.98	1.0	0.040	3.85	86.38	0.140	3.19	2.57	2
26.739	0.82	0.06	0.95	1.0	0.045	38.72	62.74	0.091	2.01	0.87	0.28	0.80	0.97	1.0	0.039	3.52	84.47	0.136	3.09	2.55	2
26.903	0.82	0.06	0.95	1.0	0.045	38.97	63.70	0.092	2.04	0.87	0.29	0.80	0.97	1.0	0.039	3.10	76.78	0.122	2.76	2.40	2
27.067	0.82	0.05	0.95	1.0	0.045	36.80	55.33	0.083	1.83	0.87	0.25	0.80	0.97	1.0	0.039	4.10	75.99	0.121	2.72	2.27	2
27.231	0.82	0.05	0.96	1.0	0.045	36.53	54.29	0.082	1.80	0.87	0.24	0.80	0.97	1.0	0.040	3.67	65.24	0.106	2.37	2.08	2
27.395	0.82	0.05	0.96	1.0	0.045	36.54	54.34	0.082	1.80	0.87	0.24	0.80	0.97	1.0	0.040	3.66	65.18	0.106	2.35	2.08	2
27.559	0.81	0.05	0.96	1.0	0.045	36.00	54.01	0.081	1.79	0.86	0.24	0.80	0.97	1.0	0.040	4.23	74.31	0.118	2.61	2.20	2
27.723	0.81	0.06	0.95	1.0	0.045	39.02	63.89	0.092	2.04	0.86	0.29	0.80	0.97	1.0	0.040	3.29	81.72	0.131	2.88	2.46	2
27.887	0.81	0.06	0.95	1.0	0.045	41.72	74.28	0.105	2.33	0.86	0.33	0.80	0.97	1.0	0.040	2.62	85.37	0.138	3.02	2.67	2
28.051	0.81	0.06	0.95	1.0	0.045	41.04	71.64	0.102	2.25	0.86	0.32	0.80	0.97	1.0	0.040	2.80	85.63	0.138	3.01	2.63	2
28.215	0.81	0.06	0.95	1.0	0.045	42.58	77.59	0.109	2.43	0.86	0.34	0.80	0.97	1.0	0.040	2.36	82.64	0.132	2.87	2.65	2
28.379	0.81	0.05	0.96	1.0	0.045	38.67	62.53	0.091	2.01	0.86	0.28	0.80	0.96	1.0	0.040	3.25	77.44	0.123	2.65	2.33	2
28.543	0.81	0.05	0.96	1.0	0.045	37.08	57.17	0.085	1.86	0.86	0.26	0.80	0.96	1.0	0.040	4.87	97.86	0.167	3.58	2.72	2
28.707	0.80	0.05	0.96	1.0	0.045	37.18	57.55	0.085	1.87	0.86	0.26	0.80	0.96	1.0	0.040	4.93	100.50	0.174	3.72	2.80	2
28.871	0.80	0.09	0.92	1.0	0.044	40.95	114.71	0.169	3.83	0.85	0.50	0.75	0.95	1.0	0.041	1.40	103.45	0.183	3.88	3.85	2
29.035	0.80	0.09	0.92	1.0	0.044	41.38	116.84	0.173	3.92	0.85	0.50	0.75	0.95	1.0	0.041	1.35	101.77	0.178	3.76	3.84	2
29.199	0.80	0.09	0.91	1.0	0.044	43.23	125.91	0.193	4.40	0.85	0.52	0.74	0.95	1.0	0.041	1.51	124.72	0.260	5.46	4.93	2
29.363	0.80	0.12	0.89	1.0	0.043	52.69	172.40	0.433	10.18	0.85	0.63	0.68	0.94	1.0	0.041	1.28	153.66	0.417	8.71	9.44	2
29.527	0.80	0.15	0.87	1.0	0.041	58.35	200.17	1.000	24.11	0.85	0.69	0.66	0.93	1.0	0.042	1.30	184.56	1.000	20.76	22.43	2
29.691	0.80	0.15	0.87	1.0	0.041	80.18	222.39	1.000	24.12	0.85	0.69	0.66	0.93	1.0	0.042	1.44	205.32	1.000	20.66	22.39	2
29.855	0.79	0.12	0.89	1.0	0.043	72.31	192.09	0.813	19.11	0.85	0.63	0.68	0.93	1.0	0.042	1.62	194.57	1.000	20.55	19.83	2
30.019	0.79	0.24	0.78	1.0	0.037	71.33	263.94	1.000	26.69	0.84	0.85	0.60	0.91	1.0	0.042	1.19	229.76	1.000	20.45	23.57	2
30.183	0.79	0.30	0.73	1.0	0.035	82.54	318.98	1.000	28.64	0.84	0.89	0.60	0.91	1.0	0.043	1.10	259.26	1.000	20.34	24.49	2

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.494

Depth at t_1, z_1 m	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Maximum Shear Strain Modulus, G_{max} tsf	P = γ_{eff}*(G_{eff}/G_{max}) tsf	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
8.48	500	1.8E-03	4.6E+02	3.1E-04	10	0.224	6877	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.03%	0.0033
8.53	500	1.8E-03	4.6E+02	3.1E-04	10	0.225	6859	0.08%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.06%	0.0034
8.58	500	1.8E-03	4.6E+02	3.2E-04	10	0.225	6840	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.09%	0.0034
8.63	500	1.8E-03	4.6E+02	3.2E-04	10	0.226	6822	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.12%	0.0035
8.68	500	1.8E-03	4.6E+02	3.2E-04	10	0.226	6804	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.15%	0.0035
8.73	500	1.8E-03	4.6E+02	3.2E-04	10	0.226	6785	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.18%	0.0036
8.78	500	1.8E-03	4.6E+02	3.2E-04	10	0.227	6768	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.20%	0.0036
8.83	500	1.8E-03	4.6E+02	3.3E-04	10	0.227	6750	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.23%	0.0037
8.88	500	1.8E-03	4.6E+02	3.3E-04	10	0.227	6732	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.26%	0.0037
8.93	500	1.8E-03	4.6E+02	3.3E-04	10	0.228	6715	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.29%	0.0038
8.98	500	1.8E-03	4.6E+02	3.3E-04	10	0.228	6698	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.32%	0.0038
9.03	500	1.8E-03	4.6E+02	3.4E-04	10	0.229	6681	0.09%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.35%	0.0039
9.08	500	1.8E-03	4.6E+02	3.4E-04	10	0.229	6664	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.38%	0.0039
9.13	500	1.8E-03	4.6E+02	3.4E-04	10	0.229	6647	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.41%	0.0039
9.18	538	1.8E-03	5.3E+02	2.9E-04	10	0.230	6630	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.66%	0.0027
9.23	538	1.8E-03	5.3E+02	3.0E-04	10	0.230	6614	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.69%	0.0028
9.28	538	1.8E-03	5.3E+02	3.0E-04	10	0.230	6597	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.71%	0.0028
9.33	538	1.8E-03	5.3E+02	3.0E-04	10	0.231	6581	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.73%	0.0028
9.38	538	1.8E-03	5.3E+02	3.0E-04	10	0.231	6565	0.07%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.76%	0.0029
9.43	538	1.8E-03	5.3E+02	3.0E-04	10	0.231	6549	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.78%	0.0029
9.48	538	1.8E-03	5.3E+02	3.1E-04	10	0.232	6533	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.80%	0.0030
9.53	538	1.8E-03	5.3E+02	3.1E-04	10	0.232	6517	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.82%	0.0030
9.58	538	1.8E-03	5.3E+02	3.1E-04	10	0.232	6502	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.85%	0.0030
9.63	538	1.8E-03	5.1E+02	3.3E-04	16	0.484	5348	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.28%	0.0037
9.68	538	1.8E-03	5.1E+02	3.3E-04	16	0.484	5336	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.30%	0.0038
9.73	538	1.8E-03	5.1E+02	3.3E-04	16	0.484	5325	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.32%	0.0038
9.78	538	1.8E-03	5.1E+02	3.3E-04	16	0.485	5313	0.09%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.35%	0.0038
9.83	538	1.8E-03	5.1E+02	3.3E-04	16	0.485	5301	0.09%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.37%	0.0039
9.88	538	1.8E-03	5.3E+02	3.2E-04	10	0.234	6415	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.98%	0.0032
9.93	538	1.8E-03	5.3E+02	3.2E-04	10	0.235	6400	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.00%	0.0033
9.98	538	1.8E-03	5.3E+02	3.2E-04	10	0.235	6385	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.02%	0.0033
10.03	538	1.8E-03	5.1E+02	3.4E-04	16	0.486	5254	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.46%	0.0040
10.08	538	1.8E-03	5.3E+02	3.3E-04	10	0.236	6357	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.07%	0.0034
10.13	538	1.8E-03	5.3E+02	3.3E-04	10	0.236	6343	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.09%	0.0034
10.18	538	1.8E-03	5.3E+02	3.3E-04	10	0.236	6328	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.12%	0.0035
10.23	538	1.8E-03	5.3E+02	3.3E-04	10	0.237	6314	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.14%	0.0035
10.28	538	1.8E-03	5.3E+02	3.3E-04	10	0.237	6300	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.16%	0.0035
10.33	538	1.8E-03	5.3E+02	3.4E-04	10	0.237	6286	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.19%	0.0036
10.38	538	1.8E-03	5.3E+02	3.4E-04	10	0.237	6273	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.21%	0.0036
10.43	538	1.8E-03	5.3E+02	3.4E-04	10	0.238	6259	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.23%	0.0037
10.48	538	1.8E-03	5.3E+02	3.4E-04	10	0.238	6245	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.26%	0.0037
10.53	538	1.8E-03	5.3E+02	3.4E-04	10	0.238	6232	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.28%	0.0037
10.58	538	1.8E-03	5.1E+02	3.6E-04	16	0.490	5129	0.10%	2.00	0.65	0.03%	0.018	0.34	0.079	0.765	2.73%	0.0045
10.63	538	1.8E-03	5.1E+02	3.6E-04	16	0.490	5119	0.10%	2.00	0.65	0.03%	0.018	0.34	0.079	0.765	2.75%	0.0045
10.68	538	1.8E-03	5.3E+02	3.5E-04	10	0.239	6193	0.09%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.35%	0.0039
10.73	594	1.8E-03	6.5E+02	2.9E-04	10	0.240	6180	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.42%	0.0023
10.78	594	1.8E-03	6.5E+02	2.9E-04	10	0.240	6167	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.43%	0.0024
10.83	594	1.8E-03	6.5E+02	2.9E-04	10	0.240	6154	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.45%	0.0024
10.88	594	1.8E-03	6.5E+02	2.9E-04	10	0.241	6141	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.47%	0.0024
10.93	594	1.8E-03	6.5E+02	2.9E-04	10	0.241	6129	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.49%	0.0024
10.98	594	1.8E-03	6.5E+02	2.9E-04	10	0.241	6116	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.50%	0.0025
11.03	594	1.8E-03	6.5E+02	3.0E-04	10	0.241	6104	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.52%	0.0025
11.08	594	1.8E-03	6.5E+02	3.0E-04	10	0.242	6091	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.54%	0.0025
11.13	594	1.8E-03	6.5E+02	3.0E-04	10	0.242	6079	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.56%	0.0026
11.18	594	1.8E-03	6.5E+02	3.0E-04	10	0.242	6066	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.57%	0.0026
11.23	594	1.8E-03	6.5E+02	3.0E-04	10	0.243	6054	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.59%	0.0026
11.28	594	1.8E-03	6.5E+02	3.0E-04	10	0.243	6042	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.61%	0.0026
11.33	594	1.8E-03	6.5E+02	3.0E-04	10	0.243	6030	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.63%	0.0027
11.38	594	1.8E-03	6.5E+02	3.1E-04	10	0.244	6020	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.64%	0.0027
11.43	594	1.8E-03	6.5E+02	3.1E-04	10	0.244	6014	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.66%	0.0027
11.48	594	1.8E-03	6.5E+02	3.1E-04	10	0.244	6009	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.68%	0.0028
11.53	594	1.8E-03	6.5E+02	3.1E-04	10	0.244	6003	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.70%	0.0028
11.58	594	1.8E-03	6.5E+02	3.1E-04	10	0.244	5997	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.72%	0.0028
11.63	594	1.8E-03	6.5E+02	3.1E-04	10	0.244	5992	0.07%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.74%	0.0029
11.68	594	1.8E-03	6.5E+02	3.1E-04	10	0.244	5986	0.07%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.76%	0.0029
11.73	594	1.8E-03	6.5E+02	3.2E-04	10	0.245	5981	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.78%	0.0029
11.78	594	1.8E-03	6.5E+02	3.2E-04	10	0.245	5975	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.80%	0.0029
11.83	594	1.8E-03	6.5E+02	3.2E-04	10	0.245	5970	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.82%	0.0030
11.88	594	1.8E-03	6.2E+02	3.4E-04	16	0.496	4922	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.21%	0.0036
11.93	594	1.8E-03	6.2E+02	3.4E-04	16	0.496	4918	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.23%	0.0037
11.98	594	1.9E-03	6.8E+02	3.1E-04	0	0.244	7534	0.09%	5.00	1.00	0.03%	0.003	0.34	0.079	0.765	0.45%	0.0007
12.03	594	1.9E-03	6.8E+02	3.1E-04	0	0.245	7527	0.09%	5.00	1.00	0.03%	0.003	0.34	0.079	0.765	0.46%	0.0007
12.08	594	1.9E-03	6.8E+02	3.1E-04	0	0.245	7519	0.09%	5.00	1.00	0.03%	0.003	0.34	0.079	0.765	0.46%	0.0008
12.13	594	1.9E-03	6.8E+02	3.2E-04	0	0.245	7512	0.09%	5.00	1.00	0.03%	0.003	0.34	0.079	0.765	0.47%	0.0008
12.18	594	1.9E-03	6.8E+02	3.2E-04	0	0.245	7505	0.09%	5.00	1.00	0.03%	0.003	0.34	0.079	0.765	0.48%	0.0008
12.23	594	1.8E-03	6.5E+02	3.3E-04	10	0.246	5925	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.97%	0.0032
12.28	594	1.8E-03	6.5E+02	3.3E-04	10	0.246	5920	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.99%	0.0033
12.33	594	1.9E-03	6.8E+02	3.2E-04	0	0.245	7484	0.10%	5.00	1.00	0.03%	0.003	0.34	0.079	0.765	0.50%	0.0008
12.38	594	1.9E-03	6.8E+02	3.2E-04	0	0.245	7477	0.10%	5.00	1.00	0.03%	0.003	0.34	0.079	0.765	0.51%	0.0008
12.88	594	1.9E-03	6.8E+02	3.4E-04	0	0.247	7369	0.11%	5.00	1.00	0.03%	0.004	0.34	0.079	0.765	0.59%	0.0099

Extra layer added to analyze seismic settlement of tailings below the bottom of CPT investigation.

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W6-S

Data File: 13-52106_SP2W6-S-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Tailings Sands
Tailings Sand-Slimes
Tailings Slimes
Interim Cover
Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Parameter
5604.40	Water surface elevation during CPT investigation (ft
5604.40	Water surface elevation at t_1 (ft amsl)
5588.59	Water surface elevation at t_2 (ft amsl)
5583.59	Water surface elevation at t_3 (ft amsl)
1.44	Scaling Factor for stress ratio, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Ear
7.51	Equiv. Number of Uniform Strain Cycles, N
5615.85	Ground Surface Elevation at time of CPT (ft amsl)
5625.41	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pl
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
1.56	Thickness of Random/Platform Fill on top of existing interim cover (ft)
1065.26	Additional Stress due to Final Cover Placement, $\Delta\sigma_c$ (psf)
5583.59	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer	Total Stress at Midpoint of Layer	Equil Pore Pressure at Bottom of Layer	Equil Pore Pressure at Midpoint of Layer (tsf)	Effective Stress at Bottom of Layer	Effective Stress at Midpoint of Layer	Midpoint Depth at t_1, z_1	Shear Wave Velocity, V_s	Soil Density, ρ	Max Shear Modulus, G_{max} (tsf)	P* = $\gamma_{eff}(G_{eff}/G_{max})$	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, $\varepsilon_{v,15}$ (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
Erosion Protection Layer	######	5625.16	5624.91	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014	0.08	508	1.7E-03	4.4E+02	3.0E-06	11	0.068	46696	0.00%	1.20	0.80	0.04%	0.000	0.32	0.133	0.778	0.00%	0.0000
Water Storage/Rooting Zone Layer	######	5623.16	5621.41	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121	0.69	508	1.7E-03	4.3E+02	2.8E-05	11	0.118	18930	0.00%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
High Compaction Layer	######	5619.41	5617.41	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334	1.83	508	1.9E-03	4.8E+02	6.8E-05	11	0.153	12419	0.01%	0.65	0.75	0.02%	0.000	0.34	0.079	0.765	0.00%	0.0000
Platform/Random Fill Layer	######	5616.63	5615.85	1.56	0.050	101	0.533	0.493	0.00	0.00	0.533	0.493	2.68	508	1.6E-03	4.0E+02	1.2E-04	11	0.169	10568	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Pore Pressure at time of CPT (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q	Normalized Friction Ratio, F (%)	Ic	FC %	Total Stress at t_1 (tsf)	Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
0.164	5615.69	6.5	0.020	6.5	1.2	0.51	0.31%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0	1.70	11.067	153.83	12.87	788	0.31%	0.9	51%	0.54	0.00	0.54	0
0.328	5615.52	22.2	0.060	22.2	2.8	1.22	0.27%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	37.723	524.35	43.85	1343	0.27%	0.7	51%	0.55	0.00	0.55	0
0.492	5615.36	34.7	0.122	34.7	1.7	0.75	0.35%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	58.973	819.72	68.51	1399	0.35%	0.8	51%	0.56	0.00	0.56	0
0.656	5615.19	54.7	0.219	54.6	1.9	0.81	0.40%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0	1.70	92.888	1291.14	107.91	1653	0.40%	0.9	51%	0.57	0.00	0.57	0
0.820	5615.03	83.1	0.349	83.1	2.0	0.85	0.42%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0	1.70	141.202	1962.71	164.02	2010	0.42%	0.9	51%	0.57	0.00	0.57	0
0.984	5614.87	94.0	0.544	94.0	2.0	0.85	0.58%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0	1.70	159.715	2220.04	185.52	1895	0.58%	1.0	51%	0.58	0.00	0.58	0
1.148	5614.70	94.8	0.470	94.8	2.0	0.87	0.50%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0	1.70	161.126	2239.65	187.16	1638	0.50%	1.0	51%	0.59	0.00	0.59	0
1.312	5614.54	92.2	0.392	92.2	1.8	0.77	0.43%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	156.689	2177.98	182.01	1394	0.43%	0.9	51%	0.60	0.00	0.60	0
1.476	5614.37	90.8	0.315	90.8	0.7	0.29	0.35%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	154.309	2144.90	179.23	1220	0.35%	0.9	51%	0.61	0.00	0.61	0
1.640	5614.21	85.8	0.359	85.8	4.3	1.87	0.42%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0	1.70	145.843	2027.22	169.44	1038	0.42%	1.0	51%	0.62	0.00	0.62	0
1.804	5614.05	83.8	0.375	83.8	2.0	0.86	0.45%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0	1.70	142.375	1979.01	165.38	921	0.45%	1.0	51%	0.62	0.00	0.62	0
1.968	5613.88	76.6	0.445	76.6	1.8	0.79	0.58%	Interim Cover	0.050	100.7	0.10	0.00	0.10	0	1.70	130.135	1808.88	151.17	771	0.58%	1.1	51%	0.63	0.00	0.63	0
2.133	5613.72	61.3	0.546	61.3	1.1	0.47	0.89%	Interim Cover	0.050	100.7	0.11	0.00	0.11	0	1.70	104.159	1447.81	120.99	570	0.89%	1.4	51%	0.64	0.00	0.64	0
2.297	5613.55	64.2	0.470	64.2	1.8	0.79	0.73%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	109.123	1516.81	126.76	554	0.73%	1.3	51%	0.65	0.00	0.65	0
2.461	5613.39	68.7	0.730	68.7	2.8	1.20	1.06%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	116.807	1623.62	135.70	554	1.06%	1.4	51%	0.66	0.00	0.66	0
2.625	5613.23	191.6	1.300	191.6	4.3	1.85	0.68%	Interim Cover	0.050	100.7	0.13	0.00	0.13	0	1.61	314.125	4366.34	364.89	1449	0.68%	1.1	51%	0.66	0.00	0.66	0
2.789	5613.06	241.3	3.362	241.3	3.2	1.37	1.39%	Interim Cover	0.050	100.7	0.14	0.00	0.14	0	1.61	389.250	5410.57	452.13	1717	1.39%	1.4	51%	0.67	0.00	0.67	0
2.953	5612.90	265.3	5.646	265.3	4.3	1.85	2.13%	Interim Cover	0.050	100.7	0.15	0.00	0.15	0	1.59	421.663	5861.12	489.79	1783	2.13%	1.6	51%	0.68	0.00	0.68	0
3.117	5612.73	238.5	7.457	238.5	2.5	1.06	3.13%	Interim Cover	0.050	100.7	0.16	0.00	0.16	0	1.57	373.653	5193.78	434.00	1518	3.13%	1.7	51%	0.69	0.00	0.69	0
3.281	5612.57	217.3	7.057	217.3	1.3	0.58	3.25%	Sand-Slime Tailings	0.047	93.3	0.16	0.00	0.16	0	1.55	336.251	4673.89	390.55	1319	3.25%	1.8	47%	0.70	0.00	0.70	0
3.445	5612.41	217.9	6.621	217.9	0.9	0.38	3.04%	Sand-Slime Tailings	0.047	93.3	0.17	0.00	0.17	0	1.53	333.101	4630.11	386.53	1264	3.04%	1.7	47%	0.71	0.00	0.71	0
3.609	5612.24	256.0	7.793	256.0	1.4	0.59	3.04%	Sand-Slime Tailings	0.047	93.3	0.18	0.00	0.18	0	1.51	386.904	5377.97	449.38	1422	3.05%	1.7	47%	0.71	0.00	0.71	0
3.773	5612.08	314.1	8.489	314.1	6.9	2.98	2.70%	Sand Tailings	0.051	102.8	0.19	0.00	0.19	0	1.49	469.029	6519.50	544.82	1667	2.70%	1.7	18%	0.72	0.00	0.72	0
3.937	5611.91	227.8	8.106	227.7	12.0	5.18	3.56%	Sand-Slime Tailings	0.047	93.3	0.20	0.00	0.20	0	1.48	336.474	4676.99	390.92	1161	3.56%	1.8	47%	0.73	0.00	0.73	0
4.101	5611.75	218.4	6.483	218.4	6.5	2.83	2.97%	Sand-Slime Tailings	0.047	93.3	0.20	0.00	0.20	0	1.46	319.444	4440.28	371.08	1072	2.97%	1.7	47%	0.74	0.00	0.74	0
4.265	5611.58	214.9	5.761	214.9	3.0	1.32	2.68%	Sand-Slime Tailings	0.047	93.3	0.21	0.00	0.21	0	1.45	311.252	4326.41	361.53	1016	2.68%	1.7	47%	0.74	0.00	0.74	0
4.429	5611.42	175.0	4.480	175.0	2.3	0.98	2.56%	Sand-Slime Tailings	0.047	93.3	0.22	0.00	0.22	0	1.44	251.142	3490.88	291.71	798	2.56%	1.7	47%	0.75	0.00	0.75	0
4.593	5611.26	150.8	3.824	150.8	1.6	0.68	2.54%	Sand-Slime Tailings	0.047	93.3	0.23	0.00	0.23	0	1.43	215.630	2997.26	250.46	665	2.54%	1.7	47%	0.76	0.00	0.76	0
4.757	5611.09	121.0	2.453	121.0	1.6	0.71	2.03%	Sand Tailings	0.051	102.8	0.24	0.00	0.24	0	1.50	181.995	2529.74	211.39	514	2.03%	1.6	18%	0.77	0.00	0.77	0
4.921	5610.93	111.4	1.755	111.4	0.9	0.40	1.57%	Sand Tailings	0.051	102.8	0.24	0.00	0.24	0	1.52	169.758	2359.64	197.17	457	1.58%	1.6	18%	0.78	0.00	0.78	0
5.085	5610.76	105.9	2.102	105.9	0.1	0.06	1.99%	Sand Tailings	0.051	102.8	0.25	0.00	0.25	0	1.53	161.916	2250.64	188.06	419	1.99%	1.7	18%	0.78	0.00	0.78	0
5.249	5610.60	102.9	2.378	102.9	-1.0	-0.44	2.31%	Sand-Slime Tailings	0.047	93.3	0.26	0.00	0.26	0	1.53	157.250	2185.78	182.63	396	2.32%	1.8	47%	0.79	0.00	0.79	0
5.413	5610.44	102.4	2.370	102.4	-0.5	-0.23	2.31%	Sand-Slime Tailings	0.047	93.3	0.27	0.00	0.27	0	1.52	155.399	2160.05	180.48	382	2.32%	1.8	47%	0.80	0.00	0.80	0
5.577	5610.27	101.3	2.366	101.3	-0.4	-0.15	2.34%	Sand-Slime Tailings	0.047	93.3	0.27	0.00	0.27	0	1.51	152.916	2125.53	177.60	368	2.34%	1.8	47%	0.81	0.00	0.81	0
5.741	5610.11	96.2	2.597	96.2	-1.0	-0.43	2.70%	Sand-Slime Tailings	0.047	93.3	0.28	0.00	0.28	0	1.52	145.768	2026.18	169.29	339	2.71%	1.9	47%	0.81	0.00	0.81	0
5.905	5609.94	86.9	2.414	86.9	-0.9	-0.40	2.78%	Sand-Slime Tailings	0.047	93.3	0.29	0.00	0.29	0	1.54	133.514	1855.84	155.06	298	2.79%	1.9	47%	0.82	0.00	0.82	0
6.069	5609.78	80.9	2.523	80.9	-1.0	-0.43	3.12%	Sand-Slime Tailings	0.047	93.3	0.30	0.00	0.30	0	1.55	125.130	1739.31	145.32	271	3.13%	2.0	47%	0.83	0.00	0.83	0
6.234	5609.62	79.6	2.316	79.6	-1.1	-0.49	2.91%	Sand-Slime Tailings	0.047	93.3	0.31	0.00	0.31	0	1.54	122.573	1703.76	142.35	260	2.92%	2.0	47%	0.84	0.00	0.84	0
6.398	5609.45	76.6	2.134	76.6	-0.5	-0.21	2.79%	Sand-Slime Tailings	0.047	93.3	0.31	0.00	0.31	0	1.54	117.783	1637.19	136.80	244	2.80%	2.0	47%	0.85	0.00	0.85	0
6.562	5609.29	57.1	1.783	57.1	-0.0	-0.01	3.12%	Sand-Slime Tailings	0.047	93.3	0.32	0.00	0.32	0	1.61	91.966	1278.33	106.81	177	3.14%	2.1	47%	0.85	0.00	0.85	0
6.726	5609.12	51.8	1.588	51.8	-0.1	-0.03	3.07%	Sand-Slime Tailings	0.047	93.3	0.33	0.00	0.33	0	1.62	84.096	1168.93	97.67	157	3.09%	2.1	47%	0.86	0.00	0.86	0
6.890	5608.96	49.7	1.224	49.7	-0.8	-0.33	2.46%	Sand-Slime Tailings	0.047	93.3	0.34	0.00	0.34	0	1.62	80.549	1119.63	93.54	147	2.48%	2.1	47%	0.87	0.00	0.87	0
7.054	5608.80	56.3	1.510	56.4	-0.3	-0.13	2.68%	Sand-Slime Tailings	0.047	93.3	0.34	0.00	0.34	0	1.57	88.530	1230.57	102.82	163	2.70%	2.1	47%	0.88	0.00	0.88	0
7.218	5608.63	68.1	2.477	68.1	7.0	3.01	3.64%	Slime Tailings	0.041	82.7	0.35	0.00	0.35	0	1.51	102.716	1427.76	119.37	193	3.66%	2.1	71%	0.88	0.00	0.88	0
7.382	5608.47	66.2	2.994	66.2	1.5	0.65	4.52%	Slime Tailings	0.041	82.7	0.36	0.00	0.36	0	1.51	99.683	1385.59	115.79	184	4.55%	2.2	71%	0.89	0.00	0.89	0
7.546	5608.30	143.2	1.935	143.2	2.8	1.21	1.35%	Sand Tailings	0.051	102.8	0.37	0.00	0.37	0	1.30	186.431	2591.40	216.56	391	1.35%	1.6	18%	0.90	0.00	0.90	0
7.710	5608.14	161.7	1.640	161.7	-0.1	-0.04	1.01%	Sand Tailings	0.051	102.8	0.37	0.00	0.37	0	1.27	204.599	2843.92	237.63	431	1.02%	1.5	18%	0.91	0.00	0.91	0
7.874	5607.98	86.8	1.774	86.8	4.1	1.79	2.04%	Sand-Slime Tailings	0.047	93.3	0.38	0.00	0.38	0	1.40	121.855	1693.79	141.57	226	2.05%	1.9	47%	0.91	0.00	0.91	0
8.038	5607.81	50.5	1.194	50.5	1.7	0.75	2.36%	Sand-Slime Tailings	0.047	93.3	0.39	0.00	0.39	0	1.52	76.535	1063.84	88.91	129	2.38%	2.1	47%	0.92	0.00	0.92	0
8.202	5607.65	34.7	0.878	34.7	0.9	0.37	2.53%	Sand-Slime Tailings	0.047	93.3	0.40	0.00	0.40	0	1.58	54.878	762.80	63.75	86	2.56%	2.2	47%	0.93	0.00	0.93	0
8.366	5607.48	25.8	0.664	25.8	0.5	0.20	2.58%	Sand-Slime Tailings	0.047	93.3	0.40	0.00	0.40	0	1.63	41.903	582.45	48.67	63	2.62%	2.3	47%	0.94	0.00	0.94	0
8.530	5607.32	31.8	0.573	31.8	2.8	1.21	1.80%	Sand-Slime Tailings	0.047	93.3	0.41	0.00	0.41	0	1.57	49.800	692.22	57.87	76	1.83%	2.2	47%	0.95	0.00	0.95	0
8.694	5607.16	34.8	0.413	34.8	2.3	1.01	1.19%	Sand-Slime Tailings	0.047	93.3	0.42	0.00	0.42	0	1.54	53.460	743.09	62.12	82	1.20%	2.0	47%	0.95	0.00	0.95	0
8.858	5606.99	33.7	0.343	33.7	0.9	0.37	1.02%	Sand-Slime Tailings	0.047	93.3	0.43	0.00	0.43	0	1.53	51.481	715.59	59.80	78	1.03%	2.0	47%	0.96	0.00	0.96	0
9.022	5606.83	29.3	0.358	29.3	0.1	0.05	1.22%	Sand-Slime Tailings	0.047	93.3	0.44	0.00	0.44	0	1.54	44.964	624.99	52.22	66	1.24%	2.1	47%	0.97	0.00	0.97	0
9.186	5606.66	20.9	0.342	20.9	-0.3	-0.13	1.64%	Sand-Slime Tailings	0.047	93.3	0.44	0.00	0.44	0	1.58	32.960	458.14	38.28	46	1.67%	2.3	47%	0.98	0.00	0.98	0
9.350	5606.50	12.6	0.327	12.6	-0.6	-0.25	2.59%	Slime Tailings	0.041	82.7	0.45	0.00	0.45	0	1.64	20.679	287.43	24.01	27	2.69%	2.6	71%	0.98	0.00	0.98	0
9.514	5606.34	12.0	0.251	12.0	-0.7	-0.29	2.10%	Slime Tailings	0.041	82.7	0.46	0.00	0.46	0	1.63	19.500	271.05	22.64	25	2.18%	2.6	71%	0.99	0.00	0.99	0
9.678	5606.17	14.1	0.216	14.1	-0.6	-0.26	1.53%	Sand-Slime Tailings	0.047	93.3	0.46	0.00	0.46	0	1.59	22.445	311.98	26.06	29	1.58%	2.5	47%	1.00	0.00	1.00	0
9.842	5606.01	23.2	0.158	23.2	-0.3	-0.12	0.68%	Sand-Slime Tailings	0.047	93.3	0.47	0.00	0.47	0	1.50	34.822	484.03	40.44	48	0.70%	2.1	47%	1.00	0.00	1.00	0
10.006	5605.84	22.6	0.274	22.6	-0.3	-0.12	1.21%	Sand-Slime Tailings	0.047	93.3	0.48	0.00	0.48	0	1.49	33.696	468.37	39.13	46	1.24%	2.2	47%	1.01	0.00	1.01	0
10.170	5605.68	11.1	0.368	11.1	-0.5	-0.23	3.32%	Slime Tailings	0.041	82.7	0.49	0.00	0.49	0	1.56	17.349	241.15	20.14	22	3.47%	2.8	71%	1.02	0.00	1.02	0
10.335	5605.52	10.3	0.383	10.3	0.3	0.12	3.73%	Slime Tailings	0.041	82.7	0.49	0.00	0.49	0	1.55	15.894	220.93	18.46	20	3.91%	2.8	71%	1.03	0.00	1.03	0
10.499	5605.35	8.6	0.299	8.6	1.8	0.79	3.46%	Slime Tailings	0.041	82.7	0.50	0.00	0.50	0	1.53	13.186	183.29	15.34	16	3.68%	2.9	71%	1.03	0.00	1.03	0
10.663	5605.19	11.2	0.222	11.2	2.1	0.91	1.98%	Slime Tailings	0.041	82.7	0.51	0.00	0.51	0	1.51	16.923	235.23	19.68	21	2.08%	2.6	71%	1.04	0.00	1.04	0
10.827	5605.02	22.3	0.182	22.3	1.3	0.55	0.82%	Sand-Slime Tailings	0.047	93.3	0.51	0.00	0.51	0	1.43	31.828	442.41	36.98	42	0.84%	2.2	47%	1.05	0.00	1.05	0
10.991	5604.86	26.2	0.185	26.2	0.6	0.25	0.71%	Sand-Slime Tailings	0.047	93.3	0.52	0.00	0.52	0	1.40	36.562	508.21	42.47	49	0.72%	2.1	47%	1.05	0.00	1.05	0
11.155	5604.70	24.7	0.273	24.7	0.3	0.14	1.10%	Sand-Slime Tailings	0.047	93.3	0.53	0.00	0.53	0	1.39	34.382	477.91	39.94	46	1.13%	2.2	47%	1.06	0.00	1.06	0
11.319	5604.53	17.5	0.349	17.5	-0.1	-0.05	1.99%	Sand-Slime Tailings	0.047	93.3	0.54	0.00	0.54	0	1.41	24.763	344.20	28.76	32	2.06%	2.5	47%	1.07	0.00	1.07	0
11.483	5604.37	12.5	0.390	12.5	-0.2	-0.07	3.12%	Slime Tailings	0.057	113.1	0.55	0.00	0.55	1	1.43	17.845	248.04	20.72	22	3.27%	2.7	71%	1.08	0.00	1.08	0
11.647	5604.20	12.1	0.339	12.1	2.0	0.88	2.79%	Slime Tailings	0.057	113.1	0.56	0.01	0.55	1	1.42	17.214	239.27	20.01	21	2.93%	2.7	71%	1.09	0.00	1.09	0
11.811	5604.04	10.7	0.328	10.7	10.4	4.49	3.06%	Slime Tailings	0.057	113.1	0.57	0.01	0.55	1	1.41	15.051	209.21	17.59	18	3.23%	2.8	71%	1.10	0.00	1.10	0
11.975	5603.88	17.0	0.353	16.9	18.5	8.03	2.08%	Sand-Slime Tailings	0.059	119.0	0.57	0.02	0.56	1	1.38	23.239	323.02	27.18	29	2.15%	2.5	47%	1.11	0.00	1.11	0
12.139	5603.71	12.2	0.338	12.1	8.3	3.58	2.77%	Slime Tailings	0.057	113.1	0.58	0.02	0.56	1	1.39	16.931	235.34	19.75	21	2.91%	2.7	71%	1.12	0.00	1.12	0
12.303	5603.55	8.8	0.266	8.8	6.5	2.80	3.02%	Slime Tailings	0.057	113.1	0.59	0.03	0.57	1	1.39	12.161	169.03	14.19	14	3.24%	2.9	71%	1.13	0.00	1.13	0
12.467	5603.38	5.7	0.163	5.7	9.4	4.08	2.86%	Slime Tailings	0.057	113.1	0.60	0.03	0.57	1	1.38	7.790	108.28	9.14	9	3.19%	3.1	71%	1.14	0.00	1.14	0
12.631	5603.22	6.7	0.119	6.6	17.7	7.65	1.77%	Slime Tailings	0.057	113.1	0.61	0.04	0.58	1	1.37	9.089	126.34	10.73	11	1.94%	2.9	71%	1.14	0.00	1.14	0
12.795	5603.05	9.3	0.181	9.2	25.8	11.18	1.94%	Slime Tailings	0.057	113.1	0.62	0.04	0.58	1	1.36	12.514	173.95	14.79	15	2.08%	2.8	71%	1.15	0.00	1.15	0
12.959	5602.89	8.3	0.182	8.2	18.0	7.82	2.18%	Slime Tailings	0.057	113.1	0.63	0.05	0.58	1	1.36	11.157	155.08	13.13	13	2.36%	2.8	71%	1.16	0.00	1.16	0
13.123	5602.73	6.3	0.181	6.2	22.2	9.60	2.85%	Slime Tailings	0.057	113.1	0.64	0.05	0.59	1	1.35	8.372	116.37	9.94	10	3.17%	3.0	71%	1.17	0.00	1.17	0
13.287	5602.56	5.9	0.160	5.6	56.5	24.47	2.70%	Slime Tailings	0.057	113.1	0.65	0.06	0.59	1	1.34	7.468	103.80	9.22	9	3.03%	3.0	71%	1.18	0.00	1.18	0
13.451	5602.40	5.0	0.142	4.6	62.6	27.11	2.87%	Slime Tailings	0.057	113.1	0.66	0.06	0.60	1	1.33	6.080	84.51	7.67	7	3.31%	3.1	71%	1.19	0.00	1.19	0
13.615	5602.23	4.7	0.156	4.3	65.6	28.41	3.34%	Slime Tailings	0.057	113.1	0.67	0.07	0.60	1	1.33	5.649	78.52	7.19	7	3.90%	3.2	71%	1.20	0.00	1.20	0
13.779	5602.07	5.0	0.155	4.5	70.8	30.68	3.12%	Slime Tailings	0.057	113.1	0.68	0.07	0.60	1	1.32	5.962	82.87	7.60	7	3.62%	3.2	71%	1.21	0.00	1.21	0
13.943	5601.91	5.3	0.171	4.9	65.5	28.40	3.21%	Slime Tailings	0.057	113.1	0.69	0.08	0.61	1	1.31	6.441	89.54	8.10	8	3.69%	3.1	71%	1.22	0.00	1.22	0
14.107	5601.74	5.7	0.161	5.3	66.6	28.87	2.81%	Slime Tailings	0.057	113.1	0.70	0.08	0.61	1	1.30	6.929	96.32	8.68	8	3.20%	3.1	71%	1.23	0.00	1.23	0
14.271	5601.58	6.2	0.224	5.8	64.0	27.75	3.64%	Slime Tailings	0.057	113.1	0.70	0.09	0.62	1	1.30	7.477	103.93	9.29	9	4.11%	3.1	71%	1.24	0.00	1.24	0
14.436	5601.41	6.8	0.221	6.7	27.2	11.78	3.24%	Slime Tailings	0.057	113.1	0.71	0.09	0.62	1	1.29	8.600	119.54	10.24	10	3.61%	3.0	71%	1.25	0.00	1.25	0
14.600	5601.25	12.2	0.194	12.0	33.9	14.70	1.58%	Sand-Slime Tailings	0.059	119.0	0.72	0.10	0.63	1	1.28	15.444	214.67	18.25	18	1.68%	2.6	47%	1.26	0.00	1.26	0
14.764	5601.09	17.1	0.255	17.0	12.7	5.52	1.49%	Sand-Slime Tailings	0.059	119.0	0.73	0.10	0.63	1	1.27	21.529	299.25	25.12	26	1.56%	2.5	47%	1.27	0.00	1.27	0
14.928	5600.92	15.7	0.220	15.7	4.6	1.99	1.40%	Sand-Slime Tailings	0.059	119.0	0.74	0.11	0.63	1	1.26	19.827	275.59	23.07	24	1.47%	2.5	47%	1.28	0.00	1.28	0
15.092	5600.76	10.8	0.225	10.8	8.1	3.49	2.08%	Slime Tailings	0.057	113.1	0.75	0.11	0.64	1	1.26	13.623	189.36	15.90	16	2.23%	2.8	71%	1.29	0.00	1.29	0
15.256	5600.59	23.2	0.308	23.2	2.0	0.87	1.33%	Sand-Slime Tailings	0.059	119.0	0.76	0.12	0.64	1	1.23	28.564	397.04	33.19	35	1.37%	2.4	47%	1.29	0.00	1.29	0
15.420	5600.43	16.2	0.412	16.2	0.7	0.28	2.55%	Slime Tailings	0.057	113.1	0.77	0.12	0.65	1	1.24	20.096	279.34	23.35	24	2.68%	2.7	71%	1.30	0.00	1.30	0
15.584	5600.27	12.6	0.274	12.6	2.6	1.12	2.17%	Slime Tailings	0.057	113.1	0.78	0.13	0.65	1	1.24	15.661	217.69	18.21	18	2.32%	2.7	71%	1.31	0.00	1.31	0
15.748	5600.10	10.3	0.241	10.2	8.8	3.82	2.34%	Slime Tailings	0.057	113.1	0.79	0.13	0.66	1	1.24	12.652	175.86	14.77	14	2.54%	2.8	71%	1.32	0.00	1.32	0
15.912	5599.94	9.3	0.182	8.8	77.2	33.43	1.96%	Slime Tailings	0.057	113.1	0.80	0.14	0.66	1	1.23	10.854	150.88	13.30	13	2.14%	2.8	71%	1.33	0.00	1.33	0
16.076	5599.77	9.1	0.171	8.6	82.6	35.81	1.87%	Slime Tailings	0.057	113.1	0.81	0.14	0.66	1	1.22	10.569	146.90	13.01	13	2.05%	2.8	71%	1.34	0.00	1.34	0
16.240	5599.61	10.3	0.119	9.8	84.2	36.48	1.15%	Sand-Slime Tailings	0.059	119.0	0.82	0.15	0.67	1	1.22	11.912	165.58	14.58	14	1.25%	2.7	47%	1.35	0.00	1.35	0
16.404	5599.45	10.7	0.142	10.3	64.6	28.00	1.33%	Sand-Slime Tailings	0.059	119.0	0.83	0.15	0.67	1	1.21	12.466	173.27	15.05	15	1.44%	2.7	47%	1.36	0.00	1.36	0
16.568	5599.28	9.7	0.148	9.1	90.7	39.29	1.52%	Sand-Slime Tailings	0.059	119.0	0.84	0.16	0.68	1	1.20	11.013	153.08	13.58	13	1.67%	2.8	47%	1.37	0.00	1.37	0
16.732	5599.12	11.2	0.142	10.7	72.9	31.59	1.27%	Sand-Slime Tailings	0.059	119.0	0.85	0.16	0.68	1	1.20	12.872	178.92	15.58	15	1.37%	2.7	47%	1.38	0.00	1.38	0
16.896	5598.95	11.8	0.171	11.3	78.1	33.86	1.45%	Sand-Slime Tailings	0.059	119.0	0.86	0.17	0.69	1	1.19	13.484	187.43	16.34	16	1.56%	2.7	47%	1.39	0.00	1.39	0
17.060	5598.79	12.0	0.161	11.4	83.5	36.17	1.35%	Sand-Slime Tailings	0.059	119.0	0.87	0.18	0.69	1	1.19	13.567	188.59	16.48	16	1.45%	2.7	47%	1.40	0.00	1.40	0
17.224	5598.63	12.8	0.164	12.3	73.7	31.95	1.28%	Sand-Slime Tailings	0.059	119.0	0.88	0.18	0.70	1	1.18	14.547	202.20	17.53	17	1.38%	2.6	47%	1.41	0.00	1.41	0

Liquefaction Triggering Analyses

Depth at time of CPT (ft)	I&B (2008) r_d	I&B C_σ	I&B K_σ	I&B K_α	I&B CSR M=7.5, σ'=1atm	I&B Δq_{c1N}	I&B q_{c1N-cs}	I&B (CRR) M=7.5, σ'=1atm	I&B FoS	Youd (2001) r_d	Youd D_r	Youd f	Youd K_σ	Youd K_α	Youd CSR M=7.5, σ'=1atm	Youd Kc	Youd q_{c1N-cs}	Youd (CRR) M=7.5	Youd FoS	Avg FoS	Liquefiable? 1=Yes 2=No
0.164	1.00	0.05	1.02	1.0	0.059	34.84	47.70	0.075	1.27	0.98	0.21	0.80	2.53	1.0	0.017	1.00	12.87	0.061	3.63	2.45	2
0.328	1.00	0.07	1.03	1.0	0.060	45.71	89.56	0.126	2.12	0.98	0.38	0.80	2.20	1.0	0.020	1.00	43.85	0.087	4.59	3.35	2
0.492	1.00	0.08	1.04	1.0	0.060	54.36	122.88	0.186	3.10	0.98	0.48	0.76	2.33	1.0	0.018	1.00	68.51	0.110	5.44	4.27	2
0.656	1.00	0.10	1.05	1.0	0.061	68.19	176.10	0.478	7.90	0.98	0.60	0.70	2.66	1.0	0.017	1.00	107.91	0.197	119.17	63.53	2
0.820	1.00	0.18	1.07	1.0	0.062	87.88	251.90	1.000	16.11	0.98	0.74	0.63	3.07	1.0	0.014	1.00	164.02	1.000	484.49	250.30	2
0.984	1.00	0.22	1.09	1.0	0.063	95.43	280.95	1.000	15.90	0.98	0.79	0.61	3.07	1.0	0.014	1.00	185.52	1.000	403.90	209.90	2
1.148	1.00	0.23	1.09	1.0	0.063	96.00	283.16	1.000	15.93	0.98	0.79	0.61	2.91	1.0	0.015	1.00	187.16	1.000	346.34	181.13	2
1.312	1.00	0.22	1.08	1.0	0.062	94.19	276.20	1.000	16.04	0.97	0.78	0.61	2.72	1.0	0.016	1.00	182.01	1.000	303.16	159.60	2
1.476	1.00	0.21	1.07	1.0	0.062	93.22	272.45	1.000	16.12	0.97	0.77	0.61	2.58	1.0	0.017	1.00	179.23	1.000	269.58	142.85	2
1.640	1.00	0.19	1.06	1.0	0.062	89.78	259.22	1.000	16.26	0.97	0.75	0.62	2.41	1.0	0.018	1.00	169.44	1.000	242.72	129.49	2
1.804	1.00	0.18	1.06	1.0	0.061	88.36	253.74	1.000	16.33	0.97	0.74	0.63	2.30	1.0	0.019	1.00	165.38	1.000	220.74	118.54	2
1.968	1.00	0.16	1.05	1.0	0.061	83.37	234.54	1.000	16.49	0.97	0.71	0.65	2.15	1.0	0.020	1.00	151.17	0.401	81.22	48.86	2
2.133	1.00	0.13	1.04	1.0	0.060	72.78	193.77	0.869	14.52	0.97	0.64	0.68	1.94	1.0	0.022	1.00	120.99	0.245	45.74	30.13	2
2.297	1.00	0.13	1.04	1.0	0.060	74.81	201.57	1.000	16.72	0.97	0.65	0.67	1.92	1.0	0.022	1.00	126.76	0.269	46.79	31.75	2
2.461	1.00	0.14	1.04	1.0	0.060	77.94	213.64	1.000	16.72	0.97	0.67	0.66	1.92	1.0	0.022	1.00	135.70	0.312	50.65	33.68	2
2.625	1.00	0.30	1.08	1.0	0.062	#####	523.26	1.000	16.12	0.97	1.10	0.60	2.12	1.0	0.020	1.00	364.89	1.000	152.06	84.09	2
2.789	0.99	0.30	1.07	1.0	0.062	#####	641.11	1.000	16.19	0.97	1.23	0.60	2.07	1.0	0.021	1.00	452.13	1.000	143.17	79.68	2
2.953	0.99	0.30	1.07	1.0	0.061	#####	691.99	1.000	16.26	0.97	1.28	0.60	2.02	1.0	0.021	1.00	489.79	1.000	135.27	75.77	2
3.117	0.99	0.30	1.07	1.0	0.061	#####	616.63	1.000	16.33	0.97	1.20	0.60	1.98	1.0	0.021	1.00	434.00	1.000	128.20	72.27	2
3.281	0.99	0.30	1.06	1.0	0.061	#####	557.82	1.000	16.40	0.97	1.15	0.60	1.94	1.0	0.022	1.08	423.01	1.000	122.29	69.34	2
3.445	0.99	0.30	1.06	1.0	0.061	#####	552.87	1.000	16.46	0.97	1.14	0.60	1.90	1.0	0.022	1.07	412.59	1.000	116.91	66.68	2
3.609	0.99	0.30	1.06	1.0	0.061	#####	637.29	1.000	16.53	0.97	1.22	0.60	1.87	1.0	0.023	1.06	476.39	1.000	111.98	64.25	2
3.773	0.99	0.30	1.05	1.0	0.060	#####	706.20	1.000	16.60	0.97	1.35	0.60	1.84	1.0	0.023	1.02	554.48	1.000	107.01	61.80	2
3.937	0.99	0.30	1.05	1.0	0.060	#####	558.33	1.000	16.66	0.97	1.14	0.60	1.81	1.0	0.024	1.09	424.66	1.000	102.87	59.77	2
4.101	0.99	0.30	1.05	1.0	0.060	#####	531.53	1.000	16.73	0.97	1.11	0.60	1.78	1.0	0.024	1.07	397.43	1.000	99.05	57.89	2
4.265	0.99	0.30	1.04	1.0	0.060	#####	518.63	1.000	16.79	0.97	1.10	0.60	1.75	1.0	0.024	1.05	378.28	1.000	95.50	56.15	2
4.429	0.99	0.30	1.04	1.0	0.059	#####	424.32	1.000	16.86	0.97	0.99	0.60	1.73	1.0	0.025	1.05	307.64	1.000	92.20	54.53	2
4.593	0.98	0.30	1.04	1.0	0.059	#####	368.60	1.000	16.93	0.97	0.91	0.60	1.71	1.0	0.025	1.07	268.21	1.000	89.12	53.02	2
4.757	0.98	0.30	1.03	1.0	0.059	76.13	287.53	1.000	17.00	0.97	0.84	0.60	1.68	1.0	0.025	1.04	220.27	1.000	85.96	51.48	2
4.921	0.98	0.25	1.03	1.0	0.058	72.50	269.67	1.000	17.14	0.97	0.81	0.60	1.66	1.0	0.025	1.00	197.17	1.000	83.01	50.08	2
5.085	0.98	0.23	1.02	1.0	0.058	70.17	258.22	1.000	17.25	0.97	0.79	0.60	1.63	1.0	0.026	1.06	200.17	1.000	80.26	48.75	2
5.249	0.98	0.22	1.02	1.0	0.058	94.35	276.98	1.000	17.32	0.97	0.78	0.61	1.60	1.0	0.027	1.11	203.34	1.000	77.93	47.62	2
5.413	0.98	0.21	1.02	1.0	0.058	93.60	274.08	1.000	17.38	0.97	0.78	0.61	1.57	1.0	0.027	1.12	202.03	1.000	75.73	46.55	2
5.577	0.98	0.21	1.01	1.0	0.057	92.59	270.19	1.000	17.44	0.96	0.77	0.62	1.55	1.0	0.027	1.13	200.40	1.000	73.65	45.54	2
5.741	0.98	0.19	1.01	1.0	0.057	89.67	258.96	1.000	17.50	0.96	0.75	0.62	1.52	1.0	0.028	1.19	201.39	1.000	71.68	44.59	2
5.905	0.98	0.17	1.01	1.0	0.057	84.68	239.74	1.000	17.57	0.96	0.72	0.64	1.48	1.0	0.029	1.23	190.57	1.000	69.82	43.69	2
6.069	0.98	0.15	1.01	1.0	0.057	81.27	226.59	1.000	17.62	0.96	0.70	0.65	1.45	1.0	0.029	1.31	189.90	1.000	68.05	42.84	2
6.234	0.98	0.15	1.00	1.0	0.057	80.23	222.57	1.000	17.67	0.96	0.69	0.66	1.43	1.0	0.030	1.29	182.97	1.000	66.38	42.02	2
6.398	0.97	0.14	1.00	1.0	0.056	78.28	215.07	1.000	17.71	0.96	0.69	0.66	1.41	1.0	0.030	1.28	175.75	1.000	64.78	41.25	2
6.562	0.97	0.11	1.00	1.0	0.056	67.76	174.57	0.459	8.14	0.96	0.60	0.70	1.34	1.0	0.031	1.47	156.93	0.439	27.80	17.97	2
6.726	0.97	0.10	1.00	1.0	0.056	64.56	162.23	0.341	6.07	0.96	0.57	0.71	1.32	1.0	0.032	1.52	148.18	0.383	23.65	14.86	2
6.890	0.97	0.10	1.00	1.0	0.056	63.28	156.83	0.305	5.45	0.96	0.56	0.72	1.30	1.0	0.033	1.41	131.92	0.294	17.74	11.59	2
7.054	0.97	0.11	1.00	1.0	0.056	66.36	169.18	0.399	7.14	0.96	0.59	0.71	1.31	1.0	0.032	1.41	145.18	0.365	21.55	14.34	2
7.218	0.97	0.12	1.00	1.0	0.056	71.66	191.03	0.781	13.98	0.96	0.63	0.68	1.33	1.0	0.031	1.63	182.92	1.000	57.98	35.98	2
7.382	0.97	0.12	1.00	1.0	0.056	70.41	186.20	0.655	11.75	0.96	0.62	0.69	1.31	1.0	0.032	1.75	202.06	1.000	56.91	34.33	2
7.546	0.97	0.30	0.99	1.0	0.055	77.45	294.01	1.000	18.12	0.96	0.85	0.60	1.41	1.0	0.030	1.00	216.56	1.000	55.62	36.87	2
7.710	0.97	0.30	0.98	1.0	0.055	82.84	320.47	1.000	18.19	0.96	0.89	0.60	1.40	1.0	0.030	1.00	237.63	1.000	54.38	36.29	2
7.874	0.96	0.15	0.99	1.0	0.055	79.95	221.52	1.000	18.09	0.96	0.69	0.66	1.32	1.0	0.032	1.18	167.67	1.000	53.32	35.70	2
8.038	0.96	0.10	0.99	1.0	0.055	61.48	150.39	0.273	4.93	0.96	0.54	0.73	1.24	1.0	0.034	1.45	128.98	0.280	14.62	9.78	2
8.202	0.96	0.08	0.99	1.0	0.055	52.66	116.41	0.172	3.11	0.96	0.46	0.77	1.20	1.0	0.035	1.76	112.27	0.212	10.86	6.98	2
8.366	0.96	0.07	0.99	1.0	0.055	47.37	96.05	0.136	2.46	0.96	0.40	0.80	1.16	1.0	0.036	2.09	101.59	0.178	8.94	5.70	2
8.530	0.96	0.08	0.99	1.0	0.055	50.60	108.47	0.157	2.85	0.96	0.44	0.78	1.18	1.0	0.036	1.60	92.72	0.154	7.62	5.23	2
8.694	0.96	0.08	0.99	1.0	0.055	52.09	114.20	0.168	3.05	0.96	0.46	0.77	1.18	1.0	0.036	1.34	83.09	0.133	6.48	4.76	2
8.858	0.96	0.08	0.99	1.0	0.055	51.27	111.08	0.162	2.95	0.96	0.45	0.78	1.17	1.0	0.036	1.30	77.98	0.124	5.92	4.43	2
9.022	0.96	0.07	0.99	1.0	0.055	48.62	100.84	0.144	2.62	0.96	0.42	0.79	1.15	1.0	0.037	1.47	76.82	0.122	5.73	4.18	2
9.186	0.96	0.06	0.99	1.0	0.055	43.73	82.00	0.115	2.10	0.96	0.36	0.80	1.14	1.0	0.037	1.99	76.07	0.121	5.57	3.84	2
9.350	0.96	0.06	0.99	1.0	0.055	38.45	62.46	0.091	1.65	0.96	0.28	0.80	1.14	1.0	0.037	3.47	83.20	0.134	6.07	3.86	2
9.514	0.95	0.05	0.99	1.0	0.055	37.97	60.61	0.089	1.62	0.96	0.27	0.80	1.14	1.0	0.037	3.27	74.01	0.118	5.27	3.44	2
9.678	0.95	0.06	0.99	1.0	0.055	39.44	65.50	0.094	1.72	0.96	0.29	0.80	1.13	1.0	0.037	2.54	66.27	0.107	4.72	3.22	2
9.842	0.95	0.07	0.99	1.0	0.054	44.48	84.93	0.120	2.19	0.95	0.37	0.80	1.13	1.0	0.037	1.42	57.38	0.098	4.23	3.21	2
10.006	0.95	0.06	0.99	1.0	0.054	44.03	83.16	0.117	2.15	0.95	0.36	0.80	1.12	1.0	0.037	1.75	68.53	0.110	4.69	3.42	2
10.170	0.95	0.05	0.99	1.0	0.054	37.10	57.25	0.085	1.56	0.95	0.26	0.80	1.12	1.0	0.038	4.49	90.38	0.149	6.26	3.91	2
10.335	0.95	0.05	0.99	1.0	0.054	36.52	54.98	0.082	1.52	0.95	0.25	0.80	1.12	1.0	0.038	5.04	92.99	0.155	6.43	3.97	2
10.499	0.95	0.05	0.99	1.0	0.054	35.43	50.76	0.078	1.44	0.95	0.23	0.80	1.11	1.0	0.038	5.50	84.30	0.136	5.56	3.50	2
10.663	0.95	0.05	0.99	1.0	0.054	36.94	56.62	0.084	1.55	0.95	0.26	0.80	1.11	1.0	0.038	3.58	70.44	0.113	4.55	3.05	2
10.827	0.95	0.06	0.99	1.0	0.054	43.27	80.25	0.113	2.09	0.95	0.35	0.80	1.11	1.0	0.038	1.59	58.90	0.099	3.95	3.02	2
10.991	0.94	0.07	0.99	1.0	0.054	45.20	87.67	0.123	2.29	0.95	0.38	0.80	1.11	1.0	0.038	1.42	60.27	0.100	3.94	3.12	2
11.155	0.94	0.06	0.99	1.0	0.054	44.31	84.24	0.119	2.20	0.95	0.36	0.80	1.10	1.0	0.038	1.70	67.83	0.109	4.22	3.21	2
11.319	0.94	0.06	0.99	1.0	0.054	40.39	69.15	0.099	1.83	0.95	0.31	0.80	1.10	1.0	0.038	2.75	79.07	0.126	4.81	3.32	2
11.483	0.94	0.05	0.99	1.0	0.054	37.30	58.03	0.086	1.59	0.95	0.26	0.80	1.10	1.0	0.038	4.35	90.07	0.148	5.57	3.58	2
11.647	0.94	0.05	0.99	1.0	0.054	37.06	57.07	0.085	1.58	0.95	0.26	0.80	1.09	1.0	0.038	4.22	84.43	0.136	5.08	3.33	2
11.811	0.94	0.05	0.99	1.0	0.054	36.21	53.80	0.081	1.52	0.95	0.24	0.80	1.09	1.0	0.038	4.81	84.62	0.136	5.06	3.29	2
11.975	0.94	0.06	0.99	1.0	0.053	39.83	67.01	0.096	1.80	0.95	0.30	0.80	1.09	1.0	0.038	2.95	80.09	0.128	4.70	3.25	2
12.139	0.94	0.05	0.99	1.0	0.053	36.96	56.71	0.084	1.58	0.95	0.26	0.80	1.09	1.0	0.038	4.26	84.15	0.135	4.95	3.26	2
12.303	0.94	0.05	0.99	1.0	0.053	35.03	49.22	0.077	1.44	0.95	0.22	0.80	1.09	1.0	0.038	5.55	78.80	0.126	4.56	3.00	2
12.467	0.93	0.04	0.99	1.0	0.053	33.27	42.41	0.071	1.32	0.95	0.17	0.80	1.09	1.0	0.039	7.34	67.12	0.108	3.90	2.61	2
12.631	0.93	0.05	0.99	1.0	0.053	33.82	44.56	0.072	1.36	0.95	0.19	0.80	1.08	1.0	0.039	5.42	58.12	0.098	3.52	2.44	2
12.795	0.93	0.05	0.99	1.0	0.053	35.24	50.03	0.078	1.46	0.95	0.22	0.80	1.08	1.0	0.039	4.45	65.88	0.107	3.79	2.63	2
12.959	0.93	0.05	0.99	1.0	0.053	34.66	47.80	0.075	1.42	0.95	0.21	0.80	1.08	1.0	0.039	5.12	67.20	0.108	3.82	2.62	2
13.123	0.93	0.05	0.99	1.0	0.053	33.55	43.49	0.072	1.35	0.95	0.18	0.80	1.08	1.0	0.039	6.98	69.37	0.111	3.90	2.62	2
13.287	0.93	0.04	0.99	1.0	0.053	33.30	42.52	0.071	1.34	0.95	0.18	0.80	1.08	1.0	0.039	7.21	66.51	0.107	3.74	2.54	2
13.451	0.93	0.04	0.99	1.0	0.053	32.76	40.42	0.069	1.31	0.95	0.16	0.80	1.08	1.0	0.039	8.42	64.56	0.105	3.64	2.47	2
13.615	0.93	0.04	0.99	1.0	0.053	32.59	39.78	0.068	1.30	0.95	0.15	0.80	1.07	1.0	0.039	9.34	67.15	0.108	3.72	2.51	2
13.779	0.92	0.04	0.99	1.0	0.053	32.73	40.34	0.069	1.31	0.95	0.16	0.80	1.07	1.0	0.039	8.78	66.76	0.108	3.68	2.49	2
13.943	0.92	0.04	0.98	1.0	0.053	32.91	41.01	0.069	1.32	0.95	0.16	0.80	1.07	1.0	0.039	8.51	68.96	0.111	3.75	2.54	2
14.107	0.92	0.04	0.98	1.0	0.052	33.11	41.79	0.070	1.34	0.94	0.17	0.80	1.07	1.0	0.039	7.72	67.00	0.108	3.64	2.49	2
14.271	0.92	0.04	0.98	1.0	0.052	33.32	42.61	0.071	1.35	0.94	0.18	0.80	1.07	1.0	0.039	8.17	75.85	0.121	4.04	2.70	2
14.436	0.92	0.05	0.98	1.0	0.052	33.65	43.90	0.072	1.38	0.94	0.18	0.80	1.07	1.0	0.039	7.30	74.79	0.119	3.96	2.67	2
14.600	0.92	0.05	0.98	1.0	0.052	36.70	54.96	0.082	1.58	0.94	0.25	0.80	1.07	1.0	0.039	3.56	64.99	0.106	3.49	2.54	2
14.764	0.92	0.06	0.98	1.0	0.052	39.11	64.23	0.093	1.79	0.94	0.29	0.80	1.06	1.0	0.039	2.74	68.85	0.110	3.63	2.71	2
14.928	0.92	0.05	0.98	1.0	0.052	38.39	61.46	0.089	1.73	0.94	0.28	0.80	1.06	1.0	0.039	2.84	65.58	0.106	3.47	2.60	2
15.092	0.91	0.05	0.98	1.0	0.052	35.62	51.52	0.079	1.52	0.94	0.23	0.80	1.06	1.0	0.039	4.46	70.87	0.113	3.67	2.60	2
15.256	0.91	0.06	0.98	1.0	0.051	41.94	75.14	0.106	2.06	0.94	0.33	0.80	1.06	1.0	0.039	2.14	71.16	0.114	3.66	2.86	2
15.420	0.91	0.05	0.98	1.0	0.052	38.22	61.56	0.090	1.74	0.94	0.28	0.80	1.06	1.0	0.039	3.75	87.44	0.142	4.55	3.15	2
15.584	0.91	0.05	0.98	1.0	0.052	36.43	54.64	0.082	1.59	0.94	0.25	0.80	1.06	1.0	0.039	4.15	75.50	0.120	3.82	2.71	2
15.748	0.91	0.05	0.98	1.0	0.051	35.23	50.01	0.077	1.51	0.94	0.22	0.80	1.06	1.0	0.039	4.99	73.70	0.117	3.71	2.61	2
15.912	0.91	0.05	0.98	1.0	0.051	34.72	48.01	0.076	1.47	0.94	0.21	0.80	1.05	1.0	0.039	4.99	66.36	0.107	3.37	2.42	2
16.076	0.91	0.05	0.98	1.0	0.051	34.62	47.63	0.075	1.47	0.94	0.21	0.80	1.05	1.0	0.039	4.99	64.85	0.105	3.29	2.38	2
16.240	0.91	0.05	0.98	1.0	0.051	35.41	49.99	0.077	1.51	0.94	0.22	0.80	1.05	1.0	0.039	3.76	54.85	0.095	2.96	2.24	2
16.404	0.90	0.05	0.98	1.0	0.051	35.58	50.62	0.078	1.53	0.94	0.22	0.80	1.05	1.0	0.039	3.89	58.50	0.099	3.04	2.29	2
16.568	0.90	0.05	0.98	1.0	0.051	35.07	48.65	0.076	1.49	0.94	0.21	0.80	1.05	1.0	0.039	4.46	60.55	0.101	3.09	2.29	2
16.732	0.90	0.05	0.98	1.0	0.051	35.77	51.35	0.079	1.55	0.94	0.23	0.80	1.05	1.0	0.040	3.73	58.07	0.098	2.99	2.27	2
16.896	0.90	0.05	0.98	1.0	0.051	36.03	52.37	0.080	1.57	0.94	0.23	0.80	1.05	1.0	0.040	3.80	62.13	0.102	3.10	2.33	2
17.060	0.90	0.05	0.98	1.0	0.051	36.08	52.56	0.080	1.58	0.94	0.23	0.80	1.04	1.0	0.040	3.67	60.46	0.101	3.02	2.30	2
17.224	0.90	0.05	0.97	1.0	0.051	36.45	53.97	0.081	1.61	0.94	0.24	0.80	1.04	1.0	0.040	3.44	60.21	0.100	3.00	2.30	2

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.481

Depth at time of CPT (ft)	Depth at t_1, z_1 (m)	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Maximum Shear Modulus, G_{max} (tsf)	P* = $\gamma_{eff}(G_{eff}/G_{max})$ (tsf)	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, $\varepsilon_{v,15}$ (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
0.164	2.96	594	1.6E-03	5.5E+02	9.6E-05	11	0.173	10172	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.328	3.01	594	1.6E-03	5.5E+02	9.7E-05	11	0.174	10108	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.492	3.06	594	1.6E-03	5.5E+02	9.8E-05	11	0.175	10045	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.656	3.11	594	1.6E-03	5.5E+02	1.0E-04	11	0.175	9984	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.820	3.16	594	1.6E-03	5.5E+02	1.0E-04	11	0.176	9924	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.984	3.21	594	1.6E-03	5.5E+02	1.0E-04	11	0.177	9865	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.148	3.26	594	1.6E-03	5.5E+02	1.0E-04	11	0.177	9808	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.312	3.31	594	1.6E-03	5.5E+02	1.1E-04	11	0.178	9751	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.476	3.36	594	1.6E-03	5.5E+02	1.1E-04	11	0.179	9696	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.640	3.41	594	1.6E-03	5.5E+02	1.1E-04	11	0.179	9642	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.804	3.46	594	1.6E-03	5.5E+02	1.1E-04	11	0.180	9589	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.968	3.51	594	1.6E-03	5.5E+02	1.1E-04	11	0.180	9536	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.133	3.56	594	1.6E-03	5.5E+02	1.1E-04	11	0.181	9485	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.297	3.61	594	1.6E-03	5.5E+02	1.2E-04	11	0.182	9435	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.461	3.66	594	1.6E-03	5.5E+02	1.2E-04	11	0.182	9385	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.625	3.71	594	1.6E-03	5.5E+02	1.2E-04	11	0.183	9337	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.789	3.76	594	1.6E-03	5.5E+02	1.2E-04	11	0.183	9289	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.953	3.81	594	1.6E-03	5.5E+02	1.2E-04	11	0.184	9242	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.117	3.86	495	1.6E-03	3.8E+02	1.8E-04	11	0.185	9196	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.281	3.91	495	1.4E-03	3.5E+02	1.9E-04	10	0.185	9397	0.03%	2.00	0.65	0.03%	0.003	0.34	0.079	0.765	0.44%	0.0007
3.445	3.96	495	1.4E-03	3.5E+02	1.9E-04	10	0.186	9355	0.03%	2.00	0.65	0.03%	0.003	0.34	0.079	0.765	0.48%	0.0008
3.609	4.01	495	1.4E-03	3.5E+02	2.0E-04	10	0.187	9313	0.04%	2.00	0.65	0.03%	0.003	0.34	0.079	0.765	0.52%	0.0009
3.773	4.06	495	1.6E-03	3.9E+02	1.8E-04	0	0.191	11669	0.04%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.03%	0.0000
3.937	4.11	495	1.4E-03	3.5E+02	2.0E-04	10	0.188	9227	0.04%	2.00	0.65	0.03%	0.004	0.34	0.079	0.765	0.60%	0.0010
4.101	4.16	495	1.4E-03	3.5E+02	2.0E-04	10	0.188	9187	0.04%	2.00	0.65	0.03%	0.004	0.34	0.079	0.765	0.64%	0.0011
4.265	4.21	495	1.4E-03	3.5E+02	2.1E-04	10	0.189	9148	0.04%	2.00	0.65	0.03%	0.004	0.34	0.079	0.765	0.68%	0.0011
4.429	4.26	495	1.4E-03	3.5E+02	2.1E-04	10	0.189	9109	0.04%	2.00	0.65	0.03%	0.004	0.34	0.079	0.765	0.71%	0.0012
4.593	4.31	495	1.4E-03	3.5E+02	2.1E-04	10	0.190	9071	0.04%	2.00	0.65	0.03%	0.005	0.34	0.079	0.765	0.75%	0.0012
4.757	4.36	495	1.6E-03	3.9E+02	1.9E-04	0	0.194	11373	0.04%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.05%	0.0001
4.921	4.41	495	1.6E-03	3.9E+02	1.9E-04	0	0.194	11322	0.04%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.05%	0.0001
5.085	4.46	495	1.6E-03	3.9E+02	2.0E-04	0	0.195	11272	0.05%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.05%	0.0001
5.249	4.51	495	1.4E-03	3.5E+02	2.2E-04	10	0.192	8913	0.04%	2.00	0.65	0.03%	0.005	0.34	0.079	0.765	0.89%	0.0015
5.413	4.56	495	1.4E-03	3.5E+02	2.2E-04	10	0.192	8877	0.04%	2.00	0.65	0.03%	0.006	0.34	0.079	0.765	0.93%	0.0015
5.577	4.61	495	1.4E-03	3.5E+02	2.2E-04	10	0.193	8842	0.04%	2.00	0.65	0.03%	0.006	0.34	0.079	0.765	0.96%	0.0016
5.741	4.66	495	1.4E-03	3.5E+02	2.3E-04	10	0.193	8808	0.04%	2.00	0.65	0.03%	0.006	0.34	0.079	0.765	0.99%	0.0016
5.905	4.71	495	1.4E-03	3.5E+02	2.3E-04	10	0.193	8774	0.05%	2.00	0.65	0.03%	0.007	0.34	0.079	0.765	1.02%	0.0017
6.069	4.76	495	1.4E-03	3.5E+02	2.3E-04	10	0.194	8740	0.05%	2.00	0.65	0.03%	0.007	0.34	0.079	0.765	1.06%	0.0017
6.234	4.81	495	1.4E-03	3.5E+02	2.3E-04	10	0.194	8707	0.05%	2.00	0.65	0.03%	0.007	0.34	0.079	0.765	1.09%	0.0017
6.398	4.86	495	1.4E-03	3.5E+02	2.3E-04	10	0.195	8674	0.05%	2.00	0.65	0.03%	0.007	0.34	0.079	0.765	1.12%	0.0018
6.562	4.91	495	1.4E-03	3.5E+02	2.4E-04	10	0.195	8642	0.05%	2.00	0.65	0.03%	0.008	0.34	0.079	0.765	1.15%	0.0019
6.726	4.96	495	1.4E-03	3.5E+02	2.4E-04	10	0.196	8610	0.05%	2.00	0.65	0.03%	0.008	0.34	0.079	0.765	1.18%	0.0019
6.890	5.01	495	1.4E-03	3.5E+02	2.4E-04	10	0.196	8578	0.05%	2.00	0.65	0.03%	0.008	0.34	0.079	0.765	1.22%	0.0020
7.054	5.06	495	1.4E-03	3.5E+02	2.4E-04	10	0.197	8547	0.05%	2.00	0.65	0.03%	0.008	0.34	0.079	0.765	1.25%	0.0020
7.218	5.11	495	1.3E-03	3.1E+02	2.7E-04	16	0.449	7010	0.08%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.09%	0.0034
7.382	5.16	495	1.3E-03	3.1E+02	2.8E-04	16	0.449	6988	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.12%	0.0035
7.546	5.21	495	1.6E-03	3.9E+02	2.2E-04	0	0.201	10663	0.06%	2.20	1.00	0.03%	0.001	0.34	0.079	0.765	0.10%	0.0002
7.710	5.26	495	1.6E-03	3.9E+02	2.3E-04	0	0.201	10622	0.06%	2.20	1.00	0.03%	0.001	0.34	0.079	0.765	0.10%	0.0002
7.874	5.31	495	1.4E-03	3.5E+02	2.5E-04	10	0.199	8398	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.40%	0.0023
8.038	5.36	495	1.4E-03	3.5E+02	2.5E-04	10	0.199	8369	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.44%	0.0024
8.202	5.41	495	1.4E-03	3.5E+02	2.6E-04	10	0.200	8340	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.47%	0.0024
8.366	5.46	495	1.4E-03	3.5E+02	2.6E-04	10	0.200	8312	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.50%	0.0025
8.530	5.51	495	1.4E-03	3.5E+02	2.6E-04	10	0.200	8284	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.53%	0.0025
8.694	5.56	495	1.4E-03	3.5E+02	2.6E-04	10	0.201	8256	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.56%	0.0026
8.858	5.61	495	1.4E-03	3.5E+02	2.6E-04	10	0.201	8229	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.59%	0.0026
9.022	5.66	495	1.4E-03	3.5E+02	2.7E-04	10	0.202	8202	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.62%	0.0027
9.186	5.71	495	1.4E-03	3.5E+02	2.7E-04	10	0.202	8175	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.66%	0.0027
9.350	5.76	460	1.3E-03	2.7E+02	3.5E-04	16	0.454	6709	0.14%	2.00	0.65	0.03%	0.024	0.34	0.079	0.765	3.68%	0.0060
9.514	5.81	460	1.3E-03	2.7E+02	3.6E-04	16	0.455	6690	0.14%	2.00	0.65	0.03%	0.024	0.34	0.079	0.765	3.73%	0.0061
9.678	5.86	460	1.4E-03	3.1E+02	3.2E-04	10	0.203	8103	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.63%	0.0043
9.842	5.91	460	1.4E-03	3.1E+02	3.2E-04	10	0.203	8077	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.67%	0.0044
10.006	5.96	460	1.4E-03	3.1E+02	3.2E-04	10	0.204	8052	0.10%	2.00	0.65	0.03%	0.018	0.34	0.079	0.765	2.71%	0.0044
10.170	6.01	460	1.3E-03	2.7E+02	3.7E-04	16	0.456	6609	0.15%	2.00	0.65	0.03%	0.026	0.34	0.079	0.765	3.94%	0.0065
10.335	6.06	460	1.3E-03	2.7E+02	3.7E-04	16	0.456	6591	0.16%	2.00	0.65	0.03%	0.026	0.34	0.079	0.765	3.98%	0.0065
10.499	6.11	460	1.3E-03	2.7E+02	3.7E-04	16	0.457	6573	0.16%	2.00	0.65	0.03%	0.026	0.34	0.079	0.765	4.03%	0.0066
10.663	6.16	460	1.3E-03	2.7E+02	3.7E-04	16	0.457	6555	0.16%	2.00	0.65	0.03%	0.027	0.34	0.079	0.765	4.08%	0.0067
10.827	6.21	460	1.4E-03	3.1E+02	3.3E-04	10	0.206	7940	0.11%	2.00	0.65	0.03%	0.019	0.34	0.079	0.765	2.91%	0.0048
10.991	6.26	460	1.4E-03	3.1E+02	3.4E-04	10	0.206	7916	0.11%	2.00	0.65	0.03%	0.019	0.34	0.079	0.765	2.95%	0.0048
11.155	6.31	460	1.4E-03	3.1E+02	3.4E-04	10	0.206	7892	0.11%	2.00	0.65	0.03%	0.020	0.34	0.079	0.765	3.00%	0.0049
11.319	6.36	460	1.4E-03	3.1E+02	3.4E-04	10	0.207	7868	0.11%	2.00	0.65	0.03%	0.020	0.34	0.079	0.765	3.04%	0.0050
11.483	6.41	460	1.8E-03	3.7E+02	2.8E-04	16	0.459	6454	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.03%	0.0033
11.647	6.46	460	1.8E-03	3.7E+02	2.9E-04	16	0.459	6432	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.07%	0.0034
11.811	6.51	460	1.8E-03	3.7E+02	2.9E-04	16	0.460	6409	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.10%	0.0035
11.975	6.56	460	1.8E-03	3.9E+02	2.8E-04	10	0.209	7757	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.69%	0.0028
12.139	6.61	460	1.8E-03	3.7E+02	2.9E-04	16	0.461	6364	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.18%	0.0036
12.303	6.66	460	1.8E-03	3.7E+02	3.0E-04	16	0.461	6342	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.21%	0.0036
12.467	6.71	460	1.8E-03	3.7E+02	3.0E-04	16	0.462	6321	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.25%	0.0037
12.631	6.76	460	1.8E-03	3.7E+02	3.0E-04	16	0.462	6300	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.28%	0.0037
12.795	6.81	460	1.8E-03	3.7E+02	3.0E-04	16	0.462	6279	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.32%	0.0038
12.959	6.86	460	1.8E-03	3.7E+02	3.1E-04	16	0.463	6258	0.09%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.35%	0.0039
13.123	6.91	460	1.8E-03	3.7E+02	3.1E-04	16	0.463	6238	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.39%	0.0039
13.287	6.96	460	1.8E-03	3.7E+02	3.1E-04	16	0.464	6217	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.43%	0.0040
13.451	7.01	460	1.8E-03	3.7E+02	3.1E-04	16	0.464	6197	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.46%	0.0040
13.615	7.06	460	1.8E-03	3.7E+02	3.1E-04	16	0.464	6178	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.50%	0.0041
13.779	7.11	460	1.8E-03	3.7E+02	3.2E-04	16	0.465	6158	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.53%	0.0042
13.943	7.16	460	1.8E-03	3.7E+02	3.2E-04	16	0.465	6139	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.57%	0.0042
14.107	7.21	460	1.8E-03	3.7E+02	3.2E-04	16	0.466	6120	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.61%	0.0043
14.271	7.26	460	1.8E-03	3.7E+02	3.2E-04	16	0.466	6101	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.64%	0.0043
14.436	7.31	460	1.8E-03	3.7E+02	3.3E-04	16	0.466	6082	0.10%	2.00	0.65	0.03%	0.018	0.34	0.079	0.765	2.68%	0.0044
14.600	7.36	500	1.8E-03	4.6E+02	2.7E-04	10	0.215	7361	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.39%	0.0023
14.764	7.41	500	1.8E-03	4.6E+02	2.7E-04	10	0.216	7338	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.42%	0.0023
14.928	7.46	500	1.8E-03	4.6E+02	2.7E-04	10	0.216	7314	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.45%	0.0024
15.092	7.51	500	1.8E-03	4.4E+02	2.9E-04	16	0.468	6006	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.89%	0.0031
15.256	7.56	500	1.8E-03	4.6E+02	2.7E-04	10	0.217	7270	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.50%	0.0025
15.420	7.61	500	1.8E-03	4.4E+02	2.9E-04	16	0.469	5970	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.95%	0.0032
15.584	7.66	500	1.8E-03	4.4E+02	2.9E-04	16	0.469	5953	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.97%	0.0032
15.748	7.71	500	1.8E-03	4.4E+02	2.9E-04	16	0.470	5935	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.00%	0.0033
15.912	7.76	500	1.8E-03	4.4E+02	3.0E-04	16	0.470	5918	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.03%	0.0033
16.076	7.81	500	1.8E-03	4.4E+02	3.0E-04	16	0.470	5901	0.08%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.06%	0.0034
16.240	7.86	500	1.8E-03	4.6E+02	2.9E-04	10	0.219	7143	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.66%	0.0027
16.404	7.91	500	1.8E-03	4.6E+02	2.9E-04	10	0.220	7121	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.69%	0.0028
16.568	7.96	500	1.8E-03	4.6E+02	2.9E-04	10	0.220	7100	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.72%	0.0028
16.732	8.01	500	1.8E-03	4.6E+02	2.9E-04	10	0.221	7080	0.07%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.74%	0.0029
16.896	8.06	500	1.8E-03	4.6E+02	2.9E-04	10	0.221	7059	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.77%	0.0029
17.060	8.11	500	1.8E-03	4.6E+02	3.0E-04	10	0.221	7038	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.80%	0.0030
17.224	8.16	500	1.8E-03	4.6E+02	3.0E-04	10	0.222	7018	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.83%	0.0030

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W6-S

Data File: 13-52106_SP2W6-S-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Dat

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Parameter	Value	Parameter
5604.40	Water surface elevation during CPT investigation (ft	5615.85	Ground Surface Elevation at time of CPT (ft amsl)
5604.40	Water surface elevation at t_0 (ft amsl)	5625.41	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
5588.59	Water surface elevation at t_1 (ft amsl)	0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pla
5583.59	Water surface elevation at t_2 (ft amsl)	3.50	Thickness of Water Storage/Rooting Zone (ft)
		4.00	Thickness of High Compaction Layer (ft)
1.44	Scaling Factor for stress ration, r_m	1.56	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
0.47	Volumetric Strain Ratio for Site-Specific Design Ear	1065.26	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
7.51	Equiv. Number of Uniform Strain Cycles, N	5583.59	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer	Thickness of Layer (ft)	Unit Weight t (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer	Total Stress at Midpoint of Layer	Equil Pore Pressure at Bottom of Layer	Equil Pore Pressure at Midpoint of Layer (tsf)	Effective Stress at Bottom of Layer	Effective Stress at Midpoint of Layer	Midpoint Depth at t_1, z_1	Shear Wave Velocity, V_s	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
Erosion Protection Layer	######	5625.16	5624.91	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014	0.08	508	1.7E-03	4.4E+02	3.0E-06	11	0.068	46696	0.00%	1.20	0.80	0.04%	0.000	0.32	0.133	0.778	0.00%	0.0000
Water Storage/Rooting Zone Layer	######	5623.16	5621.41	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121	0.69	508	1.7E-03	4.3E+02	2.8E-05	11	0.118	18930	0.00%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
High Compaction Layer	######	5619.41	5617.41	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334	1.83	508	1.9E-03	4.8E+02	6.8E-05	11	0.153	12419	0.01%	0.65	0.75	0.02%	0.000	0.34	0.079	0.765	0.00%	0.0000
Platform/Random Fill Layer	######	5616.63	5615.85	1.56	0.050	101	0.533	0.493	0.00	0.00	0.533	0.493	2.68	508	1.6E-03	4.0E+02	1.2E-04	11	0.169	10568	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
17.388	5598.46	10.4	0.217	9.9	73.6	31.89	2.09%	Slime Tailings	0.057	113.1	0.89	0.19	0.70	1	1.17	11.637	161.76	14.14	14	2.29%	2.8	71%	1.42	0.00	1.42	0
17.552	5598.30	9.6	0.305	9.0	98.4	42.63	3.19%	Slime Tailings	0.057	113.1	0.90	0.19	0.71	1	1.17	10.462	145.41	12.98	12	3.52%	3.0	71%	1.43	0.00	1.43	0
17.716	5598.13	12.3	0.378	11.6	110.0	47.65	3.07%	Slime Tailings	0.057	113.1	0.90	0.20	0.71	1	1.16	13.532	188.09	16.64	16	3.31%	2.9	71%	1.44	0.00	1.44	0
17.880	5597.97	15.9	0.393	15.5	61.9	26.81	2.47%	Slime Tailings	0.057	113.1	0.91	0.20	0.71	1	1.16	17.966	249.73	21.39	21	2.62%	2.7	71%	1.45	0.00	1.45	0
18.044	5597.81	13.0	0.378	12.5	74.4	32.24	2.91%	Slime Tailings	0.057	113.1	0.92	0.21	0.72	1	1.15	14.435	200.65	17.39	17	3.13%	2.8	71%	1.46	0.00	1.46	0
18.208	5597.64	15.2	0.346	14.8	53.4	23.14	2.28%	Sand-Slime Tailings	0.059	119.0	0.93	0.21	0.72	1	1.15	17.001	236.31	20.19	20	2.43%	2.7	47%	1.47	0.00	1.47	0
18.372	5597.48	20.1	0.278	20.0	22.1	9.56	1.38%	Sand-Slime Tailings	0.059	119.0	0.94	0.22	0.73	1	1.13	22.670	315.11	26.51	26	1.45%	2.5	47%	1.48	0.00	1.48	0
18.537	5597.31	25.1	0.274	25.1	0.0	0.00	1.09%	Sand-Slime Tailings	0.059	119.0	0.95	0.22	0.73	1	1.12	28.232	392.43	32.79	33	1.13%	2.3	47%	1.49	0.00	1.49	0
18.701	5597.15	25.6	0.284	25.6	-1.5	-0.63	1.11%	Sand-Slime Tailings	0.059	119.0	0.96	0.23	0.74	1	1.12	28.599	397.53	33.20	33	1.15%	2.3	47%	1.50	0.00	1.50	0
18.865	5596.99	26.1	0.274	26.0	4.6	1.98	1.05%	Sand-Slime Tailings	0.059	119.0	0.97	0.23	0.74	1	1.11	28.952	402.43	33.66	34	1.09%	2.3	47%	1.50	0.00	1.50	0
19.029	5596.82	26.3	0.324	26.2	6.9	2.99	1.23%	Sand-Slime Tailings	0.059	119.0	0.98	0.24	0.75	1	1.11	29.032	403.54	33.77	34	1.28%	2.4	47%	1.51	0.00	1.51	0
19.193	5596.66	19.7	0.359	19.6	11.6	5.03	1.82%	Sand-Slime Tailings	0.059	119.0	0.99	0.24	0.75	1	1.11	21.744	302.25	25.35	25	1.92%	2.6	47%	1.52	0.00	1.52	0
19.357	5596.49	17.3	0.409	17.2	10.2	4.42	2.36%	Sand-Slime Tailings	0.059	119.0	1.00	0.25	0.75	1	1.11	19.087	265.31	22.25	22	2.51%	2.7	47%	1.53	0.00	1.53	0
19.521	5596.33	21.7	0.317	21.6	11.8	5.13	1.46%	Sand-Slime Tailings	0.059	119.0	1.01	0.25	0.76	1	1.10	23.745	330.06	27.67	27	1.53%	2.5	47%	1.54	0.00	1.54	0
19.685	5596.17	22.7	0.488	22.7	9.2	3.99	2.15%	Sand-Slime Tailings	0.059	119.0	1.02	0.26	0.76	1	1.09	24.734	343.80	28.80	28	2.25%	2.6	47%	1.55	0.00	1.55	0
19.849	5596.00	19.2	0.558	19.2	4.8	2.06	2.91%	Slime Tailings	0.057	113.1	1.03	0.26	0.77	1	1.09	20.883	290.27	24.29	24	3.07%	2.7	71%	1.56	0.00	1.56	0
20.013	5595.84	17.8	0.580	17.8	9.9	4.27	3.26%	Slime Tailings	0.057	113.1	1.04	0.27	0.77	1	1.09	19.301	268.29	22.49	22	3.46%	2.8	71%	1.57	0.00	1.57	0
20.177	5595.67	16.5	0.428	16.5	3.3	1.42	2.59%	Slime Tailings	0.057	113.1	1.05	0.27	0.78	1	1.08	17.865	248.32	20.77	20	2.77%	2.7	71%	1.58	0.00	1.58	0
20.341	5595.51	16.1	0.364	15.8	46.6	20.19	2.26%	Sand-Slime Tailings	0.059	119.0	1.06	0.28	0.78	1	1.08	17.027	236.67	20.14	19	2.42%	2.7	47%	1.59	0.00	1.59	0
20.505	5595.35	17.0	0.387	16.6	69.6	30.17	2.27%	Sand-Slime Tailings	0.059	119.0	1.07	0.28	0.79	1	1.07	17.836	247.93	21.26	20	2.42%	2.7	47%	1.60	0.00	1.60	0
20.669	5595.18	17.8	0.559	17.1	110.3	47.80	3.15%	Slime Tailings	0.057	113.1	1.08	0.29	0.79	1	1.07	18.247	253.63	22.05	21	3.35%	2.8	71%	1.61	0.00	1.61	0
20.833	5595.02	20.8	0.452	20.2	105.5	45.73	2.17%	Sand-Slime Tailings	0.059	119.0	1.09	0.29	0.79	1	1.06	21.444	298.07	25.72	25	2.29%	2.6	47%	1.62	0.00	1.62	0
20.997	5594.85	32.5	0.419	32.2	39.9	17.27	1.29%	Sand-Slime Tailings	0.059	119.0	1.10	0.30	0.80	1	1.05	33.912	471.38	39.69	39	1.33%	2.3	47%	1.63	0.00	1.63	0
21.161	5594.69	30.5	0.438	30.5	-5.4	-2.35	1.44%	Sand-Slime Tailings	0.059	119.0	1.11	0.30	0.80	1	1.05	32.002	444.83	37.13	37	1.49%	2.4	47%	1.64	0.00	1.64	0
21.325	5594.52	26.6	0.429	26.6	10.9	4.71	1.61%	Sand-Slime Tailings	0.059	119.0	1.12	0.31	0.81	1	1.05	27.780	386.14	32.35	32	1.68%	2.4	47%	1.65	0.00	1.65	0
21.489	5594.36	31.3	0.445	31.2	10.5	4.56	1.42%	Sand-Slime Tailings	0.059	119.0	1.13	0.31	0.81	1	1.04	32.472	451.36	37.79	37	1.48%	2.4	47%	1.66	0.00	1.66	0
21.653	5594.20	33.9	0.558	33.9	8.4	3.65	1.64%	Sand-Slime Tailings	0.059	119.0	1.14	0.32	0.82	1	1.04	35.087	487.71	40.81	40	1.70%	2.4	47%	1.67	0.00	1.67	0
21.817	5594.03	28.7	0.579	28.7	11.6	5.03	2.01%	Sand-Slime Tailings	0.059	119.0	1.15	0.32	0.82	1	1.03	29.609	411.56	34.48	34	2.10%	2.5	47%	1.68	0.00	1.68	0
21.981	5593.87	32.2	0.577	32.1	12.6	5.46	1.79%	Sand-Slime Tailings	0.059	119.0	1.16	0.33	0.83	1	1.03	33.006	458.78	38.43	38	1.86%	2.4	47%	1.69	0.00	1.69	0
22.145	5593.70	31.5	0.519	31.4	11.5	4.97	1.65%	Sand-Slime Tailings	0.059	119.0	1.17	0.33	0.83	1	1.02	32.168	447.13	37.45	36	1.71%	2.4	47%	1.70	0.00	1.70	0
22.309	5593.54	38.3	0.405	38.2	9.8	4.23	1.06%	Sand-Slime Tailings	0.059	119.0	1.18	0.34	0.84	1	1.02	38.964	541.60	45.33	44	1.09%	2.2	47%	1.71	0.00	1.71	0
22.473	5593.38	36.9	0.465	36.9	8.3	3.58	1.26%	Sand-Slime Tailings	0.059	119.0	1.18	0.34	0.84	1	1.02	37.469	520.81	43.58	43	1.30%	2.3	47%	1.72	0.00	1.72	0
22.638	5593.21	38.4	0.519	38.4	9.0	3.91	1.35%	Sand-Slime Tailings	0.059	119.0	1.19	0.35	0.85	1	1.01	38.805	539.39	45.14	44	1.39%	2.3	47%	1.73	0.00	1.73	0
22.802	5593.05	41.4	0.519	41.3	10.3	4.46	1.25%	Sand-Slime Tailings	0.059	119.0	1.20	0.35	0.85	1	1.01	41.633	578.70	48.43	47	1.29%	2.2	47%	1.74	0.00	1.74	0
22.966	5592.88	42.6	0.493	42.5	9.8	4.23	1.16%	Sand-Slime Tailings	0.059	119.0	1.21	0.36	0.85	1	1.00	42.702	593.55	49.67	48	1.19%	2.2	47%	1.75	0.00	1.75	0
23.130	5592.72	41.6	0.532	41.6	11.5	4.97	1.28%	Sand-Slime Tailings	0.059	119.0	1.22	0.36	0.86	1	1.00	41.593	578.15	48.39	47	1.32%	2.2	47%	1.76	0.00	1.76	0
23.294	5592.56	42.3	0.534	42.2	13.1	5.66	1.26%	Sand-Slime Tailings	0.059	119.0	1.23	0.37	0.86	1	1.00	42.088	585.03	48.98	47	1.30%	2.2	47%	1.77	0.00	1.77	0
23.458	5592.39	47.2	0.593	47.2	13.5	5.86	1.26%	Sand-Slime Tailings	0.059	119.0	1.24	0.37	0.87	1	0.99	46.893	651.82	54.56	53	1.29%	2.2	47%	1.78	0.00	1.78	0
23.622	5592.23	49.1	0.674	49.0	13.7	5.94	1.37%	Sand-Slime Tailings	0.059	119.0	1.25	0.38	0.87	1	0.99	48.576	675.21	56.52	55	1.41%	2.2	47%	1.79	0.00	1.79	0
23.786	5592.06	47.0	0.774	46.9	14.2	6.14	1.65%	Sand-Slime Tailings	0.059	119.0	1.26	0.38	0.88	1	0.99	46.335	644.06	53.92	52	1.69%	2.3	47%	1.80	0.00	1.80	0
23.950	5591.90	41.4	0.772	41.4	13.6	5.88	1.86%	Sand-Slime Tailings	0.059	119.0	1.27	0.39	0.88	1	0.98	40.695	565.65	47.36	46	1.92%	2.4	47%	1.81	0.00	1.81	0
24.114	5591.74	41.1	0.727	41.0	13.4	5.82	1.77%	Sand-Slime Tailings	0.059	119.0	1.28	0.40	0.89	1	0.98	40.240	559.34	46.83	45	1.82%	2.3	47%	1.82	0.00	1.82	0
24.278	5591.57	37.0	0.661	36.9	13.4	5.82	1.79%	Sand-Slime Tailings	0.059	119.0	1.29	0.40	0.89	1	0.98	36.033	500.86	41.95	40	1.85%	2.4	47%	1.82	0.00	1.82	0
24.442	5591.41	32.5	0.603	32.4	13.5	5.86	1.85%	Sand-Slime Tailings	0.059	119.0	1.30	0.41	0.90	1	0.97	31.538	438.38	36.73	35	1.93%	2.4	47%	1.83	0.00	1.83	0
24.606	5591.24	31.6	0.528	31.5	13.5	5.86	1.67%	Sand-Slime Tailings	0.059	119.0	1.31	0.41	0.90	1	0.97	30.546	424.59	35.57	34	1.74%	2.4	47%	1.84	0.00	1.84	0
24.770	5591.08	31.6	0.507	31.5	15.0	6.51	1.60%	Sand-Slime Tailings	0.059	119.0	1.32	0.42	0.91	1	0.97	30.436	423.06	35.45	33	1.67%	2.4	47%	1.85	0.00	1.85	0
24.934	5590.92	32.8	0.414	32.7	16.5	7.16	1.26%	Sand-Slime Tailings	0.059	119.0	1.33	0.42	0.91	1	0.96	31.433	436.92	36.62	35	1.32%	2.4	47%	1.86	0.00	1.86	0
25.098	5590.75	34.3	0.437	34.2	17.3	7.49	1.27%	Sand-Slime Tailings	0.059	119.0	1.34	0.43	0.92	1	0.96	32.804	455.97	38.22	36	1.33%	2.3	47%	1.87	0.00	1.87	0
25.262	5590.59	36.0	0.512	35.9	14.2	6.17	1.42%	Sand-Slime Tailings	0.059	119.0	1.35	0.43	0.92	1	0.96	34.352	477.49	40.00	38	1.48%	2.3	47%	1.88	0.00	1.88	0
25.426	5590.42	41.3	0.688	41.2	15.1	6.55	1.67%	Sand-Slime Tailings	0.059	119.0	1.36	0.44	0.92	1	0.95	39.342	546.86	45.80	43	1.72%	2.3	47%	1.89	0.00	1.89	0
25.590	5590.26	34.2	0.767	34.1	15.3	6.63	2.24%	Sand-Slime Tailings	0.059	119.0	1.37	0.44	0.93	1	0.95	32.336	449.47	37.66	35	2.34%	2.5	47%	1.90	0.00	1.90	0
25.754	5590.10	26.7	0.796	26.6	16.0	6.92	2.98%	Slime Tailings	0.057	113.1	1.38	0.45	0.93	1	0.94	25.105	348.96	29.27	27	3.14%	2.7	71%	1.91	0.00	1.91	0
25.918	5589.93	29.3	0.592	29.2	15.0	6.51	2.02%	Sand-Slime Tailings	0.059	119.0	1.39	0.45	0.94	1	0.94	27.443	381.46	31.98	30	2.12%	2.5	47%	1.92	0.00	1.92	0
26.082	5589.77	35.4	0.454	35.3	14.3	6.19	1.28%	Sand-Slime Tailings	0.059	119.0	1.40	0.46	0.94	1	0.94	33.177	461.16	38.63	36	1.34%	2.3	47%	1.93	0.00	1.93	0
26.246	5589.60	36.2	0.371	36.2	3.2	1.39	1.02%	Sand-Slime Tailings	0.059	119.0	1.41	0.46	0.95	1	0.94	33.911	471.36	39.41	37	1.07%	2.3	47%	1.94	0.00	1.94	0
26.410	5589.44	36.1	0.419	36.1	4.6	1.98	1.16%	Sand-Slime Tailings	0.059	119.0	1.42	0.47	0.95	1	0.93	33.729	468.84	39.21	36	1.21%	2.3	47%	1.95	0.00	1.95	0
26.574	5589.28	33.9	0.531	33.8	12.8	5.56	1.57%	Sand-Slime Tailings	0.059	119.0	1.43	0.47	0.96	1	0.93	31.447	437.12	36.61	34	1.63%	2.4	47%	1.96	0.00	1.96	0
26.739	5589.11	36.3	0.568	36.2	16.5	7.16	1.57%	Sand-Slime Tailings	0.059	119.0	1.44	0.48	0.96	1	0.93	33.570	466.63	39.10	36	1.63%	2.4	47%	1.97	0.00	1.97	0
26.903	5588.95	38.8	0.595	38.7	16.5	7.16	1.53%	Sand-Slime Tailings	0.059	119.0	1.45	0.48	0.97	1	0.93	35.865	498.52	41.77	39	1.59%	2.4	47%	1.98	0.00	1.98	0
27.067	5588.78	39.4	0.647	39.3	18.0	7.81	1.64%	Sand-Slime Tailings	0.059	119.0	1.46	0.49	0.97	1	0.92	36.285	504.36	42.26	39	1.70%	2.4	47%	1.99	0.00	1.99	0
27.231	5588.62	40.3	0.712	40.2	20.4	8.83	1.77%	Sand-Slime Tailings	0.059	119.0	1.47	0.49	0.98	1	0.92	37.005	514.36	43.11	40	1.83%	2.4	47%	2.00	0.00	2.00	0
27.395	5588.46	41.4	0.723	41.3	21.0	9.12	1.75%	Sand-Slime Tailings	0.059	119.0	1.48	0.50	0.98	1	0.92	37.919	527.07	44.18	41	1.81%	2.4	47%	2.01	0.00	2.01	1
27.559	5588.29	42.9	0.670	42.8	19.2	8.30	1.56%	Sand-Slime Tailings	0.059	119.0	1.49	0.50	0.98	1	0.92	39.157	544.29	45.61	42	1.62%	2.3	47%	2.02	0.01	2.01	1
27.723	5588.13	42.3	0.619	42.2	18.1	7.86	1.46%	Sand-Slime Tailings	0.059	119.0	1.50	0.51	0.99	1	0.91	38.500	535.15	44.84	41	1.52%	2.3	47%	2.03	0.01	2.01	1
27.887	5587.96	42.4	0.626	42.2	20.2	8.77	1.48%	Sand-Slime Tailings	0.059	119.0	1.51	0.51	0.99	1	0.91	38.435	534.24	44.77	41	1.53%	2.3	47%	2.04	0.02	2.02	1
28.051	5587.80	39.8	0.634	39.7	20.9	9.07	1.59%	Sand-Slime Tailings	0.059	119.0	1.52	0.52	1.00	1	0.91	35.941	499.57	41.88	38	1.66%	2.4	47%	2.05	0.02	2.02	1
28.215	5587.64	43.4	0.590	43.3	19.6	8.48	1.36%	Sand-Slime Tailings	0.059	119.0	1.53	0.52	1.00	1	0.90	39.142	544.07	45.59	42	1.41%	2.3	47%	2.06	0.03	2.03	1
28.379	5587.47	44.3	0.552	44.2	15.3	6.61	1.25%	Sand-Slime Tailings	0.059	119.0	1.54	0.53	1.01	1	0.90	39.911	554.76	46.45	42	1.29%	2.3	47%	2.07	0.03	2.03	1
28.543	5587.31	44.6	0.539	44.5	16.5	7.16	1.21%	Sand-Slime Tailings	0.059	119.0	1.55	0.53	1.01	1	0.90	40.085	557.18	46.66	43	1.25%	2.3	47%	2.08	0.04	2.04	1
28.707	5587.14	45.4	0.570	45.2	18.3	7.93	1.26%	Sand-Slime Tailings	0.059	119.0	1.56	0.54	1.02	1	0.90	40.610	564.48	47.29	43	1.30%	2.3	47%	2.09	0.05	2.04	1
28.871	5586.98	47.7	0.530	47.6	19.4	8.39	1.11%	Sand Tailings	0.062	123.5	1.57	0.54	1.02	1	0.90	42.658	592.95	49.67	45	1.15%	2.2	18%	2.10	0.05	2.05	1
29.035	5586.81	50.3	0.530	50.2	19.4	8.42	1.05%	Sand Tailings	0.062	123.5	1.58	0.55	1.03	1	0.89	44.933	624.57	52.31	47	1.09%	2.2	18%	2.11	0.06	2.05	1
29.199	5586.65	52.6	0.530	52.4	18.7	8.10	1.01%	Sand Tailings	0.062	123.5	1.59	0.55	1.03	1	0.89	46.851	651.23	54.54	49	1.04%	2.2	18%	2.12	0.06	2.06	1
32.260	5583.59							Sand Tailings	0.062	123.5													2.31	0.11	2.20	1

Liquefaction Triggering Analyses

Depth at time of CPT (ft)	I&B r_d	C_σ	K_σ	K_α	CSR M=7.5, σ'v=1atm	Δq_{c1n}	q_{c1n-cs}	(CRR) M=7.5, σ'v=1atm	FoS	Youd r_d	D_r	f	K_σ	K_α	CSR M=7.5	Kc	q_{c1n-cs}	(CRR) M=7.5	FoS	Avg FoS	Liquefiable? 1=Yes 2=No
17.388	0.90	0.05	0.98	1.0	0.051	35.01	49.19	0.077	1.52	0.94	0.22	0.80	1.04	1.0	0.040	4.98	70.37	0.112	3.34	2.43	2
17.552	0.90	0.05	0.98	1.0	0.051	34.61	47.59	0.075	1.49	0.94	0.21	0.80	1.04	1.0	0.040	6.35	82.50	0.132	3.91	2.70	2
17.716	0.89	0.05	0.97	1.0	0.050	35.88	52.53	0.080	1.59	0.94	0.24	0.80	1.04	1.0	0.040	5.27	87.75	0.143	4.20	2.89	2
17.880	0.89	0.05	0.97	1.0	0.050	37.54	58.93	0.087	1.73	0.94	0.27	0.80	1.04	1.0	0.040	4.01	85.65	0.138	4.05	2.89	2
18.044	0.89	0.05	0.97	1.0	0.050	36.14	53.53	0.081	1.61	0.94	0.24	0.80	1.04	1.0	0.040	5.00	87.01	0.141	4.11	2.86	2
18.208	0.89	0.05	0.97	1.0	0.050	37.38	57.57	0.085	1.70	0.94	0.26	0.80	1.04	1.0	0.040	4.03	81.33	0.130	3.76	2.73	2
18.372	0.89	0.06	0.97	1.0	0.050	39.60	66.11	0.095	1.90	0.93	0.30	0.80	1.03	1.0	0.040	2.63	69.61	0.111	3.20	2.55	2
18.537	0.89	0.06	0.97	1.0	0.050	41.80	74.59	0.105	2.12	0.93	0.33	0.80	1.03	1.0	0.040	2.05	67.17	0.108	3.09	2.61	2
18.701	0.89	0.06	0.97	1.0	0.050	41.95	75.15	0.106	2.14	0.93	0.33	0.80	1.03	1.0	0.040	2.05	68.05	0.109	3.10	2.62	2
18.865	0.89	0.06	0.97	1.0	0.049	42.11	75.77	0.107	2.16	0.93	0.33	0.80	1.03	1.0	0.040	1.99	66.98	0.108	3.05	2.61	2
19.029	0.88	0.06	0.97	1.0	0.049	42.15	75.92	0.107	2.17	0.93	0.34	0.80	1.03	1.0	0.040	2.12	71.66	0.114	3.21	2.69	2
19.193	0.88	0.06	0.97	1.0	0.049	39.19	64.54	0.093	1.88	0.93	0.29	0.80	1.03	1.0	0.040	3.10	78.57	0.125	3.49	2.69	2
19.357	0.88	0.05	0.97	1.0	0.049	38.11	60.36	0.088	1.79	0.93	0.27	0.80	1.03	1.0	0.040	3.85	85.76	0.139	3.85	2.82	2
19.521	0.88	0.06	0.97	1.0	0.049	40.01	67.68	0.097	1.97	0.93	0.30	0.80	1.03	1.0	0.040	2.63	72.87	0.116	3.20	2.58	2
19.685	0.88	0.06	0.97	1.0	0.049	40.40	69.20	0.099	2.01	0.93	0.31	0.80	1.02	1.0	0.040	3.07	88.53	0.145	3.96	2.99	2
19.849	0.88	0.06	0.97	1.0	0.049	38.55	62.84	0.091	1.86	0.93	0.28	0.80	1.02	1.0	0.040	4.03	97.81	0.167	4.56	3.21	2
20.013	0.88	0.05	0.97	1.0	0.049	37.92	60.42	0.088	1.80	0.93	0.27	0.80	1.02	1.0	0.040	4.49	101.07	0.176	4.78	3.29	2
20.177	0.87	0.05	0.97	1.0	0.049	37.32	58.10	0.086	1.75	0.93	0.26	0.80	1.02	1.0	0.040	4.25	88.39	0.144	3.90	2.82	2
20.341	0.87	0.05	0.97	1.0	0.049	37.36	57.50	0.085	1.74	0.93	0.26	0.80	1.02	1.0	0.040	4.08	82.25	0.132	3.54	2.64	2
20.505	0.87	0.05	0.97	1.0	0.049	37.76	59.02	0.087	1.78	0.93	0.27	0.80	1.02	1.0	0.040	3.94	83.73	0.135	3.60	2.69	2
20.669	0.87	0.05	0.97	1.0	0.049	37.77	59.81	0.088	1.80	0.93	0.27	0.80	1.02	1.0	0.040	4.50	99.19	0.171	4.55	3.18	2
20.833	0.87	0.06	0.97	1.0	0.048	39.32	65.04	0.094	1.93	0.93	0.29	0.80	1.02	1.0	0.040	3.37	86.69	0.141	3.73	2.83	2
20.997	0.87	0.06	0.96	1.0	0.048	44.22	83.91	0.118	2.45	0.93	0.36	0.80	1.01	1.0	0.040	1.98	78.44	0.125	3.30	2.88	2
21.161	0.87	0.06	0.96	1.0	0.048	43.32	80.45	0.113	2.36	0.92	0.35	0.80	1.01	1.0	0.040	2.16	80.34	0.128	3.37	2.86	2
21.325	0.87	0.06	0.96	1.0	0.048	41.65	73.99	0.105	2.18	0.92	0.33	0.80	1.01	1.0	0.040	2.50	80.95	0.129	3.39	2.78	2
21.489	0.86	0.06	0.96	1.0	0.048	43.56	81.35	0.114	2.39	0.92	0.35	0.80	1.01	1.0	0.040	2.13	80.68	0.129	3.36	2.87	2
21.653	0.86	0.07	0.96	1.0	0.048	44.62	85.43	0.120	2.52	0.92	0.37	0.80	1.01	1.0	0.040	2.17	88.64	0.145	3.76	3.14	2
21.817	0.86	0.06	0.96	1.0	0.048	42.39	76.87	0.108	2.27	0.92	0.34	0.80	1.01	1.0	0.040	2.68	92.26	0.153	3.96	3.11	2
21.981	0.86	0.06	0.96	1.0	0.048	43.78	82.21	0.116	2.43	0.92	0.36	0.80	1.01	1.0	0.040	2.36	90.58	0.149	3.84	3.13	2
22.145	0.86	0.06	0.96	1.0	0.048	43.43	80.88	0.114	2.40	0.92	0.35	0.80	1.01	1.0	0.040	2.31	86.41	0.140	3.59	2.99	2
22.309	0.86	0.07	0.95	1.0	0.047	46.20	91.53	0.129	2.73	0.91	0.39	0.80	1.01	1.0	0.040	1.70	77.22	0.123	3.14	2.94	2
22.473	0.86	0.07	0.95	1.0	0.047	45.59	89.16	0.126	2.66	0.91	0.38	0.80	1.00	1.0	0.040	1.87	81.40	0.130	3.31	2.99	2
22.638	0.85	0.07	0.95	1.0	0.047	46.13	91.27	0.129	2.74	0.91	0.39	0.80	1.00	1.0	0.040	1.89	85.12	0.137	3.48	3.11	2
22.802	0.85	0.07	0.95	1.0	0.047	47.29	95.72	0.136	2.89	0.91	0.40	0.80	1.00	1.0	0.040	1.76	85.15	0.137	3.47	3.18	2
22.966	0.85	0.07	0.95	1.0	0.047	47.72	97.39	0.138	2.96	0.91	0.41	0.80	1.00	1.0	0.040	1.68	83.56	0.134	3.37	3.16	2
23.130	0.85	0.07	0.95	1.0	0.047	47.27	95.66	0.136	2.90	0.91	0.40	0.80	1.00	1.0	0.040	1.78	85.96	0.139	3.48	3.19	2
23.294	0.85	0.07	0.95	1.0	0.047	47.48	96.46	0.137	2.93	0.91	0.40	0.80	1.00	1.0	0.040	1.76	86.10	0.139	3.47	3.20	2
23.458	0.85	0.07	0.95	1.0	0.046	49.44	104.00	0.149	3.22	0.91	0.43	0.79	1.00	1.0	0.040	1.66	90.30	0.148	3.69	3.45	2
23.622	0.85	0.08	0.95	1.0	0.046	50.12	106.64	0.154	3.32	0.90	0.43	0.78	1.00	1.0	0.040	1.68	95.21	0.160	3.96	3.64	2
23.786	0.85	0.07	0.95	1.0	0.046	49.21	103.13	0.148	3.20	0.90	0.42	0.79	1.00	1.0	0.040	1.87	100.76	0.175	4.31	3.76	2
23.950	0.84	0.07	0.95	1.0	0.046	46.91	94.27	0.133	2.88	0.90	0.40	0.80	1.00	1.0	0.040	2.14	101.19	0.176	4.33	3.61	2
24.114	0.84	0.07	0.95	1.0	0.046	46.73	93.56	0.132	2.86	0.90	0.40	0.80	0.99	1.0	0.040	2.10	98.40	0.169	4.12	3.49	2
24.278	0.84	0.07	0.95	1.0	0.046	45.01	86.96	0.122	2.65	0.90	0.37	0.80	0.99	1.0	0.040	2.26	94.94	0.160	3.89	3.27	2
24.442	0.84	0.06	0.95	1.0	0.046	43.18	79.91	0.113	2.43	0.90	0.35	0.80	0.99	1.0	0.040	2.51	92.27	0.153	3.71	3.07	2
24.606	0.84	0.06	0.95	1.0	0.046	42.78	78.35	0.110	2.39	0.90	0.34	0.80	0.99	1.0	0.040	2.44	86.95	0.141	3.41	2.90	2
24.770	0.84	0.06	0.95	1.0	0.046	42.74	78.19	0.110	2.39	0.89	0.34	0.80	0.99	1.0	0.040	2.41	85.32	0.138	3.32	2.85	2
24.934	0.84	0.06	0.95	1.0	0.046	43.15	79.77	0.112	2.44	0.89	0.35	0.80	0.99	1.0	0.040	2.12	77.71	0.124	2.97	2.71	2
25.098	0.83	0.06	0.95	1.0	0.046	43.71	81.93	0.115	2.51	0.89	0.36	0.80	0.99	1.0	0.040	2.07	79.27	0.126	3.02	2.77	2
25.262	0.83	0.06	0.95	1.0	0.045	44.33	84.32	0.119	2.60	0.89	0.37	0.80	0.99	1.0	0.040	2.12	84.60	0.136	3.25	2.92	2
25.426	0.83	0.07	0.95	1.0	0.045	46.36	92.16	0.130	2.86	0.89	0.39	0.80	0.98	1.0	0.040	2.09	95.76	0.162	3.84	3.35	2
25.590	0.83	0.06	0.95	1.0	0.045	43.51	81.17	0.114	2.51	0.89	0.35	0.80	0.98	1.0	0.040	2.74	103.10	0.182	4.31	3.41	2
25.754	0.83	0.06	0.95	1.0	0.045	40.28	69.55	0.099	2.17	0.89	0.31	0.80	0.98	1.0	0.040	3.74	109.38	0.202	4.76	3.46	2
25.918	0.83	0.06	0.95	1.0	0.045	41.52	73.49	0.104	2.28	0.89	0.33	0.80	0.98	1.0	0.040	2.90	92.83	0.154	3.63	2.96	2
26.082	0.83	0.06	0.95	1.0	0.045	43.85	82.48	0.116	2.56	0.88	0.36	0.80	0.98	1.0	0.040	2.08	80.35	0.128	3.01	2.78	2
26.246	0.82	0.06	0.95	1.0	0.045	44.12	83.53	0.118	2.60	0.88	0.36	0.80	0.98	1.0	0.040	1.88	73.99	0.118	2.75	2.67	2
26.410	0.82	0.06	0.95	1.0	0.045	44.05	83.26	0.117	2.60	0.88	0.36	0.80	0.98	1.0	0.040	1.98	77.62	0.123	2.87	2.74	2
26.574	0.82	0.06	0.95	1.0	0.045	43.14	79.75	0.112	2.49	0.88	0.35	0.80	0.98	1.0	0.040	2.36	86.38	0.140	3.25	2.87	2
26.739	0.82	0.06	0.95	1.0	0.045	44.01	83.12	0.117	2.60	0.88	0.36	0.80	0.98	1.0	0.040	2.26	88.48	0.144	3.34	2.97	2
26.903	0.82	0.07	0.95	1.0	0.045	44.95	86.72	0.122	2.73	0.88	0.37	0.80	0.98	1.0	0.040	2.15	89.86	0.147	3.40	3.06	2
27.067	0.82	0.07	0.95	1.0	0.045	45.12	87.39	0.123	2.75	0.87	0.38	0.80	0.98	1.0	0.040	2.21	93.25	0.155	3.57	3.16	2
27.231	0.82	0.07	0.94	1.0	0.045	45.42	88.54	0.125	2.80	0.87	0.38	0.80	0.98	1.0	0.040	2.26	97.33	0.166	3.80	3.30	2
27.395	0.82	0.07	0.94	1.0	0.045	45.80	89.98	0.127	2.85	0.87	0.38	0.80	0.98	1.0	0.040	2.21	97.80	0.167	3.80	3.33	2
27.559	0.81	0.07	0.94	1.0	0.045	46.30	91.90	0.130	2.91	0.87	0.39	0.80	0.97	1.0	0.040	2.07	94.21	0.158	3.57	3.24	2
27.723	0.81	0.07	0.94	1.0	0.045	46.03	90.86	0.128	2.88	0.87	0.39	0.80	0.97	1.0	0.040	2.03	90.98	0.150	3.38	3.13	2
27.887	0.81	0.07	0.94	1.0	0.045	46.00	90.78	0.128	2.87	0.87	0.39	0.80	0.97	1.0	0.040	2.04	91.41	0.151	3.38	3.13	2
28.051	0.81	0.07	0.94	1.0	0.045	44.99	86.87	0.122	2.74	0.87	0.37	0.80	0.97	1.0	0.040	2.20	92.24	0.153	3.41	3.07	2
28.215	0.81	0.07	0.94	1.0	0.045	46.29	91.88	0.130	2.91	0.87	0.39	0.80	0.97	1.0	0.040	1.95	89.01	0.146	3.22	3.07	2
28.379	0.81	0.07	0.94	1.0	0.045	46.59	93.05	0.132	2.95	0.87	0.39	0.80	0.97	1.0	0.040	1.86	86.56	0.140	3.09	3.02	2
28.543	0.81	0.07	0.94	1.0	0.045	46.67	93.33	0.132	2.95	0.86	0.39	0.80	0.97	1.0	0.040	1.84	85.72	0.139	3.04	3.00	2
28.707	0.80	0.07	0.94	1.0	0.045	46.89	94.17	0.133	2.98	0.86	0.40	0.80	0.97	1.0	0.040	1.85	87.70	0.143	3.11	3.05	2
28.871	0.80	0.07	0.94	1.0	0.045	34.79	84.46	0.119	2.66	0.86	0.41	0.80	0.97	1.0	0.040	1.72	85.44	0.138	2.99	2.83	2
29.035	0.80	0.07	0.94	1.0	0.045	35.46	87.78	0.124	2.77	0.86	0.42	0.79	0.96	1.0	0.040	1.64	85.89	0.139	2.99	2.88	2
29.199	0.80	0.07	0.94	1.0	0.045	36.03	90.57	0.128	2.87	0.86	0.43	0.79	0.96	1.0	0.041	1.58	86.40	0.140	3.00	2.93	2

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.481

Depth at t_1, z_1 m	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Maximum Shear Strain Modulus, G_{max} tsf	P = γ_{eff}*(G_{eff}/G_{max}) tsf	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
8.21	500	1.8E-03	4.4E+02	3.2E-04	16	0.473	5767	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.29%	0.0038
8.26	500	1.8E-03	4.4E+02	3.2E-04	16	0.474	5751	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.32%	0.0038
8.31	500	1.8E-03	4.4E+02	3.2E-04	16	0.474	5736	0.09%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.35%	0.0038
8.36	500	1.8E-03	4.4E+02	3.2E-04	16	0.474	5721	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.37%	0.0039
8.41	500	1.8E-03	4.4E+02	3.2E-04	16	0.475	5706	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.40%	0.0039
8.46	500	1.8E-03	4.6E+02	3.1E-04	10	0.224	6905	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.99%	0.0033
8.51	500	1.8E-03	4.6E+02	3.1E-04	10	0.224	6886	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.02%	0.0033
8.56	500	1.8E-03	4.6E+02	3.1E-04	10	0.225	6868	0.08%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.05%	0.0034
8.61	500	1.8E-03	4.6E+02	3.2E-04	10	0.225	6849	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.08%	0.0034
8.66	500	1.8E-03	4.6E+02	3.2E-04	10	0.225	6831	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.10%	0.0035
8.71	500	1.8E-03	4.6E+02	3.2E-04	10	0.226	6812	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.13%	0.0035
8.76	500	1.8E-03	4.6E+02	3.2E-04	10	0.226	6794	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.16%	0.0035
8.81	500	1.8E-03	4.6E+02	3.2E-04	10	0.227	6776	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.19%	0.0036
8.86	500	1.8E-03	4.6E+02	3.3E-04	10	0.227	6758	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.22%	0.0036
8.91	538	1.8E-03	5.3E+02	2.8E-04	10	0.227	6741	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.52%	0.0025
8.96	538	1.8E-03	5.1E+02	3.0E-04	16	0.479	5542	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.93%	0.0032
9.01	538	1.8E-03	5.1E+02	3.0E-04	16	0.479	5528	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.96%	0.0032
9.06	538	1.8E-03	5.1E+02	3.0E-04	16	0.479	5515	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.98%	0.0032
9.11	538	1.8E-03	5.3E+02	2.9E-04	10	0.229	6674	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.60%	0.0026
9.16	538	1.8E-03	5.3E+02	2.9E-04	10	0.229	6657	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.63%	0.0027
9.21	538	1.8E-03	5.1E+02	3.1E-04	16	0.480	5474	0.08%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.05%	0.0034
9.26	538	1.8E-03	5.3E+02	3.0E-04	10	0.230	6625	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.67%	0.0027
9.31	538	1.8E-03	5.3E+02	3.0E-04	10	0.230	6608	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.69%	0.0028
9.36	538	1.8E-03	5.3E+02	3.0E-04	10	0.230	6592	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.72%	0.0028
9.41	538	1.8E-03	5.3E+02	3.0E-04	10	0.231	6576	0.07%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.74%	0.0029
9.46	538	1.8E-03	5.3E+02	3.0E-04	10	0.231	6560	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.76%	0.0029
9.51	538	1.8E-03	5.3E+02	3.0E-04	10	0.231	6544	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.79%	0.0029
9.56	538	1.8E-03	5.3E+02	3.1E-04	10	0.232	6528	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.81%	0.0030
9.61	538	1.8E-03	5.3E+02	3.1E-04	10	0.232	6512	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.83%	0.0030
9.66	538	1.8E-03	5.3E+02	3.1E-04	10	0.232	6497	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.85%	0.0030
9.71	538	1.8E-03	5.3E+02	3.1E-04	10	0.233	6481	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.88%	0.0031
9.76	538	1.8E-03	5.3E+02	3.1E-04	10	0.233	6466	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.90%	0.0031
9.81	538	1.8E-03	5.3E+02	3.1E-04	10	0.233	6451	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.92%	0.0032
9.86	538	1.8E-03	5.3E+02	3.2E-04	10	0.234	6436	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.95%	0.0032
9.91	538	1.8E-03	5.3E+02	3.2E-04	10	0.234	6421	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.97%	0.0032
9.96	538	1.8E-03	5.3E+02	3.2E-04	10	0.234	6406	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.99%	0.0033
10.01	538	1.8E-03	5.3E+02	3.2E-04	10	0.235	6391	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.01%	0.0033
10.06	538	1.8E-03	5.3E+02	3.2E-04	10	0.235	6377	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.04%	0.0033
10.11	538	1.8E-03	5.3E+02	3.3E-04	10	0.235	6362	0.08%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.06%	0.0034
10.16	538	1.8E-03	5.3E+02	3.3E-04	10	0.236	6348	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.08%	0.0034
10.21	538	1.8E-03	5.3E+02	3.3E-04	10	0.236	6334	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.11%	0.0035
10.26	538	1.8E-03	5.3E+02	3.3E-04	10	0.236	6320	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.13%	0.0035
10.31	538	1.8E-03	5.3E+02	3.3E-04	10	0.237	6306	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.15%	0.0035
10.36	538	1.8E-03	5.3E+02	3.3E-04	10	0.237	6292	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.18%	0.0036
10.41	538	1.8E-03	5.3E+02	3.4E-04	10	0.237	6278	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.20%	0.0036
10.46	594	1.8E-03	6.5E+02	2.8E-04	10	0.238	6264	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.31%	0.0021
10.51	594	1.8E-03	6.5E+02	2.8E-04	10	0.238	6251	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.33%	0.0022
10.56	594	1.8E-03	6.5E+02	2.8E-04	10	0.238	6237	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.34%	0.0022
10.61	594	1.8E-03	6.5E+02	2.8E-04	10	0.239	6224	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.36%	0.0022
10.66	594	1.8E-03	6.5E+02	2.8E-04	10	0.239	6210	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.38%	0.0023
10.71	594	1.8E-03	6.5E+02	2.8E-04	10	0.239	6197	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.40%	0.0023
10.76	594	1.8E-03	6.2E+02	3.0E-04	16	0.490	5101	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.77%	0.0029
10.81	594	1.8E-03	6.5E+02	2.9E-04	10	0.240	6172	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.43%	0.0023
10.86	594	1.8E-03	6.5E+02	2.9E-04	10	0.240	6159	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.45%	0.0024
10.91	594	1.8E-03	6.5E+02	2.9E-04	10	0.240	6146	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.46%	0.0024
10.96	594	1.8E-03	6.5E+02	2.9E-04	10	0.241	6133	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.48%	0.0024
11.01	594	1.8E-03	6.5E+02	2.9E-04	10	0.241	6120	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.50%	0.0025
11.06	594	1.8E-03	6.5E+02	2.9E-04	10	0.241	6108	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.52%	0.0025
11.11	594	1.8E-03	6.5E+02	3.0E-04	10	0.242	6095	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.53%	0.0025
11.16	594	1.8E-03	6.5E+02	3.0E-04	10	0.242	6083	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.55%	0.0025
11.21	594	1.8E-03	6.5E+02	3.0E-04	10	0.242	6071	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.57%	0.0026
11.26	594	1.8E-03	6.5E+02	3.0E-04	10	0.242	6064	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.59%	0.0026
11.31	594	1.8E-03	6.5E+02	3.0E-04	10	0.243	6058	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.61%	0.0026
11.36	594	1.8E-03	6.5E+02	3.0E-04	10	0.243	6052	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.62%	0.0027
11.41	594	1.8E-03	6.5E+02	3.1E-04	10	0.243	6046	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.64%	0.0027
11.46	594	1.8E-03	6.5E+02	3.1E-04	10	0.243	6040	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.66%	0.0027
11.51	594	1.8E-03	6.5E+02	3.1E-04	10	0.243	6035	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.68%	0.0028
11.56	594	1.8E-03	6.5E+02	3.1E-04	10	0.243	6029	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.70%	0.0028
11.61	594	1.8E-03	6.5E+02	3.1E-04	10	0.243	6023	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.72%	0.0028
11.66	594	1.8E-03	6.5E+02	3.1E-04	10	0.244	6018	0.07%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.74%	0.0029
11.71	594	1.9E-03	6.8E+02	3.0E-04	0	0.243	7606	0.08%	5.00	1.00	0.03%	0.003	0.34	0.079	0.765	0.41%	0.0007
11.76	594	1.9E-03	6.8E+02	3.0E-04	0	0.243	7598	0.08%	5.00	1.00	0.03%	0.003	0.34	0.079	0.765	0.41%	0.0007
11.81	594	1.9E-03	6.8E+02	3.1E-04	0	0.243	7591	0.09%	5.00	1.00	0.03%	0.003	0.34	0.079	0.765	0.42%	0.0007
12.75	594	1.9E-03	6.8E+02	3.3E-04	0	0.247	7387	0.10%	5.00	1.00	0.03%	0.004	0.34	0.079	0.765	0.56%	0.0172

Extra layer added to analyze seismic settlement of tailings below the bottom of CPT investigation.

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W7-C

Data File: 13-52106_SP2W7-C-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Parameter
5613.10	Water surface elevation during CPT investigation (ft
5611.32	Water surface elevation at t_0 (ft amsl)
5595.40	Water surface elevation at t_1 (ft amsl)
5590.40	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_σ
0.47	Volumetric Strain Ratio for Site-Specific Design Ear
7.51	Equiv. Number of Uniform Strain Cycles, N
5619.60	Ground Surface Elevation at time of CPT (ft amsl)
5626.65	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pl
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
-0.95	Thickness of Random/Platform Fill on top of existing interim cover (ft)
812.44	Additional Stress due to Final Cover Placement, Δσv (psf)
5590.40	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer	Total Stress at Midpoint of Layer	Equil Pore Pressure at Bottom of Layer	Equil Pore Pressure at Midpoint of Layer (tsf)	Effective Stress at Bottom of Layer	Effective Stress at Midpoint of Layer	Midpoint Depth at t_1, z_1	Shear Wave Velocity, V_s	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	P = γ_{eff}(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, $\varepsilon_{v,15}$ (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
Erosion Protection Layer	######	5626.4	5626.15	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014	0.08	508	1.7E-03	4.4E+02	3.0E-06	11	0.068	46696	0.00%	1.20	0.80	0.04%	0.000	0.32	0.133	0.778	0.00%	0.0000
Water Storage/Rooting Zone Layer	######	5624.4	5622.65	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121	0.69	508	1.7E-03	4.3E+02	2.8E-05	11	0.118	18930	0.00%	0.65	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
High Compaction Layer	######	5620.65	5618.65	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334	1.83	508	1.9E-03	4.8E+02	6.8E-05	11	0.153	12419	0.01%	0.65	0.75	0.02%	0.000	0.34	0.079	0.765	0.00%	0.0000
Platform/Random Fill Layer	######	5619.13	5619.60	-0.95	0.050	101	0.406	0.430	0.00	0.00	0.406	0.430	2.29	508	1.6E-03	4.0E+02	1.0E-04	11	0.164	11187	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1 / Liquefaction Triggering Analyses (Idriss & Boulanger (2008); Youd et al. (2001))

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Pore Pressure at time of CPT (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q	Normalized Friction Ratio, F (%)	Type Index, Ic	FC %	Total Stress at t_1 (tsf)	Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No	I&B r_d	I&B C_σ	I&B K_σ	I&B K_α	I&B CSR M=7.5 σ'=1atm	I&B Δq_{c1n}	I&B q_{c1n-cs}	I&B (CRR) M=7.5 σ'=1atm	I&B FoS	Youd r_d	Youd D_r	Youd f	Youd K_σ	Youd K_α	Youd CSR	Youd K_c	Youd q_{c1n-cs}	Youd (CRR) M=7.5	Youd FoS	Avg FoS	Liquefiable? 1=Yes 2=No
0.164	5619.44	37.3	0.106	37.3	3.0	1.31	0.28%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0	1.70	63.359	880.69	73.63	4513	0.28%	0.7	51%	0.41	0.00	0.41	0	1.00	0.09	1.06	1.0	0.061	56.16	129.78	0.202	3.29	0.98	0.50	0.75	3.16	1.0	0.014	1.00	73.63	0.117	281.58	142.44	2
0.328	5619.27	49.3	0.150	49.3	3.1	1.34	0.30%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	83.827	######	97.40	2985	0.30%	0.7	51%	0.42	0.00	0.42	0	1.00	0.10	1.07	1.0	0.062	64.50	161.90	0.339	5.46	0.98	0.57	0.72	3.08	1.0	0.014	1.00	97.40	0.166	199.54	102.50	2
0.492	5619.11	59.2	0.224	59.1	4.5	1.95	0.38%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	100.521	######	116.80	2386	0.38%	0.8	51%	0.43	0.00	0.43	0	1.00	0.12	1.08	1.0	0.063	71.31	188.12	0.701	11.18	0.98	0.62	0.69	3.02	1.0	0.014	1.00	116.80	0.228	183.03	97.10	2
0.656	5618.94	63.9	0.317	63.8	2.3	0.98	0.50%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0	1.70	108.528	######	126.08	1931	0.50%	0.9	51%	0.44	0.00	0.44	0	1.00	0.13	1.09	1.0	0.063	74.56	200.64	1.000	15.90	0.98	0.65	0.68	2.88	1.0	0.015	1.00	126.08	0.266	160.29	88.10	2
0.820	5618.78	65.3	0.442	65.3	2.3	1.01	0.68%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0	1.70	110.925	######	128.86	1579	0.68%	1.1	51%	0.45	0.00	0.45	0	1.00	0.13	1.09	1.0	0.063	75.54	204.40	1.000	15.91	0.98	0.66	0.67	2.71	1.0	0.016	1.00	128.86	0.279	134.37	75.14	2
0.984	5618.62	74.0	0.500	74.0	6.1	2.66	0.68%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0	1.70	125.766	######	146.15	1492	0.68%	1.1	51%	0.46	0.00	0.46	0	1.00	0.15	1.10	1.0	0.063	81.61	227.75	1.000	15.75	0.98	0.70	0.65	2.71	1.0	0.016	1.00	146.15	0.370	148.67	82.21	2
1.148	5618.45	70.5	0.458	70.5	1.5	0.67	0.65%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0	1.70	119.799	######	139.16	1218	0.65%	1.1	51%	0.46	0.00	0.46	0	1.00	0.15	1.09	1.0	0.063	79.16	218.31	1.000	15.87	0.98	0.68	0.66	2.51	1.0	0.017	1.00	139.16	0.328	113.82	64.85	2
1.312	5618.29	76.0	0.403	76.0	0.8	0.34	0.53%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	129.234	######	150.11	1149	0.53%	1.0	51%	0.47	0.00	0.47	0	1.00	0.16	1.10	1.0	0.063	83.00	233.11	1.000	15.78	0.98	0.71	0.65	2.48	1.0	0.017	1.00	150.11	0.395	118.90	67.34	2
1.476	5618.12	71.1	0.468	71.1	3.0	1.32	0.66%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	120.887	######	140.44	956	0.66%	1.1	51%	0.48	0.00	0.48	0	1.00	0.15	1.09	1.0	0.063	79.61	220.05	1.000	15.93	0.98	0.68	0.66	2.31	1.0	0.019	1.00	140.44	0.338	90.47	53.20	2
1.640	5617.96	69.3	0.535	69.3	1.0	0.42	0.77%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0	1.70	117.742	######	136.76	837	0.77%	1.2	51%	0.49	0.00	0.49	0	1.00	0.14	1.08	1.0	0.062	78.31	215.08	1.000	16.00	0.98	0.68	0.66	2.21	1.0	0.020	1.00	136.76	0.318	76.70	46.35	2
1.804	5617.80	67.9	0.630	67.9	1.5	0.63	0.93%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0	1.70	115.362	######	134.00	746	0.93%	1.3	51%	0.50	0.00	0.50	0	1.00	0.14	1.08	1.0	0.062	77.35	211.35	1.000	16.07	0.98	0.67	0.67	2.12	1.0	0.020	1.00	134.00	0.304	66.66	41.36	2
1.968	5617.63	62.3	0.676	62.3	2.1	0.91	1.08%	Interim Cover	0.050	100.7	0.10	0.00	0.10	0	1.70	105.927	######	123.05	628	1.09%	1.4	51%	0.51	0.00	0.51	0	1.00	0.13	1.07	1.0	0.062	73.50	196.56	0.871	15.83	0.98	0.64	0.68	2.00	1.0	0.021	1.00	123.05	0.253	50.97	33.40	2
2.133	5617.47	58.0	0.590	58.0	0.7	0.30	1.02%	Interim Cover	0.050	100.7	0.11	0.00	0.11	0	1.70	98.566	######	114.49	539	1.02%	1.4	51%	0.51	0.00	0.51	0	1.00	0.12	1.06	1.0	0.061	70.50	184.98	0.628	10.25	0.98	0.62	0.69	1.90	1.0	0.023	1.00	114.49	0.220	40.80	25.53	2
2.297	5617.30	56.9	0.428	56.9	1.5	0.65	0.75%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	96.730	######	112.36	491	0.75%	1.3	51%	0.52	0.00	0.52	0	1.00	0.12	1.06	1.0	0.061	69.75	182.12	0.572	9.37	0.98	0.61	0.69	1.85	1.0	0.023	1.00	112.36	0.212	36.58	22.98	2
2.461	5617.14	58.9	0.597	58.9	2.3	0.99	1.01%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	100.062	######	116.24	474	1.02%	1.5	51%	0.53	0.00	0.53	0	1.00	0.12	1.06	1.0	0.061	71.11	187.36	0.682	11.18	0.98	0.62	0.69	1.83	1.0	0.024	1.00	116.24	0.226	36.44	23.81	2
2.625	5616.98	67.5	0.562	67.5	1.5	0.63	0.83%	Interim Cover	0.050	100.7	0.13	0.00	0.13	0	1.70	114.801	######	133.35	510	0.83%	1.4	51%	0.54	0.00	0.54	0	1.00	0.14	1.07	1.0	0.061	77.12	210.47	1.000	16.43	0.98	0.67	0.67	1.87	1.0	0.023	1.00	133.35	0.301	45.43	30.87	2
2.789	5616.81	68.3	0.681	68.3	1.1	0.49	1.00%	Interim Cover	0.050	100.7	0.14	0.00	0.14	0	1.70	116.076	######	134.83	485	1.00%	1.5	51%	0.55	0.00	0.55	0	0.99	0.14	1.06	1.0	0.061	77.64	212.47	1.000	16.34	0.98	0.67	0.66	1.84	1.0	0.023	1.00	134.83	0.308	43.82	30.08	2
2.953	5616.65	72.4	0.913	72.4	0.1	0.04	1.26%	Interim Cover	0.050	100.7	0.15	0.00	0.15	0	1.70	123.114	######	142.99	486	1.26%	1.5	51%	0.55	0.00	0.55	0	0.99	0.15	1.07	1.0	0.061	80.50	223.49	1.000	16.32	0.98	0.69	0.65	1.83	1.0	0.023	1.00	142.99	0.352	47.32	31.82	2
3.117	5616.48	67.6	0.613	67.6	0.1	0.04	0.91%	Interim Cover	0.050	100.7	0.16	0.00	0.16	0	1.70	114.869	######	133.41	429	0.91%	1.4	51%	0.56	0.00	0.56	0	0.99	0.14	1.06	1.0	0.061	77.14	210.55	1.000	16.45	0.98	0.67	0.67	1.76	1.0	0.024	1.00	133.41	0.301	38.34	27.39	2
3.281	5616.32	81.3	2.130	81.3	-0.3	-0.12	2.62%	Sand-Slime Tailings	0.047	93.3	0.16	0.00	0.16	0	1.70	138.261	######	160.58	493	2.62%	1.8	47%	0.57	0.00	0.57	0	0.99	0.18	1.07	1.0	0.062	86.62	247.20	1.000	16.26	0.98	0.73	0.63	1.83	1.0	0.023	1.12	179.35	1.000	121.56	68.91	2
3.445	5616.16	80.0	1.732	79.9	8.4	3.65	2.17%	Sand-Slime Tailings	0.047	93.3	0.17	0.00	0.16	0	1.70	135.864	######	157.90	463	2.17%	1.8	47%	0.58	0.00	0.58	0	0.99	0.17	1.07	1.0	0.062	85.68	243.58	1.000	16.34	0.98	0.73	0.64	1.79	1.0	0.024	1.07	169.42	1.000	116.20	66.27	2
3.609	5615.99	65.9	1.776	65.8	3.9	1.68	2.70%	Sand-Slime Tailings	0.047	93.3	0.18	0.00	0.18	0	1.70	111.911	######	130.03	365	2.70%	1.9	47%	0.59	0.00	0.59	0	0.99	0.14	1.05	1.0	0.060	75.90	205.93	1.000	16.60	0.98	0.66	0.67	1.67	1.0	0.026	1.18	152.78	0.412	45.82	31.21	2
3.773	5615.83	50.8	1.506	50.8	2.8	1.21	2.96%	Sand-Slime Tailings	0.047	93.3	0.19	0.00	0.19	0	1.70	86.343	######	100.32	270	2.98%	2.0	47%	0.59	0.00	0.59	0	0.99	0.11	1.04	1.0	0.059	65.48	165.80	0.369	6.21	0.97	0.58	0.71	1.55	1.0	0.028	1.28	128.71	0.278	29.73	17.97	2
3.937	5615.66	56.3	1.282	56.3	3.5	1.52	2.28%	Sand-Slime Tailings	0.047	93.3	0.20	0.00	0.20	0	1.70	95.642	######	111.13	287	2.29%	1.9	47%	0.60	0.00	0.60	0	0.99	0.12	1.04	1.0	0.060	69.27	180.40	0.542	9.11	0.97	0.61	0.70	1.57	1.0	0.027	1.17	129.62	0.283	29.01	19.06	2
4.101	5615.50	62.9	1.087	62.9	1.5	0.65	1.73%	Sand-Slime Tailings	0.047	93.3	0.20	0.00	0.20	0	1.70	106.913	######	124.19	309	1.73%	1.8	47%	0.61	0.00	0.61	0	0.99	0.13	1.04	1.0	0.060	73.86	198.05	1.000	16.77	0.97	0.64	0.68	1.59	1.0	0.027	1.08	133.72	0.302	29.89	23.33	2
4.265	5615.33	59.1	1.275	59.1	0.2	0.10	2.16%	Sand-Slime Tailings	0.047	93.3	0.21	0.00	0.21	0	1.70	100.402	######	116.61	280	2.17%	1.9	47%	0.62	0.00	0.62	0	0.99	0.12	1.04	1.0	0.059	71.20	187.81	0.693	11.68	0.97	0.62	0.69	1.55	1.0	0.028	1.16	134.72	0.307	29.29	20.48	2
4.429	5615.17	53.9	1.413	53.9	6.9	3.00	2.62%	Sand-Slime Tailings	0.047	93.3	0.22	0.00	0.22	0	1.70	91.630	######	106.51	246	2.63%	2.0	47%	0.62	0.00	0.62	0	0.99	0.11	1.04	1.0	0.059	67.66	174.16	0.453	7.68	0.97	0.60	0.70	1.51	1.0	0.029	1.25	133.61	0.302	27.76	17.72	2
4.593	5615.01	52.0	1.603	52.0	1.0	0.44	3.08%	Sand-Slime Tailings	0.047	93.3	0.23	0.00	0.23	0	1.70	88.468	######	102.76	229	3.09%	2.0	47%	0.63	0.00	0.63	0	0.98	0.11	1.03	1.0	0.059	66.34	169.10	0.399	6.77	0.97	0.59	0.71	1.48	1.0	0.029	1.35	139.13	0.330	29.37	18.07	2
4.757	5614.84	50.3	1.706	50.2	1.6	0.71	3.40%	Sand-Slime Tailings	0.047	93.3	0.23	0.00	0.23	0	1.70	85.408	######	99.22	214	3.41%	2.1	47%	0.64	0.00	0.64	0	0.98	0.11	1.03	1.0	0.059	65.10	164.31	0.357	6.09	0.97	0.58	0.71	1.46	1.0	0.029	1.44	142.65	0.350	30.10	18.09	2
4.921	5614.68	56.7	1.658	56.7	1.0	0.41	2.93%	Sand-Slime Tailings	0.047	93.3	0.24	0.00	0.24	0	1.70	96.339	######	111.90	234	2.94%	2.0	47%	0.65	0.00	0.65	0	0.98	0.12	1.03	1.0	0.059	69.55	181.45	0.560	9.54	0.97	0.61	0.69	1.48	1.0	0.029	1.32	147.75	0.379	31.66	20.60	2
5.085	5614.51	41.7	0.963	41.7	2.7	1.19	2.31%	Sand-Slime Tailings	0.047	93.3	0.25	0.00	0.25	0	1.70	70.856	984.90	82.33	167	2.32%	2.0	47%	0.65	0.00	0.65	0	0.98	0.09	1.03	1.0	0.058	59.18	141.50	0.238	4.08	0.97	0.52	0.74	1.38	1.0	0.031	1.32	109.07	0.201	16.21	10.15	2
5.249	5614.35	52.5	1.083	52.5	3.5	1.53	2.06%	Sand-Slime Tailings	0.047	93.3	0.26	0.00	0.26	0	1.70	89.199	######	103.64	204	2.07%	1.9	47%	0.66	0.00	0.66	0	0.98	0.11	1.03	1.0	0.058	66.65	170.29	0.410	7.03	0.97	0.59	0.71	1.43	1.0	0.030	1.21	125.85	0.265	20.81	13.92	2
5.413	5614.19	21.3	0.563	21.3	1.4	0.60	2.64%	Sand-Slime Tailings	0.047	93.3	0.26	0.00	0.26	0	1.70	36.210	503.32	42.07	80	2.68%	2.3	47%	0.67	0.00	0.67	0	0.98	0.07	1.02	1.0	0.058	45.06	87.13	0.123	2.13	0.97	0.37	0.80	1.27	1.0	0.034	1.87	78.68	0.125	9.54	5.84	2
5.577	5614.02	22.2	0.545	22.2	0.6	0.28	2.46%	Sand-Slime Tailings	0.047	93.3	0.27	0.00	0.27	0	1.70	37.706	524.11	43.80	81	2.49%	2.2	47%	0.68	0.00	0.68	0	0.98	0.07	1.02	1.0	0.058	45.66	89.46	0.126	2.19	0.97	0.38	0.80	1.26	1.0	0.034	1.79	78.56	0.125	9.26	5.73	2
5.741	5613.86	18.0	0.373	18.0	0.3	0.13	2.07%	Sand-Slime Tailings	0.047	93.3	0.28	0.00	0.28	0	1.70	30.668	426.29	35.62	64	2.10%	2.3	47%	0.69	0.00	0.69	0	0.98	0.07	1.01	1.0	0.058	42.80	78.42	0.110	1.93	0.97	0.34	0.80	1.25	1.0	0.034	1.86	66.24	0.107	7.71	4.82	2
5.905	5613.69	7.7	0.333	7.7	3.8	1.64	4.34%	Slime Tailings	0.041	82.7	0.29	0.00	0.29	0	1.70	13.005	180.77	15.15	26	4.51%	2.8	71%	0.69	0.00	0.69	0	0.98	0.05	1.01	1.0	0.057	35.36	50.52	0.078	1.37	0.97	0.22	0.80	1.25	1.0	0.034	4.65	70.38	0.112	7.91	4.64	2
6.069	5613.53	10.4	0.134	10.3	9.4	4.09	1.29%	Sand-Slime Tailings	0.047	93.3	0.29	0.00	0.29	0	1.70	17.544	243.86	20.49	34	1.33%	2.4	47%	0.70	0.00	0.70	0	0.98	0.05	1.01	1.0	0.057	37.49	57.98	0.086	1.50	0.97	0.26	0.80	1.24	1.0	0.035	2.14	43.82	0.080	5.93	3.72	2
6.234	5613.37	11.4	0.206	11.4	8.9	3.87	1.80%	Sand-Slime Tailings	0.047	93.3	0.30	0.00	0.30	0	1.70	19.363	269.15	22.60	37	1.85%	2.4	47%	0.71	0.00	0.71	0	0.98	0.05	1.01	1.0	0.057	38.23	60.83	0.089	1.56	0.97	0.27	0.80	1.23	1.0	0.035	2.37	53.60	0.094	6.31	3.93	2
6.398	5613.20	13.7	0.185	13.7	7.0	3.05	1.35%	Sand-Slime Tailings	0.047	93.3	0.31	0.00	0.31	0	1.70	23.239	323.02	27.08	43	1.38%	2.3	47%	0.72	0.00	0.72	0	0.97	0.06	1.01	1.0	0.057	39.80	66.87	0.096	1.68	0.97	0.30	0.80	1.23	1.0	0.035	1.89	51.26	0.093	6.03	3.86	2
6.562	5613.04	12.1	0.174	12.0	6.7	2.91	1.44%	Sand-Slime Tailings	0.059	119.0	0.32	0.00	0.32	1	1.70	20.417	283.80	23.80	37	1.48%	2.4	47%	0.73	0.00	0.73	0	0.97	0.06	1.01	1.0	0.057	38.65	62.44	0.091	1.60	0.97	0.28	0.80	1.22	1.0	0.035	2.14	50.86	0.092	5.87	3.73	2
6.726	5612.87	13.0	0.171	13.0	6.5	2.83	1.32%	Sand-Slime Tailings	0.059	119.0	0.33	0.01	0.32	1	1.70	22.032	306.24	25.67	39	1.35%	2.3	47%	0.73	0.00	0.73	0	0.97	0.06	1.01	1.0	0.057	39.30	64.97	0.094	1.65	0.97	0.29	0.80	1.22	1.0	0.035	1.98	50.86	0.092	5.79	3.72	2
6.890	5612.71	12.7	0.139	12.6	5.2	2.27	1.10%	Sand-Slime Tailings	0.059	119.0	0.34	0.01	0.33	1	1.70	21.488	298.68	25.02	38	1.13%	2.3	47%	0.74	0.00	0.74	0	0.97	0.06	1.01	1.0	0.057	39.08	64.10	0.093	1.63	0.97	0.29	0.80	1.21	1.0	0.035	1.89	47.20	0.089	5.53	3.58	2
7.054	5612.55	17.0	0.146	16.9	6.6	2.86	0.86%	Sand-Slime Tailings	0.059	119.0	0.35	0.02	0.33	1	1.70	28.747	399.58	33.47	50	0.88%	2.1	47%	0.75	0.00	0.75	0	0.97	0.06	1.01	1.0	0.057	42.04	75.51	0.107	1.89	0.97	0.33	0.80	1.21	1.0	0.035	1.49	49.82	0.091	5.58	3.74	2
7.218	5612.38	20.2	0.150	20.2	3.0	1.29	0.74%	Sand-Slime Tailings	0.059	119.0	0.36	0.02	0.34	1	1.70	34.272	476.38	39.84	59	0.76%	2.0	47%	0.76	0.00	0.76	0	0.97	0.06	1.01	1.0	0.056	44.27	84.12	0.118	2.10	0.97	0.36	0.80	1.21	1.0	0.035	1.35	53.46	0.094	5.65	3.87	2
7.382	5612.22	19.8	0.235	19.8	2.2	0.97	1.18%	Sand-Slime Tailings	0.059	119.0	0.37	0.03	0.34	1	1.70	33.711	468.58	39.18	57	1.21%	2.2	47%	0.77	0.00	0.77	0	0.97	0.06	1.01	1.0	0.056	44.04	83.22	0.117	2.08	0.97	0.36	0.80	1.20	1.0	0.035	1.55	60.90	0.101	6.00	4.04	2
7.546	5612.05	17.7	0.285	17.7	2.4	1.03	1.61%	Sand-Slime Tailings	0.059	119.0	0.38	0.03	0.34	1	1.70	30.022	417.31	34.90	50	1.65%	2.3	47%	0.78	0.00	0.78	0	0.97	0.06	1.01	1.0	0.056	42.54	77.44	0.109	1.94	0.97	0.34	0.80	1.20	1.0	0.035	1.88	65.77	0.106	6.24	4.09	2
7.710	5611.89	13.4	0.165	13.3	4.3	1.85	1.24%	Sand-Slime Tailings	0.059	119.0	0.39	0.04	0.35	1	1.70	22.661	314.99	26.37	37	1.27%	2.3	47%	0.79	0.00	0.79	0	0.97	0.06	1.00	1.0	0.056	39.55	65.92	0.095	1.69	0.97	0.30	0.80	1.20	1.0	0.036	2.00	52.82	0.094	5.42	3.56	2
7.874	5611.73	9.6	0.188	9.6	6.8	2.93	1.96%	Slime Tailings	0.057	113.1	0.40	0.04	0.35	1	1.70	16.269	226.14	18.98	26	2.04%	2.6	71%	0.80	0.00	0.80	0	0.96	0.05	1.00	1.0	0.056	36.70	55.68	0.083	1.49	0.97	0.25	0.80	1.19	1.0	0.036	3.10	58.76	0.099	5.66	3.57	2
8.038	5611.56	13.1	0.151	13.1	10.1	4.39	1.15%	Sand-Slime Tailings	0.059	119.0	0.41	0.05	0.36	1	1.70	22.219	308.84	25.93	36	1.19%	2.3	47%	0.81	0.00	0.81	0	0.96	0.06	1.00	1.0	0.056	39.40	65.33	0.094	1.68	0.96	0.29	0.80	1.19	1.0	0.036	2.00	51.81	0.093	5.25	3.47	2
8.202	5611.40	15.0	0.146	15.0	9.8	4.25	0.97%	Sand-Slime Tailings	0.059	119.0	0.42	0.05	0.36	1	1.70	25.449	353.74	29.68	40	1.00%	2.2	47%	0.82	0.00	0.82	0	0.96	0.06	1.00	1.0	0.056	40.71	70.39	0.100	1.79	0.96	0.31	0.80	1.19	1.0	0.036	1.74	51.61	0.093	5.18	3.49	2
8.366	5611.23	23.6	0.220	23.6	9.0	3.91	0.93%	Sand-Slime Tailings	0.059	119.0	0.43	0.06	0.37	1	1.70	40.086	557.20	46.67	63	0.95%	2.1	47%	0.83	0.00	0.83	0	0.96	0.07	1.00	1.0	0.056	46.67	93.34	0.132	2.37	0.96	0.39	0.80	1.19	1.0	0.036	1.38	64.29	0.105	5.77	4.07	2
8.530	5611.07	19.7	0.264	19.7	4.3	1.88	1.34%	Sand-Slime Tailings	0.059	119.0	0.44	0.06	0.37	1	1.70	33.473	465.27	38.93	52	1.37%	2.2	47%	0.84	0.00	0.84	0	0.96	0.06	1.00	1.0	0.056	43.95	82.89	0.117	2.10	0.96	0.36	0.80	1.18	1.0	0.036	1.71	66.71	0.108	5.86	3.98	2
8.694	5610.91	18.6	0.186	18.5	5.3	2.28	1.00%	Sand-Slime Tailings	0.059	119.0	0.45	0.07	0.38	1	1.70	31.518	438.10	36.67	48	1.03%	2.2	47%	0.85	0.00	0.85	0	0.96	0.06	1.00	1.0	0.056	43.16	79.83	0.112	2.02	0.96	0.35	0.80	1.18	1.0	0.036	1.60	58.60	0.099	5.31	3.67	2
8.858	5610.74	20.2	0.179	20.2	4.2	1.83	0.88%	Sand-Slime Tailings	0.059	119.0	0.46	0.07	0.38	1	1.70	34.340	477.33	39.94	52	0.91%	2.1	47%	0.86	0.00	0.86	0	0.96	0.06	1.00	1.0	0.055	44.31	84.24	0.119	2.14	0.96	0.36	0.80	1.18	1.0	0.036	1.48	59.08	0.099	5.27	3.71	2
9.022	5610.58	17.5	0.248	17.5	1.3	0.56	1.42%	Sand-Slime Tailings	0.059	119.0	0.46	0.08	0.39	1	1.70	29.750	413.53	34.57	44	1.46%	2.3	47%	0.87	0.00	0.87	0	0.96	0.06	1.00	1.0	0.055	42.43	76.99	0.109	1.96	0.96	0.34	0.80	1.17	1.0	0.036	1.92	66.25	0.107	5.63	3.79	2
9.186	5610.41	11.5	0.137	11.5	1.4	0.62	1.19%	Sand-Slime Tailings	0.059	119.0	0.47	0.08	0.39	1	1.70	19.584	272.22	22.76	28	1.24%	2.4	47%	0.88	0.00	0.88	0	0.96	0.05	1.00	1.0	0.055	38.29	61.05	0.089	1.61	0.96	0.28	0.80	1.17	1.0	0.036	2.34	53.38	0.094	4.89	3.25	2
9.350	5610.25	8.4	0.124	8.3	6.1	2.63	1.48%	Sand-Slime Tailings	0.059	119.0	0.48	0.09	0.40	1	1.70	14.178	197.07	16.54	20	1.57%	2.6	47%	0.89	0.00	0.89	0	0.96	0.05	1.00	1.0	0.055	36.10	52.64	0.080	1.45	0.96	0.23	0.80	1.17	1.0	0.036	3.27	54.12	0.095	4.87	3.16	2
9.514	5610.09	6.6	0.048	6.4	25.6	11.08	0.73%	Slime Tailings	0.057	113.1	0.49	0.09	0.40	1	1.70	10.897	151.47	12.97	15	0.79%	2.5	71%	0.90	0.00	0.90	0	0.95	0.05	1.00	1.0	0.055	34.60	47.58	0.075	1.37	0.96	0.21	0.80	1.17	1.0	0.036	3.01	39.09	0.083	4.20	2.78	2
9.678	5609.92	7.3	0.052	7.1	34.6	14.98	0.72%	Sand-Slime Tailings	0.059	119.0	0.50	0.10	0.40	1	1.70	11.985	166.59	14.35	17	0.77%	2.5	47%	0.91	0.00	0.91	0	0.95	0.05	1.00	1.0	0.055	35.33	49.68	0.077	1.40	0.96	0.22	0.80	1.16	1.0	0.036	2.79	40.00	0.083	4.19	2.80	2
9.842	5609.76	7.7	0.118	7.4	48.9	21.19	1.54%	Slime Tailings	0.057	113.1	0.51	0.10	0.41	1	1.70	12.529	174.15	15.15	18	1.65%	2.6	71%	0.92	0.00	0.92	0	0.95	0.05	1.00	1.0	0.055	35.36	50.52	0.078	1.42	0.96	0.22	0.80	1.16	1.0	0.036	3.64	55.20	0.096	4.76	3.09	2
10.006	5609.59	9.2	0.064	8.8	56.4	24.42	0.70%	Sand-Slime Tailings	0.059	119.0	0.52	0.11	0.41	1	1.70	15.028	208.89	18.15	21	0.74%	2.4	47%	0.93	0.00	0.93	0	0.95	0.05	1.00	1.0	0.055	36.67	54.82	0.082	1.50	0.96	0.25	0.80	1.16	1.0	0.037	2.34	42.55	0.085	4.21	2.86	2
10.170	5609.43	12.6	0.064	12.5	12.0	5.22	0.51%	Sand-Slime Tailings	0.059	119.0	0.53	0.11	0.42	1	1.70	21.318	296.32	24.91	29	0.53%	2.2	47%	0.94	0.00	0.94	0	0.95	0.06	1.00	1.0	0.055	39.04	63.95	0.092	1.69	0.96	0.29	0.80	1.16	1.0	0.037	1.72	42.73	0.086	4.17	2.93	2
10.335	5609.27	10.7	0.069	10.6	15.8	6.85	0.65%	Sand-Slime Tailings	0.059	119.0	0.54	0.12	0.42	1	1.70	17.969	249.77	21.06	24	0.68%	2.3	47%	0.95	0.00	0.95	0	0.95	0.05	0.99	1.0	0.055	37.69	58.75	0.086	1.59	0.96	0.26	0.80	1.15	1.0	0.037	2.09	43.93	0.087	4.17	2.88	2
10.499	5609.10	9.8	0.093	9.6	39.8	17.26	0.95%	Sand-Slime Tailings	0.059	119.0	0.55	0.12	0.43	1	1.70	16.235	225.67	19.35	22	1.01%	2.5	47%	0.96	0.00	0.96	0	0.95	0.05	0.99	1.0	0.054	37.09	56.43	0.084	1.54	0.96	0.25	0.80	1.15	1.0	0.037	2.57	49.77	0.091	4.36	2.95	2
10.663	5608.94	10.0	0.042	9.7	47.3	20.49	0.42%	Sand-Slime Tailings	0.059	119.0	0.56	0.13	0.43	1	1.70	16.558	230.16	19.81	22	0.44%	2.3	47%	0.97	0.00	0.97	0	0.95	0.05	0.99	1.0	0.054	37.25	57.06	0.085	1.56	0.96	0.26	0.80	1.15	1.0	0.037	1.94	38.50	0.082	3.87	2.72	2
10.827	5608.77	11.7	0.072	11.4	46.6	20.18	0.62%	Sand-Slime Tailings	0.059	119.0	0.57	0.13	0.44	1	1.69	19.231	267.31	22.91	25	0.65%	2.3	47%	0.98	0.00	0.98	0	0.95	0.05	0.99	1.0	0.054	38.33	61.24	0.089	1.64	0.96	0.28	0.80	1.15	1.0	0.037	1.97	45.15	0.088	4.09	2.87	2
10.991	5608.61	10.9	0.095	10.4	75.1	32.54	0.87%	Sand-Slime Tailings	0.059	119.0	0.58	0.14	0.44	1	1.69	17.592	244.52	21.35	23	0.92%	2.4	47%	0.99	0.00	0.99	0	0.94	0.05	0.99	1.0	0.054	37.79	59.14	0.087	1.60	0.96	0.27	0.80	1.14	1.0	0.037	2.36	50.32	0.092	4.25	2.93	2
11.155	5608.45	12.8	0.156	12.4	77.1	33.42	1.22%	Sand-Slime Tailings	0.059	119.0	0.59	0.15	0.45	1	1.65	20.356	282.95	24.56	27	1.27%	2.4	47%	1.00	0.00	1.00	0	0.94	0.05	0.99	1.0	0.054	38.92	63.48	0.092	1.70	0.96	0.29	0.80	1.14	1.0	0.037	2.42	59.39	0.099	4.55	3.13	2
11.319	5608.28	18.2	0.117	17.6	85.5	37.06	0.64%	Sand-Slime Tailings	0.059	119.0	0.60	0.15	0.45	1	1.58	27.942	388.40	33.44	39	0.67%	2.1	47%	1.01	0.00	1.01	0	0.94	0.06	0.99	1.0	0.054	42.03	75.46	0.107	1.98	0.96	0.33	0.80	1.14	1.0	0.037	1.55	51.83	0.093	4.21	3.09	2
11.483	5608.12	21.9	0.123	21.8	24.8	10.73	0.56%	Sand-Slime Tailings	0.059	119.0	0.61	0.16	0.45	1	1.55	33.650	467.74	39.36	47	0.58%	2.0	47%	1.02	0.00	1.02	0	0.94	0.06	0.99	1.0	0.054	44.11	83.47	0.117	2.18	0.96	0.36	0.80	1.14	1.0	0.037	1.37	53.90	0.095	4.24	3.21	2
11.647	5607.95	18.8	0.102	18.7	18.8	8.14	0.54%	Sand-Slime Tailings	0.059	119.0	0.62	0.16	0.46	1	1.56	29.097	404.45	34.01	40	0.56%	2.1	47%	1.03	0.00	1.03	0	0.94	0.06	0.99	1.0	0.054	42.23	76.24	0.108	2.00	0.96	0.34	0.80	1.13	1.0	0.037	1.47	50.02	0.092	4.07	3.04	2
11.811	5607.79	17.1	0.083	17.0	30.1	13.06	0.48%	Sand-Slime Tailings	0.059	119.0	0.63	0.17	0.46	1	1.56	26.471	367.95	31.09	36	0.50%	2.1	47%	1.04	0.00	1.04	0	0.94	0.06	0.99	1.0	0.054	41.20	72.29	0.102	1.91	0.96	0.32	0.80	1.13	1.0	0.037	1.51	46.90	0.089	3.92	2.92	2
11.975	5607.63	15.6	0.099	15.4	45.3	19.65	0.63%	Sand-Slime Tailings	0.059	119.0	0.64	0.17	0.47	1	1.56	24.026	333.97	28.42	32	0.66%	2.2	47%	1.05	0.00	1.05	0	0.94	0.06	0.99	1.0	0.054	40.27	68.69	0.098	1.83	0.96	0.31	0.80	1.13	1.0	0.037	1.72	49.00	0.091	3.96	2.89	2
12.139	5607.46	12.7	0.171	12.4	58.5	25.36	1.34%	Sand-Slime Tailings	0.059	119.0	0.65	0.18	0.47	1	1.58	19.546	271.68	23.37	26	1.42%	2.5	47%	1.06	0.00	1.06	0	0.94	0.05	0.99	1.0	0.054	38.50	61.87	0.090	1.68	0.96	0.28	0.80	1.13	1.0	0.037	2.66	62.07	0.102	4.42	3.05	2
12.303	5607.30	13.0	0.141	12.6	69.8	30.26	1.09%	Sand-Slime Tailings	0.059	119.0	0.66	0.18	0.48	1	1.57	19.678	273.52	23.65	26	1.14%	2.4	47%	1.07	0.00	1.07	0	0.94	0.05	0.99	1.0	0.053	38.60	62.24	0.090	1.69	0.95	0.28	0.80	1.12	1.0	0.037	2.41	56.98	0.097	4.16	2.93	2
12.467	5607.13	17.3	0.074	17.2	11.4	4.93	0.43%	Sand-Slime Tailings	0.059	119.0	0.67	0.19	0.48	1	1.52	26.200	364.19	30.56	34	0.44%	2.1	47%	1.07	0.00	1.07	0	0.93	0.06	0.99	1.0	0.053	41.02	71.57	0.102	1.91	0.95	0.32	0.80	1.12	1.0	0.037	1.49	45.52	0.088	3.73	2.82	2
12.631	5606.97	14.6	0.118	14.6	12.4	5.38	0.81%	Sand-Slime Tailings	0.059	119.0	0.68	0.19	0.49	1	1.53	22.293	309.87	26.03	29	0.85%	2.3	47%	1.08	0.00	1.08	0	0.93	0.06	0.99	1.0	0.053	39.43	65.46	0.094	1.77	0.95	0.29	0.80	1.12	1.0	0.038	2.00	52.19	0.093	3.92	2.84	2
12.795	5606.80	14.9	0.109	14.7	29.3	12.70	0.73%	Sand-Slime Tailings	0.059	119.0	0.69	0.20	0.49	1	1.52	22.317	310.21	26.24	29	0.77%	2.3	47%	1.09	0.00	1.09	0	0.93	0.06	0.99	1.0	0.053	39.51	65.75	0.094	1.78	0.95	0.30	0.80	1.12	1.0	0.038	1.93	50.67	0.092	3.83	2.81	2
12.959	5606.64	17.4	0.213	17.4	6.0	2.59	1.23%	Sand-Slime Tailings	0.059	119.0	0.70	0.20	0.50	1	1.49	25.878	359.71	30.12	34	1.28%	2.4	47%	1.10	0.00	1.10	0	0.93	0.06	0.99	1.0	0.053	40.87	70.99	0.101	1.90	0.95	0.32	0.80	1.12	1.0	0.038	2.13	64.14	0.105	4.31	3.11	2
13.123	5606.48	11.4	0.174	11.3	13.4	5.82	1.53%	Sand-Slime Tailings	0.059	119.0	0.71	0.21	0.50	1	1.53	17.252	239.81	20.19	21	1.63%	2.6	47%	1.11	0.00	1.11	0	0.93	0.05	0.99	1.0	0.053	37.38	57.57	0.085	1.61	0.95	0.26	0.80	1.11	1.0	0.038	3.18	64.28	0.105	4.28	2.94	2
13.287	5606.31	10.3	0.144	10.2	24.4	10.58	1.40%	Sand-Slime Tailings	0.059	119.0	0.72	0.21	0.51	1	1.52	15.385	213.85	18.14	19	1.50%	2.6	47%	1.12	0.00	1.12	0	0.93	0.05	0.99	1.0	0.053	36.66	54.80	0.082	1.56	0.95	0.25	0.80	1.11	1.0	0.038	3.32	60.28	0.100	4.07	2.81	2
13.451	5606.15	8.1	0.085	7.9	29.0	12.57	1.05%	Sand-Slime Tailings	0.059	119.0	0.73	0.22	0.51	1	1.50	11.935	165.89	14.18	14	1.15%	2.6	47%	1.13	0.00	1.13	0	0.93	0.05	0.99	1.0	0.053	35.27	49.45	0.077	1.46	0.95	0.22	0.80	1.11	1.0	0.038	3.59	50.87	0.092	3.71	2.58	2
13.615	5605.98	8.1	0.071	7.9	37.9	16.43	0.88%	Sand-Slime Tailings	0.059	119.0	0.74	0.22	0.52	1	1.49	11.761	163.48	14.07	14	0.96%	2.6	47%	1.14	0.00	1.14	0	0.93	0.05	0.99	1.0	0.053	35.24	49.31	0.077	1.46	0.95	0.22	0.80	1.11	1.0	0.038	3.38	47.57	0.090	3.57	2.51	2
13.779	5605.82	8.4	0.071	8.2	32.9	14.24	0.85%	Sand-Slime Tailings	0.059	119.0	0.75	0.23	0.52	1	1.48	12.139	168.73	14.45	15	0.93%	2.6	47%	1.15	0.00	1.15	0	0.92	0.05	0.99	1.0	0.053	35.37	49.82	0.077	1.47	0.95	0.22	0.80	1.11	1.0	0.038	3.27	47.31	0.089	3.53	2.50	2
13.943	5605.66	8.9	0.054	8.7	37.7	16.35	0.61%	Sand-Slime Tailings	0.059	119.0	0.76	0.23	0.52	1	1.47	12.806	178.01	15.28	16	0.66%	2.5	47%	1.16	0.00	1.16	0	0.92	0.05	0.99	1.0	0.053	35.66	50.94	0.078	1.49	0.95	0.23	0.80	1.10	1.0	0.038	2.79	42.58	0.085	3.35	2.42	2
14.107	5605.49	11.6	0.101	11.4	38.4	16.62	0.87%	Sand-Slime Tailings	0.059	119.0	0.77	0.24	0.53	1	1.46	16.641	231.30	19.73	20	0.93%	2.5	47%	1.17	0.00	1.17	0	0.92	0.05	0.98	1.0	0.052	37.22	56.96	0.085	1.61	0.95	0.26	0.80	1.10	1.0	0.038	2.59	51.19	0.092	3.59	2.60	2
14.271	5605.33	9.4	0.125	9.3	28.4	12.32	1.32%	Sand-Slime Tailings	0.059	119.0	0.78	0.24	0.53	1	1.45	13.475	187.30	15.95	16	1.44%	2.6	47%	1.18	0.00	1.18	0	0.92	0.05	0.98	1.0	0.052	35.90	51.85	0.079	1.51	0.95	0.23	0.80	1.10	1.0	0.038	3.62	57.81	0.098	3.77	2.64	2
14.436	5605.16	8.8	0.126	8.5	40.5	17.53	1.44%	Sand-Slime Tailings	0.059	119.0	0.79	0.25	0.54	1	1.44	12.287	170.78	14.69	15	1.58%	2.7	47%	1.19	0.00	1.19	0	0.92	0.05	0.98	1.0	0.052	35.45	50.15	0.078	1.48	0.95	0.22	0.80	1.10	1.0	0.038	4.01	58.88	0.099	3.78	2.63	2
14.600	5605.00	11.2	0.094	11.1	28.5	12.36	0.84%	Sand-Slime Tailings	0.059	119.0	0.80	0.25	0.54	1	1.43	15.862	220.48	18.72	19	0.90%	2.5	47%	1.20	0.00	1.20	0	0.92	0.05	0.98	1.0	0.052	36.87	55.59	0.083	1.59	0.95	0.25	0.80	1.10	1.0	0.038	2.68	50.09	0.092	3.47	2.53	2
14.764	5604.84	15.3	0.076	15.3	10.5	4.53	0.50%	Sand-Slime Tailings	0.059	119.0	0.81	0.26	0.55	1	1.41	21.493	298.76	25.07	27	0.52%	2.3	47%	1.21	0.00	1.21	0	0.92	0.06	0.98	1.0	0.052	39.09	64.16	0.093	1.78	0.95	0.29	0.80	1.09	1.0	0.038	1.80	45.16	0.088	3.29	2.54	2
14.928	5604.67	15.6	0.127	15.5	13.6	5.87	0.81%	Sand-Slime Tailings	0.059	119.0	0.82	0.26	0.55	1	1.40	21.691	301.51	25.33	27	0.86%	2.3	47%	1.22	0.00	1.22	0	0.92	0.06	0.98	1.0	0.052	39.19	64.52	0.093	1.79	0.95	0.29	0.80	1.09	1.0	0.038	2.10	53.28	0.094	3.51	2.65	2
15.092	5604.51	13.7	0.155	13.6	16.5	7.13	1.13%	Sand-Slime Tailings	0.059	119.0	0.82	0.27	0.56	1	1.40	19.062	264.96	22.31	23	1.20%	2.5	47%	1.23	0.00	1.23	0	0.91	0.05	0.98	1.0	0.052	38.12	60.43	0.088	1.70	0.95	0.27	0.80	1.09	1.0	0.038	2.64	58.96	0.099	3.66	2.68	2
15.256	5604.34	17.0	0.133	17.0	4.9	2.14	0.78%	Sand-Slime Tailings	0.059	119.0	0.83	0.27	0.56	1	1.37	23.328	324.26	27.14	29	0.82%	2.3	47%	1.24	0.00	1.24	0	0.91	0.06	0.98	1.0	0.052	39.82	66.96	0.096	1.85	0.95	0.30	0.80	1.09	1.0	0.038	1.98	53.66	0.094	3.46	2.66	2
15.420	5604.18	13.1	0.107	13.1	3.5	1.53	0.82%	Sand-Slime Tailings	0.059	119.0	0.84	0.28	0.57	1	1.39	18.162	252.45	21.13	22	0.87%	2.4	47%	1.25	0.00	1.25	0	0.91	0.05	0.98	1.0	0.052	37.71	58.84	0.087	1.68	0.95	0.27	0.80	1.09	1.0	0.038	2.44	51.47	0.093	3.37	2.52	2
15.584	5604.02	9.6	0.107	9.5	9.3	4.03	1.12%	Sand-Slime Tailings	0.059	119.0	0.85	0.28	0.57	1	1.38	13.129	182.50	15.34	15	1.23%	2.6	47%	1.26	0.00	1.26	0	0.91	0.05	0.98	1.0	0.052	35.68	51.02	0.078	1.52	0.95	0.23	0.80	1.09	1.0	0.038	3.54	54.32	0.095	3.43	2.47	2
15.748	5603.85	9.8	0.122	9.7	17.6	7.63	1.24%	Sand-Slime Tailings	0.059	119.0	0.86	0.29	0.58	1	1.37	13.307	184.97	15.63	16	1.36%	2.6	47%	1.27	0.00	1.27	0	0.91	0.05	0.98	1.0	0.052	35.78	51.41	0.079	1.53	0.95	0.23	0.80	1.08	1.0	0.039	3.65	57.00	0.097	3.49	2.51	2
15.912	5603.69	7.9	0.102	7.7	32.5	14.09	1.29%	Sand-Slime Tailings	0.059	119.0	0.87	0.29	0.58	1	1.36	10.527	146.33	12.55	12	1.44%	2.8	47%	1.28	0.00	1.28	0	0.91	0.05	0.98	1.0	0.052	34.70	47.25	0.075	1.45	0.95	0.20	0.80	1.08	1.0	0.039	4.42	55.40	0.096	3.41	2.43	2
16.076	5603.52	8.2	0.088	7.9	46.7	20.23	1.07%	Sand-Slime Tailings	0.059	119.0	0.88	0.30	0.58	1	1.35	10.719	148.99	12.91	13	1.20%	2.7	47%	1.29	0.00	1.29	0	0.91	0.05	0.98	1.0	0.051	34.83	47.74	0.075	1.46	0.95	0.21	0.80	1.08	1.0	0.039	4.03	52.01	0.093	3.29	2.38	2
16.240	5603.36	8.7	0.081	8.3	59.6	25.83	0.93%	Sand-Slime Tailings	0.059	119.0	0.89	0.30	0.59	1	1.35	11.178	155.37	13.56	13	1.04%	2.7	47%	1.30	0.00	1.30	0	0.91	0.05	0.98	1.0	0.051	35.06	48.62	0.076	1.48	0.95	0.21	0.80	1.08	1.0	0.039	3.68	49.89	0.092	3.21	2.35	2
16.404	5603.20	8.6	0.104	8.2	71.5	31.00	1.21%	Sand-Slime Tailings	0.059	119.0	0.90	0.31	0.59	1	1.34	10.935	152.00	13.39	13	1.35%	2.7	47%	1.31	0.00	1.31	0	0.90	0.05	0.98	1.0	0.051	35.00	48.39	0.076	1.48	0.95	0.21	0.80	1.08	1.0	0.039	4.11	54.99	0.095	3.32	2.40	2
16.568	5603.03	9.3	0.138	8.8	83.6	36.24	1.48%	Sand-Slime Tailings	0.059	119.0	0.91	0.31	0.60	1	1.33	11.719	162.90	14.42	14	1.64%	2.7	47%	1.32	0.00	1.32	0	0.90	0.05	0.98	1.0	0.051	35.36	49.78	0.077	1.51	0.94	0.22	0.80	1.08	1.0	0.039	4.21	60.68	0.101	3.48	2.50	2
16.732	5602.87	9.9	0.155	9.3	84.3	36.52	1.57%	Sand-Slime Tailings	0.059	119.0	0.92	0.32	0.60	1	1.32	12.323	171.28	15.12	15	1.74%	2.7	47%	1.33	0.00	1.33	0	0.90	0.05	0.98	1.0	0.051	35.60	50.72	0.078	1.53	0.94	0.22	0.80	1.07	1.0	0.039	4.17	63.04	0.103	3.54	2.54	2
16.896	5602.70	26.6	0.355	26.0	83.4	36.16	1.34%	Sand-Slime Tailings	0.059	119.0	0.93	0.32	0.61	1	1.27	33.013	458.88	39.11	42	1.39%	2.3	47%	1.34	0.00	1.34	0	0.90	0.06	0.97	1.0	0.051	44.02	83.13	0.117	2.31	0.94	0.36	0.80	1.07	1.0	0.039	1.93	75.38	0.120	4.08	3.19	2
17.060	5602.54	17.7	0.388	17.6	16.1	6.97	2.20%	Sand-Slime Tailings	0.059	119.0	0.94	0.33	0.61	1	1.29	22.634	314.61	26.44	27	2.32%	2.6	47%	1.35	0.00	1.35	0	0.90	0.06	0.97	1.0	0.051	39.57	66.01	0.095	1.87	0.94	0.30	0.80	1.07	1.0	0.039	3.20	84.66	0.136	4.61	3.24	2
17.224	5602.38	12.0	0.476	11.8	26.8	11.63	3.97%	Slime Tailings	0.057	113.1	0.95	0.33	0.62	1	1.30	15.332	213.11	18.06	18	4.32%	2.9	71%	1.36	0.00	1.36	0	0.90	0.05	0.98	1.0	0.051	36.38	54.44	0.082	1.62	0.94	0.25	0.80	1.07	1.0	0.039	5.61	101.37	0.177	5.94	3.78	2

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.347

Depth at t_1, z_1 (m)	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Maximum Shear Strain Modulus, G_{max} (tsf)	P = γ_{eff}(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, $\varepsilon_{v,15}$ (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
2.20	594	1.6E-03	5.5E+02	7.3E-05	11	0.162	11360	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.25	594	1.6E-03	5.5E+02	7.5E-05	11	0.163	11268	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.30	594	1.6E-03	5.5E+02	7.6E-05	11	0.164	11177	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.35	594	1.6E-03	5.5E+02	7.8E-05	11	0.164	11090	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.40	594	1.6E-03	5.5E+02	7.9E-05	11	0.165	11004	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.45	594	1.6E-03	5.5E+02	8.1E-05	11	0.166	10921	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.50	594	1.6E-03	5.5E+02	8.2E-05	11	0.167	10840	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.55	594	1.6E-03	5.5E+02	8.3E-05	11	0.168	10761	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.60	594	1.6E-03	5.5E+02	8.5E-05	11	0.168	10683	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.65	594	1.6E-03	5.5E+02	8.6E-05	11	0.169	10608	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.70	594	1.6E-03	5.5E+02	8.8E-05	11	0.170	10535	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.75	594	1.6E-03	5.5E+02	8.9E-05	11	0.170	10463	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.80	594	1.6E-03	5.5E+02	9.1E-05	11	0.171	10392	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.85	594	1.6E-03	5.5E+02	9.2E-05	11	0.172	10324	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.90	594	1.6E-03	5.5E+02	9.4E-05	11	0.173	10257	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.95	594	1.6E-03	5.5E+02	9.5E-05	11	0.173	10191	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.00	594	1.6E-03	5.5E+02	9.7E-05	11	0.174	10127	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.05	594	1.6E-03	5.5E+02	9.8E-05	11	0.175	10064	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.10	495	1.4E-03	3.8E+02	1.4E-04	11	0.175	10002	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.15	495	1.4E-03	3.5E+02	1.6E-04	10	0.176	10210	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.20	495	1.4E-03	3.5E+02	1.6E-04	10	0.177	10153	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.25	495	1.4E-03	3.5E+02	1.6E-04	10	0.177	10098	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.30	495	1.4E-03	3.5E+02	1.6E-04	10	0.178	10044	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.35	495	1.4E-03	3.5E+02	1.7E-04	10	0.179	9991	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.40	495	1.4E-03	3.5E+02	1.7E-04	10	0.179	9939	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.45	495	1.4E-03	3.5E+02	1.7E-04	10	0.180	9887	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.50	495	1.4E-03	3.5E+02	1.7E-04	10	0.180	9837	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.55	495	1.4E-03	3.5E+02	1.7E-04	10	0.181	9787	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.60	495	1.4E-03	3.5E+02	1.8E-04	10	0.181	9739	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.65	495	1.4E-03	3.5E+02	1.8E-04	10	0.182	9691	0.03%	2.00	0.65	0.03%	0.001	0.34	0.079	0.765	0.09%	0.0001
3.70	495	1.4E-03	3.5E+02	1.8E-04	10	0.183	9644	0.03%	2.00	0.65	0.03%	0.001	0.34	0.079	0.765	0.17%	0.0003
3.75	495	1.4E-03	3.5E+02	1.8E-04	10	0.183	9597	0.03%	2.00	0.65	0.03%	0.001	0.34	0.079	0.765	0.23%	0.0004
3.80	495	1.4E-03	3.5E+02	1.8E-04	10	0.184	9552	0.03%	2.00	0.65	0.03%	0.002	0.34	0.079	0.765	0.28%	0.0005
3.85	495	1.4E-03	3.5E+02	1.9E-04	10	0.184	9507	0.03%	2.00	0.65	0.03%	0.002	0.34	0.079	0.765	0.28%	0.0005
3.90	495	1.4E-03	3.5E+02	1.9E-04	10	0.185	9463	0.03%	2.00	0.65	0.03%	0.002	0.34	0.079	0.765	0.38%	0.0006
3.95	495	1.3E-03	3.1E+02	2.1E-04	16	0.438	7751	0.05%	2.00	0.65	0.03%	0.005	0.34	0.079	0.765	1.18%	0.0019
4.00	495	1.4E-03	3.5E+02	1.9E-04	10	0.186	9382	0.03%	2.00	0.65	0.03%	0.003	0.34	0.079	0.765	0.46%	0.0008
4.05	495	1.4E-03	3.5E+02	1.9E-04	10	0.186	9339	0.04%	2.00	0.65	0.03%	0.003	0.34	0.079	0.765	0.50%	0.0008
4.10	495	1.4E-03	3.5E+02	1.9E-04	10	0.187	9298	0.04%	2.00	0.65	0.03%	0.003	0.34	0.079	0.765	0.54%	0.0009
4.15	495	1.8E-03	4.5E+02	1.6E-04	10	0.187	9246	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
4.20	495	1.8E-03	4.5E+02	1.6E-04	10	0.188	9195	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
4.25	495	1.8E-03	4.5E+02	1.6E-04	10	0.189	9144	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
4.30	495	1.8E-03	4.5E+02	1.7E-04	10	0.189	9095	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
4.35	495	1.8E-03	4.5E+02	1.7E-04	10	0.190	9047	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
4.40	495	1.8E-03	4.5E+02	1.7E-04	10	0.190	8999	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
4.45	495	1.8E-03	4.5E+02	1.7E-04	10	0.191	8953	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
4.50	495	1.8E-03	4.5E+02	1.7E-04	10	0.192	8907	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
4.55	495	1.8E-03	4.3E+02	1.8E-04	16	0.444	7292	0.03%	2.00	0.65	0.03%	0.003	0.34	0.079	0.765	0.40%	0.0007
4.60	495	1.8E-03	4.5E+02	1.7E-04	10	0.193	8820	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
4.65	495	1.8E-03	4.5E+02	1.8E-04	10	0.193	8776	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
4.70	495	1.8E-03	4.5E+02	1.8E-04	10	0.194	8733	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
4.75	495	1.8E-03	4.5E+02	1.8E-04	10	0.195	8691	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
4.80	495	1.8E-03	4.5E+02	1.8E-04	10	0.195	8650	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
4.85	495	1.8E-03	4.5E+02	1.9E-04	10	0.196	8609	0.03%	2.00	0.65	0.03%	0.001	0.34	0.079	0.765	0.11%	0.0002
4.90	495	1.8E-03	4.5E+02	1.9E-04	10	0.196	8569	0.03%	2.00	0.65	0.03%	0.001	0.34	0.079	0.765	0.18%	0.0003
4.95	495	1.8E-03	4.5E+02	1.9E-04	10	0.197	8529	0.03%	2.00	0.65	0.03%	0.002	0.34	0.079	0.765	0.23%	0.0004
5.00	460	1.8E-03	3.9E+02	2.2E-04	10	0.197	8491	0.04%	2.00	0.65	0.03%	0.006	0.34	0.079	0.765	0.90%	0.0015
5.05	460	1.8E-03	3.7E+02	2.4E-04	16	0.450	6956	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.36%	0.0022
5.10	460	1.8E-03	3.9E+02	2.3E-04	10	0.198	8416	0.04%	2.00	0.65	0.03%	0.006	0.34	0.079	0.765	0.97%	0.0016
5.15	460	1.8E-03	3.7E+02	2.4E-04	16	0.451	6897	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.43%	0.0024
5.20	460	1.8E-03	3.9E+02	2.3E-04	10	0.199	8344	0.05%	2.00	0.65	0.03%	0.007	0.34	0.079	0.765	1.04%	0.0017
5.25	460	1.8E-03	3.9E+02	2.3E-04	10	0.200	8308	0.05%	2.00	0.65	0.03%	0.007	0.34	0.079	0.765	1.08%	0.0018
5.30	460	1.8E-03	3.9E+02	2.4E-04	10	0.201	8273	0.05%	2.00	0.65	0.03%	0.007	0.34	0.079	0.765	1.11%	0.0018
5.35	460	1.8E-03	3.9E+02	2.4E-04	10	0.201	8238	0.05%	2.00	0.65	0.03%	0.007	0.34	0.079	0.765	1.15%	0.0019
5.40	460	1.8E-03	3.9E+02	2.4E-04	10	0.202	8203	0.05%	2.00	0.65	0.03%	0.008	0.34	0.079	0.765	1.18%	0.0019
5.45	460	1.8E-03	3.9E+02	2.4E-04	10	0.202	8169	0.05%	2.00	0.65	0.03%	0.008	0.34	0.079	0.765	1.22%	0.0020
5.50	460	1.8E-03	3.9E+02	2.5E-04	10	0.203	8136	0.05%	2.00	0.65	0.03%	0.008	0.34	0.079	0.765	1.25%	0.0021
5.55	460	1.8E-03	3.9E+02	2.5E-04	10	0.203	8102	0.05%	2.00	0.65	0.03%	0.008	0.34	0.079	0.765	1.29%	0.0021
5.60	460	1.8E-03	3.9E+02	2.5E-04	10	0.204	8070	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.32%	0.0022
5.65	460	1.8E-03	3.9E+02	2.5E-04	10	0.204	8038	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.36%	0.0022
5.70	460	1.8E-03	3.9E+02	2.6E-04	10	0.205	8006	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.39%	0.0023
5.75	460	1.8E-03	3.9E+02	2.6E-04	10	0.205	7974	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.43%	0.0023
5.80	460	1.8E-03	3.9E+02	2.6E-04	10	0.206	7943	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.46%	0.0024
5.85	460	1.8E-03	3.9E+02	2.6E-04	10	0.206	7913	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.50%	0.0025
5.90	460	1.8E-03	3.9E+02	2.7E-04	10	0.207	7883	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.53%	0.0025
5.95	460	1.8E-03	3.9E+02	2.7E-04	10	0.207	7853	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.57%	0.0026
6.00	460	1.8E-03	3.9E+02	2.7E-04	10	0.207	7824	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.60%	0.0026
6.05	460	1.8E-03	3.9E+02	2.7E-04	10	0.208	7795	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.64%	0.0027
6.10	460	1.8E-03	3.9E+02	2.8E-04	10	0.208	7766	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.67%	0.0027
6.15	460	1.8E-03	3.9E+02	2.8E-04	10	0.209	7738	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.71%	0.0028
6.20	460	1.8E-03	3.9E+02	2.8E-04	10	0.209	7710	0.07%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.74%	0.0029
6.25	460	1.8E-03	3.9E+02	2.8E-04	10	0.210	7682	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.78%	0.0029
6.30	460	1.8E-03	3.9E+02	2.9E-04	10	0.210	7655	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.81%	0.0030
6.35	460	1.8E-03	3.9E+02	2.9E-04	10	0.211	7628	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.85%	0.0030
6.40	460	1.8E-03	3.9E+02	2.9E-04	10	0.211	7601	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.89%	0.0031
6.45	460	1.8E-03	3.9E+02	2.9E-04	10	0.212	7575	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.92%	0.0032
6.50	460	1.8E-03	3.9E+02	2.9E-04	10	0.212	7549	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.96%	0.0032
6.55	460	1.8E-03	3.9E+02	3.0E-04	10	0.212	7523	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.99%	0.0033
6.60	500	1.8E-03	4.6E+02	2.5E-04	10	0.213	7498	0.05%	2.00	0.65	0.03%	0.008	0.34	0.079	0.765	1.24%	0.0020
6.65	500	1.8E-03	4.6E+02	2.6E-04	10	0.213	7473	0.05%	2.00	0.65	0.03%	0.008	0.34	0.079	0.765	1.26%	0.0021
6.70	500	1.8E-03	4.6E+02	2.6E-04	10	0.214	7448	0.05%	2.00	0.65	0.03%	0.008	0.34	0.079	0.765	1.29%	0.0021
6.75	500	1.8E-03	4.6E+02	2.6E-04	10	0.214	7424	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.32%	0.0022
6.80	500	1.8E-03	4.6E+02	2.6E-04	10	0.215	7399	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.35%	0.0022
6.85	500	1.8E-03	4.6E+02	2.6E-04	10	0.215	7375	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.37%	0.0023
6.90	500	1.8E-03	4.6E+02	2.7E-04	10	0.216	7352	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.40%	0.0023
6.95	500	1.8E-03	4.6E+02	2.7E-04	10	0.216	7328	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.43%	0.0023
7.00	500	1.8E-03	4.6E+02	2.7E-04	10	0.216	7305	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.46%	0.0024
7.05	500	1.8E-03	4.6E+02	2.7E-04	10	0.217	7282	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.49%	0.0024
7.10	500	1.8E-03	4.6E+02	2.7E-04	10	0.217	7259	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.51%	0.0025
7.15	500	1.8E-03	4.6E+02	2.8E-04	10	0.218	7237	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.54%	0.0025
7.20	500	1.8E-03	4.6E+02	2.8E-04	10	0.218	7215	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.57%	0.0026
7.25	500	1.8E-03	4.6E+02	2.8E-04	10	0.218	7193	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.60%	0.0026
7.30	500	1.8E-03	4.6E+02	2.8E-04	10	0.219	7171	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.62%	0.0027
7.35	500	1.8E-03	4.6E+02	2.8E-04	10	0.219	7149	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.65%	0.0027
7.40	500	1.8E-03	4.4E+02	3.0E-04	16	0.471	5873	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.10%	0.0035

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W7-C

Data File: 13-52106_SP2W7-C-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Dat

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

5613.10	Water surface elevation during CPT investigation (ft
5611.32	Water surface elevation at t_0 (ft amsl)
5595.40	Water surface elevation at t_1 (ft amsl)
5590.40	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Ear
7.51	Equiv. Number of Uniform Strain Cycles, N

5619.60	Ground Surface Elevation at time of CPT (ft amsl)
5626.65	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pla
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
-0.95	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
812.44	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5590.40	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer	Total Stress at Midpoint of Layer	Equil Pore Pressure at Bottom of Layer	Equil Pore Pressure at Midpoint of Layer (tsf)	Effective Stress at Bottom of Layer	Effective Stress at Midpoint of Layer	Midpoint Depth at t_1, z_1	Shear Wave Velocity, V_s	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
Erosion Protection Layer	######	5626.4	5626.15	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014	0.08	508	1.7E-03	4.4E+02	3.0E-06	11	0.068	46696	0.00%	1.20	0.80	0.04%	0.000	0.32	0.133	0.778	0.00%	0.0000
Water Storage/Rooting Zone Layer	######	5624.4	5622.65	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121	0.69	508	1.7E-03	4.3E+02	2.8E-05	11	0.118	18930	0.00%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
High Compaction Layer	######	5620.65	5618.65	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334	1.83	508	1.9E-03	4.8E+02	6.8E-05	11	0.153	12419	0.01%	0.65	0.75	0.02%	0.000	0.34	0.079	0.765	0.00%	0.0000
Platform/Random Fill Layer	######	5619.13	5619.60	-0.95	0.050	101	0.406	0.430	0.00	0.00	0.406	0.430	2.29	508	1.6E-03	4.0E+02	1.0E-04	11	0.164	11187	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000

2013 CPT Data from ConeTec / CPT Data Interpretations

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of CPT (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %
17.388	5602.21	14.6	0.394	14.5	24.8	10.76	2.69%	Slime Tailings	0.057	113.1	0.96	0.34	0.62	1	1.29	18.673	259.56	21.92	22	2.88%	2.7	71%
17.552	5602.05	10.6	0.341	10.5	16.3	7.05	3.20%	Slime Tailings	0.057	113.1	0.97	0.34	0.62	1	1.28	13.540	188.21	15.88	15	3.53%	2.9	71%
17.716	5601.88	11.2	0.288	10.8	64.1	27.78	2.57%	Slime Tailings	0.057	113.1	0.98	0.35	0.63	1	1.28	13.790	191.68	16.61	16	2.82%	2.8	71%
17.880	5601.72	12.9	0.210	12.7	33.7	14.62	1.63%	Sand-Slime Tailin	0.059	119.0	0.99	0.36	0.63	1	1.27	16.138	224.31	19.05	19	1.76%	2.6	47%
18.044	5601.56	10.5	0.231	10.2	41.6	18.04	2.20%	Slime Tailings	0.057	113.1	1.00	0.36	0.64	1	1.26	12.920	179.59	15.39	15	2.44%	2.8	71%
18.208	5601.39	9.1	0.184	8.6	70.9	30.71	2.03%	Slime Tailings	0.057	113.1	1.01	0.37	0.64	1	1.26	10.855	150.88	13.25	13	2.28%	2.8	71%
18.372	5601.23	10.2	0.118	9.8	69.3	30.03	1.16%	Sand-Slime Tailin	0.059	119.0	1.02	0.37	0.65	1	1.25	12.220	169.85	14.82	14	1.28%	2.7	47%
18.537	5601.06	10.3	0.159	9.8	81.3	35.24	1.55%	Sand-Slime Tailin	0.059	119.0	1.03	0.38	0.65	1	1.24	12.152	168.91	14.85	14	1.72%	2.7	47%
18.701	5600.90	12.1	0.167	11.4	113.1	49.03	1.38%	Sand-Slime Tailin	0.059	119.0	1.04	0.38	0.66	1	1.24	14.138	196.51	17.43	17	1.50%	2.6	47%
18.865	5600.74	14.0	0.166	13.5	77.6	33.64	1.19%	Sand-Slime Tailin	0.059	119.0	1.05	0.39	0.66	1	1.23	16.569	230.31	19.94	20	1.29%	2.6	47%
19.029	5600.57	13.9	0.222	13.5	75.7	32.80	1.59%	Sand-Slime Tailin	0.059	119.0	1.06	0.39	0.67	1	1.22	16.479	229.06	19.81	19	1.72%	2.6	47%
19.193	5600.41	14.2	0.182	13.9	41.6	18.02	1.28%	Sand-Slime Tailin	0.059	119.0	1.07	0.40	0.67	1	1.22	16.937	235.42	20.04	20	1.39%	2.6	47%
19.357	5600.24	12.2	0.148	11.8	73.0	31.64	1.21%	Sand-Slime Tailin	0.059	119.0	1.08	0.40	0.67	1	1.21	14.220	197.65	17.16	16	1.33%	2.6	47%
19.521	5600.08	10.5	0.113	9.8	106.9	46.30	1.08%	Sand-Slime Tailin	0.059	119.0	1.09	0.41	0.68	1	1.20	11.845	164.64	14.69	14	1.20%	2.7	47%
19.685	5599.92	10.6	0.200	9.8	131.7	57.08	1.89%	Slime Tailings	0.057	113.1	1.09	0.41	0.68	1	1.20	11.716	162.86	14.75	14	2.10%	2.8	71%
19.849	5599.75	36.3	0.300	35.3	156.8	67.96	0.83%	Sand Tailings	0.062	123.5	1.10	0.42	0.69	1	1.15	40.813	567.29	48.71	51	0.85%	2.1	18%
20.013	5599.59	33.0	0.456	32.9	14.8	6.43	1.38%	Sand-Slime Tailin	0.059	119.0	1.11	0.42	0.69	1	1.15	37.997	528.16	44.26	46	1.43%	2.3	47%
20.177	5599.42	18.7	0.520	18.6	13.8	5.96	2.78%	Slime Tailings	0.057	113.1	1.12	0.43	0.70	1	1.17	21.803	303.07	25.44	25	2.96%	2.7	71%
20.341	5599.26	13.7	0.464	13.5	40.0	17.35	3.39%	Slime Tailings	0.057	113.1	1.13	0.43	0.70	1	1.17	15.789	219.47	18.68	18	3.69%	2.8	71%
20.505	5599.10	11.5	0.373	11.1	62.3	27.01	3.25%	Slime Tailings	0.057	113.1	1.14	0.44	0.71	1	1.17	12.959	180.13	15.58	15	3.61%	2.9	71%
20.669	5598.93	12.4	0.338	11.7	107.6	46.62	2.73%	Slime Tailings	0.057	113.1	1.15	0.44	0.71	1	1.16	13.644	189.65	16.75	16	3.00%	2.8	71%
20.833	5598.77	13.3	0.244	12.9	67.9	29.44	1.84%	Sand-Slime Tailin	0.059	119.0	1.16	0.45	0.71	1	1.16	14.894	207.02	17.87	17	2.01%	2.7	47%
20.997	5598.60	15.3	0.235	15.0	45.2	19.60	1.54%	Sand-Slime Tailin	0.059	119.0	1.17	0.45	0.72	1	1.15	17.248	239.75	20.41	20	1.67%	2.6	47%
21.161	5598.44	18.4	0.276	18.0	52.8	22.87	1.50%	Sand-Slime Tailin	0.059	119.0	1.18	0.46	0.72	1	1.14	20.588	286.17	24.35	24	1.61%	2.5	47%
21.325	5598.27	17.9	0.231	17.7	21.2	9.20	1.29%	Sand-Slime Tailin	0.059	119.0	1.19	0.46	0.73	1	1.14	20.141	279.96	23.57	23	1.39%	2.5	47%
21.489	5598.11	12.3	0.171	12.1	31.8	13.76	1.39%	Sand-Slime Tailin	0.059	119.0	1.20	0.47	0.73	1	1.13	13.736	190.93	16.21	15	1.54%	2.7	47%
21.653	5597.95	9.4	0.173	9.0	70.1	30.36	1.84%	Slime Tailings	0.057	113.1	1.21	0.47	0.74	1	1.13	10.141	140.96	12.35	11	2.11%	2.9	71%
21.817	5597.78	10.2	0.308	9.6	109.8	47.60	3.01%	Slime Tailings	0.057	113.1	1.22	0.48	0.74	1	1.12	10.748	149.40	13.38	12	3.41%	3.0	71%
21.981	5597.62	16.3	0.494	15.9	55.4	24.01	3.04%	Slime Tailings	0.057	113.1	1.23	0.48	0.75	1	1.12	17.829	247.82	21.16	20	3.28%	2.8	71%
22.145	5597.45	14.7	0.580	14.5	37.9	16.40	3.94%	Slime Tailings	0.057	113.1	1.24	0.49	0.75	1	1.11	16.127	224.17	19.04	18	4.31%	2.9	71%
22.309	5597.29	15.8	0.533	15.5	43.5	18.86	3.38%	Slime Tailings	0.057	113.1	1.25	0.49	0.75	1	1.11	17.189	238.93	20.31	19	3.67%	2.8	71%
22.473	5597.13	14.0	0.457	13.9	15.6	6.74	3.26%	Slime Tailings	0.057	113.1	1.26	0.50	0.76	1	1.10	15.381	213.79	17.99	17	3.58%	2.9	71%
22.638	5596.96	22.3	0.455	22.1	22.5	9.75	2.04%	Sand-Slime Tailin	0.059	119.0	1.27	0.50	0.76	1	1.09	24.213	336.55	28.30	28	2.17%	2.6	47%
22.802	5596.80	17.6	0.383	17.4	21.7	9.38	2.18%	Sand-Slime Tailin	0.059	119.0	1.28	0.51	0.77	1	1.09	19.057	264.90	22.31	21	2.35%	2.7	47%
22.966	5596.63	11.2	0.327	10.7	70.0	30.33	2.93%	Slime Tailings	0.057	113.1	1.28	0.51	0.77	1	1.09	11.705	162.70	14.15	13	3.31%	2.9	71%
23.130	5596.47	11.9	0.236	11.3	90.3	39.11	1.99%	Sand-Slime Tailin	0.059	119.0	1.29	0.52	0.78	1	1.08	12.269	170.54	14.96	14	2.23%	2.8	47%
23.294	5596.31	13.5	0.214	12.9	103.9	45.01	1.59%	Sand-Slime Tailin	0.059	119.0	1.30	0.52	0.78	1	1.08	13.874	192.85	16.93	16	1.75%	2.7	47%
23.458	5596.14	12.3	0.222	11.8	82.8	35.86	1.80%	Sand-Slime Tailin	0.059	119.0	1.31	0.53	0.79	1	1.07	12.714	176.73	15.41	14	2.01%	2.8	47%
23.622	5595.98	10.7	0.234	10.1	92.5	40.09	2.19%	Slime Tailings	0.057	113.1	1.32	0.53	0.79	1	1.07	10.821	150.41	13.29	12	2.50%	2.9	71%
23.786	5595.81	17.2	0.313	16.6	101.1	43.81	1.82%	Sand-Slime Tailin	0.059	119.0	1.33	0.54	0.79	1	1.07	17.630	245.06	21.26	20	1.98%	2.6	47%
23.950	5595.65	18.0	0.305	17.9	11.3	4.88	1.70%	Sand-Slime Tailin	0.059	119.0	1.34	0.54	0.80	1	1.06	18.952	263.44	22.10	21	1.84%	2.6	47%
24.114	5595.49	13.6	0.288	13.4	40.7	17.64	2.12%	Sand-Slime Tailin	0.059	119.0	1.35	0.55	0.80	1	1.06	14.105	196.06	16.69	15	2.35%	2.8	47%
24.278	5595.32	19.1	0.356	18.5	95.5	41.38	1.87%	Sand-Slime Tailin	0.059	119.0	1.36	0.55	0.81	1	1.05	19.383	269.43	23.24	22	2.01%	2.6	47%
24.442	5595.16	19.8	0.406	19.6	24.9	10.80	2.05%	Sand-Slime Tailin	0.059	119.0	1.37	0.56	0.81	1	1.05	20.495	284.88	23.99	23	2.21%	2.6	47%
24.606	5594.99	17.4	0.456	17.3	12.2	5.27	2.62%	Slime Tailings	0.057	113.1	1.38	0.56	0.82	1	1.04	18.050	250.89	21.06	20	2.85%	2.7	71%
24.770	5594.83	12.0	0.315	11.9	21.2	9.17	2.62%	Slime Tailings	0.057	113.1	1.39	0.57	0.82	1	1.04	12.353	171.70	14.51	13	2.96%	2.9	71%
24.934	5594.67	10.2	0.249	9.9	49.0	21.21	2.45%	Slime Tailings	0.057	113.1	1.40	0.58	0.83	1	1.03	10.195	141.71	12.21	11	2.84%	3.0	71%
25.098	5594.50	10.1	0.244	9.6	79.6	34.51	2.41%	Slime Tailings	0.057	113.1	1.41	0.58	0.83	1	1.03	9.897	137.57	12.09	10	2.81%	3.0	71%
25.262	5594.34	14.2	0.261	14.1	10.4	4.50	1.84%	Sand-Slime Tailin	0.059	119.0	1.42	0.59	0.83	1	1.03	14.489	201.40	16.91	15	2.04%	2.7	47%
25.426	5594.17	14.1	0.415	13.8	52.2	22.60	2.93%	Slime Tailings	0.057	113.1	1.43	0.59	0.84	1	1.02	14.116	196.21	16.78	15	3.26%	2.9	71%
25.590	5594.01	15.1	0.371	15.0	20.2	8.75	2.46%	Slime Tailings	0.057	113.1	1.44	0.60	0.84	1	1.02	15.231	211.72	17.84	16	2.72%	2.8	71%
25.754	5593.85	12.5	0.387	12.0	70.3	30.45	3.10%	Slime Tailings	0.057	113.1	1.45	0.60	0.85	1	1.01	12.203	169.62	14.69	13	3.51%	2.9	71%
25.918	5593.68	15.4	0.224	15.0	51.8	22.46	1.46%	Sand-Slime Tailin	0.059	119.0	1.46	0.61	0.85	1	1.01	15.169	210.85	18.00	16	1.61%	2.7	47%
26.082	5593.52	20.6	0.226	20.5	15.0	6.51	1.10%	Sand-Slime Tailin	0.059	119.0	1.47	0.61	0.86	1	1.00	20.609	286.46	24.05	22	1.18%	2.5	47%
26.246	5593.35	17.9	0.228	17.7	30.6	13.24	1.27%	Sand-Slime Tailin	0.059	119.0	1.48	0.62	0.86	1	1.00	17.733	246.48	20.82	19	1.39%	2.6	47%
26.410	5593.19	13.3	0.303	13.1	41.9	18.16	2.27%	Slime Tailings	0.057	113.1	1.49	0.62	0.86	1	1.00	13.030	181.12	15.44	14	2.56%	2.8	71%
26.574	5593.03	12.3	0.204	11.9	75.2	32.58	1.65%	Sand-Slime Tailin	0.059	119.0	1.50	0.63	0.87	1	0.99	11.774	163.66	14.22	12	1.88%	2.8	47%
26.739	5592.86	21.0	0.154	20.8	25.1	10.86	0.73%	Sand-Slime Tailin	0.059	119.0	1.51	0.63	0.87	1	0.99	20.610	286.48	24.12	22	0.79%	2.4	47%
26.903	5592.70	21.7	0.157	21.6	16.6	7.20	0.72%	Sand-Slime Tailin	0.059	119.0	1.51	0.64	0.88	1	0.99	21.287	295.89	24.84	23	0.78%	2.4	47%
27.067	5592.53	21.5	0.222	21.4	21.0	9.11	1.03%	Sand-Slime Tailin	0.059	119.0	1.52	0.64	0.88	1	0.98	20.946	291.15	24.48	23	1.11%	2.5	47%
27.231	5592.37	20.3	0.256	20.2	23.1	10.02	1.26%	Sand-Slime Tailin	0.059	119.0	1.53	0.65	0.89	1	0.98	19.734	274.30	23.08	21	1.36%	2.5	47%
27.395	5592.21	26.5	0.406	26.3	23.6	10.23	1.53%	Sand-Slime Tailin	0.059	119.0	1.54	0.65	0.89	1	0.97	25.657	356.63	29.97	28	1.63%	2.5	47%
27.559	5592.04	19.7	0.516	19.6	24.8	10.73	2.61%	Sand-Slime Tailin	0.059	119.0	1.55	0.66	0.90	1	0.97	18.972	263.71	22.21	20	2.84%	2.7	47%
27.723	5591.88	15.4	0.486	15.2	25.6	11.08	3.16%	Slime Tailings	0.057	113.1	1.56	0.66	0.90	1	0.97	14.708	204.44	17.26	15	3.51%	2.9	71%
27.887	5591.71	13.0	0.486	12.8	45.1	19.56	3.73%	Slime Tailings	0.057	113.1	1.57	0.67	0.91	1	0.96	12.270	170.56	14.57	13	4.24%	3.0	71%
28.051	5591.55	11.8	0.486	11.3	75.6	32.75	4.13%	Slime Tailings	0.057	113.1	1.58	0.67	0.91	1	0.96	10.818	150.37	13.09	11	4.77%	3.1	71%
29.200	5590.40							Slime Tailings	0.057	113.1												

Conditions at t_1 / Liquefaction Triggering Analyses (Idriss & Boulanger (2008); Youd et al. (2001))

Depth at time of CPT (ft)	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No	I&B r_d	I&B C_σ	I&B K_σ	I&B K_α	I&B CSR M=7.5, σ'=1atm	I&B Δq_{c1n}	I&B $q_{c1n\text{-}cs}$	I&B (CRR) M=7.5, σ'=1atm	I&B FoS	Youd r_d	Youd D_r	Youd f	Youd K_σ	Youd K_α	Youd CSR M=7.5, σ'=1atm	Youd Kc	Youd $q_{c1n\text{-}cs}$	Youd (CRR) M=7.5, σ'=1atm	Youd FoS	Avg FoS	Liquefiable? 1=Yes 2=No
17.388	1.37	0.00	1.37	0	0.90	0.05	0.98	1.0	0.051	37.72	59.64	0.087	1.73	0.94	0.27	0.80	1.07	1.0	0.039	4.07	89.16	0.146	4.87	3.30	2
17.552	1.38	0.00	1.38	0	0.90	0.05	0.98	1.0	0.051	35.62	51.49	0.079	1.56	0.94	0.23	0.80	1.07	1.0	0.039	5.55	88.16	0.144	4.76	3.16	2
17.716	1.39	0.00	1.39	0	0.89	0.05	0.98	1.0	0.050	35.87	52.48	0.080	1.58	0.94	0.24	0.80	1.06	1.0	0.039	4.87	80.89	0.129	4.26	2.92	2
17.880	1.40	0.00	1.40	0	0.89	0.05	0.97	1.0	0.050	36.98	56.04	0.084	1.66	0.94	0.25	0.80	1.06	1.0	0.039	3.58	68.22	0.110	3.58	2.62	2
18.044	1.40	0.00	1.40	0	0.89	0.05	0.98	1.0	0.050	35.45	50.83	0.078	1.56	0.94	0.23	0.80	1.06	1.0	0.039	4.82	74.13	0.118	3.83	2.69	2
18.208	1.41	0.00	1.41	0	0.89	0.05	0.98	1.0	0.050	34.70	47.96	0.076	1.50	0.94	0.21	0.80	1.06	1.0	0.039	5.21	69.03	0.111	3.57	2.54	2
18.372	1.42	0.00	1.42	0	0.89	0.05	0.98	1.0	0.050	35.50	50.32	0.078	1.55	0.94	0.22	0.80	1.06	1.0	0.039	3.79	56.22	0.097	3.10	2.32	2
18.537	1.43	0.00	1.43	0	0.89	0.05	0.98	1.0	0.050	35.51	50.36	0.078	1.55	0.94	0.22	0.80	1.06	1.0	0.039	4.27	63.40	0.104	3.31	2.43	2
18.701	1.44	0.00	1.44	0	0.89	0.05	0.97	1.0	0.050	36.42	53.85	0.081	1.63	0.94	0.24	0.80	1.06	1.0	0.039	3.59	62.60	0.103	3.26	2.44	2
18.865	1.45	0.00	1.45	0	0.89	0.05	0.97	1.0	0.050	37.29	57.23	0.085	1.70	0.94	0.26	0.80	1.05	1.0	0.039	3.05	60.77	0.101	3.17	2.44	2
19.029	1.46	0.00	1.46	0	0.88	0.05	0.97	1.0	0.050	37.25	57.06	0.085	1.70	0.94	0.26	0.80	1.05	1.0	0.039	3.48	68.88	0.110	3.45	2.58	2
19.193	1.47	0.00	1.47	0	0.88	0.05	0.97	1.0	0.050	37.33	57.37	0.085	1.71	0.94	0.26	0.80	1.05	1.0	0.039	3.14	62.99	0.103	3.21	2.46	2
19.357	1.48	0.00	1.48	0	0.88	0.05	0.97	1.0	0.050	36.32	53.47	0.081	1.63	0.94	0.24	0.80	1.05	1.0	0.039	3.47	59.53	0.100	3.07	2.35	2
19.521	1.49	0.00	1.49	0	0.88	0.05	0.97	1.0	0.050	35.45	50.14	0.078	1.57	0.94	0.22	0.80	1.05	1.0	0.039	3.75	55.14	0.096	2.93	2.25	2
19.685	1.50	0.00	1.50	0	0.88	0.05	0.97	1.0	0.049	35.22	49.98	0.077	1.57	0.94	0.22	0.80	1.05	1.0	0.039	4.71	69.55	0.111	3.39	2.48	2
19.849	1.51	0.00	1.51	0	0.88	0.07	0.96	1.0	0.049	34.54	83.26	0.117	2.40	0.94	0.40	0.80	1.05	1.0	0.040	1.46	71.18	0.114	3.44	2.92	2
20.013	1.52	0.00	1.52	0	0.88	0.07	0.96	1.0	0.049	45.82	90.08	0.127	2.61	0.94	0.38	0.80	1.04	1.0	0.040	1.86	82.24	0.132	3.96	3.29	2
20.177	1.53	0.00	1.53	0	0.87	0.06	0.97	1.0	0.049	38.95	64.39	0.093	1.90	0.94	0.29	0.80	1.04	1.0	0.040	3.80	96.63	0.164	4.90	3.40	2
20.341	1.54	0.00	1.54	0	0.87	0.05	0.97	1.0	0.049	36.59	55.27	0.083	1.69	0.94	0.25	0.80	1.04	1.0	0.040	5.20	97.17	0.165	4.92	3.30	2
20.505	1.55	0.00	1.55	0	0.87	0.05	0.97	1.0	0.049	35.51	51.09	0.079	1.60	0.94	0.23	0.80	1.04	1.0	0.040	5.80	90.30	0.148	4.39	3.00	2
20.669	1.56	0.00	1.56	0	0.87	0.05	0.97	1.0	0.049	35.92	52.68	0.080	1.64	0.94	0.24	0.80	1.04	1.0	0.040	5.09	85.21	0.138	4.05	2.84	2
20.833	1.57	0.00	1.57	0	0.87	0.05	0.97	1.0	0.049	36.57	54.44	0.082	1.68	0.93	0.24	0.80	1.04	1.0	0.040	4.06	72.57	0.116	3.38	2.53	2
20.997	1.58	0.00	1.58	0	0.87	0.05	0.97	1.0	0.049	37.46	57.87	0.086	1.76	0.93	0.26	0.80	1.04	1.0	0.040	3.40	69.41	0.111	3.23	2.49	2
21.161	1.59	0.00	1.59	0	0.87	0.06	0.97	1.0	0.048	38.84	63.19	0.091	1.89	0.93	0.28	0.80	1.04	1.0	0.040	2.94	71.66	0.114	3.30	2.59	2
21.325	1.60	0.00	1.60	0	0.87	0.05	0.97	1.0	0.048	38.57	62.13	0.090	1.87	0.93	0.28	0.80	1.03	1.0	0.040	2.83	66.67	0.108	3.09	2.48	2
21.489	1.61	0.00	1.61	0	0.86	0.05	0.97	1.0	0.048	35.99	52.20	0.080	1.65	0.93	0.23	0.80	1.03	1.0	0.040	3.91	63.32	0.104	2.96	2.30	2
21.653	1.62	0.00	1.62	0	0.86	0.05	0.97	1.0	0.048	34.39	46.74	0.074	1.54	0.93	0.20	0.80	1.03	1.0	0.040	5.44	67.21	0.108	3.07	2.31	2
21.817	1.63	0.00	1.63	0	0.86	0.05	0.97	1.0	0.048	34.75	48.13	0.076	1.57	0.93	0.21	0.80	1.03	1.0	0.040	6.30	84.34	0.136	3.84	2.70	2
21.981	1.63	0.00	1.63	0	0.86	0.05	0.97	1.0	0.048	37.46	58.61	0.086	1.80	0.93	0.27	0.80	1.03	1.0	0.040	4.58	96.83	0.164	4.62	3.21	2
22.145	1.64	0.00	1.64	0	0.86	0.05	0.97	1.0	0.048	36.72	55.75	0.083	1.74	0.93	0.25	0.80	1.03	1.0	0.040	5.59	106.43	0.192	5.37	3.55	2
22.309	1.65	0.00	1.65	0	0.86	0.05	0.97	1.0	0.048	37.16	57.48	0.085	1.78	0.93	0.26	0.80	1.03	1.0	0.040	4.97	100.99	0.176	4.89	3.33	2
22.473	1.66	0.00	1.66	0	0.86	0.05	0.97	1.0	0.048	36.35	54.34	0.082	1.71	0.93	0.24	0.80	1.03	1.0	0.040	5.32	95.70	0.162	4.47	3.09	2
22.638	1.67	0.00	1.67	0	0.85	0.06	0.96	1.0	0.048	40.23	68.53	0.098	2.06	0.93	0.31	0.80	1.02	1.0	0.040	3.07	87.01	0.141	3.89	2.97	2
22.802	1.68	0.00	1.68	0	0.85	0.05	0.96	1.0	0.048	38.12	60.43	0.088	1.86	0.93	0.27	0.80	1.02	1.0	0.040	3.78	84.25	0.136	3.71	2.78	2
22.966	1.69	0.00	1.69	0	0.85	0.05	0.97	1.0	0.048	35.01	49.16	0.077	1.61	0.93	0.22	0.80	1.02	1.0	0.040	6.03	85.32	0.138	3.75	2.68	2
23.130	1.70	0.00	1.70	0	0.85	0.05	0.97	1.0	0.048	35.55	50.51	0.078	1.64	0.93	0.22	0.80	1.02	1.0	0.040	4.90	73.26	0.117	3.16	2.40	2
23.294	1.71	0.00	1.71	0	0.85	0.05	0.97	1.0	0.047	36.24	53.17	0.081	1.70	0.93	0.24	0.80	1.02	1.0	0.040	4.04	68.45	0.110	2.96	2.33	2
23.458	1.72	0.00	1.72	0	0.85	0.05	0.97	1.0	0.047	35.71	51.12	0.079	1.66	0.93	0.23	0.80	1.02	1.0	0.040	4.60	70.84	0.113	3.04	2.35	2
23.622	1.73	0.00	1.73	0	0.85	0.05	0.97	1.0	0.047	34.71	48.00	0.076	1.60	0.92	0.21	0.80	1.02	1.0	0.040	5.61	74.52	0.118	3.17	2.38	2
23.786	1.74	0.00	1.74	0	0.85	0.05	0.96	1.0	0.047	37.76	59.01	0.087	1.84	0.92	0.27	0.80	1.02	1.0	0.040	3.63	77.06	0.123	3.27	2.56	2
23.950	1.75	0.00	1.75	0	0.84	0.05	0.96	1.0	0.047	38.05	60.15	0.088	1.88	0.92	0.27	0.80	1.02	1.0	0.040	3.41	75.45	0.120	3.18	2.53	2
24.114	1.76	0.00	1.76	0	0.84	0.05	0.96	1.0	0.047	36.16	52.85	0.080	1.71	0.92	0.24	0.80	1.01	1.0	0.040	4.66	77.81	0.124	3.27	2.49	2
24.278	1.77	0.00	1.77	1	0.84	0.05	0.96	1.0	0.047	38.45	61.69	0.090	1.92	0.92	0.28	0.80	1.01	1.0	0.040	3.44	79.99	0.128	3.35	2.63	2
24.442	1.78	0.01	1.77	1	0.84	0.06	0.96	1.0	0.047	38.72	62.71	0.091	1.94	0.92	0.28	0.80	1.01	1.0	0.040	3.52	84.43	0.136	3.55	2.74	2
24.606	1.79	0.01	1.78	1	0.84	0.05	0.96	1.0	0.047	37.42	58.48	0.086	1.84	0.92	0.26	0.80	1.01	1.0	0.040	4.35	91.61	0.151	3.92	2.88	2
24.770	1.80	0.02	1.78	1	0.84	0.05	0.96	1.0	0.047	35.14	49.65	0.077	1.64	0.92	0.22	0.80	1.01	1.0	0.040	5.71	82.84	0.133	3.42	2.53	2
24.934	1.81	0.02	1.78	1	0.84	0.05	0.97	1.0	0.047	34.34	46.55	0.074	1.57	0.91	0.20	0.80	1.01	1.0	0.040	6.33	77.25	0.123	3.14	2.36	2
25.098	1.82	0.03	1.79	1	0.83	0.05	0.97	1.0	0.047	34.30	46.39	0.074	1.57	0.91	0.20	0.80	1.01	1.0	0.041	6.34	76.70	0.122	3.10	2.33	2
25.262	1.83	0.03	1.79	1	0.83	0.05	0.96	1.0	0.047	36.23	53.14	0.081	1.71	0.91	0.24	0.80	1.01	1.0	0.041	4.37	73.93	0.118	2.97	2.34	2
25.426	1.83	0.04	1.80	1	0.83	0.05	0.96	1.0	0.047	35.93	52.71	0.080	1.70	0.91	0.24	0.80	1.01	1.0	0.041	5.42	91.00	0.150	3.76	2.73	2
25.590	1.84	0.04	1.80	1	0.83	0.05	0.96	1.0	0.047	36.30	54.14	0.082	1.73	0.91	0.24	0.80	1.00	1.0	0.041	4.79	85.43	0.138	3.44	2.58	2
25.754	1.85	0.05	1.80	1	0.83	0.05	0.96	1.0	0.047	35.20	49.89	0.077	1.63	0.91	0.22	0.80	1.00	1.0	0.041	6.13	90.06	0.148	3.67	2.65	2
25.918	1.86	0.05	1.81	1	0.83	0.05	0.96	1.0	0.047	36.61	54.61	0.082	1.73	0.91	0.24	0.80	1.00	1.0	0.041	3.79	68.14	0.109	2.69	2.21	2
26.082	1.87	0.06	1.81	1	0.83	0.06	0.96	1.0	0.047	38.73	62.78	0.091	1.92	0.90	0.28	0.80	1.00	1.0	0.041	2.68	64.55	0.105	2.57	2.25	2
26.246	1.88	0.06	1.82	1	0.82	0.05	0.96	1.0	0.047	37.60	58.42	0.086	1.82	0.90	0.26	0.80	1.00	1.0	0.041	3.20	66.52	0.107	2.61	2.21	2
26.410	1.89	0.07	1.82	1	0.82	0.05	0.96	1.0	0.048	35.46	50.90	0.078	1.65	0.90	0.23	0.80	1.00	1.0	0.041	5.18	79.94	0.128	3.08	2.36	2
26.574	1.90	0.07	1.83	1	0.82	0.05	0.96	1.0	0.048	35.29	49.50	0.077	1.62	0.90	0.22	0.80	1.00	1.0	0.041	4.83	68.70	0.110	2.64	2.13	2
26.739	1.91	0.08	1.83	1	0.82	0.06	0.96	1.0	0.047	38.76	62.88	0.091	1.92	0.90	0.28	0.80	1.00	1.0	0.041	2.30	55.56	0.096	2.29	2.10	2
26.903	1.92	0.08	1.84	1	0.82	0.06	0.96	1.0	0.047	39.01	63.86	0.092	1.94	0.90	0.29	0.80	1.00	1.0	0.042	2.24	55.75	0.096	2.28	2.11	2
27.067	1.93	0.09	1.84	1	0.82	0.06	0.96	1.0	0.047	38.89	63.36	0.092	1.93	0.90	0.29	0.80	0.99	1.0	0.042	2.60	63.68	0.104	2.45	2.19	2
27.231	1.94	0.09	1.85	1	0.82	0.05	0.96	1.0	0.048	38.40	61.48	0.090	1.88	0.90	0.28	0.80	0.99	1.0	0.042	2.95	68.20	0.110	2.56	2.22	2
27.395	1.95	0.10	1.85	1	0.82	0.06	0.96	1.0	0.047	40.81	70.78	0.101	2.12	0.89	0.32	0.80	0.99	1.0	0.042	2.66	79.84	0.127	2.96	2.54	2
27.559	1.96	0.10	1.86	1	0.81	0.05	0.96	1.0	0.048	38.09	60.30	0.088	1.85	0.89	0.27	0.80	0.99	1.0	0.042	4.26	94.50	0.158	3.66	2.76	2
27.723	1.97	0.11	1.86	1	0.81	0.05	0.96	1.0	0.048	36.10	53.36	0.081	1.69	0.89	0.24	0.80	0.99	1.0	0.042	5.57	96.13	0.163	3.73	2.71	2
27.887	1.98	0.12	1.86	1	0.81	0.05	0.96	1.0	0.048	35.16	49.73	0.077	1.61	0.89	0.22	0.80	0.99	1.0	0.042	6.77	98.65	0.169	3.87	2.74	2
28.051	1.99	0.12	1.87	1	0.81	0.05	0.96	1.0	0.048	34.65	47.74	0.075	1.57	0.89	0.21	0.80	0.99	1.0	0.042	7.64	100.00	0.173	3.93	2.75	2
29.200	2.05	0.14	1.91	1																					

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.347

Depth at t_1, z_1 m	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Maximum Shear Strain Modulus, G_{max} tsf	P = γ_{eff}*(G_{eff}/G_{max}) tsf	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
7.45	500	1.8E-03	4.4E+02	3.0E-04	16	0.471	5856	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.13%	0.0035
7.50	500	1.8E-03	4.4E+02	3.1E-04	16	0.472	5840	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.16%	0.0035
7.55	500	1.8E-03	4.4E+02	3.1E-04	16	0.472	5824	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.19%	0.0036
7.60	500	1.8E-03	4.6E+02	2.9E-04	10	0.221	7049	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.79%	0.0029
7.65	500	1.8E-03	4.4E+02	3.1E-04	16	0.473	5791	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.25%	0.0037
7.70	500	1.8E-03	4.4E+02	3.1E-04	16	0.473	5775	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.27%	0.0037
7.75	500	1.8E-03	4.6E+02	3.0E-04	10	0.222	6990	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.87%	0.0031
7.80	500	1.8E-03	4.6E+02	3.0E-04	10	0.223	6970	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.90%	0.0031
7.85	500	1.8E-03	4.6E+02	3.0E-04	10	0.223	6951	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.92%	0.0032
7.90	500	1.8E-03	4.6E+02	3.1E-04	10	0.223	6931	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.95%	0.0032
7.95	500	1.8E-03	4.6E+02	3.1E-04	10	0.224	6912	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.98%	0.0032
8.00	500	1.8E-03	4.6E+02	3.1E-04	10	0.224	6893	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.01%	0.0033
8.05	500	1.8E-03	4.6E+02	3.1E-04	10	0.225	6874	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.04%	0.0033
8.10	500	1.8E-03	4.6E+02	3.1E-04	10	0.225	6856	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.07%	0.0034
8.15	538	1.8E-03	5.1E+02	2.9E-04	16	0.476	5635	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.78%	0.0029
8.20	538	1.9E-03	5.5E+02	2.7E-04	0	0.227	8615	0.07%	2.20	1.00	0.03%	0.001	0.34	0.079	0.765	0.13%	0.0002
8.25	538	1.8E-03	5.3E+02	2.8E-04	10	0.226	6801	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.44%	0.0024
8.30	538	1.8E-03	5.1E+02	2.9E-04	16	0.478	5590	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.85%	0.0030
8.35	538	1.8E-03	5.1E+02	3.0E-04	16	0.478	5577	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.88%	0.0031
8.40	538	1.8E-03	5.1E+02	3.0E-04	16	0.478	5563	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.90%	0.0031
8.45	538	1.8E-03	5.1E+02	3.0E-04	16	0.479	5549	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.92%	0.0032
8.50	538	1.8E-03	5.3E+02	2.9E-04	10	0.228	6716	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.55%	0.0025
8.55	538	1.8E-03	5.3E+02	2.9E-04	10	0.228	6698	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.57%	0.0026
8.60	538	1.8E-03	5.3E+02	2.9E-04	10	0.228	6681	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.60%	0.0026
8.65	538	1.8E-03	5.3E+02	2.9E-04	10	0.229	6664	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.62%	0.0027
8.70	538	1.8E-03	5.3E+02	2.9E-04	10	0.229	6648	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.64%	0.0027
8.75	538	1.8E-03	5.1E+02	3.1E-04	16	0.481	5466	0.08%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.06%	0.0034
8.80	538	1.8E-03	5.1E+02	3.1E-04	16	0.481	5454	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.08%	0.0034
8.85	538	1.8E-03	5.1E+02	3.1E-04	16	0.481	5441	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.11%	0.0035
8.90	538	1.8E-03	5.1E+02	3.2E-04	16	0.482	5428	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.13%	0.0035
8.95	538	1.8E-03	5.1E+02	3.2E-04	16	0.482	5416	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.15%	0.0035
9.00	538	1.8E-03	5.1E+02	3.2E-04	16	0.482	5403	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.17%	0.0036
9.05	538	1.8E-03	5.3E+02	3.0E-04	10	0.232	6538	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.79%	0.0029
9.10	538	1.8E-03	5.3E+02	3.1E-04	10	0.232	6523	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.82%	0.0030
9.15	538	1.8E-03	5.1E+02	3.2E-04	16	0.483	5365	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.25%	0.0037
9.20	538	1.8E-03	5.3E+02	3.1E-04	10	0.233	6492	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.86%	0.0031
9.25	538	1.8E-03	5.3E+02	3.1E-04	10	0.233	6477	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.88%	0.0031
9.30	538	1.8E-03	5.3E+02	3.1E-04	10	0.233	6462	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.91%	0.0031
9.35	538	1.8E-03	5.1E+02	3.3E-04	16	0.485	5316	0.09%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.34%	0.0038
9.40	538	1.8E-03	5.3E+02	3.2E-04	10	0.234	6432	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.95%	0.0032
9.45	538	1.8E-03	5.3E+02	3.2E-04	10	0.234	6417	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.97%	0.0032
9.50	538	1.8E-03	5.3E+02	3.2E-04	10	0.235	6403	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.00%	0.0033
9.55	538	1.8E-03	5.3E+02	3.2E-04	10	0.235	6392	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.02%	0.0033
9.60	538	1.8E-03	5.3E+02	3.2E-04	10	0.235	6385	0.08%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.05%	0.0034
9.65	538	1.8E-03	5.1E+02	3.4E-04	16	0.486	5260	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.49%	0.0041
9.70	594	1.8E-03	6.2E+02	2.8E-04	16	0.486	5254	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.56%	0.0026
9.75	594	1.8E-03	6.2E+02	2.8E-04	16	0.486	5249	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.58%	0.0026
9.80	594	1.8E-03	6.2E+02	2.9E-04	16	0.486	5244	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.60%	0.0026
9.85	594	1.8E-03	6.5E+02	2.7E-04	10	0.236	6353	0.05%	2.00	0.65	0.03%	0.008	0.34	0.079	0.765	1.27%	0.0021
9.90	594	1.8E-03	6.2E+02	2.9E-04	16	0.487	5234	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.64%	0.0027
9.95	594	1.8E-03	6.2E+02	2.9E-04	16	0.487	5229	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.66%	0.0027
10.00	594	1.8E-03	6.2E+02	2.9E-04	16	0.487	5224	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.68%	0.0028
10.05	594	1.8E-03	6.5E+02	2.8E-04	10	0.236	6328	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.34%	0.0022
10.10	594	1.8E-03	6.5E+02	2.8E-04	10	0.236	6321	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.36%	0.0022
10.15	594	1.8E-03	6.5E+02	2.8E-04	10	0.237	6315	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.38%	0.0023
10.20	594	1.8E-03	6.2E+02	3.0E-04	16	0.488	5203	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.76%	0.0029
10.25	594	1.8E-03	6.5E+02	2.8E-04	10	0.237	6302	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.42%	0.0023
10.30	594	1.8E-03	6.5E+02	2.9E-04	10	0.237	6295	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.44%	0.0024
10.35	594	1.8E-03	6.5E+02	2.9E-04	10	0.237	6289	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.46%	0.0024
10.40	594	1.8E-03	6.5E+02	2.9E-04	10	0.237	6282	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.48%	0.0024
10.45	594	1.8E-03	6.5E+02	2.9E-04	10	0.237	6276	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.50%	0.0025
10.50	594	1.8E-03	6.5E+02	2.9E-04	10	0.238	6269	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.52%	0.0025
10.55	594	1.8E-03	6.5E+02	2.9E-04	10	0.238	6263	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.54%	0.0025
10.60	594	1.8E-03	6.2E+02	3.1E-04	16	0.489	5160	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.93%	0.0032
10.65	594	1.8E-03	6.2E+02	3.1E-04	16	0.489	5156	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.95%	0.0032
10.70	594	1.8E-03	6.2E+02	3.1E-04	16	0.489	5151	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.97%	0.0032
11.05	594	1.8E-03	6.2E+02	3.2E-04	16	0.490	5098	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.10%	0.0241

Extra layer added to analyze seismic settlement of tailings below the bottom of CPT investigation.

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2E1

Data File: 13-52106_SP2E1-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Dat

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

5613.10	Water surface elevation during CPT investigation (ft a
5611.67	Water surface elevation at t_0 (ft amsl)
5595.46	Water surface elevation at t_1 (ft amsl)
5590.46	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earth
7.51	Equiv. Number of Uniform Strain Cycles, N

5619.95	Ground Surface Elevation at time of CPT (ft amsl)
5630.46	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after place
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
2.51	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1160.95	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5590.46	Elevation of bottom of tailings (liner) (ft amsl)

2013 CPT Data from ConeTec / CPT Data Interpretations

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN
0.164	5619.79	13.5	0.057	13.5	-0.0	-0.01	0.42%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0	1.70
0.328	5619.62	36.9	0.160	36.9	0.1	0.05	0.43%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70
0.492	5619.46	45.5	0.725	45.5	0.2	0.09	1.59%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70
0.656	5619.29	78.6	0.721	78.6	0.4	0.19	0.92%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0	1.70
0.820	5619.13	133.5	1.017	133.5	1.1	0.48	0.76%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0	1.70
0.984	5618.97	159.6	1.857	159.6	1.1	0.48	1.16%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0	1.70
1.148	5618.80	202.0	1.570	202.0	1.5	0.66	0.78%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0	1.70
1.312	5618.64	282.1	2.962	282.1	2.0	0.85	1.05%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70
1.476	5618.47	258.6	3.915	258.6	2.8	1.19	1.51%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70
1.640	5618.31	203.5	4.263	203.5	3.0	1.31	2.09%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0	1.70
1.804	5618.15	196.8	3.157	196.7	3.4	1.46	1.60%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0	1.70
1.968	5617.98	198.9	2.435	198.9	3.1	1.34	1.22%	Interim Cover	0.050	100.7	0.10	0.00	0.10	0	1.70
2.133	5617.82	169.5	1.671	169.5	3.4	1.46	0.99%	Interim Cover	0.050	100.7	0.11	0.00	0.11	0	1.70
2.297	5617.65	152.5	1.369	152.5	3.4	1.45	0.90%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70
2.461	5617.49	96.6	1.501	96.6	1.4	0.60	1.55%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70
2.625	5617.33	111.8	1.580	111.8	1.3	0.55	1.41%	Interim Cover	0.050	100.7	0.13	0.00	0.13	0	1.70
2.789	5617.16	136.8	1.973	136.8	1.2	0.50	1.44%	Interim Cover	0.050	100.7	0.14	0.00	0.14	0	1.61
2.953	5617.00	124.7	1.720	124.7	1.6	0.69	1.38%	Interim Cover	0.050	100.7	0.15	0.00	0.15	0	1.64
3.117	5616.83	124.7	1.712	124.7	1.4	0.61	1.37%	Interim Cover	0.050	100.7	0.16	0.00	0.16	0	1.63
3.281	5616.67	121.9	1.635	121.9	1.2	0.52	1.34%	Sand Tailings	0.051	102.8	0.17	0.00	0.17	0	1.62
3.445	5616.51	125.5	1.702	125.5	0.9	0.41	1.36%	Sand Tailings	0.051	102.8	0.17	0.00	0.17	0	1.59
3.609	5616.34	150.5	1.842	150.5	1.6	0.68	1.22%	Sand Tailings	0.051	102.8	0.18	0.00	0.18	0	1.51
3.773	5616.18	107.6	1.906	107.6	1.3	0.56	1.77%	Sand Tailings	0.051	102.8	0.19	0.00	0.19	0	1.63
3.937	5616.01	87.2	1.794	87.2	1.1	0.46	2.06%	Sand-Slime Tailin	0.047	93.3	0.20	0.00	0.20	0	1.70
4.101	5615.85	65.2	1.491	65.2	1.0	0.41	2.29%	Sand-Slime Tailin	0.047	93.3	0.21	0.00	0.21	0	1.70
4.265	5615.68	46.2	1.366	46.2	0.5	0.23	2.96%	Sand-Slime Tailin	0.047	93.3	0.21	0.00	0.21	0	1.70
4.429	5615.52	32.1	1.104	32.1	0.4	0.18	3.44%	Slime Tailings	0.041	82.7	0.22	0.00	0.22	0	1.70
4.593	5615.36	21.5	0.652	21.5	-0.3	-0.13	3.03%	Slime Tailings	0.041	82.7	0.23	0.00	0.23	0	1.70
4.757	5615.19	14.9	0.336	15.0	-0.3	-0.11	2.25%	Sand-Slime Tailin	0.047	93.3	0.23	0.00	0.23	0	1.70
4.921	5615.03	12.8	0.162	12.8	2.1	0.92	1.27%	Sand-Slime Tailin	0.047	93.3	0.24	0.00	0.24	0	1.70
5.085	5614.86	42.1	0.172	42.1	8.1	3.53	0.41%	Sand Tailings	0.051	102.8	0.25	0.00	0.25	0	1.70
5.249	5614.70	49.6	0.237	49.6	-0.1	-0.03	0.48%	Sand Tailings	0.051	102.8	0.26	0.00	0.26	0	1.70
5.413	5614.54	53.8	0.297	53.8	0.1	0.06	0.55%	Sand Tailings	0.051	102.8	0.27	0.00	0.27	0	1.70
5.577	5614.37	52.6	0.352	52.6	-0.1	-0.03	0.67%	Sand Tailings	0.051	102.8	0.28	0.00	0.28	0	1.70
5.741	5614.21	48.6	0.424	48.6	-0.1	-0.03	0.87%	Sand Tailings	0.051	102.8	0.28	0.00	0.28	0	1.70
5.905	5614.04	40.4	0.469	40.4	-0.1	-0.02	1.16%	Sand-Slime Tailin	0.047	93.3	0.29	0.00	0.29	0	1.70
6.069	5613.88	31.5	0.463	31.5	-0.1	-0.02	1.47%	Sand-Slime Tailin	0.047	93.3	0.30	0.00	0.30	0	1.70
6.234	5613.72	26.6	0.418	26.6	-0.2	-0.07	1.57%	Sand-Slime Tailin	0.047	93.3	0.31	0.00	0.31	0	1.70
6.398	5613.55	29.2	0.352	29.2	-0.1	-0.04	1.20%	Sand-Slime Tailin	0.047	93.3	0.32	0.00	0.32	0	1.70
6.562	5613.39	31.3	0.327	31.3	-0.1	-0.04	1.04%	Sand-Slime Tailin	0.047	93.3	0.32	0.00	0.32	0	1.70
6.726	5613.22	39.3	0.336	39.4	-0.1	-0.06	0.85%	Sand Tailings	0.051	102.8	0.33	0.00	0.33	0	1.70
6.890	5613.06	39.3	0.331	39.4	-0.2	-0.10	0.84%	Sand Tailings	0.062	123.5	0.34	0.00	0.34	1	1.67
7.054	5612.90	38.3	0.410	38.3	-0.2	-0.07	1.07%	Sand-Slime Tailin	0.059	119.0	0.35	0.01	0.34	1	1.67
7.218	5612.73	36.3	0.454	36.4	-0.2	-0.09	1.25%	Sand-Slime Tailin	0.059	119.0	0.36	0.01	0.35	1	1.67
7.382	5612.57	32.3	0.463	32.3	-0.5	-0.21	1.43%	Sand-Slime Tailin	0.059	119.0	0.37	0.02	0.35	1	1.69
7.546	5612.40	29.1	0.420	29.1	-0.5	-0.23	1.44%	Sand-Slime Tailin	0.059	119.0	0.38	0.02	0.36	1	1.70
7.710	5612.24	35.5	0.360	35.5	-0.4	-0.19	1.01%	Sand-Slime Tailin	0.059	119.0	0.39	0.03	0.36	1	1.65
7.874	5612.08	29.1	0.340	29.1	-0.8	-0.33	1.17%	Sand-Slime Tailin	0.059	119.0	0.40	0.03	0.37	1	1.69
8.038	5611.91	19.8	0.302	19.8	-0.8	-0.33	1.53%	Sand-Slime Tailin	0.059	119.0	0.41	0.04	0.37	1	1.70
8.202	5611.75	15.7	0.241	15.7	-0.7	-0.32	1.53%	Sand-Slime Tailin	0.059	119.0	0.42	0.04	0.38	1	1.70
8.366	5611.58	12.1	0.199	12.1	0.0	0.00	1.64%	Sand-Slime Tailin	0.059	119.0	0.43	0.05	0.38	1	1.70
8.530	5611.42	12.2	0.172	12.2	1.6	0.68	1.41%	Sand-Slime Tailin	0.059	119.0	0.44	0.05	0.39	1	1.70
8.694	5611.26	15.4	0.055	15.4	3.8	1.64	0.36%	Sand-Slime Tailin	0.059	119.0	0.45	0.06	0.39	1	1.70
8.858	5611.09	18.3	0.062	18.3	2.3	0.99	0.34%	Sand-Slime Tailin	0.059	119.0	0.46	0.06	0.40	1	1.70
9.022	5610.93	16.7	0.107	16.7	1.6	0.68	0.64%	Sand-Slime Tailin	0.059	119.0	0.47	0.07	0.40	1	1.70
9.186	5610.76	20.6	0.079	20.6	2.3	1.01	0.38%	Sand-Slime Tailin	0.059	119.0	0.48	0.07	0.41	1	1.67
9.350	5610.60	19.5	0.075	19.5	1.6	0.68	0.38%	Sand-Slime Tailin	0.059	119.0	0.49	0.08	0.41	1	1.67
9.514	5610.44	17.8	0.086	17.8	1.5	0.66	0.48%	Sand-Slime Tailin	0.059	119.0	0.50	0.08	0.41	1	1.67
9.678	5610.27	15.7	0.078	15.6	1.8	0.77	0.50%	Sand-Slime Tailin	0.059	119.0	0.51	0.09	0.42	1	1.68
9.842	5610.11	16.0	0.072	16.0	2.3	1.01	0.45%	Sand-Slime Tailin	0.059	119.0	0.52	0.09	0.42	1	1.67
10.006	5609.94	15.8	0.137	15.8	2.7	1.18	0.87%	Sand-Slime Tailin	0.059	119.0	0.53	0.10	0.43	1	1.66
10.170	5609.78	17.6	0.093	17.6	0.8	0.35	0.53%	Sand-Slime Tailin	0.059	119.0	0.54	0.10	0.43	1	1.63
10.335	5609.62	16.3	0.209	16.3	0.9	0.39	1.28%	Sand-Slime Tailin	0.059	119.0	0.55	0.11	0.44	1	1.63
10.499	5609.45	17.8	0.152	17.8	2.3	1.00	0.85%	Sand-Slime Tailin	0.059	119.0	0.56	0.11	0.44	1	1.60
10.663	5609.29	19.9	0.083	19.9	0.8	0.33	0.42%	Sand-Slime Tailin	0.059	119.0	0.57	0.12	0.45	1	1.58
10.827	5609.12	16.0	0.095	16.0	-0.5	-0.20	0.59%	Sand-Slime Tailin	0.059	119.0	0.58	0.12	0.45	1	1.60
10.991	5608.96	13.0	0.120	13.0	0.1	0.02	0.92%	Sand-Slime Tailin	0.059	119.0	0.59	0.13	0.46	1	1.62
11.155	5608.80	10.5	0.104	10.5	0.8	0.35	0.99%	Sand-Slime Tailin	0.059	119.0	0.60	0.13	0.46	1	1.63
11.319	5608.63	9.8	0.058	9.8	2.8	1.20	0.59%	Sand-Slime Tailin	0.059	119.0	0.60	0.14	0.47	1	1.62
11.483	5608.47	10.7	0.143	10.7	4.7	2.02	1.33%	Sand-Slime Tailin	0.059	119.0	0.61	0.14	0.47	1	1.60
11.647	5608.30	9.4	0.085	9.4	6.2	2.70	0.91%	Sand-Slime Tailin	0.059	119.0	0.62	0.15	0.47	1	1.59
11.811	5608.14	9.7	0.067	9.6	8.3	3.60	0.69%	Sand-Slime Tailin	0.059	119.0	0.63	0.15	0.48	1	1.58
11.975	5607.98	9.5	0.042	9.4	9.2	3.97	0.44%	Sand-Slime Tailin	0.059	119.0	0.64	0.16	0.48	1	1.57
12.139	5607.81	8.5	0.033	8.5	11.3	4.90	0.39%	Sand-Slime Tailin	0.059	119.0	0.65	0.17	0.49	1	1.56
12.303	5607.65	7.5	0.137	7.4	15.9	6.87	1.83%	Slime Tailings	0.057	113.1	0.66	0.17	0.49	1	1.55
12.467	5607.48	9.8	0.166	9.7	9.9	4.27	1.70%	Sand-Slime Tailin	0.059	119.0	0.67	0.18	0.50	1	1.54
12.631	5607.32	8.6	0.151	8.5	17.3	7.50	1.76%	Slime Tailings	0.057	113.1	0.68	0.18	0.50	1	1.53
12.795	5607.15	13.0	0.092	12.9	18.8	8.15	0.71%	Sand-Slime Tailin	0.059	119.0	0.69	0.19	0.51	1	1.51
12.959	5606.99	16.0	0.166	15.9	19.0	8.23	1.04%	Sand-Slime Tailin	0.059	119.0	0.70	0.19	0.51	1	1.47
13.123	5606.83	14.4	0.162	14.3	15.8	6.85	1.13%	Sand-Slime Tailin	0.059	119.0	0.71	0.20	0.52	1	1.48
13.287	5606.66	17.3	0.194	17.2	19.5	8.43	1.12%	Sand-Slime Tailin	0.059	119.0	0.72	0.20	0.52	1	1.45
13.451	5606.50	19.4	0.173	19.3	8.1	3.49	0.89%	Sand-Slime Tailin	0.059	119.0	0.73	0.21	0.52	1	1.43
13.615	5606.33	16.0	0.144	15.9	7.5	3.27	0.90%	Sand-Slime Tailin	0.059	119.0	0.74	0.21	0.53	1	1.44
13.779	5606.17	12.6	0.124	12.5	6.8	2.94	0.99%	Sand-Slime Tailin	0.059	119.0	0.75	0.22	0.53	1	1.45
13.943	5606.01	11.2	0.094	11.1	15.0	6.52	0.84%	Sand-Slime Tailin	0.059	119.0	0.76	0.22	0.54	1	1.44
14.107	5605.84	10.0	0.113	9.9	19.5	8.43	1.13%	Sand-Slime Tailin	0.059	119.0	0.77	0.23	0.54	1	1.43
14.271	5605.68	9.1	0.159	8.8	48.1	20.86	1.75%	Slime Tailings	0.057	113.1	0.78	0.23	0.55	1	1.42
14.436	5605.51	14.3	0.207	13.9	61.3	26.57	1.45%	Sand-Slime Tailin	0.059	119.0	0.79	0.24	0.55	1	1.41
14.600	5605.35	20.5	0.331	20.4	11.3	4.89	1.62%	Sand-Slime Tailin	0.059	119.0	0.80	0.24	0.56	1	1.37
14.764	5605.19	14.9	0.361	14.8	6.9	3.00	2.43%	Slime Tailings	0.057	113.1	0.81	0.25	0.56	1	1.39
14.928	5605.02	12.9	0.158	12.8	9.8	4.24	1.23%	Sand-Slime Tailin	0.059	119.0	0.82	0.25	0.57	1	1.39
15.092	5604.86	13.3	0.157	13.3	13.5	5.85	1.18%	Sand-Slime Tailin	0.059	119.0	0.83	0.26	0.57	1	1.38
15.256	5604.69	16.0	0.117	16.0	9.0	3.88	0.73%	Sand-Slime Tailin	0.059	119.0	0.84	0.26	0.57	1	1.36
15.420	5604.53	20.1	0.148	20.0	8.1	3.53	0.74%	Sand-Slime Tailin	0.059	119.0	0.85	0.27	0.58	1	1.33
15.584	5604.37	17.1	0.147	17.1	5.0	2.18	0.86%	Sand-Slime Tailin	0.059	119.0	0.86	0.27	0.58	1	1.34
15.748	5604.20	24.6	0.148	24.6	5.9	2.55	0.60%	Sand-Slime Tailin	0.059	119.0	0.87	0.28	0.59	1	1.30
15.912	5604.04	28.1	0.259	28.1	1.3	0.58	0.92%	Sand-Slime Tailin	0.059	119.0	0.88	0.28	0.59	1	1.28
16.076	5603.87	18.4	0.329	18.4	2.2	0.96	1.79%	Sand-Slime Tailin	0.059	119.0	0.89	0.29	0.60	1	1.31
16.240	5603.71	15.8	0.279	15.8	3.6	1.57	1.76%	Sand-Slime Tailin	0.059	119.0	0.90	0.29	0.60	1	1.31
16.404	5603.55	16.9	0.229	16.8	5.1	2.20	1.36%	Sand-Slime Tailin	0.059	119.0	0.91	0.30	0.61	1	1.30
16.568	5603.38	15.2	0.239	15.2	7.9	3.42	1.57%	Sand-Slime Tailin	0.059	119.0	0.92	0.30	0.61	1	1.30
16.732	5603.22	13.1	0.158	13.0	11.1	4.82	1.21%	Sand-Slime Tailin	0.059	119.0	0.93	0.31	0.62	1	1.30
16.896	5603.05	15.1	0.126	15.0	13.3	5.78	0.84%	Sand-Slime Tailin	0.059	119.0	0.93	0.31	0.62	1	1.29
17.060	5602.89	12.8	0.181	12.7	13.0	5.63	1.41%	Sand-Slime Tailin	0.059	119.0	0.94	0.32	0.63	1	1.28
17.224	5602.73	12.9	0.200	12.8	18.8	8.16	1.55%	Sand-Slime Tailin	0.059	119.0	0.95	0.32	0.63	1	1.28

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2E1

Data File: 13-52106_SP2E1-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Dat

Legend:
- Tailings Sands
- Tailings Sand-Slimes
- Tailings Slimes
- Interim Cover
- Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69

Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Parameter
5613.10	Water surface elevation during CPT investigation (ft a
5611.67	Water surface elevation at t_0 (ft amsl)
5595.46	Water surface elevation at t_1 (ft amsl)
5590.46	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earth
7.51	Equiv. Number of Uniform Strain Cycles, N

Value	Parameter
5619.95	Ground Surface Elevation at time of CPT (ft amsl)
5630.46	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after place
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
2.51	Thickness of Random/Platform Fill on top of existing interim cover (ft)
1160.95	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5590.46	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer	Total Stress at Midpoint of Layer	Equil Pore Pressure at Bottom of Layer	Equil Pore Pressure at Midpoint of Layer (tsf)	Effective Stress at Bottom of Layer	Effective Stress at Midpoint of Layer	Midpoint Depth at t_1, z_1	Shear Wave Velocity, V_s	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
Erosion Protection Layer	######	5630.21	5629.96	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014	0.08	508	1.7E-03	4.4E+02	3.0E-06	11	0.068	46696	0.00%	1.20	0.80	0.04%	0.000	0.32	0.133	0.778	0.00%	0.0000
Water Storage/Rooting Zone Layer	######	5628.21	5626.46	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121	0.69	508	1.7E-03	4.3E+02	2.8E-05	11	0.118	18930	0.00%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
High Compaction Layer	######	5624.46	5622.46	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334	1.83	508	1.9E-03	4.8E+02	6.8E-05	11	0.153	12419	0.01%	0.65	0.75	0.02%	0.000	0.34	0.079	0.765	0.00%	0.0000
Platform/Random Fill Layer	######	5621.21	5619.95	2.51	0.050	101	0.580	0.517	0.00	0.00	0.580	0.517	2.82	508	1.6E-03	4.0E+02	1.2E-04	11	0.171	10362	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
17.388	5602.56	12.5	0.226	12.4	18.9	8.17	1.81%	Sand-Slime Tailin	0.059	119.0	0.96	0.33	0.64	1	1.27	15.676	217.89	18.38	18	1.96%	2.7	47%	1.54	0.00	1.54	0
17.552	5602.40	10.1	0.119	9.9	19.4	8.42	1.18%	Sand-Slime Tailin	0.059	119.0	0.97	0.33	0.64	1	1.26	12.535	174.24	14.74	14	1.31%	2.7	47%	1.55	0.00	1.55	0
17.716	5602.23	11.0	0.133	10.8	23.1	10.02	1.21%	Sand-Slime Tailin	0.059	119.0	0.98	0.34	0.64	1	1.25	13.593	188.94	16.00	16	1.33%	2.6	47%	1.56	0.00	1.56	0
17.880	5602.07	10.6	0.104	10.5	25.6	11.08	0.98%	Sand-Slime Tailin	0.059	119.0	0.99	0.34	0.65	1	1.25	13.043	181.30	15.38	15	1.08%	2.6	47%	1.57	0.00	1.57	0
18.044	5601.91	15.6	0.215	15.4	27.3	11.85	1.38%	Sand-Slime Tailin	0.059	119.0	1.00	0.35	0.65	1	1.24	19.083	265.26	22.41	22	1.47%	2.5	47%	1.58	0.00	1.58	0
18.208	5601.74	11.4	0.182	11.3	22.1	9.59	1.59%	Sand-Slime Tailin	0.059	119.0	1.01	0.35	0.66	1	1.23	13.923	193.53	16.37	16	1.75%	2.7	47%	1.59	0.00	1.59	0
18.372	5601.58	9.5	0.143	9.3	33.5	14.51	1.50%	Sand-Slime Tailin	0.059	119.0	1.02	0.36	0.66	1	1.23	11.418	158.71	13.56	13	1.68%	2.8	47%	1.60	0.00	1.60	0
18.537	5601.41	16.2	0.140	15.9	56.4	24.43	0.86%	Sand-Slime Tailin	0.059	119.0	1.03	0.36	0.67	1	1.22	19.318	268.52	22.93	23	0.92%	2.4	47%	1.61	0.00	1.61	0
18.701	5601.25	17.9	0.177	17.7	23.0	9.97	0.99%	Sand-Slime Tailin	0.059	119.0	1.04	0.37	0.67	1	1.21	21.370	297.05	25.02	25	1.05%	2.4	47%	1.62	0.00	1.62	0
18.865	5601.09	14.9	0.143	14.7	24.5	10.62	0.96%	Sand-Slime Tailin	0.059	119.0	1.05	0.37	0.68	1	1.21	17.787	247.23	20.87	20	1.03%	2.5	47%	1.63	0.00	1.63	0
19.029	5600.92	18.2	0.189	18.2	13.4	5.82	1.04%	Sand-Slime Tailin	0.059	119.0	1.06	0.38	0.68	1	1.19	21.656	301.01	25.27	25	1.10%	2.4	47%	1.64	0.00	1.64	0
19.193	5600.76	15.7	0.226	15.6	17.1	7.41	1.44%	Sand-Slime Tailin	0.059	119.0	1.07	0.39	0.69	1	1.19	18.615	258.74	21.77	21	1.54%	2.6	47%	1.65	0.00	1.65	0
19.357	5600.59	12.4	0.221	12.1	42.6	18.48	1.79%	Sand-Slime Tailin	0.059	119.0	1.08	0.39	0.69	1	1.19	14.370	199.75	17.06	16	1.96%	2.7	47%	1.66	0.00	1.66	0
19.521	5600.43	15.2	0.223	14.8	64.4	27.89	1.47%	Sand-Slime Tailin	0.059	119.0	1.09	0.40	0.70	1	1.18	17.474	242.88	20.85	20	1.58%	2.6	47%	1.67	0.00	1.67	0
19.685	5600.27	12.3	0.248	12.1	35.7	15.47	2.01%	Sand-Slime Tailin	0.059	119.0	1.10	0.40	0.70	1	1.18	14.233	197.84	16.84	16	2.21%	2.8	47%	1.68	0.00	1.68	0
19.849	5600.10	12.3	0.010	12.0	55.6	24.11	0.08%	Sand-Slime Tailin	0.059	119.0	1.11	0.41	0.70	1	1.17	14.008	194.71	16.74	16	0.09%	2.3	47%	1.69	0.00	1.69	0
20.013	5599.94	16.7	0.105	16.5	32.1	13.89	0.63%	Sand-Slime Tailin	0.059	119.0	1.12	0.41	0.71	1	1.16	19.178	266.58	22.54	22	0.67%	2.4	47%	1.70	0.00	1.70	0
20.177	5599.77	11.0	0.151	11.0	8.6	3.72	1.37%	Sand-Slime Tailin	0.059	119.0	1.13	0.42	0.71	1	1.16	12.696	176.48	14.82	14	1.53%	2.7	47%	1.71	0.00	1.71	0
20.341	5599.61	16.5	0.104	16.4	12.3	5.34	0.63%	Sand-Slime Tailin	0.059	119.0	1.14	0.42	0.72	1	1.15	18.850	262.02	22.00	21	0.68%	2.4	47%	1.72	0.00	1.72	0
20.505	5599.45	26.3	0.244	26.2	16.8	7.29	0.93%	Sand-Slime Tailin	0.059	119.0	1.15	0.43	0.72	1	1.13	29.559	410.87	34.47	35	0.97%	2.3	47%	1.73	0.00	1.73	0
20.669	5599.28	18.0	0.319	18.0	11.3	4.89	1.77%	Sand-Slime Tailin	0.059	119.0	1.16	0.43	0.73	1	1.14	20.422	283.87	23.81	23	1.89%	2.6	47%	1.74	0.00	1.74	0
20.833	5599.12	15.8	0.362	15.7	15.0	6.52	2.29%	Sand-Slime Tailin	0.059	119.0	1.17	0.44	0.73	1	1.13	17.855	248.19	20.86	20	2.47%	2.7	47%	1.75	0.00	1.75	0
20.997	5598.95	13.5	0.268	13.3	25.6	11.09	1.99%	Sand-Slime Tailin	0.059	119.0	1.18	0.44	0.74	1	1.13	15.024	208.84	17.66	17	2.18%	2.7	47%	1.76	0.00	1.76	0
21.161	5598.79	13.5	0.247	13.3	33.1	14.34	1.83%	Sand-Slime Tailin	0.059	119.0	1.19	0.45	0.74	1	1.12	14.951	207.82	17.63	17	2.00%	2.7	47%	1.77	0.00	1.77	0
21.325	5598.62	14.2	0.171	14.0	32.9	14.27	1.20%	Sand-Slime Tailin	0.059	119.0	1.20	0.45	0.75	1	1.12	15.661	217.68	18.46	17	1.31%	2.6	47%	1.78	0.00	1.78	0
21.489	5598.46	21.5	0.169	21.3	27.8	12.05	0.79%	Sand-Slime Tailin	0.059	119.0	1.21	0.46	0.75	1	1.11	23.539	327.20	27.56	27	0.83%	2.3	47%	1.79	0.00	1.79	0
21.653	5598.30	19.5	0.201	19.4	19.6	8.49	1.03%	Sand-Slime Tailin	0.059	119.0	1.22	0.46	0.76	1	1.10	21.372	297.07	24.98	24	1.10%	2.4	47%	1.80	0.00	1.80	0
21.817	5598.13	15.2	0.196	15.1	19.5	8.45	1.29%	Sand-Slime Tailin	0.059	119.0	1.23	0.47	0.76	1	1.10	16.637	231.26	19.48	18	1.40%	2.6	47%	1.81	0.00	1.81	0
21.981	5597.97	13.5	0.188	13.3	22.6	9.79	1.40%	Sand-Slime Tailin	0.059	119.0	1.24	0.47	0.77	1	1.10	14.595	202.88	17.13	16	1.54%	2.7	47%	1.82	0.00	1.82	0
22.145	5597.80	12.1	0.166	12.0	27.8	12.05	1.37%	Sand-Slime Tailin	0.059	119.0	1.25	0.48	0.77	1	1.09	13.053	181.44	15.38	14	1.52%	2.7	47%	1.83	0.00	1.83	0
22.309	5597.64	9.5	0.208	9.3	33.0	14.31	2.19%	Slime Tailings	0.057	113.1	1.26	0.48	0.77	1	1.09	10.097	140.34	11.99	11	2.52%	2.9	71%	1.84	0.00	1.84	0
22.473	5597.48	10.2	0.214	9.9	57.5	24.93	2.09%	Slime Tailings	0.057	113.1	1.27	0.49	0.78	1	1.08	10.671	148.33	12.85	12	2.39%	2.9	71%	1.85	0.00	1.85	0
22.638	5597.31	12.2	0.168	12.0	43.6	18.90	1.37%	Sand-Slime Tailin	0.059	119.0	1.28	0.49	0.78	1	1.08	12.884	179.09	15.30	14	1.53%	2.7	47%	1.86	0.00	1.86	0
22.802	5597.15	15.7	0.124	15.5	28.3	12.28	0.79%	Sand-Slime Tailin	0.059	119.0	1.29	0.50	0.79	1	1.07	16.653	231.47	19.56	18	0.86%	2.5	47%	1.87	0.00	1.87	0
22.966	5596.98	18.3	0.115	18.2	21.4	9.29	0.63%	Sand-Slime Tailin	0.059	119.0	1.29	0.50	0.79	1	1.07	19.355	269.03	22.65	21	0.68%	2.4	47%	1.88	0.00	1.88	0
23.130	5596.82	17.6	0.122	17.5	22.6	9.77	0.69%	Sand-Slime Tailin	0.059	119.0	1.30	0.51	0.80	1	1.06	18.534	257.62	21.70	20	0.75%	2.4	47%	1.89	0.00	1.89	0
23.294	5596.66	16.7	0.117	16.6	23.3	10.10	0.70%	Sand-Slime Tailin	0.059	119.0	1.31	0.51	0.80	1	1.06	17.505	243.32	20.51	19	0.76%	2.4	47%	1.89	0.00	1.89	0
23.458	5596.49	18.6	0.112	18.5	23.3	10.10	0.60%	Sand-Slime Tailin	0.059	119.0	1.32	0.52	0.81	1	1.05	19.432	270.11	22.75	21	0.65%	2.4	47%	1.90	0.00	1.90	0
23.622	5596.33	24.6	0.061	24.5	18.8	8.15	0.25%	Sand-Slime Tailin	0.059	119.0	1.33	0.52	0.81	1	1.04	25.556	355.23	29.82	29	0.26%	2.1	47%	1.91	0.00	1.91	0
23.786	5596.16	27.8	0.103	27.7	11.3	4.89	0.37%	Sand-Slime Tailin	0.059	119.0	1.34	0.53	0.82	1	1.04	28.802	400.34	33.54	32	0.39%	2.1	47%	1.92	0.00	1.92	0
23.950	5596.00	23.4	0.209	23.4	12.0	5.22	0.89%	Sand-Slime Tailin	0.059	119.0	1.35	0.53	0.82	1	1.04	24.226	336.75	28.23	27	0.95%	2.4	47%	1.93	0.00	1.93	0
24.114	5595.84	18.1	0.289	18.0	13.9	6.03	1.60%	Sand-Slime Tailin	0.059	119.0	1.36	0.54	0.82	1	1.03	18.635	259.03	21.75	20	1.73%	2.6	47%	1.94	0.00	1.94	0
24.278	5595.67	18.2	0.238	18.1	15.7	6.80	1.31%	Sand-Slime Tailin	0.059	119.0	1.37	0.54	0.83	1	1.03	18.616	258.76	21.74	20	1.42%	2.6	47%	1.95	0.00	1.95	0
24.442	5595.51	24.4	0.195	24.3	16.8	7.27	0.80%	Sand-Slime Tailin	0.059	119.0	1.38	0.55	0.83	1	1.02	24.907	346.21	29.05	28	0.85%	2.3	47%	1.96	0.00	1.96	0
24.606	5595.34	34.4	0.343	34.3	15.2	6.60	1.00%	Sand-Slime Tailin	0.059	119.0	1.39	0.55	0.84	1	1.02	34.889	484.95	40.63	39	1.04%	2.2	47%	1.97	0.00	1.97	1
24.770	5595.18	20.5	0.393	20.4	14.3	6.19	1.91%	Sand-Slime Tailin	0.059	119.0	1.40	0.56	0.84	1	1.02	20.768	288.68	24.23	23	2.05%	2.6	47%	1.98	0.01	1.97	1
24.934	5595.02	16.7	0.314	16.6	16.6	7.19	1.89%	Sand-Slime Tailin	0.059	119.0	1.41	0.56	0.85	1	1.01	16.751	232.84	19.58	18	2.06%	2.7	47%	1.99	0.01	1.98	1
25.098	5594.85	14.6	0.266	14.4	26.3	11.40	1.83%	Sand-Slime Tailin	0.059	119.0	1.42	0.57	0.85	1	1.01	14.503	201.59	17.04	15	2.03%	2.7	47%	2.00	0.02	1.98	1
25.262	5594.69	24.0	0.214	23.8	30.2	13.07	0.89%	Sand-Slime Tailin	0.059	119.0	1.43	0.57	0.86	1	1.00	23.851	331.52	27.92	26	0.95%	2.4	47%	2.01	0.02	1.99	1
25.426	5594.52	24.6	0.322	24.5	24.1	10.42	1.31%	Sand-Slime Tailin	0.059	119.0	1.44	0.58	0.86	1	1.00	24.455	339.93	28.58	27	1.39%	2.5	47%	2.02	0.03	1.99	1
25.590	5594.36	18.9	0.380	18.7	25.6	11.07	2.01%	Sand-Slime Tailin	0.059	119.0	1.45	0.58	0.87	1	1.00	18.640	259.10	21.83	20	2.18%	2.7	47%	2.03	0.03	2.00	1
25.754	5594.20	17.6	0.410	17.4	32.3	14.00	2.33%	Sand-Slime Tailin	0.059	119.0	1.46	0.59	0.87	1	0.99	17.234	239.55	20.25	19	2.54%	2.7	47%	2.04	0.04	2.00	1
25.918	5594.03	15.1	0.388	14.8	47.4	20.55	2.56%	Slime Tailings	0.057	113.1	1.47	0.59	0.88	1	0.99	14.652	203.67	17.36	16	2.84%	2.8	71%	2.05	0.04	2.01	1
26.082	5593.87	12.7	0.338	12.4	51.7	22.40	2.65%	Slime Tailings	0.057	113.1	1.48	0.60	0.88	1	0.98	12.217	169.82	14.56	13	3.00%	2.9	71%	2.06	0.05	2.01	1
26.246	5593.70	17.4	0.296	17.0	74.4	32.24	1.70%	Sand-Slime Tailin	0.059	119.0	1.49	0.61	0.88	1	0.98	16.605	230.81	19.81	18	1.86%	2.7	47%	2.07	0.05	2.01	1
26.410	5593.54	15.8	0.331	15.5	39.8	17.23	2.10%	Sand-Slime Tailin	0.059	119.0	1.50	0.61	0.89	1	0.98	15.162	210.75	17.89	16	2.32%	2.8	47%	2.08	0.06	2.02	1
26.574	5593.38	15.8	0.404	15.3	86.3	37.40	2.55%	Slime Tailings	0.057	113.1	1.51	0.62	0.89	1	0.97	14.863	206.60	17.87	16	2.82%	2.8	71%	2.09	0.07	2.02	1
26.739	5593.21	16.2	0.416	16.0	39.0	16.89	2.56%	Slime Tailings	0.057	113.1	1.52	0.62	0.90	1	0.97	15.487	215.27	18.26	16	2.83%	2.8	71%	2.10	0.07	2.03	1
26.903	5593.05	19.8	0.353	19.4	59.3	25.69	1.78%	Sand-Slime Tailin	0.059	119.0	1.53	0.63	0.90	1	0.97	18.751	260.63	22.19	20	1.93%	2.6	47%	2.11	0.08	2.03	1
27.067	5592.88	25.7	0.481	25.6	31.0	13.43	1.87%	Sand-Slime Tailin	0.059	119.0	1.54	0.63	0.91	1	0.96	24.609	342.07	28.80	27	1.99%	2.5	47%	2.12	0.08	2.04	1
27.231	5592.72	23.6	0.456	23.3	42.6	18.45	1.93%	Sand-Slime Tailin	0.059	119.0	1.55	0.64	0.91	1	0.96	22.359	310.79	26.26	24	2.07%	2.6	47%	2.13	0.09	2.04	1
27.395	5592.56	22.8	0.504	22.4	57.1	24.73	2.21%	Sand-Slime Tailin	0.059	119.0	1.56	0.64	0.92	1	0.95	21.416	297.69	25.27	23	2.37%	2.6	47%	2.14	0.09	2.05	1
27.559	5592.39	17.8	0.379	17.4	71.1	30.80	2.13%	Sand-Slime Tailin	0.059	119.0	1.57	0.65	0.92	1	0.95	16.510	229.49	19.67	18	2.33%	2.7	47%	2.15	0.10	2.05	1
27.723	5592.23	23.3	0.387	22.9	65.4	28.36	1.66%	Sand-Slime Tailin	0.059	119.0	1.58	0.65	0.92	1	0.95	21.674	301.27	25.62	23	1.78%	2.6	47%	2.16	0.10	2.06	1
27.887	5592.06	19.0	0.387	18.8	36.8	15.95	2.03%	Sand-Slime Tailin	0.059	119.0	1.59	0.66	0.93	1	0.94	17.700	246.03	20.81	19	2.22%	2.7	47%	2.17	0.11	2.06	1
28.051	5591.90	23.9	0.387	23.5	75.0	32.50	1.62%	Sand-Slime Tailin	0.059	119.0	1.60	0.66	0.93	1	0.94	22.063	306.68	26.14	24	1.73%	2.6	47%	2.18	0.11	2.06	1
29.490	5590.46							Sand-Slime Tailin	0.059	119.0													2.26	0.13	2.13	1

Liquefaction Triggering Analyses

Depth at time of CPT (ft)	Idriss & Boulanger (2008) Cyclic Stress Ratio r_d	C_σ	K_σ	K_α	CSR $_{M=7.5, \sigma'v=1atm}$	Cyclic Resistance Ratio Δqc_{1n}	qc_{1n-cs}	(CRR) $_{M=7.5, \sigma'v=1atm}$	FoS	Youd et al. (2001) Cyclic Stress Ratio r_d	D_r	f	K_σ	K_α	CSR $_{M=7.5, \sigma'v=1atm}$	Kc	qc_{1n-cs}	(CRR) $_{M=7.5, \sigma'v=1atm}$	FoS	Avg FoS	Liquefiable? 1=Yes 2=No
17.388	0.90	0.05	0.97	1.0	0.050	36.75	55.13	0.083	1.64	0.93	0.25	0.80	1.06	1.0	0.039	3.85	70.78	0.113	3.71	2.68	2
17.552	0.90	0.05	0.97	1.0	0.050	35.47	50.21	0.078	1.54	0.93	0.22	0.80	1.06	1.0	0.039	3.82	56.34	0.097	3.16	2.35	2
17.716	0.89	0.05	0.97	1.0	0.050	35.91	51.91	0.079	1.58	0.93	0.23	0.80	1.06	1.0	0.039	3.62	57.91	0.098	3.18	2.38	2
17.880	0.89	0.05	0.97	1.0	0.050	35.70	51.08	0.079	1.57	0.93	0.23	0.80	1.06	1.0	0.039	3.44	52.94	0.094	3.02	2.29	2
18.044	0.89	0.05	0.97	1.0	0.050	38.16	60.57	0.088	1.77	0.93	0.27	0.80	1.06	1.0	0.039	2.95	66.15	0.107	3.42	2.60	2
18.208	0.89	0.05	0.97	1.0	0.050	36.04	52.41	0.080	1.60	0.93	0.23	0.80	1.06	1.0	0.039	4.00	65.53	0.106	3.37	2.49	2
18.372	0.89	0.05	0.97	1.0	0.050	35.06	48.62	0.076	1.53	0.93	0.21	0.80	1.05	1.0	0.039	4.53	61.47	0.102	3.21	2.37	2
18.537	0.89	0.05	0.97	1.0	0.050	38.34	61.28	0.089	1.80	0.93	0.28	0.80	1.05	1.0	0.039	2.40	55.11	0.096	3.00	2.40	2
18.701	0.89	0.06	0.97	1.0	0.050	39.08	64.10	0.093	1.87	0.93	0.29	0.80	1.05	1.0	0.039	2.38	59.44	0.100	3.10	2.49	2
18.865	0.89	0.05	0.97	1.0	0.049	37.62	58.49	0.086	1.74	0.93	0.26	0.80	1.05	1.0	0.039	2.70	56.46	0.097	3.00	2.37	2
19.029	0.88	0.06	0.96	1.0	0.049	39.16	64.43	0.093	1.89	0.93	0.29	0.80	1.05	1.0	0.039	2.41	60.84	0.101	3.11	2.50	2
19.193	0.88	0.05	0.97	1.0	0.049	37.94	59.70	0.088	1.78	0.93	0.27	0.80	1.05	1.0	0.039	3.11	67.59	0.109	3.32	2.55	2
19.357	0.88	0.05	0.97	1.0	0.049	36.28	53.34	0.081	1.64	0.93	0.24	0.80	1.04	1.0	0.039	4.12	70.25	0.112	3.41	2.52	2
19.521	0.88	0.05	0.97	1.0	0.049	37.61	58.46	0.086	1.76	0.93	0.26	0.80	1.04	1.0	0.039	3.25	67.72	0.109	3.29	2.52	2
19.685	0.88	0.05	0.97	1.0	0.049	36.21	53.04	0.080	1.64	0.93	0.24	0.80	1.04	1.0	0.039	4.39	73.96	0.118	3.53	2.59	2
19.849	0.88	0.05	0.97	1.0	0.049	36.17	52.91	0.080	1.64	0.93	0.24	0.80	1.04	1.0	0.039	1.87	31.30	0.076	2.27	1.96	2
20.013	0.88	0.05	0.96	1.0	0.049	38.21	60.75	0.089	1.82	0.93	0.27	0.80	1.04	1.0	0.039	2.20	49.63	0.091	2.72	2.27	2
20.177	0.87	0.05	0.97	1.0	0.049	35.50	50.32	0.078	1.59	0.92	0.22	0.80	1.04	1.0	0.039	4.13	61.27	0.101	3.00	2.30	2
20.341	0.87	0.05	0.96	1.0	0.049	38.02	60.01	0.088	1.81	0.92	0.27	0.80	1.04	1.0	0.039	2.25	49.58	0.091	2.69	2.25	2
20.505	0.87	0.06	0.96	1.0	0.048	42.39	76.86	0.108	2.25	0.92	0.34	0.80	1.04	1.0	0.039	1.88	64.63	0.105	3.08	2.66	2
20.669	0.87	0.05	0.96	1.0	0.048	38.65	62.46	0.091	1.87	0.92	0.28	0.80	1.03	1.0	0.039	3.22	76.70	0.122	3.55	2.71	2
20.833	0.87	0.05	0.96	1.0	0.048	37.63	58.49	0.086	1.78	0.92	0.26	0.80	1.03	1.0	0.039	4.01	83.73	0.135	3.90	2.84	2
20.997	0.87	0.05	0.96	1.0	0.048	36.50	54.15	0.082	1.69	0.92	0.24	0.80	1.03	1.0	0.039	4.26	75.26	0.120	3.45	2.57	2
21.161	0.87	0.05	0.96	1.0	0.048	36.49	54.12	0.082	1.69	0.92	0.24	0.80	1.03	1.0	0.039	4.11	72.54	0.115	3.32	2.50	2
21.325	0.87	0.05	0.96	1.0	0.048	36.77	55.23	0.083	1.72	0.91	0.25	0.80	1.03	1.0	0.039	3.32	61.36	0.101	2.90	2.31	2
21.489	0.86	0.06	0.96	1.0	0.048	39.97	67.53	0.097	2.02	0.91	0.30	0.80	1.03	1.0	0.039	2.07	57.16	0.097	2.77	2.39	2
21.653	0.86	0.06	0.96	1.0	0.048	39.06	64.04	0.092	1.93	0.91	0.29	0.80	1.03	1.0	0.039	2.48	61.83	0.102	2.89	2.41	2
21.817	0.86	0.05	0.96	1.0	0.048	37.13	56.61	0.084	1.76	0.91	0.25	0.80	1.03	1.0	0.039	3.29	64.11	0.105	2.95	2.35	2
21.981	0.86	0.05	0.96	1.0	0.048	36.31	53.44	0.081	1.69	0.91	0.24	0.80	1.02	1.0	0.039	3.77	64.60	0.105	2.95	2.32	2
22.145	0.86	0.05	0.96	1.0	0.048	35.70	51.08	0.079	1.64	0.91	0.23	0.80	1.02	1.0	0.039	4.08	62.70	0.103	2.87	2.26	2
22.309	0.86	0.05	0.96	1.0	0.048	34.26	46.25	0.074	1.55	0.91	0.20	0.80	1.02	1.0	0.039	6.02	72.19	0.115	3.20	2.37	2
22.473	0.86	0.05	0.96	1.0	0.047	34.56	47.41	0.075	1.57	0.91	0.21	0.80	1.02	1.0	0.039	5.61	72.09	0.115	3.18	2.38	2
22.638	0.85	0.05	0.96	1.0	0.047	35.67	50.97	0.078	1.65	0.90	0.23	0.80	1.02	1.0	0.039	4.11	62.96	0.103	2.85	2.25	2
22.802	0.85	0.05	0.96	1.0	0.047	37.16	56.72	0.084	1.78	0.90	0.26	0.80	1.02	1.0	0.039	2.72	53.26	0.094	2.58	2.18	2
22.966	0.85	0.06	0.96	1.0	0.047	38.24	60.89	0.088	1.86	0.90	0.27	0.80	1.02	1.0	0.039	2.24	50.80	0.092	2.52	2.20	2
23.130	0.85	0.05	0.96	1.0	0.047	37.91	59.61	0.087	1.84	0.90	0.27	0.80	1.02	1.0	0.039	2.40	52.09	0.093	2.54	2.20	2
23.294	0.85	0.05	0.96	1.0	0.047	37.49	58.00	0.086	1.82	0.90	0.26	0.80	1.02	1.0	0.039	2.52	51.71	0.093	2.52	2.17	2
23.458	0.85	0.05	0.96	1.0	0.047	38.28	61.03	0.089	1.90	0.90	0.28	0.80	1.01	1.0	0.039	2.21	50.28	0.092	2.48	2.19	2
23.622	0.85	0.06	0.95	1.0	0.047	40.76	70.59	0.101	2.15	0.90	0.32	0.80	1.01	1.0	0.039	1.48	44.02	0.087	2.33	2.24	2
23.786	0.85	0.06	0.95	1.0	0.046	42.06	75.60	0.107	2.30	0.89	0.33	0.80	1.01	1.0	0.039	1.49	50.05	0.092	2.45	2.38	2
23.950	0.84	0.06	0.96	1.0	0.047	40.20	68.43	0.098	2.10	0.89	0.31	0.80	1.01	1.0	0.039	2.17	61.33	0.101	2.70	2.40	2
24.114	0.84	0.05	0.96	1.0	0.047	37.93	59.68	0.087	1.88	0.89	0.27	0.80	1.01	1.0	0.039	3.37	73.35	0.117	3.10	2.49	2
24.278	0.84	0.05	0.96	1.0	0.046	37.93	59.66	0.087	1.88	0.89	0.27	0.80	1.01	1.0	0.039	3.10	67.33	0.108	2.87	2.37	2
24.442	0.84	0.06	0.96	1.0	0.046	40.49	69.54	0.099	2.14	0.89	0.31	0.80	1.01	1.0	0.039	2.05	59.56	0.100	2.62	2.38	2
24.606	0.84	0.07	0.95	1.0	0.046	44.55	85.19	0.120	2.61	0.89	0.37	0.80	1.01	1.0	0.039	1.79	72.69	0.116	3.03	2.82	2
24.770	0.84	0.06	0.96	1.0	0.046	38.80	63.02	0.091	1.97	0.89	0.28	0.80	1.00	1.0	0.039	3.40	82.30	0.132	3.43	2.70	2
24.934	0.84	0.05	0.96	1.0	0.047	37.17	56.75	0.084	1.81	0.89	0.26	0.80	1.00	1.0	0.039	3.96	77.45	0.123	3.18	2.50	2
25.098	0.83	0.05	0.96	1.0	0.047	36.28	53.31	0.081	1.73	0.88	0.24	0.80	1.00	1.0	0.039	4.34	73.97	0.118	3.02	2.38	2
25.262	0.83	0.06	0.95	1.0	0.046	40.09	68.01	0.097	2.09	0.88	0.31	0.80	1.00	1.0	0.039	2.21	61.74	0.102	2.60	2.35	2
25.426	0.83	0.06	0.95	1.0	0.046	40.32	68.90	0.098	2.12	0.88	0.31	0.80	1.00	1.0	0.039	2.54	72.71	0.116	2.93	2.52	2
25.590	0.83	0.05	0.96	1.0	0.047	37.96	59.79	0.088	1.88	0.88	0.27	0.80	1.00	1.0	0.040	3.77	82.36	0.132	3.32	2.60	2
25.754	0.83	0.05	0.96	1.0	0.047	37.40	57.65	0.085	1.83	0.88	0.26	0.80	1.00	1.0	0.040	4.27	86.54	0.140	3.51	2.67	2
25.918	0.83	0.05	0.96	1.0	0.047	36.13	53.49	0.081	1.73	0.88	0.24	0.80	1.00	1.0	0.040	5.00	86.83	0.141	3.50	2.62	2
26.082	0.83	0.05	0.96	1.0	0.047	35.16	49.72	0.077	1.65	0.88	0.22	0.80	1.00	1.0	0.040	5.79	84.24	0.136	3.35	2.50	2
26.246	0.82	0.05	0.96	1.0	0.047	37.25	57.06	0.085	1.81	0.87	0.26	0.80	0.99	1.0	0.040	3.77	74.76	0.119	2.93	2.37	2
26.410	0.82	0.05	0.96	1.0	0.047	36.58	54.47	0.082	1.75	0.87	0.24	0.80	0.99	1.0	0.040	4.48	80.16	0.128	3.13	2.44	2
26.574	0.82	0.05	0.96	1.0	0.047	36.31	54.18	0.082	1.74	0.87	0.24	0.80	0.99	1.0	0.040	4.91	87.67	0.143	3.47	2.60	2
26.739	0.82	0.05	0.96	1.0	0.047	36.45	54.71	0.082	1.75	0.87	0.25	0.80	0.99	1.0	0.040	4.84	88.43	0.144	3.49	2.62	2
26.903	0.82	0.05	0.96	1.0	0.047	38.08	60.28	0.088	1.87	0.87	0.27	0.80	0.99	1.0	0.040	3.55	78.85	0.126	3.02	2.45	2
27.067	0.82	0.06	0.95	1.0	0.047	40.40	69.20	0.099	2.11	0.87	0.31	0.80	0.99	1.0	0.040	3.01	86.67	0.140	3.36	2.73	2
27.231	0.82	0.06	0.95	1.0	0.047	39.51	65.78	0.094	2.02	0.87	0.30	0.80	0.99	1.0	0.040	3.27	85.87	0.139	3.30	2.66	2
27.395	0.82	0.06	0.95	1.0	0.047	39.16	64.43	0.093	1.98	0.87	0.29	0.80	0.99	1.0	0.040	3.59	90.66	0.149	3.52	2.75	2
27.559	0.81	0.05	0.96	1.0	0.047	37.20	56.86	0.084	1.80	0.86	0.26	0.80	0.99	1.0	0.040	4.23	83.15	0.133	3.13	2.46	2
27.723	0.81	0.06	0.95	1.0	0.047	39.29	64.91	0.093	1.99	0.86	0.29	0.80	0.99	1.0	0.040	3.11	79.73	0.127	2.97	2.48	2
27.887	0.81	0.05	0.96	1.0	0.047	37.60	58.42	0.086	1.85	0.86	0.27	0.80	0.99	1.0	0.041	3.98	82.85	0.133	3.08	2.46	2
28.051	0.81	0.06	0.95	1.0	0.047	39.47	65.61	0.094	2.01	0.86	0.30	0.80	0.98	1.0	0.041	3.04	79.33	0.126	2.92	2.46	2
29.490																					

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.468

Depth at t_1, z_1 m	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Maximum Shear Strain Modulus, G_{max} tsf	P = γ_{eff}*(G_{eff}/G_{max}) tsf	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
8.50	500	1.8E-03	4.6E+02	3.3E-04	10	0.227	6757	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.22%	0.0036
8.55	500	1.8E-03	4.6E+02	3.3E-04	10	0.227	6740	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.25%	0.0037
8.60	500	1.8E-03	4.6E+02	3.3E-04	10	0.228	6722	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.28%	0.0037
8.65	500	1.8E-03	4.6E+02	3.3E-04	10	0.228	6705	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.31%	0.0038
8.70	500	1.8E-03	4.6E+02	3.3E-04	10	0.228	6688	0.09%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.34%	0.0038
8.75	500	1.8E-03	4.6E+02	3.4E-04	10	0.229	6671	0.09%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.37%	0.0039
8.80	500	1.8E-03	4.6E+02	3.4E-04	10	0.229	6654	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.39%	0.0039
8.85	500	1.8E-03	4.6E+02	3.4E-04	10	0.229	6637	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.42%	0.0040
8.90	500	1.8E-03	4.6E+02	3.4E-04	10	0.230	6620	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.45%	0.0040
8.95	500	1.8E-03	4.6E+02	3.4E-04	10	0.230	6604	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.48%	0.0041
9.00	500	1.8E-03	4.6E+02	3.5E-04	10	0.230	6588	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.51%	0.0041
9.05	500	1.8E-03	4.6E+02	3.5E-04	10	0.231	6572	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.54%	0.0042
9.10	500	1.8E-03	4.6E+02	3.5E-04	10	0.231	6556	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.57%	0.0042
9.15	500	1.8E-03	4.6E+02	3.5E-04	10	0.232	6540	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.60%	0.0043
9.20	538	1.8E-03	5.3E+02	3.1E-04	10	0.232	6524	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.81%	0.0030
9.25	538	1.8E-03	5.3E+02	3.1E-04	10	0.232	6508	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.84%	0.0030
9.30	538	1.8E-03	5.3E+02	3.1E-04	10	0.233	6493	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.86%	0.0031
9.35	538	1.8E-03	5.3E+02	3.1E-04	10	0.233	6477	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.88%	0.0031
9.40	538	1.8E-03	5.3E+02	3.1E-04	10	0.233	6462	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.91%	0.0031
9.45	538	1.8E-03	5.3E+02	3.2E-04	10	0.234	6447	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.93%	0.0032
9.50	538	1.8E-03	5.3E+02	3.2E-04	10	0.234	6432	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.95%	0.0032
9.55	538	1.8E-03	5.3E+02	3.2E-04	10	0.234	6417	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.97%	0.0032
9.60	538	1.8E-03	5.3E+02	3.2E-04	10	0.235	6402	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.00%	0.0033
9.65	538	1.8E-03	5.3E+02	3.2E-04	10	0.235	6388	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.02%	0.0033
9.70	538	1.8E-03	5.3E+02	3.2E-04	10	0.235	6373	0.08%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.04%	0.0034
9.75	538	1.8E-03	5.3E+02	3.3E-04	10	0.236	6359	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.07%	0.0034
9.80	538	1.8E-03	5.3E+02	3.3E-04	10	0.236	6344	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.09%	0.0034
9.85	538	1.8E-03	5.3E+02	3.3E-04	10	0.236	6330	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.11%	0.0035
9.90	538	1.8E-03	5.3E+02	3.3E-04	10	0.236	6316	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.14%	0.0035
9.95	538	1.8E-03	5.3E+02	3.3E-04	10	0.237	6302	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.16%	0.0035
10.00	538	1.8E-03	5.1E+02	3.5E-04	16	0.488	5186	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.61%	0.0043
10.05	538	1.8E-03	5.1E+02	3.5E-04	16	0.488	5176	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.63%	0.0043
10.10	538	1.8E-03	5.3E+02	3.4E-04	10	0.238	6262	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.23%	0.0037
10.15	538	1.8E-03	5.3E+02	3.4E-04	10	0.238	6248	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.25%	0.0037
10.20	538	1.8E-03	5.3E+02	3.4E-04	10	0.238	6235	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.27%	0.0037
10.25	538	1.8E-03	5.3E+02	3.4E-04	10	0.239	6221	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.30%	0.0038
10.30	538	1.8E-03	5.3E+02	3.5E-04	10	0.239	6208	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.32%	0.0038
10.35	538	1.8E-03	5.3E+02	3.5E-04	10	0.239	6195	0.09%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.35%	0.0038
10.40	538	1.8E-03	5.3E+02	3.5E-04	10	0.240	6182	0.09%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.37%	0.0039
10.45	538	1.8E-03	5.3E+02	3.5E-04	10	0.240	6169	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.39%	0.0039
10.50	538	1.8E-03	5.3E+02	3.5E-04	10	0.240	6156	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.42%	0.0040
10.55	538	1.8E-03	5.3E+02	3.5E-04	10	0.241	6143	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.44%	0.0040
10.60	538	1.8E-03	5.3E+02	3.6E-04	10	0.241	6130	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.46%	0.0040
10.65	538	1.8E-03	5.3E+02	3.6E-04	10	0.241	6118	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.49%	0.0041
10.70	538	1.8E-03	5.3E+02	3.6E-04	10	0.241	6110	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.51%	0.0041
10.75	594	1.8E-03	6.5E+02	3.0E-04	10	0.241	6104	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.54%	0.0025
10.80	594	1.8E-03	6.5E+02	3.0E-04	10	0.242	6098	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.56%	0.0026
10.85	594	1.8E-03	6.5E+02	3.0E-04	10	0.242	6092	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.58%	0.0026
10.90	594	1.8E-03	6.5E+02	3.0E-04	10	0.242	6086	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.60%	0.0026
10.95	594	1.8E-03	6.5E+02	3.0E-04	10	0.242	6080	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.62%	0.0027
11.00	594	1.8E-03	6.5E+02	3.0E-04	10	0.242	6074	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.64%	0.0027
11.05	594	1.8E-03	6.5E+02	3.1E-04	10	0.242	6068	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.66%	0.0027
11.10	594	1.8E-03	6.2E+02	3.2E-04	16	0.493	5002	0.08%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.05%	0.0034
11.15	594	1.8E-03	6.2E+02	3.2E-04	16	0.493	4998	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.06%	0.0034
11.20	594	1.8E-03	6.5E+02	3.1E-04	10	0.243	6052	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.71%	0.0028
11.25	594	1.8E-03	6.5E+02	3.1E-04	10	0.243	6046	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.73%	0.0028
11.30	594	1.8E-03	6.2E+02	3.3E-04	16	0.494	4984	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.13%	0.0035
11.35	594	1.8E-03	6.2E+02	3.3E-04	16	0.494	4980	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.15%	0.0035
11.40	594	1.8E-03	6.5E+02	3.2E-04	10	0.243	6030	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.79%	0.0029
11.45	594	1.8E-03	6.5E+02	3.2E-04	10	0.243	6025	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.81%	0.0030
11.50	594	1.8E-03	6.5E+02	3.2E-04	10	0.244	6019	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.83%	0.0030
11.55	594	1.8E-03	6.5E+02	3.2E-04	10	0.244	6013	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.85%	0.0030
11.60	594	1.8E-03	6.5E+02	3.2E-04	10	0.244	6008	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.87%	0.0031
11.65	594	1.8E-03	6.5E+02	3.2E-04	10	0.244	6002	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.88%	0.0031
11.70	594	1.8E-03	6.5E+02	3.2E-04	10	0.244	5996	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.90%	0.0031
11.75	594	1.8E-03	6.5E+02	3.3E-04	10	0.244	5991	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.92%	0.0032
12.19	594	1.8E-03	6.5E+02	3.4E-04	10	0.246	5916	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.09%	0.0301

Extra layer added to analyze seismic settlement of tailings below the bottom of CPT investigation.

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-1S

Data File: 13-52106_SP3-1S-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Dat

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Parameter
5608.00	Water surface elevation during CPT investigation (ft)
5604.28	Water surface elevation at t_0 (ft amsl)
5595.59	Water surface elevation at t_1 (ft amsl)
5590.59	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Eart
7.51	Equiv. Number of Uniform Strain Cycles, N
5612.56	Ground Surface Elevation at time of CPT (ft amsl)
5620.47	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pl
3.50	Thickness of Water Storage/Rooting Zone (ft)
3.50	Thickness of High Compaction Layer (ft)
0.41	Thickness of Random/Platform Fill on top of existing interim cover (ft)
887.10	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5590.59	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer	Total Stress at Midpoint of Layer	Equil Pore Pressure at Bottom of Layer	Equil Pore Pressure at Midpoint of Layer (tsf)	Effective Stress at Bottom of Layer	Effective Stress at Midpoint of Layer	Midpoint Depth at t_1, z_1	Shear Wave Velocity, V_s	Soil Density, ρ (tcf)	Max Shear Modulus, G_{max} (tsf)	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{v15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
Erosion Protection Layer	######	5620.22	5619.97	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014	0.08	508	1.7E-03	4.4E+02	3.0E-06	11	0.068	46696	0.00%	1.20	0.80	0.04%	0.000	0.32	0.133	0.778	0.00%	0.0000
Water Storage/Rooting Zone Layer	######	5618.22	5616.47	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121	0.69	508	1.7E-03	4.3E+02	2.8E-05	11	0.118	18930	0.00%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
High Compaction Layer	######	5614.72	5612.97	3.50	0.060	120	0.424	0.320	0.00	0.00	0.424	0.320	1.75	508	1.9E-03	4.8E+02	6.5E-05	11	0.152	12657	0.01%	0.65	0.75	0.02%	0.000	0.34	0.079	0.765	0.00%	0.0000
Platform/Random Fill Layer	######	5612.77	5612.56	0.41	0.050	101	0.445	0.434	0.00	0.00	0.445	0.434	2.35	508	1.6E-03	4.0E+02	1.0E-04	11	0.164	11140	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000

2013 CPT Data from ConeTec / CPT Data Interpretations

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil. Pore Pressure at time of CPT (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q	Normalized Friction Ratio, F (%)	Type Index, Ic	FC %
0.164	5612.40	1.0	0.010	1.0	-0.2	-0.10	1.00%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0	1.70	1.700	23.63	1.97	120	1.01%	1.9	51%
0.328	5612.23	1.0	0.010	1.0	0.4	0.19	1.00%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	1.700	23.63	1.98	60	1.01%	2.1	51%
0.492	5612.07	1.0	0.010	1.0	-0.1	-0.04	1.00%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	1.700	23.63	1.97	39	1.03%	2.2	51%
0.656	5611.90	1.0	0.010	1.0	-0.2	-0.08	1.00%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0	1.70	1.700	23.63	1.97	29	1.04%	2.4	51%
0.820	5611.74	5.6	0.026	5.6	14.4	6.23	0.46%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0	1.70	9.435	131.15	11.14	136	0.46%	1.6	51%
0.984	5611.58	9.5	0.093	9.4	16.6	7.20	0.98%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0	1.70	15.929	221.41	18.71	190	0.99%	1.7	51%
1.148	5611.41	19.7	0.245	19.6	13.4	5.80	1.24%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0	1.70	33.371	463.86	38.92	340	1.25%	1.6	51%
1.312	5611.25	35.4	0.510	35.4	11.0	4.76	1.44%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	60.146	836.03	69.99	535	1.44%	1.6	51%
1.476	5611.08	80.0	0.912	79.9	17.9	7.76	1.14%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	135.830	1888.04	157.98	1075	1.14%	1.4	51%
1.640	5610.92	89.0	1.063	88.9	17.5	7.59	1.19%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0	1.70	151.130	2100.71	175.74	1076	1.20%	1.4	51%
1.804	5610.76	96.1	1.232	96.1	7.4	3.19	1.28%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0	1.70	163.370	2270.84	189.84	1057	1.28%	1.4	51%
1.968	5610.59	77.7	1.349	77.7	5.5	2.40	1.74%	Interim Cover	0.050	100.7	0.10	0.00	0.10	0	1.70	132.073	1835.81	153.46	783	1.74%	1.6	51%
2.133	5610.43	53.3	1.640	53.3	9.6	4.14	3.07%	Interim Cover	0.050	100.7	0.11	0.00	0.11	0	1.70	90.576	1259.01	105.32	496	3.08%	1.9	51%
2.297	5610.26	46.3	1.974	46.2	9.6	4.14	4.27%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	78.557	1091.94	91.36	399	4.28%	2.0	51%
2.461	5610.10	39.8	1.642	39.7	8.0	3.48	4.13%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	67.507	938.35	78.50	320	4.14%	2.1	51%
2.625	5609.94	45.3	1.613	45.3	4.3	1.87	3.56%	Interim Cover	0.050	100.7	0.13	0.00	0.13	0	1.70	76.959	1069.73	89.44	342	3.57%	2.0	51%
2.789	5609.77	38.8	1.441	38.8	0.7	0.30	3.72%	Interim Cover	0.050	100.7	0.14	0.00	0.14	0	1.70	65.892	915.90	76.54	275	3.73%	2.1	51%
2.953	5609.61	36.0	1.125	36.0	0.5	0.22	3.13%	Interim Cover	0.050	100.7	0.15	0.00	0.15	0	1.70	61.149	849.97	71.03	241	3.14%	2.0	51%
3.117	5609.44	31.9	1.113	31.9	-1.8	-0.76	3.49%	Interim Cover	0.050	100.7	0.16	0.00	0.16	0	1.70	54.213	753.56	62.94	202	3.51%	2.1	51%
3.281	5609.28	30.2	1.010	30.2	-1.8	-0.77	3.35%	Slime Tailings	0.041	82.7	0.16	0.00	0.16	0	1.70	51.306	713.15	59.57	183	3.37%	2.1	71%
3.445	5609.12	27.8	0.976	27.8	-1.7	-0.73	3.52%	Slime Tailings	0.041	82.7	0.17	0.00	0.17	0	1.70	47.209	656.21	54.81	162	3.54%	2.2	71%
3.609	5608.95	23.2	0.881	23.2	-1.0	-0.45	3.80%	Slime Tailings	0.041	82.7	0.18	0.00	0.18	0	1.70	39.406	547.74	45.75	130	3.83%	2.3	71%
3.773	5608.79	18.8	1.037	18.8	-0.3	-0.12	5.50%	Slime Tailings	0.041	82.7	0.18	0.00	0.18	0	1.70	32.028	445.19	37.20	101	5.56%	2.5	71%
3.937	5608.62	11.7	1.018	11.7	-0.3	-0.13	8.69%	Slime Tailings	0.041	82.7	0.19	0.00	0.19	0	1.70	19.907	276.71	23.12	60	8.84%	2.7	71%
4.101	5608.46	25.7	1.084	25.7	0.5	0.20	4.22%	Slime Tailings	0.041	82.7	0.20	0.00	0.20	0	1.70	43.622	606.35	50.67	129	4.26%	2.3	71%
4.265	5608.29	24.3	1.143	24.3	0.5	0.20	4.70%	Slime Tailings	0.041	82.7	0.20	0.00	0.20	0	1.70	41.361	574.92	48.04	118	4.74%	2.4	71%
4.429	5608.13	21.7	1.211	21.7	-1.0	-0.45	5.58%	Slime Tailings	0.041	82.7	0.21	0.00	0.21	0	1.70	36.907	513.01	42.85	102	5.63%	2.5	71%
4.593	5607.97	36.9	1.373	36.9	-0.2	-0.10	3.72%	Slime Tailings	0.057	113.1	0.22	0.00	0.22	1	1.70	62.696	871.47	72.81	167	3.75%	2.2	71%
4.757	5607.80	75.7	1.484	75.7	0.5	0.20	1.96%	Sand-Slime Tailings	0.059	119.0	0.23	0.01	0.22	1	1.70	128.690	1788.79	149.47	337	1.97%	1.8	47%
4.921	5607.64	90.7	1.093	90.7	1.8	0.79	1.21%	Sand Tailings	0.062	123.5	0.24	0.01	0.23	1	1.63	147.850	2055.11	171.74	395	1.21%	1.6	18%
5.085	5607.47	113.7	1.047	113.6	8.3	3.60	0.92%	Sand Tailings	0.062	123.5	0.25	0.02	0.23	1	1.53	173.889	2417.06	202.05	484	0.92%	1.4	18%
5.249	5607.31	123.4	0.699	123.3	4.9	2.11	0.57%	Sand Tailings	0.062	123.5	0.26	0.02	0.24	1	1.49	183.875	2555.86	213.61	515	0.57%	1.2	18%
5.413	5607.15	101.2	0.707	101.2	3.6	1.54	0.70%	Sand Tailings	0.062	123.5	0.27	0.03	0.24	1	1.56	157.808	2193.53	183.32	414	0.70%	1.4	18%
5.577	5606.98	80.8	0.675	80.8	2.2	0.94	0.84%	Sand Tailings	0.062	123.5	0.28	0.03	0.25	1	1.64	132.252	1838.30	153.63	323	0.84%	1.5	18%
5.741	5606.82	76.8	0.595	76.8	2.1	0.89	0.77%	Sand Tailings	0.062	123.5	0.29	0.04	0.25	1	1.65	126.407	1757.06	146.84	301	0.78%	1.5	18%
5.905	5606.65	74.6	0.547	74.6	2.0	0.86	0.73%	Sand Tailings	0.062	123.5	0.30	0.04	0.26	1	1.65	122.801	1706.93	142.65	287	0.74%	1.5	18%
6.069	5606.49	70.2	0.520	70.2	1.3	0.57	0.74%	Sand Tailings	0.062	123.5	0.31	0.05	0.26	1	1.66	116.482	1619.10	135.30	265	0.74%	1.5	18%
6.234	5606.33	60.0	0.488	60.0	1.2	0.52	0.81%	Sand Tailings	0.062	123.5	0.32	0.05	0.27	1	1.70	101.915	1416.62	118.38	222	0.82%	1.6	18%
6.398	5606.16	59.3	0.442	59.3	0.8	0.36	0.75%	Sand Tailings	0.062	123.5	0.33	0.06	0.27	1	1.70	100.623	1398.66	116.88	215	0.75%	1.6	18%
6.562	5606.00	58.2	0.392	58.2	1.2	0.52	0.67%	Sand Tailings	0.062	123.5	0.34	0.06	0.28	1	1.69	98.587	1370.35	114.52	207	0.68%	1.6	18%
6.726	5605.83	53.1	0.371	53.1	1.1	0.46	0.70%	Sand Tailings	0.062	123.5	0.35	0.07	0.28	1	1.70	90.304	1255.23	104.90	186	0.70%	1.6	18%
6.890	5605.67	49.1	0.311	49.1	0.6	0.26	0.63%	Sand Tailings	0.062	123.5	0.36	0.07	0.29	1	1.70	83.470	1160.23	96.95	169	0.64%	1.6	18%
7.054	5605.51	56.4	0.288	56.4	1.2	0.51	0.51%	Sand Tailings	0.062	123.5	0.37	0.08	0.29	1	1.67	94.245	1310.00	109.47	191	0.51%	1.5	18%
7.218	5605.34	56.4	0.275	56.4	1.4	0.59	0.49%	Sand Tailings	0.062	123.5	0.38	0.08	0.30	1	1.66	93.553	1300.38	108.67	187	0.49%	1.5	18%
7.382	5605.18	44.0	0.351	44.0	0.2	0.09	0.80%	Sand Tailings	0.062	123.5	0.39	0.09	0.30	1	1.70	74.766	1039.25	86.84	143	0.81%	1.7	18%
7.546	5605.01	36.9	0.372	36.9	-0.1	-0.05	1.01%	Sand-Slime Tailings	0.059	119.0	0.40	0.09	0.31	1	1.70	62.747	872.18	72.88	118	1.02%	1.9	47%
7.710	5604.85	30.0	0.299	30.0	0.2	0.08	1.00%	Sand-Slime Tailings	0.059	119.0	0.41	0.10	0.31	1	1.70	51.034	709.37	59.28	94	1.01%	1.9	47%
7.874	5604.69	32.9	0.212	32.9	1.1	0.46	0.64%	Sand-Slime Tailings	0.059	119.0	0.42	0.10	0.32	1	1.70	55.896	776.95	64.93	102	0.65%	1.8	47%
8.038	5604.52	38.9	0.166	38.9	2.2	0.94	0.43%	Sand Tailings	0.062	123.5	0.43	0.11	0.32	1	1.70	66.079	918.50	76.77	119	0.43%	1.6	18%
8.202	5604.36	38.5	0.158	38.5	1.2	0.52	0.41%	Sand Tailings	0.062	123.5	0.44	0.11	0.33	1	1.70	65.399	909.05	75.97	116	0.42%	1.6	18%
8.366	5604.19	36.9	0.159	36.9	0.5	0.22	0.43%	Sand Tailings	0.062	123.5	0.45	0.12	0.33	1	1.70	62.798	872.89	72.94	110	0.44%	1.7	18%
8.530	5604.03	31.2	0.156	31.2	-0.5	-0.20	0.50%	Sand-Slime Tailings	0.059	119.0	0.46	0.12	0.34	1	1.70	53.040	737.26	61.60	91	0.51%	1.8	47%
8.694	5603.87	24.0	0.142	24.0	-0.0	-0.02	0.59%	Sand-Slime Tailings	0.059	119.0	0.47	0.13	0.34	1	1.70	40.800	567.12	47.39	69	0.60%	1.9	47%
8.858	5603.70	20.0	0.119	20.0	3.7	1.59	0.60%	Sand-Slime Tailings	0.059	119.0	0.48	0.13	0.35	1	1.70	33.949	471.89	39.48	56	0.61%	2.0	47%
9.022	5603.54	23.7	0.086	23.7	6.8	2.94	0.36%	Sand-Slime Tailings	0.059	119.0	0.49	0.14	0.35	1	1.70	40.273	559.79	46.86	66	0.37%	1.8	47%
9.186	5603.37	27.5	0.145	27.5	5.4	2.34	0.53%	Sand-Slime Tailings	0.059	119.0	0.50	0.14	0.36	1	1.70	46.665	648.64	54.27	76	0.54%	1.9	47%
9.350	5603.21	37.0	0.177	37.0	6.8	2.95	0.48%	Sand Tailings	0.062	123.5	0.51	0.15	0.36	1	1.64	60.777	844.79	70.67	101	0.48%	1.7	18%
9.514	5603.05	43.3	0.205	43.3	8.3	3.61	0.47%	Sand Tailings	0.062	123.5	0.52	0.15	0.37	1	1.59	68.941	958.28	80.17	117	0.48%	1.7	18%
9.678	5602.88	41.4	0.300	41.3	6.0	2.61	0.73%	Sand Tailings	0.062	123.5	0.53	0.16	0.37	1	1.59	65.913	916.19	76.62	110	0.73%	1.8	18%
9.842	5602.72	27.8	0.053	27.7	6.0	2.62	0.19%	Sand-Slime Tailings	0.059	119.0	0.54	0.16	0.38	1	1.68	46.511	646.50	54.09	72	0.19%	1.7	47%
10.006	5602.55	18.0	0.353	17.9	7.9	3.43	1.96%	Sand-Slime Tailings	0.059	119.0	0.55	0.17	0.38	1	1.70	30.464	423.45	35.48	46	2.03%	2.4	47%
10.170	5602.39	8.2	0.125	8.2	7.0	3.02	1.52%	Slime Tailings	0.057	113.1	0.56	0.18	0.38	1	1.70	13.889	193.06	16.22	20	1.63%	2.6	71%
10.335	5602.23	13.5	0.090	13.4	11.9	5.17	0.67%	Sand-Slime Tailings	0.059	119.0	0.57	0.18	0.39	1	1.70	22.763	316.41	26.58	33	0.70%	2.2	47%
10.499	5602.06	10.5	0.118	10.3	21.6	9.36	1.13%	Sand-Slime Tailings	0.059	119.0	0.58	0.19	0.39	1	1.70	17.561	244.10	20.66	25	1.19%	2.4	47%
10.663	5601.90	9.7	0.087	9.5	38.5	16.68	0.89%	Sand-Slime Tailings	0.059	119.0	0.59	0.19	0.40	1	1.70	16.150	224.49	19.23	23	0.95%	2.4	47%
10.827	5601.73	10.0	0.117	9.7	46.7	20.25	1.17%	Sand-Slime Tailings	0.059	119.0	0.60	0.20	0.40	1	1.70	16.490	229.21	19.73	23	1.25%	2.5	47%
10.991	5601.57	10.2	0.059	9.9	46.8	20.28	0.58%	Sand-Slime Tailings	0.059	119.0	0.61	0.20	0.41	1	1.70	16.898	234.88	20.20	24	0.61%	2.3	47%
11.155	5601.41	16.6	0.090	16.3	43.7	18.93	0.54%	Sand-Slime Tailings	0.059	119.0	0.62	0.21	0.41	1	1.69	27.563	383.13	32.55	39	0.56%	2.1	47%
11.319	5601.24	15.8	0.118	15.7	25.2	10.92	0.75%	Sand-Slime Tailings	0.059	119.0	0.63	0.21	0.42	1	1.69	26.439	367.50	31.02	36	0.78%	2.2	47%
11.483	5601.08	12.9	0.083	12.7	24.3	10.51	0.64%	Sand-Slime Tailings	0.059	119.0	0.64	0.22	0.42	1	1.70	21.658	301.05	25.45	29	0.68%	2.3	47%
11.647	5600.91	11.0	0.114	10.8	43.0	18.65	1.03%	Sand-Slime Tailings	0.059	119.0	0.65	0.22	0.43	1	1.70	18.309	254.50	21.80	24	1.10%	2.4	47%
11.811	5600.75	9.6	0.088	9.2	64.1	27.78	0.91%	Sand-Slime Tailings	0.059	119.0	0.66	0.23	0.43	1	1.70	15.691	218.10	19.01	21	0.98%	2.5	47%
11.975	5600.59	9.8	0.035	9.4	61.1	26.46	0.36%	Sand-Slime Tailings	0.059	119.0	0.67	0.23	0.44	1	1.70	16.014	222.59	19.35	21	0.38%	2.3	47%
12.139	5600.42	9.7	0.064	9.4	51.9	22.49	0.66%	Sand-Slime Tailings	0.059	119.0	0.68	0.24	0.44	1	1.69	15.804	219.68	18.99	20	0.71%	2.4	47%
12.303	5600.26	11.1	0.121	10.7	65.5	28.37	1.09%	Sand-Slime Tailings	0.059	119.0	0.69	0.24	0.45	1	1.67	17.874	248.45	21.55	23	1.16%	2.5	47%
12.467	5600.09	16.8	0.110	16.4	67.8	29.38	0.66%	Sand-Slime Tailings	0.059	119.0	0.70	0.25	0.45	1	1.60	26.138	363.32	31.14	36	0.68%	2.2	47%
12.631	5599.93	30.9	0.086	30.8	23.6	10.23	0.28%	Sand Tailings	0.062	123.5	0.71	0.25	0.45	1	1.49	45.876	637.67	53.54	66	0.28%	1.8	18%
12.795	5599.76	30.6	0.167	30.5	23.2	10.07	0.55%	Sand-Slime Tailings	0.059	119.0	0.72	0.26	0.46	1	1.48	45.191	628.16	52.74	65	0.56%	1.9	47%
12.959	5599.60	24.9	0.293	24.8	9.7	4.19	1.18%	Sand-Slime Tailings	0.059	119.0	0.73	0.26	0.46	1	1.51	37.430	520.28	43.58	52	1.21%	2.2	47%
13.123	5599.44	22.1	0.250	22.0	13.6	5.90	1.13%	Sand-Slime Tailings	0.059	119.0	0.74	0.27	0.47	1	1.52	33.392	464.15	38.93	46	1.17%	2.2	47%
13.287	5599.27	17.9	0.174	17.8	18.4	7.98	0.97%	Sand-Slime Tailings	0.059	119.0	0.75	0.27	0.47	1	1.54	27.284	379.25	31.89	36	1.02%	2.3	47%
13.451	5599.11	18.6	0.120	18.3	33.7	14.61	0.65%	Sand-Slime Tailings	0.059	119.0	0.76	0.28	0.48	1	1.52	27.891	387.68	32.76	37	0.67%	2.2	47%
13.615	5598.94	19.0	0.093	18.8	27.6	11.94	0.49%	Sand-Slime Tailings	0.059	119.0	0.77	0.28	0.48	1	1.51	28.342	393.95	33.22	38	0.51%	2.1	47%
13.779	5598.78	18.8	0.035	18.6	24.7	10.70	0.19%	Sand-Slime Tailings	0.059	119.0	0.77	0.29	0.49	1	1.50	27.908	387.92	32.68	37	0.19%	2.0	47%
13.943	5598.62	17.5	0.045	17.4	14.9	6.47	0.26%	Sand-Slime Tailings	0.059	119.0	0.78	0.29	0.49	1	1.50	26.084	362.57	30.46	34	0.27%	2.0	47%
14.107	5598.45	15.4	0.100	15.2	27.0	11.68	0.65%	Sand-Slime Tailings	0.059	119.0	0.79	0.30	0.50	1	1.51	22.922	318.61	26.92	29	0.69%	2.3	47%
14.271	5598.29	16.8	0.261	16.6	35.9	15.54	1.55%	Sand-Slime Tailings	0.059	119.0	0.80	0.30	0.50	1	1.49	24.694	343.25	29.07	32	1.63%	2.4	47%
14.436	5598.12	15.9	0.208	15.7	41.2	17.86	1.31%	Sand-Slime Tailings	0.059	119.0	0.81	0.31	0.51	1	1.48	23.240	323.03	27.43	30	1.38%	2.4	47%
14.600	5597.96	17.8	0.165	17.6	26.3	11.41	0.93%	Sand-Slime Tailings	0.059	119.0	0.82	0.31	0.51	1	1.46	25.776	358.29	30.22	33	0.97%	2.3	47%
14.764	5597.80	15.1	0.105	15.0	29.7	12.88	0.69%	Sand-Slime Tailings	0.059	119.0	0.83	0.32	0.52	1	1.47	21.980	305.52	25.85	28	0.73%	2.3	47%
14.928	5597.63	16.4	0.396	16.2	36.8	15.96	2.41%	Sand-Slime Tailings	0.059	119.0	0.84	0.32	0.52	1	1.45	23.488	326.48	27.67	30	2.55%	2.6	47%
15.092	5597.47	15.6	0.201	15.3	59.5	25.80	1.29%	Sand-Slime Tailings	0.059	119.0	0.85	0.33	0.52	1	1.45	22.121	307.48	26.32	28	1.36%	2.4	47%
15.256	5597.30	25.6	0.270	25.4	23.7	10.26	1.06%	Sand-Slime Tailings	0.059	119.0	0.86	0.33	0.53	1	1.39	35.271	490.27	41.20	47	1.09%	2.2	47%
15.420	5597.14	21.4	0.308	21.3	15.0	6.48	1.44%	Sand-Slime Tailings	0.059	119.0	0.87	0.34	0.53	1	1.40	29.754	413.58	34.71	38	1.50%	2.3	47%
15.584	5596.98	18.8	0.188	18.7	18.8	8.16	1.00%	Sand-Slime Tailings	0.059	119.0	0.88	0.34	0.54	1	1.40	26.274	365.21	30.71	33	1.05%	2.3	47%
15.748	5596.81	20.6	0.295	20.4	18.0	7.78	1.44%	Sand-Slime Tailings	0.059	119.0	0.89	0.35	0.54	1	1.39	28.363	394.25	33.12	36	1.50%	2.4	47%
15.912	5596.65	16.7	0.170	16.4	37.1	16.09	1.02%	Sand-Slime Tailings	0.059	119.0	0.90	0.35	0.55	1	1.40	22.984	319.47	27.07	29	1.08%	2.4	47%
16.076	5596.48	19.8	0.165	19.5	48.9	21.20	0.83%	Sand-Slime Tailings	0.059	119.0	0.91	0.36	0.55	1	1.38	26.799	372.50	31.61	34	0.87%	2.3	47%
16.240	5596.32	21.9	0.284	21.7	42.0	18.19	1.30%	Sand-Slime Tailings	0.059	119.0	0.92	0.36	0.56	1	1.36	29.415	408.87	34.58	38	1.35%	2.3	47%
16.404	5596.16	21.9	0.319	21.5	65.3	28.28	1.46%	Sand-Slime Tailings	0.059	119.0	0.93	0.37	0.56	1	1.35	29.002	403.13	34.32	37	1.52%	2.4	47%
16.568	5595.99	28.0	0.500	27.9	24.0	10.38	1.78%	Sand-Slime Tailings	0.059	119.0	0.94	0.37	0.57	1	1.32	36.866	512.44	43.05	48	1.85%	2.3	47%
16.732	5595.83	19.0	0.522	18.7	40.7	17.62	2.75%	Slime Tailings	0.057	113.1	0.95	0.38	0.57	1	1.35	25.254	351.03	29.73	32	2.90%	2.6	71%
16.896	5595.66	22.1	0.393	21.4	112.6	48.78	1.78%	Sand-Slime Tailings	0.059	119.0	0.96	0.38	0.57	1	1.33	28.441	395.33	34.12	37	1.86%	2.4	47%
17.060	5595.50	22.9	0.460	22.6	47.8	20.69	2.01%	Sand-Slime Tailings	0.059	119.0	0.97	0.39	0.58	1	1.32	29.824	414.56	35.10	38	2.10%	2.4	47%
17.224	5595.34	19.0	0.308	18.5	76.9	33.34	1.62%	Sand-Slime Tailings	0.059	119.0	0.98	0.40	0.58	1	1.33	24.585	341.73	29.29	31	1.71%	2.5	47%

Conditions at t_1 / Liquefaction Triggering Analyses

Depth at time of CPT (ft)	Total Stress at t_1 (tsf)	Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No	I&B (2008) r_d	C_σ	K_σ	K_α	CSR M=7.5, σ'v=1atm	Δq_{c1n}	$q_{c1n\text{-}cs}$	(CRR) M=7.5, σ'v=1atm	FoS	Youd et al. (2001) r_d	D_r	f	K_σ	K_α	CSR M=7.5, σ'v=1atm	Kc	$q_{c1n\text{-}cs}$	(CRR) M=7.5, σ'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No
0.164	0.45	0.00	0.45	0	1.00	0.04	1.02	1.0	0.059	31.01	32.98	0.063	1.07	0.98	0.08	0.80	2.53	1.0	0.017	1.15	2.26	0.052	125.00	63.03	2
0.328	0.46	0.00	0.46	0	1.00	0.04	1.02	1.0	0.059	31.02	32.99	0.063	1.07	0.98	0.08	0.80	2.20	1.0	0.020	1.44	2.85	0.052	63.11	32.09	2
0.492	0.47	0.00	0.47	0	1.00	0.04	1.02	1.0	0.059	31.01	32.99	0.063	1.07	0.98	0.08	0.80	2.03	1.0	0.021	1.78	3.51	0.053	42.54	21.80	2
0.656	0.48	0.00	0.48	0	1.00	0.04	1.02	1.0	0.059	31.01	32.98	0.063	1.07	0.98	0.08	0.80	1.92	1.0	0.023	2.14	4.21	0.054	32.26	16.67	2
0.820	0.48	0.00	0.48	0	1.00	0.05	1.03	1.0	0.059	34.23	45.36	0.073	1.23	0.98	0.19	0.80	1.84	1.0	0.024	1.00	11.14	0.059	28.61	14.92	2
0.984	0.49	0.00	0.49	0	1.00	0.05	1.03	1.0	0.059	36.88	55.59	0.083	1.40	0.98	0.25	0.80	1.77	1.0	0.024	1.04	19.42	0.066	26.63	14.01	2
1.148	0.50	0.00	0.50	0	1.00	0.06	1.03	1.0	0.060	43.98	82.90	0.117	1.95	0.98	0.36	0.80	1.72	1.0	0.025	1.00	38.92	0.082	28.43	15.19	2
1.312	0.51	0.00	0.51	0	1.00	0.08	1.04	1.0	0.060	54.88	124.87	0.190	3.16	0.98	0.48	0.76	1.86	1.0	0.023	1.00	69.99	0.112	33.79	18.47	2
1.476	0.52	0.00	0.52	0	1.00	0.17	1.09	1.0	0.063	85.76	243.74	1.000	15.91	0.98	0.73	0.64	2.43	1.0	0.018	1.00	157.98	0.447	119.94	67.93	2
1.640	0.53	0.00	0.53	0	1.00	0.20	1.10	1.0	0.064	91.99	267.74	1.000	15.73	0.98	0.77	0.62	2.45	1.0	0.018	1.00	175.74	1.000	241.77	128.75	2
1.804	0.53	0.00	0.53	0	1.00	0.23	1.10	1.0	0.064	96.94	286.77	1.000	15.73	0.98	0.80	0.60	2.45	1.0	0.018	1.00	189.84	1.000	219.87	117.80	2
1.968	0.54	0.00	0.54	0	1.00	0.16	1.08	1.0	0.062	84.18	237.64	1.000	16.09	0.98	0.72	0.64	2.17	1.0	0.020	1.00	153.46	0.416	83.90	50.00	2
2.133	0.55	0.00	0.55	0	1.00	0.11	1.05	1.0	0.061	67.28	172.60	0.435	7.18	0.98	0.59	0.70	1.85	1.0	0.023	1.17	122.92	0.253	47.06	27.12	2
2.297	0.56	0.00	0.56	0	1.00	0.10	1.04	1.0	0.060	62.38	153.74	0.290	4.81	0.98	0.55	0.72	1.74	1.0	0.025	1.36	124.55	0.260	44.92	24.86	2
2.461	0.57	0.00	0.57	0	1.00	0.09	1.04	1.0	0.060	57.87	136.37	0.221	3.70	0.98	0.51	0.74	1.64	1.0	0.026	1.41	110.83	0.207	33.36	18.53	2
2.625	0.58	0.00	0.58	0	1.00	0.10	1.04	1.0	0.060	61.71	151.14	0.277	4.62	0.98	0.55	0.73	1.67	1.0	0.026	1.31	116.85	0.228	34.59	19.61	2
2.789	0.58	0.00	0.58	0	0.99	0.09	1.03	1.0	0.059	57.18	133.72	0.213	3.58	0.98	0.51	0.75	1.58	1.0	0.027	1.40	107.01	0.194	27.66	15.62	2
2.953	0.59	0.00	0.59	0	0.99	0.08	1.03	1.0	0.059	55.25	126.27	0.194	3.27	0.97	0.49	0.76	1.53	1.0	0.028	1.35	95.55	0.161	21.71	12.49	2
3.117	0.60	0.00	0.60	0	0.99	0.08	1.03	1.0	0.059	52.41	115.35	0.170	2.88	0.97	0.46	0.77	1.48	1.0	0.029	1.48	93.27	0.155	19.85	11.37	2
3.281	0.61	0.00	0.61	0	0.99	0.08	1.03	1.0	0.059	50.83	110.40	0.161	2.73	0.97	0.45	0.78	1.45	1.0	0.030	1.50	89.29	0.146	17.90	10.31	2
3.445	0.61	0.00	0.61	0	0.99	0.07	1.03	1.0	0.059	49.17	103.98	0.149	2.54	0.97	0.43	0.79	1.41	1.0	0.030	1.60	87.77	0.143	16.81	9.67	2
3.609	0.62	0.00	0.62	0	0.99	0.07	1.02	1.0	0.059	46.02	91.78	0.130	2.21	0.97	0.39	0.80	1.37	1.0	0.031	1.82	83.18	0.134	15.11	8.66	2
3.773	0.63	0.00	0.63	0	0.99	0.06	1.02	1.0	0.058	43.04	80.24	0.113	1.94	0.97	0.35	0.80	1.36	1.0	0.032	2.53	94.13	0.158	17.18	9.56	2
3.937	0.63	0.00	0.63	0	0.99	0.05	1.02	1.0	0.058	38.14	61.26	0.089	1.54	0.97	0.28	0.80	1.35	1.0	0.032	4.35	100.63	0.175	18.39	9.96	2
4.101	0.64	0.00	0.64	0	0.99	0.07	1.02	1.0	0.058	47.73	98.40	0.140	2.40	0.97	0.41	0.79	1.35	1.0	0.032	1.93	97.99	0.168	17.03	9.71	2
4.265	0.65	0.00	0.65	0	0.99	0.07	1.02	1.0	0.058	46.82	94.86	0.134	2.31	0.97	0.40	0.80	1.33	1.0	0.032	2.14	102.77	0.181	17.79	10.05	2
4.429	0.65	0.00	0.65	0	0.99	0.07	1.02	1.0	0.058	45.01	87.86	0.124	2.13	0.97	0.38	0.80	1.32	1.0	0.032	2.55	109.16	0.201	19.13	10.63	2
4.593	0.66	0.00	0.66	0	0.98	0.09	1.02	1.0	0.058	55.44	128.26	0.199	3.41	0.97	0.49	0.75	1.40	1.0	0.031	1.63	118.67	0.235	21.58	12.49	2
4.757	0.67	0.00	0.67	0	0.98	0.16	1.04	1.0	0.059	82.72	232.19	1.000	16.92	0.97	0.71	0.65	1.61	1.0	0.027	1.09	163.61	1.000	89.79	53.36	2
4.921	0.68	0.00	0.68	0	0.98	0.20	1.04	1.0	0.059	65.99	237.73	1.000	16.84	0.97	0.76	0.62	1.65	1.0	0.026	1.00	171.74	1.000	87.86	52.35	2
5.085	0.69	0.00	0.69	0	0.98	0.27	1.06	1.0	0.060	73.74	275.80	1.000	16.65	0.97	0.82	0.60	1.68	1.0	0.025	1.00	202.05	1.000	86.02	51.33	2
5.249	0.70	0.00	0.70	0	0.98	0.30	1.06	1.0	0.060	76.70	290.31	1.000	16.63	0.97	0.84	0.60	1.67	1.0	0.026	1.00	213.61	1.000	84.25	50.44	2
5.413	0.71	0.00	0.71	0	0.98	0.22	1.04	1.0	0.059	68.96	252.28	1.000	16.96	0.97	0.78	0.61	1.64	1.0	0.026	1.00	183.32	1.000	82.55	49.75	2
5.577	0.72	0.00	0.72	0	0.98	0.17	1.03	1.0	0.058	61.36	214.99	1.000	17.18	0.97	0.72	0.64	1.56	1.0	0.027	1.00	153.63	0.417	33.76	25.47	2
5.741	0.73	0.00	0.73	0	0.98	0.16	1.02	1.0	0.058	59.63	206.47	1.000	17.26	0.97	0.70	0.65	1.53	1.0	0.028	1.00	146.84	0.374	29.72	23.49	2
5.905	0.74	0.00	0.74	0	0.98	0.15	1.02	1.0	0.058	58.56	201.21	1.000	17.32	0.97	0.69	0.66	1.51	1.0	0.028	1.00	142.65	0.350	27.25	22.29	2
6.069	0.75	0.00	0.75	0	0.98	0.14	1.02	1.0	0.057	56.68	191.98	0.810	14.09	0.97	0.67	0.66	1.49	1.0	0.029	1.00	135.30	0.310	23.72	18.90	2
6.234	0.76	0.00	0.76	0	0.98	0.12	1.01	1.0	0.057	52.35	170.74	0.415	7.26	0.97	0.63	0.69	1.44	1.0	0.030	1.00	118.38	0.234	17.58	12.42	2
6.398	0.78	0.00	0.78	0	0.97	0.12	1.01	1.0	0.057	51.97	168.85	0.396	6.95	0.97	0.62	0.69	1.43	1.0	0.030	1.00	116.88	0.228	16.83	11.89	2
6.562	0.79	0.00	0.79	0	0.97	0.12	1.01	1.0	0.057	51.37	165.88	0.370	6.50	0.97	0.62	0.69	1.42	1.0	0.030	1.00	114.52	0.220	15.90	11.20	2
6.726	0.80	0.00	0.80	0	0.97	0.11	1.01	1.0	0.057	48.91	153.80	0.290	5.11	0.97	0.59	0.70	1.39	1.0	0.031	1.00	104.90	0.187	13.33	9.22	2
6.890	0.81	0.00	0.81	0	0.97	0.10	1.01	1.0	0.057	46.88	143.83	0.246	4.35	0.97	0.57	0.72	1.36	1.0	0.031	1.00	96.95	0.165	11.52	7.94	2
7.054	0.82	0.00	0.82	0	0.97	0.11	1.01	1.0	0.056	50.08	159.55	0.323	5.73	0.97	0.60	0.70	1.38	1.0	0.031	1.00	109.47	0.202	13.89	9.81	2
7.218	0.83	0.00	0.83	0	0.97	0.11	1.00	1.0	0.056	49.87	158.54	0.317	5.63	0.96	0.60	0.70	1.37	1.0	0.031	1.00	108.67	0.199	13.49	9.56	2
7.382	0.84	0.00	0.84	0	0.97	0.10	1.00	1.0	0.056	44.29	131.13	0.206	3.67	0.96	0.54	0.73	1.32	1.0	0.032	1.06	91.90	0.152	10.13	6.90	2
7.546	0.85	0.00	0.85	0	0.97	0.09	1.00	1.0	0.056	55.86	128.74	0.200	3.57	0.96	0.49	0.75	1.29	1.0	0.033	1.15	84.08	0.135	8.87	6.22	2
7.710	0.86	0.00	0.86	0	0.97	0.08	1.00	1.0	0.056	51.09	110.37	0.161	2.87	0.96	0.44	0.78	1.25	1.0	0.034	1.22	72.36	0.115	7.45	5.16	2
7.874	0.87	0.00	0.87	0	0.96	0.08	1.00	1.0	0.056	53.07	118.01	0.175	3.15	0.96	0.47	0.77	1.26	1.0	0.034	1.10	71.42	0.114	7.26	5.20	2
8.038	0.88	0.00	0.88	0	0.96	0.09	1.00	1.0	0.056	41.72	118.49	0.176	3.17	0.96	0.51	0.75	1.28	1.0	0.033	1.00	76.77	0.122	7.66	5.42	2
8.202	0.89	0.00	0.89	0	0.96	0.09	1.00	1.0	0.056	41.51	117.48	0.174	3.14	0.96	0.50	0.75	1.27	1.0	0.033	1.00	75.97	0.121	7.47	5.30	2
8.366	0.90	0.00	0.90	0	0.96	0.09	1.00	1.0	0.055	40.74	113.68	0.167	3.01	0.96	0.49	0.75	1.26	1.0	0.034	1.02	74.14	0.118	7.18	5.10	2
8.530	0.91	0.00	0.91	0	0.96	0.08	1.00	1.0	0.055	51.90	113.50	0.166	3.01	0.96	0.45	0.77	1.24	1.0	0.034	1.09	66.94	0.108	6.49	4.75	2
8.694	0.92	0.00	0.92	0	0.96	0.07	1.00	1.0	0.055	46.92	94.31	0.133	2.42	0.96	0.40	0.80	1.20	1.0	0.035	1.20	57.03	0.097	5.77	4.09	2
8.858	0.92	0.00	0.92	0	0.96	0.06	1.00	1.0	0.055	44.15	83.62	0.118	2.13	0.96	0.36	0.80	1.20	1.0	0.035	1.29	50.93	0.092	5.40	3.77	2
9.022	0.93	0.00	0.93	0	0.96	0.07	0.99	1.0	0.055	46.74	93.59	0.132	2.40	0.96	0.40	0.80	1.20	1.0	0.035	1.13	52.86	0.094	5.42	3.91	2
9.186	0.94	0.00	0.94	0	0.96	0.07	0.99	1.0	0.055	49.33	103.60	0.149	2.70	0.96	0.43	0.79	1.21	1.0	0.035	1.15	62.27	0.102	5.85	4.28	2
9.350	0.95	0.00	0.95	0	0.96	0.08	0.99	1.0	0.055	40.16	110.82	0.161	2.95	0.96	0.49	0.76	1.23	1.0	0.034	1.05	74.41	0.118	6.66	4.80	2
9.514	0.96	0.00	0.96	0	0.95	0.09	0.99	1.0	0.055	42.58	122.75	0.186	3.40	0.96	0.52	0.74	1.25	1.0	0.034	1.02	81.39	0.130	7.23	5.31	2
9.678	0.97	0.00	0.97	0	0.95	0.09	0.99	1.0	0.054	41.68	118.30	0.176	3.23	0.96	0.51	0.75	1.24	1.0	0.034	1.10	84.50	0.136	7.46	5.35	2
9.842	0.98	0.00	0.98	0	0.95	0.07	0.99	1.0	0.054	49.27	103.37	0.148	2.72	0.96	0.42	0.79	1.19	1.0	0.035	1.03	55.73	0.096	5.21	3.96	2
10.006	0.99	0.00	0.99	0	0.95	0.06	0.99	1.0	0.054	42.74	78.22	0.110	2.02	0.96	0.34	0.80	1.18	1.0	0.036	2.18	77.52	0.123	6.60	4.31	2
10.170	1.00	0.00	1.00	0	0.95	0.05	0.99	1.0	0.054	35.74	51.95	0.079	1.46	0.96	0.23	0.80	1.17	1.0	0.036	3.34	54.12	0.095	5.02	3.24	2
10.335	1.01	0.00	1.01	0	0.95	0.06	0.99	1.0	0.054	39.63	66.21	0.095	1.75	0.96	0.30	0.80	1.17	1.0	0.036	1.72	45.75	0.088	4.61	3.18	2
10.499	1.02	0.00	1.02	0	0.95	0.05	0.99	1.0	0.054	37.55	58.21	0.086	1.58	0.96	0.26	0.80	1.17	1.0	0.036	2.50	51.61	0.093	4.80	3.19	2
10.663	1.03	0.00	1.03	0	0.95	0.05	0.99	1.0	0.054	37.05	56.28	0.084	1.55	0.96	0.25	0.80	1.17	1.0	0.036	2.42	46.55	0.089	4.54	3.05	2
10.827	1.04	0.00	1.04	0	0.95	0.05	0.99	1.0	0.054	37.22	56.95	0.085	1.56	0.96	0.26	0.80	1.16	1.0	0.036	2.67	52.71	0.094	4.74	3.15	2
10.991	1.05	0.00	1.05	0	0.94	0.05	0.99	1.0	0.054	37.39	57.59	0.085	1.58	0.96	0.26	0.80	1.16	1.0	0.036	2.04	41.17	0.084	4.22	2.90	2
11.155	1.06	0.00	1.06	0	0.94	0.06	0.99	1.0	0.054	41.72	74.26	0.105	1.95	0.96	0.33	0.80	1.16	1.0	0.036	1.49	48.45	0.090	4.47	3.21	2
11.319	1.07	0.00	1.07	0	0.94	0.06	0.99	1.0	0.054	41.18	72.19	0.102	1.90	0.96	0.32	0.80	1.16	1.0	0.036	1.69	52.28	0.093	4.57	3.24	2
11.483	1.08	0.00	1.08	0	0.94	0.06	0.99	1.0	0.054	39.23	64.68	0.093	1.74	0.95	0.29	0.80	1.15	1.0	0.037	1.84	46.90	0.089	4.32	3.03	2
11.647	1.09	0.00	1.09	0	0.94	0.05	0.99	1.0	0.054	37.95	59.74	0.088	1.63	0.95	0.27	0.80	1.15	1.0	0.037	2.46	53.63	0.094	4.52	3.08	2
11.811	1.10	0.00	1.10	0	0.94	0.05	0.99	1.0	0.054	36.97	55.98	0.084	1.56	0.95	0.25	0.80	1.15	1.0	0.037	2.62	49.79	0.091	4.34	2.95	2
11.975	1.11	0.00	1.11	0	0.94	0.05	0.99	1.0	0.053	37.09	56.44	0.084	1.57	0.95	0.25	0.80	1.15	1.0	0.037	1.93	37.34	0.081	3.81	2.69	2
12.139	1.12	0.00	1.12	0	0.94	0.05	0.99	1.0	0.053	36.96	55.95	0.083	1.56	0.95	0.25	0.80	1.14	1.0	0.037	2.36	44.75	0.087	4.06	2.81	2
12.303	1.13	0.00	1.13	0	0.94	0.05	0.99	1.0	0.053	37.86	59.41	0.087	1.64	0.95	0.27	0.80	1.14	1.0	0.037	2.59	55.72	0.096	4.42	3.03	2
12.467	1.14	0.00	1.14	0	0.93	0.06	0.98	1.0	0.053	41.22	72.37	0.103	1.93	0.95	0.32	0.80	1.14	1.0	0.037	1.64	50.96	0.092	4.21	3.07	2
12.631	1.15	0.00	1.15	0	0.93	0.07	0.98	1.0	0.053	35.78	89.31	0.126	2.39	0.95	0.42	0.79	1.14	1.0	0.037	1.09	58.49	0.099	4.45	3.42	2
12.795	1.16	0.00	1.16	0	0.93	0.07	0.98	1.0	0.053	48.80	101.53	0.145	2.75	0.95	0.42	0.79	1.14	1.0	0.037	1.21	63.65	0.104	4.64	3.70	2
12.959	1.17	0.00	1.17	0	0.93	0.07	0.98	1.0	0.053	45.59	89.16	0.126	2.39	0.95	0.38	0.80	1.13	1.0	0.037	1.63	71.04	0.113	5.01	3.70	2
13.123	1.18	0.00	1.18	0	0.93	0.06	0.98	1.0	0.053	43.96	82.89	0.117	2.22	0.95	0.36	0.80	1.13	1.0	0.037	1.72	67.05	0.108	4.73	3.47	2
13.287	1.19	0.00	1.19	0	0.93	0.06	0.98	1.0	0.053	41.49	73.38	0.104	1.97	0.95	0.33	0.80	1.13	1.0	0.037	1.86	59.29	0.099	4.31	3.14	2
13.451	1.20	0.00	1.20	0	0.93	0.06	0.98	1.0	0.052	41.79	74.56	0.105	2.01	0.95	0.33	0.80	1.12	1.0	0.037	1.60	52.27	0.093	4.01	3.01	2
13.615	1.21	0.00	1.21	0	0.93	0.06	0.98	1.0	0.052	41.95	75.17	0.106	2.03	0.95	0.33	0.80	1.12	1.0	0.037	1.47	48.88	0.091	3.86	2.95	2
13.779	1.22	0.00	1.22	0	0.92	0.06	0.98	1.0	0.052	41.76	74.45	0.105	2.01	0.95	0.33	0.80	1.12	1.0	0.037	1.26	41.27	0.084	3.56	2.79	2
13.943	1.23	0.00	1.23	0	0.92	0.06	0.98	1.0	0.052	40.98	71.44	0.101	1.94	0.95	0.32	0.80	1.12	1.0	0.037	1.36	41.55	0.085	3.54	2.74	2
14.107	1.24	0.00	1.24	0	0.92	0.06	0.98	1.0	0.052	39.74	66.66	0.096	1.83	0.95	0.30	0.80	1.12	1.0	0.037	1.84	49.42	0.091	3.78	2.80	2
14.271	1.25	0.00	1.25	0	0.92	0.06	0.98	1.0	0.052	40.50	69.56	0.099	1.90	0.95	0.31	0.80	1.11	1.0	0.038	2.44	71.02	0.113	4.66	3.28	2
14.436	1.26	0.00	1.26	0	0.92	0.06	0.98	1.0	0.052	39.92	67.36	0.096	1.85	0.95	0.30	0.80	1.11	1.0	0.038	2.37	64.97	0.106	4.30	3.07	2
14.600	1.27	0.00	1.27	0	0.92	0.06	0.98	1.0	0.052	40.90	71.12	0.101	1.95	0.95	0.32	0.80	1.11	1.0	0.038	1.92	58.11	0.098	3.97	2.96	2
14.764	1.28	0.00	1.28	0	0.92	0.06	0.98	1.0	0.052	39.37	65.21	0.094	1.81	0.95	0.29	0.80	1.11	1.0	0.038	1.95	50.29	0.092	3.68	2.74	2
14.928	1.29	0.00	1.29	0	0.92	0.06	0.98	1.0	0.052	40.00	67.67	0.097	1.87	0.95	0.30	0.80	1.11	1.0	0.038	3.16	87.53	0.142	5.65	3.76	2
15.092	1.30	0.00	1.30	0	0.91	0.06	0.98	1.0	0.052	39.53	65.85	0.095	1.83	0.95	0.30	0.80	1.10	1.0	0.038	2.44	64.33	0.105	4.12	2.98	2
15.256	1.31	0.00	1.31	0	0.91	0.07	0.97	1.0	0.051	44.75	85.96	0.121	2.36	0.95	0.37	0.80	1.10	1.0	0.038	1.66	68.40	0.110	4.28	3.32	2
15.420	1.32	0.00	1.32	0	0.91	0.06	0.97	1.0	0.051	42.47	77.18	0.109	2.12	0.95	0.34	0.80	1.10	1.0	0.038	2.11	73.21	0.116	4.51	3.31	2
15.584	1.33	0.00	1.33	0	0.91	0.06	0.97	1.0	0.051	41.07	71.78	0.102	1.98	0.95	0.32	0.80	1.10	1.0	0.038	1.98	60.69	0.101	3.87	2.93	2
15.748	1.34	0.00	1.34	0	0.91	0.06	0.97	1.0	0.051	41.92	75.04	0.106	2.07	0.94	0.33	0.80	1.10	1.0	0.038	2.18	72.28	0.115	4.38	3.23	2
15.912	1.35	0.00	1.35	0	0.91	0.06	0.97	1.0	0.051	39.80	66.87	0.096	1.87	0.94	0.30	0.80	1.09	1.0	0.038	2.19	59.36	0.099	3.76	2.81	2
16.076	1.36	0.00	1.36	0	0.91	0.06	0.97	1.0	0.051	41.39	73.00	0.103	2.03	0.94	0.32	0.80	1.09	1.0	0.038	1.82	57.57	0.098	3.66	2.84	2
16.240	1.36	0.00	1.36	0	0.91	0.06	0.97	1.0	0.051	42.43	77.01	0.109	2.13	0.94	0.34	0.80	1.09	1.0	0.038	2.04	70.42	0.112	4.18	3.16	2
16.404	1.37	0.00	1.37	0	0.90	0.06	0.97	1.0	0.051	42.34	76.66	0.108	2.13	0.94	0.34	0.80	1.09	1.0	0.038	2.16	74.09	0.118	4.34	3.24	2
16.568	1.38	0.00	1.38	0	0.90	0.07	0.97	1.0	0.051	45.40	88.45	0.125	2.46	0.94	0.38	0.80	1.09	1.0	0.038	2.04	87.67	0.143	5.22	3.84	2
16.732	1.39	0.00	1.39	0	0.90	0.06	0.97	1.0	0.051	40.44	70.17	0.100	1.97	0.94	0.31	0.80	1.09	1.0	0.038	3.27	97.24	0.166	6.01	3.99	2
16.896	1.40	0.00	1.40	0	0.90	0.06	0.97	1.0	0.051	42.27	76.39	0.108	2.13	0.94	0.34	0.80	1.08	1.0	0.038	2.39	81.44	0.130	4.69	3.41	2
17.060	1.41	0.00	1.41	1	0.90	0.06	0.97	1.0	0.051	42.61	77.71	0.110	2.17	0.94	0.34	0.80	1.08	1.0	0.038	2.49	87.26	0.142	5.06	3.62	2
17.224	1.42	0.01	1.42	1	0.90	0.06	0.97	1.0	0.051	40.58	69.87	0.099	1.96	0.94	0.31	0.80	1.08	1.0	0.039	2.56	74.93	0.119	4.21	3.08	2

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.235

Depth at time of CPT (ft)	Depth at t_1, z_1 (m)	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Maximum Shear Modulus, G_{max} (tsf)	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{v15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
0.164	2.46	594	1.6E-03	5.5E+02	8.0E-05	11	0.166	10961	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.328	2.51	594	1.6E-03	5.5E+02	8.1E-05	11	0.166	10879	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.492	2.56	594	1.6E-03	5.5E+02	8.3E-05	11	0.167	10799	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.656	2.61	594	1.6E-03	5.5E+02	8.4E-05	11	0.168	10720	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.820	2.66	594	1.6E-03	5.5E+02	8.6E-05	11	0.169	10644	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.984	2.71	594	1.6E-03	5.5E+02	8.7E-05	11	0.169	10570	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.148	2.76	594	1.6E-03	5.5E+02	8.9E-05	11	0.170	10497	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.312	2.81	594	1.6E-03	5.5E+02	9.0E-05	11	0.171	10426	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.476	2.86	594	1.6E-03	5.5E+02	9.2E-05	11	0.172	10357	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.640	2.91	594	1.6E-03	5.5E+02	9.3E-05	11	0.172	10289	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.804	2.96	594	1.6E-03	5.5E+02	9.4E-05	11	0.173	10223	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.968	3.01	594	1.6E-03	5.5E+02	9.6E-05	11	0.174	10158	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.133	3.06	594	1.6E-03	5.5E+02	9.7E-05	11	0.174	10094	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.297	3.11	594	1.6E-03	5.5E+02	9.9E-05	11	0.175	10032	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.461	3.16	594	1.6E-03	5.5E+02	1.0E-04	11	0.176	9971	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.625	3.21	594	1.6E-03	5.5E+02	1.0E-04	11	0.176	9911	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.789	3.26	594	1.6E-03	5.5E+02	1.0E-04	11	0.177	9853	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.953	3.31	594	1.6E-03	5.5E+02	1.0E-04	11	0.178	9796	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.117	3.36	495	1.6E-03	3.8E+02	1.5E-04	11	0.178	9739	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.281	3.41	495	1.3E-03	3.1E+02	1.9E-04	16	0.432	8182	0.04%	2.00	0.65	0.03%	0.005	0.34	0.079	0.765	0.75%	0.0012
3.445	3.46	495	1.3E-03	3.1E+02	1.9E-04	16	0.432	8145	0.04%	2.00	0.65	0.03%	0.005	0.34	0.079	0.765	0.79%	0.0013
3.609	3.51	495	1.3E-03	3.1E+02	1.9E-04	16	0.433	8108	0.04%	2.00	0.65	0.03%	0.005	0.34	0.079	0.765	0.82%	0.0013
3.773	3.56	495	1.3E-03	3.1E+02	1.9E-04	16	0.433	8072	0.04%	2.00	0.65	0.03%	0.006	0.34	0.079	0.765	0.86%	0.0014
3.937	3.61	495	1.3E-03	3.1E+02	2.0E-04	16	0.434	8036	0.04%	2.00	0.65	0.03%	0.006	0.34	0.079	0.765	0.89%	0.0015
4.101	3.66	495	1.3E-03	3.1E+02	2.0E-04	16	0.434	8001	0.04%	2.00	0.65	0.03%	0.006	0.34	0.079	0.765	0.93%	0.0015
4.265	3.71	495	1.3E-03	3.1E+02	2.0E-04	16	0.435	7966	0.04%	2.00	0.65	0.03%	0.006	0.34	0.079	0.765	0.96%	0.0016
4.429	3.76	495	1.3E-03	3.1E+02	2.0E-04	16	0.435	7932	0.04%	2.00	0.65	0.03%	0.007	0.34	0.079	0.765	1.00%	0.0016
4.593	3.81	495	1.8E-03	4.3E+02	1.5E-04	16	0.436	7886	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
4.757	3.86	495	1.8E-03	4.5E+02	1.5E-04	10	0.184	9531	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
4.921	3.91	495	1.9E-03	4.7E+02	1.4E-04	0	0.189	11924	0.02%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
5.085	3.96	495	1.9E-03	4.7E+02	1.4E-04	0	0.189	11852	0.02%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
5.249	4.01	495	1.9E-03	4.7E+02	1.5E-04	0	0.190	11782	0.03%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
5.413	4.06	495	1.9E-03	4.7E+02	1.5E-04	0	0.191	11713	0.03%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
5.577	4.11	495	1.9E-03	4.7E+02	1.5E-04	0	0.191	11646	0.03%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
5.741	4.16	495	1.9E-03	4.7E+02	1.5E-04	0	0.192	11580	0.03%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
5.905	4.21	495	1.9E-03	4.7E+02	1.5E-04	0	0.192	11515	0.03%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
6.069	4.26	495	1.9E-03	4.7E+02	1.6E-04	0	0.193	11452	0.03%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
6.234	4.31	495	1.9E-03	4.7E+02	1.6E-04	0	0.194	11389	0.03%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
6.398	4.36	495	1.9E-03	4.7E+02	1.6E-04	0	0.194	11328	0.03%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
6.562	4.41	495	1.9E-03	4.7E+02	1.6E-04	0	0.195	11268	0.03%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
6.726	4.46	495	1.9E-03	4.7E+02	1.7E-04	0	0.195	11209	0.03%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
6.890	4.51	495	1.9E-03	4.7E+02	1.7E-04	0	0.196	11151	0.03%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.01%	0.0000
7.054	4.56	495	1.9E-03	4.7E+02	1.7E-04	0	0.197	11094	0.03%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.01%	0.0000
7.218	4.61	495	1.9E-03	4.7E+02	1.7E-04	0	0.197	11038	0.03%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.01%	0.0000
7.382	4.66	495	1.9E-03	4.7E+02	1.7E-04	0	0.198	10983	0.03%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.01%	0.0000
7.546	4.71	495	1.8E-03	4.5E+02	1.8E-04	10	0.195	8675	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
7.710	4.76	495	1.8E-03	4.5E+02	1.8E-04	10	0.195	8633	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.06%	0.0001
7.874	4.81	495	1.8E-03	4.5E+02	1.9E-04	10	0.196	8593	0.03%	2.00	0.65	0.03%	0.001	0.34	0.079	0.765	0.14%	0.0002
8.038	4.86	495	1.9E-03	4.7E+02	1.8E-04	0	0.200	10777	0.04%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.02%	0.0000
8.202	4.91	495	1.9E-03	4.7E+02	1.8E-04	0	0.200	10727	0.04%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.02%	0.0000
8.366	4.96	495	1.9E-03	4.7E+02	1.9E-04	0	0.201	10677	0.04%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.03%	0.0000
8.530	5.01	495	1.8E-03	4.5E+02	1.9E-04	10	0.198	8433	0.03%	2.00	0.65	0.03%	0.002	0.34	0.079	0.765	0.35%	0.0006
8.694	5.06	495	1.8E-03	4.5E+02	2.0E-04	10	0.199	8395	0.03%	2.00	0.65	0.03%	0.003	0.34	0.079	0.765	0.39%	0.0006
8.858	5.11	495	1.8E-03	4.5E+02	2.0E-04	10	0.199	8359	0.03%	2.00	0.65	0.03%	0.003	0.34	0.079	0.765	0.43%	0.0007
9.022	5.16	495	1.8E-03	4.5E+02	2.0E-04	10	0.200	8322	0.03%	2.00	0.65	0.03%	0.003	0.34	0.079	0.765	0.47%	0.0008
9.186	5.21	495	1.8E-03	4.5E+02	2.0E-04	10	0.200	8287	0.04%	2.00	0.65	0.03%	0.003	0.34	0.079	0.765	0.51%	0.0008
9.350	5.26	460	1.9E-03	4.1E+02	2.3E-04	0	0.204	10401	0.06%	2.20	1.00	0.03%	0.001	0.34	0.079	0.765	0.11%	0.0002
9.514	5.31	460	1.9E-03	4.1E+02	2.3E-04	0	0.204	10356	0.06%	2.20	1.00	0.03%	0.001	0.34	0.079	0.765	0.11%	0.0002
9.678	5.36	460	1.9E-03	4.1E+02	2.3E-04	0	0.205	10312	0.06%	2.20	1.00	0.03%	0.001	0.34	0.079	0.765	0.11%	0.0002
9.842	5.41	460	1.8E-03	3.9E+02	2.5E-04	10	0.202	8145	0.05%	2.00	0.65	0.03%	0.008	0.34	0.079	0.765	1.24%	0.0020
10.006	5.46	460	1.8E-03	3.9E+02	2.5E-04	10	0.203	8112	0.05%	2.00	0.65	0.03%	0.008	0.34	0.079	0.765	1.28%	0.0021
10.170	5.51	460	1.8E-03	3.7E+02	2.6E-04	16	0.455	6651	0.07%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.75%	0.0029
10.335	5.56	460	1.8E-03	3.9E+02	2.5E-04	10	0.204	8048	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.35%	0.0022
10.499	5.61	460	1.8E-03	3.9E+02	2.6E-04	10	0.204	8016	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.38%	0.0023
10.663	5.66	460	1.8E-03	3.9E+02	2.6E-04	10	0.205	7985	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.42%	0.0023
10.827	5.71	460	1.8E-03	3.9E+02	2.6E-04	10	0.205	7953	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.45%	0.0024
10.991	5.76	460	1.8E-03	3.9E+02	2.6E-04	10	0.206	7923	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.49%	0.0024
11.155	5.81	460	1.8E-03	3.9E+02	2.6E-04	10	0.206	7893	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.52%	0.0025
11.319	5.86	460	1.8E-03	3.9E+02	2.7E-04	10	0.207	7863	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.56%	0.0026
11.483	5.91	460	1.8E-03	3.9E+02	2.7E-04	10	0.207	7833	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.59%	0.0026
11.647	5.96	460	1.8E-03	3.9E+02	2.7E-04	10	0.208	7804	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.63%	0.0027
11.811	6.01	460	1.8E-03	3.9E+02	2.7E-04	10	0.208	7775	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.66%	0.0027
11.975	6.06	460	1.8E-03	3.9E+02	2.8E-04	10	0.209	7747	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.70%	0.0028
12.139	6.11	460	1.8E-03	3.9E+02	2.8E-04	10	0.209	7719	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.73%	0.0028
12.303	6.16	460	1.8E-03	3.9E+02	2.8E-04	10	0.210	7691	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.77%	0.0029
12.467	6.21	460	1.8E-03	3.9E+02	2.8E-04	10	0.210	7664	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.80%	0.0030
12.631	6.26	460	1.9E-03	4.1E+02	2.8E-04	0	0.213	9635	0.09%	2.20	1.00	0.03%	0.001	0.34	0.079	0.765	0.21%	0.0003
12.795	6.31	460	1.8E-03	3.9E+02	2.9E-04	10	0.211	7609	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.87%	0.0031
12.959	6.36	460	1.8E-03	3.9E+02	2.9E-04	10	0.211	7583	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.91%	0.0031
13.123	6.41	460	1.8E-03	3.9E+02	2.9E-04	10	0.212	7557	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.95%	0.0032
13.287	6.46	460	1.8E-03	3.9E+02	3.0E-04	10	0.212	7531	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.98%	0.0033
13.451	6.51	460	1.8E-03	3.9E+02	3.0E-04	10	0.213	7505	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.02%	0.0033
13.615	6.56	460	1.8E-03	3.9E+02	3.0E-04	10	0.213	7480	0.08%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.05%	0.0034
13.779	6.61	460	1.8E-03	3.9E+02	3.0E-04	10	0.214	7455	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.09%	0.0034
13.943	6.66	460	1.8E-03	3.9E+02	3.1E-04	10	0.214	7431	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.13%	0.0035
14.107	6.71	460	1.8E-03	3.9E+02	3.1E-04	10	0.215	7406	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.16%	0.0035
14.271	6.76	460	1.8E-03	3.9E+02	3.1E-04	10	0.215	7382	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.20%	0.0036
14.436	6.81	460	1.8E-03	3.9E+02	3.1E-04	10	0.215	7358	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.24%	0.0037
14.600	6.86	500	1.8E-03	4.6E+02	2.7E-04	10	0.216	7335	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.42%	0.0023
14.764	6.91	500	1.8E-03	4.6E+02	2.7E-04	10	0.216	7312	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.45%	0.0024
14.928	6.96	500	1.8E-03	4.6E+02	2.7E-04	10	0.217	7289	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.48%	0.0024
15.092	7.01	500	1.8E-03	4.6E+02	2.7E-04	10	0.217	7266	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.51%	0.0025
15.256	7.06	500	1.8E-03	4.6E+02	2.8E-04	10	0.217	7243	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.53%	0.0025
15.420	7.11	500	1.8E-03	4.6E+02	2.8E-04	10	0.218	7221	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.56%	0.0026
15.584	7.16	500	1.8E-03	4.6E+02	2.8E-04	10	0.218	7199	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.59%	0.0026
15.748	7.21	500	1.8E-03	4.6E+02	2.8E-04	10	0.219	7177	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.62%	0.0027
15.912	7.26	500	1.8E-03	4.6E+02	2.8E-04	10	0.219	7155	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.64%	0.0027
16.076	7.31	500	1.8E-03	4.6E+02	2.9E-04	10	0.220	7134	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.67%	0.0027
16.240	7.36	500	1.8E-03	4.6E+02	2.9E-04	10	0.220	7113	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.70%	0.0028
16.404	7.41	500	1.8E-03	4.6E+02	2.9E-04	10	0.220	7092	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.73%	0.0028
16.568	7.46	500	1.8E-03	4.6E+02	2.9E-04	10	0.221	7071	0.07%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.76%	0.0029
16.732	7.51	500	1.8E-03	4.4E+02	3.1E-04	16	0.472	5809	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.21%	0.0036
16.896	7.56	500	1.8E-03	4.6E+02	3.0E-04	10	0.221	7031	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.81%	0.0030
17.060	7.61	500	1.8E-03	4.6E+02	3.0E-04	10	0.222	7017	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.84%	0.0030
17.224	7.66	500	1.8E-03	4.6E+02	3.0E-04	10	0.222	7007	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.87%	0.0031

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-1S

Data File: 13-52106_SP3-1S-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Dat

Legend	
(blue)	Tailings Sands
(red)	Tailings Sand-Slimes
(green)	Tailings Slimes
(grey)	Interim Cover
(orange)	Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69

Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

5608.00	Water surface elevation during CPT investigation (ft
5604.28	Water surface elevation at t_0 (ft amsl)
5595.59	Water surface elevation at t_1 (ft amsl)
5590.59	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Eart
7.51	Equiv. Number of Uniform Strain Cycles, N

5612.56	Ground Surface Elevation at time of CPT (ft amsl)
5620.47	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pla
3.50	Thickness of Water Storage/Rooting Zone (ft)
3.50	Thickness of High Compaction Layer (ft)
0.41	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
887.10	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5590.59	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer	Total Stress at Midpoint of Layer	Equil Pore Pressure at Bottom of Layer	Equil Pore Pressure at Midpoint of Layer (tsf)	Effective Stress at Bottom of Layer	Effective Stress at Midpoint of Layer	Midpoint Depth at t_1, z_1	Shear Wave Velocity, V_s	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
Erosion Protection Layer	######	5620.22	5619.97	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014	0.08	508	1.7E-03	4.4E+02	3.0E-06	11	0.068	46696	0.00%	1.20	0.80	0.04%	0.000	0.32	0.133	0.778	0.00%	0.0000
Water Storage/Rooting Zone Layer	######	5618.22	5616.47	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121	0.69	508	1.7E-03	4.3E+02	2.8E-05	11	0.118	18930	0.00%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
High Compaction Layer	######	5614.72	5612.97	3.50	0.060	120	0.424	0.320	0.00	0.00	0.424	0.320	1.75	508	1.9E-03	4.8E+02	6.5E-05	11	0.152	12657	0.01%	0.65	0.75	0.02%	0.000	0.34	0.079	0.765	0.00%	0.0000
Platform/Random Fill Layer	######	5612.77	5612.56	0.41	0.050	101	0.445	0.434	0.00	0.00	0.445	0.434	2.35	508	1.6E-03	4.0E+02	1.0E-04	11	0.164	11140	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000

2013 CPT Data from ConeTec

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines
17.388	5595.17	26.8	0.182	26.7	20.4	8.84	0.68%	Sand-Slime Tailin
17.552	5595.01	24.3	0.073	24.2	8.2	3.55	0.30%	Sand-Slime Tailin
17.716	5594.84	21.7	0.073	21.6	11.9	5.16	0.34%	Sand-Slime Tailin
17.880	5594.68	17.6	0.073	17.5	13.5	5.83	0.42%	Sand-Slime Tailin
21.970	5590.59							Sand-Slime Tailin

CPT Data Interpretations

Depth at time of CPT (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %
17.388	0.059	119.0	0.99	0.40	0.59	1	1.29	34.509	479.67	40.27	44	0.70%	2.1	47%
17.552	0.059	119.0	1.00	0.41	0.59	1	1.29	31.333	435.53	36.47	39	0.31%	2.0	47%
17.716	0.059	119.0	1.01	0.41	0.60	1	1.30	27.980	388.93	32.61	35	0.35%	2.1	47%
17.880	0.059	119.0	1.02	0.42	0.60	1	1.30	22.828	317.31	26.64	27	0.44%	2.2	47%
21.970	0.059	119.0												

Conditions at t_1 / Liquefaction Triggering Analyses – Idriss & Boulanger (2008)

Depth at time of CPT (ft)	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No	Cyclic Stress Ratio: r_d	C_σ	K_σ	K_a	CSR M=7.5, s'v=1atm	Cyclic Resistance Ratio: Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS
17.388	1.43	0.01	1.42	1	0.90	0.07	0.97	1.0	0.051	44.43	84.70	0.119	2.35
17.552	1.44	0.02	1.42	1	0.90	0.06	0.97	1.0	0.051	43.09	79.56	0.112	2.21
17.716	1.45	0.02	1.43	1	0.89	0.06	0.97	1.0	0.051	41.74	74.35	0.105	2.06
17.880	1.46	0.03	1.43	1	0.89	0.06	0.97	1.0	0.051	39.64	66.29	0.095	1.86
21.970	1.71	0.09	1.61	1									

Liquefaction Triggering Analyses – Youd et al. (2001)

Depth at time of CPT (ft)	Cyclic Stress Ratio: r_d	D_r	f	K_σ	K_a	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No
17.388	0.94	0.37	0.80	1.08	1.0	0.039	1.49	59.88	0.100	3.49	2.92	2
17.552	0.94	0.35	0.80	1.08	1.0	0.039	1.31	47.86	0.090	3.10	2.65	2
17.716	0.94	0.33	0.80	1.08	1.0	0.039	1.42	46.25	0.089	3.02	2.54	2
17.880	0.94	0.30	0.80	1.07	1.0	0.039	1.68	44.88	0.087	2.95	2.41	2

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.235

Depth at t_1, z_1 m	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Maximum Shear Strain Modulus, G_{max} tsf	P = γ_{eff}*(G_{eff}/G_{max}) tsf	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
7.71	500	1.8E-03	4.6E+02	3.0E-04	10	0.222	6998	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.90%	0.0031
7.76	500	1.8E-03	4.6E+02	3.0E-04	10	0.222	6988	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.94%	0.0032
7.81	500	1.8E-03	4.6E+02	3.1E-04	10	0.222	6979	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.97%	0.0032
7.86	500	1.8E-03	4.6E+02	3.1E-04	10	0.223	6969	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.00%	0.0033
9.11	538	1.8E-03	5.3E+02	3.1E-04	10	0.229	6637	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.92%	0.0786

(yellow) Extra layer added to analyze seismic settlement of tailings below the bottom of CPT investigation.

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-2C

Data File: 13-52106_SP3-2C-BSC-CPT
Location: White Mesa 2013 CPT Investigation

Legend	
Tailings Sands	
Tailings Sand-Slimes	
Tailings Slimes	
Interim Cover	
Cells Requiring User Input/Manipulation	

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Parameter	Value	Parameter
5605.30	Water surface elevation during CPT investigation (ft amsl)	5610.82	Ground Surface Elevation at time of CPT (ft amsl)
5602.54	Water surface elevation at t_0 (ft amsl)	5621.51	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
5591.64	Water surface elevation at t_1 (ft amsl)	0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after plac
5586.64	Water surface elevation at t_2 (ft amsl)	3.50	Thickness of Water Storage/Rooting Zone (ft)
		3.50	Thickness of High Compaction Layer (ft)
1.44	Scaling Factor for stress ration, r_m	3.19	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
0.47	Volumetric Strain Ratio for Site-Specific Design Eart	1167.12	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
7.51	Equiv. Number of Uniform Strain Cycles, N	5586.64	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)
Erosion Protection Layer	######	5621.26
Water Storage/Rooting Zone Layer	######	5619.26
High Compaction Layer	######	5615.76
Platform/Random Fill Layer	######	5612.42

2013 CPT Data from ConeTec / CPT Data Interpretations

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No
0.164	5610.66	9.5	0.818	9.5	10.4	4.49	8.58%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0
0.328	5610.49	67.8	0.428	67.8	8.7	3.76	0.63%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0
0.492	5610.33	104.7	0.603	104.6	7.9	3.44	0.58%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0
0.656	5610.16	73.4	0.695	73.3	5.6	2.42	0.95%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0
0.820	5610.00	90.8	1.617	90.7	4.4	1.90	1.78%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0
0.984	5609.84	98.7	0.951	98.7	4.8	2.06	0.96%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0
1.148	5609.67	142.9	1.153	142.9	5.8	2.53	0.81%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0
1.312	5609.51	142.3	0.768	142.3	5.6	2.43	0.54%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0
1.476	5609.34	150.3	0.964	150.3	3.4	1.49	0.64%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0
1.640	5609.18	142.9	0.948	142.9	4.8	2.08	0.66%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0
1.804	5609.02	129.8	0.906	129.8	4.9	2.12	0.70%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0
1.968	5608.85	134.9	1.437	134.9	3.7	1.61	1.07%	Interim Cover	0.050	100.7	0.10	0.00	0.10	0
2.133	5608.69	130.9	0.753	130.9	2.7	1.15	0.58%	Interim Cover	0.050	100.7	0.11	0.00	0.11	0
2.297	5608.52	120.4	0.968	120.4	3.4	1.47	0.80%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0
2.461	5608.36	98.7	1.136	98.7	3.8	1.64	1.15%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0
2.625	5608.20	75.5	1.164	75.5	3.5	1.50	1.54%	Interim Cover	0.050	100.7	0.13	0.00	0.13	0
2.789	5608.03	54.0	0.768	54.0	2.0	0.85	1.42%	Interim Cover	0.050	100.7	0.14	0.00	0.14	0
2.953	5607.87	50.1	0.997	50.1	1.2	0.53	1.99%	Interim Cover	0.050	100.7	0.15	0.00	0.15	0
3.117	5607.70	56.9	1.094	56.9	2.7	1.18	1.92%	Interim Cover	0.050	100.7	0.16	0.00	0.16	0
3.281	5607.54	64.2	0.738	64.2	2.1	0.92	1.15%	Sand Tailings	0.051	102.8	0.17	0.00	0.17	0
3.445	5607.38	52.1	0.886	52.1	2.0	0.87	1.70%	Sand-Slime Tailin	0.047	93.3	0.17	0.00	0.17	0
3.609	5607.21	29.1	1.041	29.1	0.7	0.30	3.58%	Slime Tailings	0.041	82.7	0.18	0.00	0.18	0
3.773	5607.05	21.5	1.042	21.5	1.5	0.65	4.84%	Slime Tailings	0.041	82.7	0.19	0.00	0.19	0
3.937	5606.88	16.3	0.676	16.3	3.3	1.44	4.14%	Slime Tailings	0.041	82.7	0.19	0.00	0.19	0
4.101	5606.72	18.3	0.612	18.2	5.0	2.18	3.35%	Slime Tailings	0.041	82.7	0.20	0.00	0.20	0
4.265	5606.55	15.1	0.610	15.0	4.1	1.76	4.05%	Slime Tailings	0.041	82.7	0.21	0.00	0.21	0
4.429	5606.39	19.3	0.601	19.3	4.8	2.09	3.11%	Slime Tailings	0.041	82.7	0.21	0.00	0.21	0
4.593	5606.23	24.6	0.687	24.5	4.0	1.73	2.80%	Sand-Slime Tailin	0.047	93.3	0.22	0.00	0.22	0
4.757	5606.06	24.5	0.631	24.5	2.1	0.90	2.57%	Sand-Slime Tailin	0.047	93.3	0.23	0.00	0.23	0
4.921	5605.90	23.4	0.399	23.4	5.1	2.21	1.71%	Sand-Slime Tailin	0.047	93.3	0.24	0.00	0.24	0
5.085	5605.73	25.5	0.327	25.5	7.2	3.11	1.28%	Sand-Slime Tailin	0.047	93.3	0.24	0.00	0.24	0
5.249	5605.57	20.3	0.310	20.3	1.4	0.60	1.53%	Sand-Slime Tailin	0.047	93.3	0.25	0.00	0.25	0
5.413	5605.41	11.2	0.265	11.2	0.7	0.29	2.37%	Slime Tailings	0.041	82.7	0.26	0.00	0.26	0
5.577	5605.24	7.5	0.141	7.5	0.6	0.27	1.88%	Slime Tailings	0.057	113.1	0.27	0.00	0.27	1
5.741	5605.08	7.7	0.089	7.7	1.1	0.47	1.15%	Sand-Slime Tailin	0.059	119.0	0.28	0.01	0.27	1
5.905	5604.91	9.9	0.084	9.9	2.9	1.27	0.84%	Sand-Slime Tailin	0.059	119.0	0.29	0.01	0.28	1
6.069	5604.75	5.9	0.088	5.9	2.9	1.27	1.50%	Slime Tailings	0.057	113.1	0.30	0.02	0.28	1
6.234	5604.59	5.6	0.085	5.5	4.4	1.92	1.53%	Slime Tailings	0.057	113.1	0.31	0.02	0.28	1
6.398	5604.42	7.0	0.088	6.9	6.4	2.77	1.26%	Slime Tailings	0.057	113.1	0.32	0.03	0.29	1
6.562	5604.26	7.1	0.082	7.1	6.8	2.93	1.15%	Slime Tailings	0.057	113.1	0.32	0.03	0.29	1
6.726	5604.09	10.7	0.082	10.6	7.0	3.03	0.77%	Sand-Slime Tailin	0.059	119.0	0.33	0.04	0.30	1
6.890	5603.93	13.4	0.114	13.4	5.9	2.54	0.85%	Sand-Slime Tailin	0.059	119.0	0.34	0.04	0.30	1
7.054	5603.77	15.0	0.134	14.9	5.2	2.24	0.90%	Sand-Slime Tailin	0.059	119.0	0.35	0.05	0.31	1
7.218	5603.60	22.4	0.135	22.4	8.0	3.48	0.60%	Sand-Slime Tailin	0.059	119.0	0.36	0.05	0.31	1
7.382	5603.44	17.5	0.162	17.4	10.4	4.51	0.93%	Sand-Slime Tailin	0.059	119.0	0.37	0.06	0.32	1
7.546	5603.27	15.5	0.200	15.4	24.6	10.65	1.29%	Sand-Slime Tailin	0.059	119.0	0.38	0.06	0.32	1
7.710	5603.11	17.0	0.227	16.8	44.3	19.18	1.33%	Sand-Slime Tailin	0.059	119.0	0.39	0.07	0.32	1
7.874	5602.95	17.9	0.174	17.6	42.1	18.26	0.97%	Sand-Slime Tailin	0.059	119.0	0.40	0.07	0.33	1
8.038	5602.78	20.6	0.144	20.4	32.2	13.94	0.70%	Sand-Slime Tailin	0.059	119.0	0.41	0.08	0.33	1
8.202	5602.62	26.4	0.168	26.2	32.9	14.27	0.64%	Sand-Slime Tailin	0.059	119.0	0.42	0.08	0.34	1
8.366	5602.45	29.9	0.252	29.7	36.5	15.81	0.84%	Sand-Slime Tailin	0.059	119.0	0.43	0.09	0.34	1
8.530	5602.29	22.3	0.277	22.1	28.4	12.32	1.24%	Sand-Slime Tailin	0.059	119.0	0.44	0.09	0.35	1
8.694	5602.13	21.8	0.392	21.5	41.9	18.15	1.80%	Sand-Slime Tailin	0.059	119.0	0.45	0.10	0.35	1
8.858	5601.96	21.4	0.248	21.0	63.0	27.28	1.16%	Sand-Slime Tailin	0.059	119.0	0.46	0.10	0.36	1
9.022	5601.80	29.7	0.307	29.5	36.3	15.73	1.03%	Sand-Slime Tailin	0.059	119.0	0.47	0.11	0.36	1
9.186	5601.63	22.6	0.143	22.5	10.6	4.58	0.63%	Sand-Slime Tailin	0.059	119.0	0.48	0.11	0.37	1
9.350	5601.47	17.7	0.143	17.7	4.4	1.92	0.81%	Sand-Slime Tailin	0.059	119.0	0.49	0.12	0.37	1
9.514	5601.31	14.2	0.178	14.2	4.4	1.90	1.25%	Sand-Slime Tailin	0.059	119.0	0.50	0.12	0.38	1
9.678	5601.14	11.7	0.202	11.6	7.4	3.22	1.73%	Sand-Slime Tailin	0.059	119.0	0.51	0.13	0.38	1
9.842	5600.98	11.3	0.120	11.2	13.3	5.76	1.07%	Sand-Slime Tailin	0.059	119.0	0.52	0.13	0.38	1
10.006	5600.81	14.4	0.083	14.3	11.9	5.15	0.58%	Sand-Slime Tailin	0.059	119.0	0.53	0.14	0.39	1
10.170	5600.65	18.3	0.069	18.3	7.0	3.04	0.38%	Sand-Slime Tailin	0.059	119.0	0.54	0.15	0.39	1
10.335	5600.49	20.6	0.093	20.6	5.9	2.55	0.45%	Sand-Slime Tailin	0.059	119.0	0.55	0.15	0.40	1
10.499	5600.32	21.3	0.111	21.3	5.5	2.39	0.52%	Sand-Slime Tailin	0.059	119.0	0.56	0.16	0.40	1
10.663	5600.16	23.3	0.126	23.3	6.1	2.63	0.54%	Sand-Slime Tailin	0.059	119.0	0.57	0.16	0.41	1
10.827	5599.99	23.4	0.148	23.4	6.7	2.88	0.63%	Sand-Slime Tailin	0.059	119.0	0.58	0.17	0.41	1
10.991	5599.83	23.4	0.151	23.3	6.8	2.96	0.65%	Sand-Slime Tailin	0.059	119.0	0.59	0.17	0.42	1
11.155	5599.67	23.8	0.188	23.7	7.4	3.19	0.79%	Sand-Slime Tailin	0.059	119.0	0.60	0.18	0.42	1
11.319	5599.50	20.6	0.235	20.6	7.4	3.21	1.14%	Sand-Slime Tailin	0.059	119.0	0.61	0.18	0.43	1
11.483	5599.34	17.6	0.198	17.5	8.1	3.49	1.13%	Sand-Slime Tailin	0.059	119.0	0.62	0.19	0.43	1
11.647	5599.17	21.4	0.168	21.3	8.2	3.53	0.79%	Sand-Slime Tailin	0.059	119.0	0.63	0.19	0.44	1
11.811	5599.01	21.3	0.146	21.2	7.4	3.21	0.69%	Sand-Slime Tailin	0.059	119.0	0.64	0.20	0.44	1
11.975	5598.85	23.0	0.133	23.0	8.9	3.84	0.58%	Sand-Slime Tailin	0.059	119.0	0.65	0.20	0.45	1
12.139	5598.68	25.0	0.154	24.9	8.9	3.84	0.62%	Sand-Slime Tailin	0.059	119.0	0.66	0.21	0.45	1
12.303	5598.52	23.3	0.135	23.3	8.9	3.84	0.58%	Sand-Slime Tailin	0.059	119.0	0.67	0.21	0.45	1
12.467	5598.35	19.3	0.160	19.2	8.9	3.87	0.83%	Sand-Slime Tailin	0.059	119.0	0.68	0.22	0.46	1
12.631	5598.19	20.3	0.143	20.3	8.0	3.47	0.70%	Sand-Slime Tailin	0.059	119.0	0.69	0.22	0.46	1
12.795	5598.02	20.0	0.132	19.9	7.5	3.24	0.66%	Sand-Slime Tailin	0.059	119.0	0.70	0.23	0.47	1
12.959	5597.86	21.7	0.151	21.6	9.5	4.12	0.70%	Sand-Slime Tailin	0.059	119.0	0.71	0.23	0.47	1
13.123	5597.70	20.7	0.179	20.6	8.8	3.79	0.87%	Sand-Slime Tailin	0.059	119.0	0.72	0.24	0.48	1
13.287	5597.53	20.4	0.271	20.3	9.5	4.12	1.33%	Sand-Slime Tailin	0.059	119.0	0.72	0.24	0.48	1
13.451	5597.37	17.5	0.436	17.4	12.5	5.40	2.49%	Sand-Slime Tailin	0.059	119.0	0.73	0.25	0.49	1
13.615	5597.20	16.3	0.451	16.2	16.3	7.05	2.77%	Slime Tailings	0.057	113.1	0.74	0.25	0.49	1
13.779	5597.04	20.4	0.353	20.2	19.3	8.35	1.73%	Sand-Slime Tailin	0.059	119.0	0.75	0.26	0.50	1
13.943	5596.88	25.7	0.379	25.6	13.1	5.68	1.48%	Sand-Slime Tailin	0.059	119.0	0.76	0.26	0.50	1
14.107	5596.71	19.0	0.491	19.0	7.7	3.35	2.58%	Sand-Slime Tailin	0.059	119.0	0.77	0.27	0.51	1
14.271	5596.55	14.6	0.427	14.6	5.8	2.51	2.92%	Slime Tailings	0.057	113.1	0.78	0.27	0.51	1
14.436	5596.38	9.2	0.378	9.2	7.3	3.14	4.11%	Slime Tailings	0.057	113.1	0.79	0.28	0.51	1
14.600	5596.22	10.5	0.412	10.2	45.5	19.71	3.91%	Slime Tailings	0.057	113.1	0.80	0.28	0.52	1
14.764	5596.06	12.3	0.360	12.1	42.1	18.25	2.92%	Slime Tailings	0.057	113.1	0.81	0.29	0.52	1
14.928	5595.89	11.4	0.381	11.1	52.4	22.72	3.35%	Slime Tailings	0.057	113.1	0.82	0.29	0.53	1
15.092	5595.73	10.8	0.299	10.3	74.3	32.20	2.78%	Slime Tailings	0.057	113.1	0.83	0.30	0.53	1
15.256	5595.56	19.3	0.291	19.3	9.6	4.14	1.50%	Sand-Slime Tailin	0.059	119.0	0.84	0.30	0.53	1
15.420	5595.40	21.0	0.161	20.9	6.0	2.61	0.77%	Sand-Slime Tailin	0.059	119.0	0.85	0.31	0.54	1
15.584	5595.24	22.2	0.159	22.2	3.5	1.51	0.72%	Sand-Slime Tailin	0.059	119.0	0.86	0.31	0.54	1
15.748	5595.07	20.4	0.160	20.4	2.7	1.19	0.78%	Sand-Slime Tailin	0.059	119.0	0.87	0.32	0.55	1
15.912	5594.91	19.5	0.171	19.4	8.7	3.77	0.88%	Sand-Slime Tailin	0.059	119.0	0.88	0.32	0.55	1
16.076	5594.74	19.6	0.146	19.5	14.0	6.06	0.74%	Sand-Slime Tailin	0.059	119.0	0.89	0.33	0.56	1
16.240	5594.58	22.3	0.122	22.2	15.7	6.79	0.55%	Sand-Slime Tailin	0.059	119.0	0.90	0.33	0.56	1
16.404	5594.42	25.7	0.298	25.6	17.8	7.69	1.16%	Sand-Slime Tailin	0.059	119.0	0.91	0.34	0.57	1
16.568	5594.25	18.5	0.396	18.4	22.8	9.87	2.14%	Sand-Slime Tailin	0.059	119.0	0.92	0.34	0.57	1
16.732	5594.09	15.3	0.462	15.1	35.8	15.50	3.02%	Slime Tailings	0.057	113.1	0.93	0.35	0.58	1
16.896	5593.92	15.4	0.350	14.9	88.5	38.34	2.27%	Sand-Slime Tailin	0.059	119.0	0.94	0.35	0.58	1
17.060	5593.76	26.3	0.276	25.8	72.4	31.36	1.05%	Sand-Slime Tailin	0.059	119.0	0.95	0.36	0.59	1
17.224	5593.60	20.8	0.402	20.7	18.6	8.07	1.93%	Sand-Slime Tailin	0.059	119.0	0.96	0.37	0.59	1
17.388	5593.43	15.3	0.334	15.2	21.0	9.11	2.19%	Sand-Slime Tailin	0.059	119.0	0.96	0.37	0.59	1
17.552	5593.27	16.5	0.162	16.3	36.5	15.82	0.98%	Sand-Slime Tailin	0.059	119.0	0.97	0.38	0.60	1
17.716	5593.10	24.5	0.248	24.3	32.1	13.91	1.01%	Sand-Slime Tailin	0.059	119.0	0.98	0.38	0.60	1
17.880	5592.94	17.1	0.328	16.9	29.7	12.85	1.92%	Sand-Slime Tailin	0.059	119.0	0.99	0.39	0.61	1
18.044	5592.78	15.0	0.452	14.8	43.2	18.70	3.01%	Slime Tailings	0.057	113.1	1.00	0.39	0.61	1
18.208	5592.61	12.2	0.284	11.8	60.5	26.21	2.32%	Slime Tailings	0.057	113.1	1.01	0.40	0.62	1

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-2C

Data File: 13-52106_SP3-2C-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Legend:
- Tailings Sands
- Tailings Sand-Slimes
- Tailings Slimes
- Interim Cover
- Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Parameter
5605.30	Water surface elevation during CPT investigation (ft
5602.54	Water surface elevation at t_0 (ft amsl)
5591.64	Water surface elevation at t_1 (ft amsl)
5586.64	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Eart
7.51	Equiv. Number of Uniform Strain Cycles, N

Value	Parameter
5610.82	Ground Surface Elevation at time of CPT (ft amsl)
5621.51	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after plac
3.50	Thickness of Water Storage/Rooting Zone (ft)
3.50	Thickness of High Compaction Layer (ft)
3.19	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1167.12	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5586.64	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)		Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pore Pressure at Bottom of Layer	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Midpoint Depth at t_1, z_1	Shear Wave Velocity, V_s	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-}	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
Erosion Protection Layer	######		5621.26	5621.01	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014	0.08	508	1.7E-03	4.4E+02	3.0E-06	11	0.068	46696	0.00%	1.20	0.80	0.04%	0.000	0.32	0.133	0.778	0.00%	0.0000
ater Storage/Rooting Zone Layer	######		5619.26	5617.51	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121	0.69	508	1.7E-03	4.3E+02	2.8E-05	11	0.118	18930	0.00%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
High Compaction Layer	######		5615.76	5614.01	3.50	0.060	120	0.424	0.320	0.00	0.00	0.424	0.320	1.75	508	1.9E-03	4.8E+02	6.5E-05	11	0.152	12657	0.01%	0.65	0.75	0.02%	0.000	0.34	0.079	0.765	0.00%	0.0000
Platform/Random Fill Layer	######		5612.42	5610.82	3.19	0.050	101	0.585	0.504	0.00	0.00	0.585	0.504	2.77	508	1.6E-03	4.0E+02	1.2E-04	11	0.170	10470	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
18.372	5592.45	20.9	0.383	20.4	78.0	33.81	1.83%	Sand-Slime Tailin	0.059	119.0	1.02	0.40	0.62	1	1.27	25.871	359.60	30.76	32	1.92%	2.5	###	1.61	0.00	1.61	0
18.537	5592.28	18.1	0.296	17.9	41.0	17.77	1.63%	Sand-Slime Tailin	0.059	119.0	1.03	0.41	0.63	1	1.27	22.684	315.30	26.72	27	1.73%	2.5	###	1.62	0.00	1.62	0
18.701	5592.12	21.8	0.387	21.4	62.7	27.18	1.78%	Sand-Slime Tailin	0.059	119.0	1.04	0.41	0.63	1	1.25	26.759	371.95	31.65	33	1.87%	2.5	###	1.63	0.00	1.63	0
18.865	5591.96	18.8	0.412	18.5	46.5	20.15	2.19%	Sand-Slime Tailin	0.059	119.0	1.05	0.42	0.64	1	1.25	23.212	322.65	27.38	28	2.32%	2.6	###	1.64	0.00	1.64	0
19.029	5591.79	18.5	0.428	18.4	22.2	9.62	2.31%	Sand-Slime Tailin	0.059	119.0	1.06	0.42	0.64	1	1.25	22.958	319.11	26.86	27	2.45%	2.6	###	1.65	0.00	1.65	0
19.193	5591.63	13.1	0.382	12.9	32.2	13.96	2.91%	Slime Tailings	0.057	113.1	1.07	0.43	0.64	1	1.25	16.221	225.48	19.13	19	3.17%	2.8	###	1.65	0.00	1.65	1
19.357	5591.46	11.8	0.318	11.1	110.7	47.96	2.70%	Slime Tailings	0.057	113.1	1.08	0.43	0.65	1	1.25	13.843	192.42	17.08	17	2.97%	2.8	###	1.66	0.01	1.66	1
19.521	5591.30	14.0	0.235	13.6	73.8	31.99	1.67%	Sand-Slime Tailin	0.059	119.0	1.09	0.44	0.65	1	1.24	16.857	234.31	20.24	20	1.81%	2.6	###	1.67	0.01	1.66	1
19.685	5591.14	14.0	0.240	13.3	116.1	50.29	1.72%	Sand-Slime Tailin	0.059	119.0	1.10	0.44	0.66	1	1.23	16.369	227.53	20.05	20	1.86%	2.6	###	1.68	0.02	1.67	1
19.849	5590.97	13.0	0.220	12.4	100.8	43.68	1.69%	Sand-Slime Tailin	0.059	119.0	1.11	0.45	0.66	1	1.23	15.187	211.09	18.54	18	1.85%	2.7	###	1.69	0.02	1.67	1
20.013	5590.81	12.6	0.337	11.7	147.5	63.92	2.68%	Slime Tailings	0.057	113.1	1.12	0.45	0.67	1	1.22	14.257	198.18	17.87	17	2.94%	2.8	###	1.70	0.03	1.68	1
20.177	5590.64	16.5	0.337	15.6	147.0	63.70	2.05%	Sand-Slime Tailin	0.059	119.0	1.13	0.46	0.67	1	1.21	18.838	261.85	23.17	23	2.20%	2.6	###	1.71	0.03	1.68	1
20.341	5590.48	20.1	0.337	19.5	94.3	40.85	1.68%	Sand-Slime Tailin	0.059	119.0	1.14	0.46	0.68	1	1.20	23.344	324.48	27.93	28	1.78%	2.5	###	1.72	0.04	1.69	1
24.180	5586.64							Sand-Slime Tailin	0.059	119.0													1.95	0.10	1.85	1

Liquefaction Triggering Analyses

Idriss & Boulanger (2008): Cyclic Stress Ratio (r_d … CSR), Cyclic Resistance Ratio (Δqc_{1n} … CRR), FoS. Youd et al. (2001): Cyclic Stress Ratio (r_d … CSR), Kc … CRR, FoS.

Depth at time of CPT (ft)	r_d	C_σ	K_σ	K_a	CSR M=7.5, s'v=1atm	Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	r_d	D_r	f	f	K_σ	K_a	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No
18.372	0.89	0.06	0.96	1.0	0.050	41.09	71.85	0.102	2.06	0.93	0.32	0.80	0.80	1.07	1.0	0.039	2.64	81.26	0.130	4.38	3.22	2
18.537	0.89	0.06	0.96	1.0	0.049	39.67	66.40	0.095	1.92	0.93	0.30	0.80	0.80	1.07	1.0	0.039	2.78	74.25	0.118	3.95	2.94	2
18.701	0.89	0.06	0.96	1.0	0.049	41.40	73.05	0.103	2.10	0.93	0.32	0.80	0.80	1.06	1.0	0.039	2.56	81.00	0.129	4.30	3.20	2
18.865	0.89	0.06	0.96	1.0	0.049	39.90	67.29	0.096	1.95	0.93	0.30	0.80	0.80	1.06	1.0	0.039	3.15	86.26	0.140	4.61	3.28	2
19.029	0.88	0.06	0.96	1.0	0.049	39.72	66.59	0.095	1.94	0.93	0.30	0.80	0.80	1.06	1.0	0.039	3.28	88.21	0.144	4.72	3.33	2
19.193	0.88	0.05	0.97	1.0	0.049	36.75	55.88	0.083	1.69	0.93	0.25	0.80	0.80	1.06	1.0	0.039	4.71	90.11	0.148	4.82	3.26	2
19.357	0.88	0.05	0.97	1.0	0.049	36.04	53.12	0.081	1.63	0.93	0.24	0.80	0.80	1.06	1.0	0.039	4.94	84.32	0.136	4.38	3.01	2
19.521	0.88	0.05	0.97	1.0	0.049	37.40	57.64	0.085	1.73	0.93	0.26	0.80	0.80	1.06	1.0	0.039	3.50	70.92	0.113	3.62	2.67	2
19.685	0.88	0.05	0.97	1.0	0.050	37.33	57.38	0.085	1.72	0.93	0.26	0.80	0.80	1.06	1.0	0.039	3.57	71.65	0.114	3.62	2.67	2
19.849	0.88	0.05	0.97	1.0	0.050	36.80	55.34	0.083	1.67	0.93	0.25	0.80	0.80	1.05	1.0	0.039	3.77	69.95	0.112	3.52	2.59	2
20.013	0.88	0.05	0.97	1.0	0.050	36.31	54.17	0.082	1.64	0.92	0.24	0.80	0.80	1.05	1.0	0.039	4.79	85.49	0.138	4.31	2.98	2
20.177	0.87	0.05	0.96	1.0	0.050	38.43	61.60	0.090	1.81	0.92	0.28	0.80	0.80	1.05	1.0	0.039	3.49	80.79	0.129	4.00	2.90	2
20.341	0.87	0.06	0.96	1.0	0.050	40.10	68.03	0.097	1.96	0.92	0.31	0.80	0.80	1.05	1.0	0.040	2.77	77.23	0.123	3.77	2.87	2

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.397

Depth at time of CPT (ft)	Depth at t_1, z_1 m	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Maximum Shear Strain Modulus, G_{max} tsf	P = γ_{eff}*(G_{eff}/G_{max}) tsf	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-}	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
18.372	8.86	500	1.8E-03	4.6E+02	3.4E-04	10	0.229	6649	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.40%	0.0039
18.537	8.91	500	1.8E-03	4.6E+02	3.4E-04	10	0.230	6632	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.43%	0.0040
18.701	8.96	500	1.8E-03	4.6E+02	3.4E-04	10	0.230	6616	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.46%	0.0040
18.865	9.01	500	1.8E-03	4.6E+02	3.5E-04	10	0.230	6599	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.49%	0.0041
19.029	9.06	500	1.8E-03	4.6E+02	3.5E-04	10	0.231	6583	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.52%	0.0041
19.193	9.11	500	1.8E-03	4.4E+02	3.7E-04	16	0.482	5415	0.11%	2.00	0.65	0.03%	0.020	0.34	0.079	0.765	3.02%	0.0050
19.357	9.16	500	1.8E-03	4.4E+02	3.7E-04	16	0.482	5409	0.11%	2.00	0.65	0.03%	0.020	0.34	0.079	0.765	3.05%	0.0050
19.521	9.21	500	1.8E-03	4.6E+02	3.5E-04	10	0.231	6554	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.62%	0.0043
19.685	9.26	538	1.8E-03	5.3E+02	3.1E-04	10	0.231	6546	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.83%	0.0030
19.849	9.31	538	1.8E-03	5.3E+02	3.1E-04	10	0.232	6539	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.85%	0.0030
20.013	9.36	538	1.8E-03	5.1E+02	3.3E-04	16	0.483	5385	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.29%	0.0038
20.177	9.41	538	1.8E-03	5.3E+02	3.1E-04	10	0.232	6524	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.90%	0.0031
20.341	9.46	538	1.8E-03	5.3E+02	3.1E-04	10	0.232	6517	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.93%	0.0032
24.180	10.63	538	1.8E-03	5.3E+02	3.6E-04	10	0.238	6265	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.52%	0.0966

Extra layer added to analyze seismic settlement of tailings below the bottom of CPT investigation.

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-3S

Data File: 13-52106_SP3-3S-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Dat

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Parameter
5605.60	Water surface elevation during CPT investigation (ft amsl)
5601.35	Water surface elevation at t_1 (ft amsl)
5582.14	Water surface elevation at t_2 (ft amsl)
5577.14	Water surface elevation at t_3 (ft amsl)
1.44	Scaling Factor for stress ratio, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earthquake
7.51	Equiv. Number of Uniform Strain Cycles, N
5609.63	Ground Surface Elevation at time of CPT (ft amsl)
5620.49	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pla
3.50	Thickness of Water Storage/Rooting Zone (ft)
3.50	Thickness of High Compaction Layer (ft)
3.36	Thickness of Random/Platform Fill on top of existing interim cover (ft)
1184.24	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5577.14	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer	Total Stress at Midpoint of Layer	Equil Pore Pressure at Bottom of Layer	Equil Pore Pressure at Midpoint of Layer (tsf)	Effective Stress at Bottom of Layer	Effective Stress at Midpoint of Layer
Erosion Protection Layer	######	5620.24	5619.99	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
Water Storage/Rooting Zone Layer	######	5618.24	5616.49	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5614.74	5612.99	3.50	0.060	120	0.424	0.320	0.00	0.00	0.424	0.320
Platform/Random Fill Layer	######	5611.31	5609.63	3.36	0.050	101	0.593	0.509	0.00	0.00	0.593	0.509

Midpoint Depth at t_1, z_1	Shear Wave Velocity, V_s	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	P = $\gamma_{eff}(G_{eff}/G_{max})$	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, $\varepsilon_{v,15}$ (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
0.08	508	1.7E-03	4.4E+02	3.0E-06	11	0.068	46696	0.00%	1.20	0.80	0.04%	0.000	0.32	0.133	0.778	0.00%	0.0000
0.69	508	1.7E-03	4.3E+02	2.8E-05	11	0.118	18930	0.00%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.75	508	1.9E-03	4.8E+02	6.5E-05	11	0.152	12657	0.01%	0.65	0.75	0.02%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.80	508	1.6E-03	4.0E+02	1.2E-04	11	0.171	10433	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000

2013 CPT Data from ConeTec / CPT Data Interpretations

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Pore Pressure at time of CPT (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q	Normalized Friction Ratio, F (%)	Type Index, Ic	FC %
0.164	5609.47	13.9	0.034	13.9	1.5	0.64	0.25%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0	1.70	23.545	327.28	27.36	1677	0.25%	0.7	51%
0.328	5609.30	18.4	0.072	18.4	2.3	1.01	0.39%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	31.246	434.34	36.32	1112	0.39%	0.9	51%
0.492	5609.14	58.6	0.077	58.5	4.8	2.06	0.13%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	99.501	1383.06	115.62	2362	0.13%	0.4	51%
0.656	5608.97	73.3	0.296	73.3	3.9	1.68	0.40%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0	1.70	124.644	1732.55	144.81	2218	0.40%	0.8	51%
0.820	5608.81	81.4	0.267	81.4	3.7	1.62	0.33%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0	1.70	138.414	1923.95	160.81	1971	0.33%	0.8	51%
0.984	5608.65	84.2	0.326	84.2	3.9	1.68	0.39%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0	1.70	143.072	1988.70	166.22	1697	0.39%	0.8	51%
1.148	5608.48	84.7	0.187	84.7	2.9	1.27	0.22%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0	1.70	143.939	2000.75	167.21	1463	0.22%	0.6	51%
1.312	5608.32	73.0	0.231	72.9	3.0	1.31	0.32%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	123.998	1723.57	144.05	1103	0.32%	0.8	51%
1.476	5608.15	71.2	0.308	71.2	1.7	0.72	0.43%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	120.955	1681.27	140.50	956	0.43%	1.0	51%
1.640	5607.99	55.2	0.236	55.2	3.7	1.59	0.43%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0	1.70	93.772	1303.43	108.96	667	0.43%	1.1	51%
1.804	5607.83	55.4	0.150	55.4	1.9	0.82	0.27%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0	1.70	94.095	1307.92	109.31	608	0.27%	0.9	51%
1.968	5607.66	54.7	0.208	54.7	1.6	0.70	0.38%	Interim Cover	0.050	100.7	0.10	0.00	0.10	0	1.70	92.905	1291.38	107.92	550	0.38%	1.1	51%
2.133	5607.50	53.2	0.150	53.2	1.9	0.83	0.28%	Interim Cover	0.050	100.7	0.11	0.00	0.11	0	1.70	90.491	1257.82	105.12	495	0.28%	1.0	51%
2.297	5607.33	46.8	0.504	46.8	2.3	1.01	1.08%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	79.560	1105.88	92.43	404	1.08%	1.5	51%
2.461	5607.17	59.1	1.594	59.1	3.4	1.48	2.70%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	100.470	1396.53	116.73	476	2.70%	1.8	51%
2.625	5607.01	70.3	1.024	70.2	6.0	2.59	1.46%	Interim Cover	0.050	100.7	0.13	0.00	0.13	0	1.70	119.408	1659.77	138.74	531	1.46%	1.6	51%
2.789	5606.84	132.5	0.906	132.5	6.2	2.67	0.68%	Interim Cover	0.050	100.7	0.14	0.00	0.14	0	1.63	215.362	2993.24	250.20	942	0.68%	1.2	51%
2.953	5606.68	69.0	0.500	69.0	1.8	0.78	0.72%	Interim Cover	0.050	100.7	0.15	0.00	0.15	0	1.70	117.249	1629.76	136.20	463	0.73%	1.3	51%
3.117	5606.51	83.8	0.682	83.8	0.9	0.37	0.81%	Interim Cover	0.050	100.7	0.16	0.00	0.16	0	1.70	142.375	1979.01	165.37	533	0.82%	1.4	51%
3.281	5606.35	49.0	0.298	49.0	3.9	1.69	0.61%	Sand Tailings	0.051	102.8	0.17	0.00	0.17	0	1.70	83.334	1158.34	96.84	296	0.61%	1.4	18%
3.445	5606.19	47.2	0.382	47.2	0.2	0.09	0.81%	Sand Tailings	0.051	102.8	0.17	0.00	0.17	0	1.70	80.172	1114.39	93.12	270	0.81%	1.5	18%
3.609	5606.02	46.3	0.306	46.3	0.6	0.28	0.66%	Sand Tailings	0.051	102.8	0.18	0.00	0.18	0	1.70	78.761	1094.78	91.48	253	0.66%	1.5	18%
3.773	5605.86	55.3	0.508	55.3	1.0	0.42	0.92%	Sand Tailings	0.051	102.8	0.19	0.00	0.19	0	1.70	94.044	1307.21	109.24	289	0.92%	1.6	18%
3.937	5605.69	80.4	1.013	80.4	1.5	0.64	1.26%	Sand Tailings	0.051	102.8	0.20	0.00	0.20	0	1.70	136.731	1900.56	158.82	403	1.26%	1.6	18%
4.101	5605.53	74.3	1.624	74.3	3.7	1.58	2.19%	Sand-Slime Tailin	0.059	119.0	0.21	0.00	0.21	1	1.70	126.310	1755.71	146.75	359	2.19%	1.8	47%
4.265	5605.36	52.7	1.775	52.6	12.2	5.30	3.37%	Sand-Slime Tailin	0.059	119.0	0.22	0.01	0.21	1	1.70	89.471	1243.65	104.07	248	3.38%	2.1	47%
4.429	5605.20	70.0	1.960	69.6	74.7	32.37	2.80%	Sand-Slime Tailin	0.059	119.0	0.23	0.01	0.22	1	1.70	118.286	1644.18	138.30	323	2.81%	1.9	47%
4.593	5605.04	105.7	1.513	105.3	62.4	27.03	1.43%	Sand Tailings	0.062	123.5	0.24	0.01	0.22	1	1.58	166.632	2316.18	194.25	477	1.43%	1.6	18%
4.757	5604.87	102.3	1.285	102.2	16.0	6.92	1.26%	Sand Tailings	0.062	123.5	0.25	0.02	0.23	1	1.59	162.173	2254.20	188.54	452	1.26%	1.6	18%
4.921	5604.71	80.0	0.626	80.0	8.5	3.69	0.78%	Sand Tailings	0.062	123.5	0.26	0.00	0.26	1	1.68	134.193	1865.28	155.96	345	0.79%	1.5	18%
5.085	5604.54	81.2	0.386	81.2	9.8	4.26	0.48%	Sand Tailings	0.062	123.5	0.27	0.03	0.24	1	1.66	134.859	1874.54	156.75	343	0.48%	1.3	18%
5.249	5604.38	87.3	0.391	87.3	7.2	3.11	0.45%	Sand Tailings	0.062	123.5	0.28	0.04	0.24	1	1.62	141.629	1968.64	164.58	361	0.45%	1.3	18%
5.413	5604.22	72.7	0.332	72.7	2.6	1.13	0.46%	Sand Tailings	0.062	123.5	0.29	0.04	0.25	1	1.68	122.447	1702.01	142.25	294	0.46%	1.3	18%
5.577	5604.05	65.2	0.279	65.2	0.5	0.21	0.43%	Sand Tailings	0.062	123.5	0.30	0.00	0.25	1	1.70	110.874	1541.15	128.78	259	0.43%	1.4	18%
5.741	5603.89	56.7	0.216	56.7	-0.1	-0.05	0.38%	Sand Tailings	0.062	123.5	0.31	0.00	0.26	1	1.70	96.458	1340.77	112.03	220	0.38%	1.4	18%
5.905	5603.72	48.8	0.259	48.8	-0.3	-0.13	0.53%	Sand Tailings	0.062	123.5	0.32	0.06	0.26	1	1.70	83.028	1154.09	96.43	186	0.53%	1.5	18%
6.069	5603.56	32.1	0.220	32.1	-0.3	-0.12	0.68%	Sand-Slime Tailin	0.059	119.0	0.33	0.06	0.27	1	1.70	54.621	759.23	63.44	120	0.69%	1.7	47%
6.234	5603.40	28.8	0.202	28.8	2.7	1.18	0.70%	Sand-Slime Tailin	0.059	119.0	0.34	0.07	0.27	1	1.70	48.875	679.36	56.80	105	0.71%	1.8	47%
6.398	5603.23	33.3	0.244	33.3	9.5	4.10	0.73%	Sand-Slime Tailin	0.059	119.0	0.35	0.07	0.27	1	1.70	56.559	786.17	65.81	120	0.74%	1.8	47%
6.562	5603.07	23.8	0.288	23.8	5.0	2.17	1.21%	Sand-Slime Tailin	0.059	119.0	0.36	0.08	0.28	1	1.70	40.392	561.45	46.97	84	1.23%	2.0	47%
6.726	5602.90	18.2	0.238	18.1	12.5	5.43	1.31%	Sand-Slime Tailin	0.059	119.0	0.37	0.08	0.28	1	1.70	30.753	427.47	35.87	63	1.34%	2.1	47%
6.890	5602.74	11.8	0.147	11.7	14.5	6.28	1.25%	Sand-Slime Tailin	0.059	119.0	0.38	0.08	0.29	1	1.70	19.907	276.71	23.30	40	1.29%	2.3	47%
7.054	5602.58	9.2	0.122	9.1	23.8	10.33	1.32%	Sand-Slime Tailin	0.059	119.0	0.39	0.09	0.29	1	1.70	15.453	214.80	18.24	30	1.38%	2.4	47%
7.218	5602.41	9.2	0.089	9.0	30.6	13.24	0.97%	Sand-Slime Tailin	0.059	119.0	0.40	0.10	0.30	1	1.70	15.232	211.72	18.07	29	1.02%	2.3	47%
7.382	5602.25	9.9	0.100	9.7	31.6	13.69	1.01%	Sand-Slime Tailin	0.059	119.0	0.41	0.10	0.30	1	1.70	16.524	229.68	19.58	31	1.05%	2.3	47%
7.546	5602.08	8.5	0.080	8.3	34.3	14.88	0.94%	Sand-Slime Tailin	0.059	119.0	0.42	0.11	0.31	1	1.70	14.127	196.37	16.83	26	0.99%	2.4	47%
7.710	5601.92	10.2	0.068	10.0	38.1	16.51	0.67%	Sand-Slime Tailin	0.059	119.0	0.43	0.11	0.31	1	1.70	16.932	235.35	20.13	31	0.70%	2.2	47%
7.874	5601.76	8.5	0.060	8.2	38.1	16.49	0.71%	Sand-Slime Tailin	0.059	119.0	0.44	0.12	0.32	1	1.70	14.008	194.71	16.74	25	0.75%	2.3	47%
8.038	5601.59	7.6	0.064	7.3	45.6	19.77	0.84%	Sand-Slime Tailin	0.059	119.0	0.45	0.13	0.32	1	1.70	12.478	173.44	15.05	22	0.89%	2.4	47%
8.202	5601.43	8.1	0.076	7.8	53.2	23.04	0.94%	Sand-Slime Tailin	0.059	119.0	0.46	0.13	0.33	1	1.70	13.226	183.84	16.02	23	0.99%	2.4	47%
8.366	5601.26	9.0	0.102	8.6	58.4	25.30	1.14%	Sand-Slime Tailin	0.059	119.0	0.47	0.14	0.33	1	1.70	14.637	203.45	17.72	26	1.20%	2.4	47%
8.530	5601.10	9.6	0.210	9.2	60.7	26.28	2.18%	Slime Tailings	0.057	113.1	0.48	0.14	0.33	1	1.70	15.708	218.34	18.99	27	2.30%	2.6	71%
8.694	5600.94	9.5	0.212	9.1	55.4	24.01	2.24%	Slime Tailings	0.057	113.1	0.48	0.15	0.34	1	1.70	15.487	215.27	18.67	26	2.36%	2.6	71%
8.858	5600.77	13.5	0.188	13.3	28.4	12.31	1.39%	Sand-Slime Tailin	0.059	119.0	0.49	0.15	0.34	1	1.70	22.610	314.28	26.61	38	1.45%	2.3	47%
9.022	5600.61	9.0	0.166	8.9	12.6	5.48	1.85%	Slime Tailings	0.057	113.1	0.50	0.16	0.35	1	1.70	15.130	210.31	17.73	24	1.96%	2.6	71%
9.186	5600.44	7.1	0.173	6.9	30.7	13.29	2.45%	Slime Tailings	0.057	113.1	0.51	0.16	0.35	1	1.70	11.662	162.10	13.92	19	2.65%	2.7	71%
9.350	5600.28	12.4	0.106	12.1	47.2	20.44	0.86%	Sand-Slime Tailin	0.059	119.0	0.52	0.17	0.36	1	1.70	20.536	285.45	24.43	33	0.89%	2.3	47%
9.514	5600.12	15.4	0.097	15.3	14.9	6.47	0.63%	Sand-Slime Tailin	0.059	119.0	0.53	0.17	0.36	1	1.70	25.959	360.83	30.33	41	0.65%	2.1	47%
9.678	5599.95	15.1	0.080	15.0	11.2	4.83	0.53%	Sand-Slime Tailin	0.059	119.0	0.54	0.18	0.37	1	1.70	25.517	354.69	29.77	40	0.55%	2.1	47%
9.842	5599.79	22.9	0.122	22.8	15.7	6.78	0.53%	Sand-Slime Tailin	0.059	119.0	0.55	0.18	0.37	1	1.70	38.743	538.53	45.19	60	0.55%	1.9	47%
10.006	5599.62	18.5	0.100	18.4	10.4	4.49	0.54%	Sand-Slime Tailin	0.059	119.0	0.56	0.19	0.38	1	1.70	31.263	434.56	36.44	48	0.56%	2.0	47%
10.170	5599.46	16.5	0.082	16.5	6.1	2.66	0.50%	Sand-Slime Tailin	0.059	119.0	0.57	0.19	0.38	1	1.70	28.050	389.90	32.65	42	0.51%	2.1	47%
10.335	5599.30	11.5	0.074	11.5	5.9	2.54	0.64%	Sand-Slime Tailin	0.059	119.0	0.58	0.20	0.38	1	1.70	19.482	270.80	22.70	28	0.68%	2.3	47%
10.499	5599.13	8.2	0.078	8.2	6.6	2.85	0.95%	Sand-Slime Tailin	0.059	119.0	0.59	0.20	0.39	1	1.70	13.855	192.58	16.17	20	1.03%	2.5	47%
10.663	5598.97	8.3	0.043	8.3	9.0	3.92	0.52%	Sand-Slime Tailin	0.059	119.0	0.60	0.21	0.39	1	1.70	14.059	195.42	16.44	20	0.56%	2.4	47%
10.827	5598.80	9.2	0.024	9.2	10.5	4.53	0.26%	Sand-Slime Tailin	0.059	119.0	0.61	0.21	0.40	1	1.70	15.589	216.69	18.23	22	0.28%	2.2	47%
10.991	5598.64	8.6	0.074	8.5	13.3	5.75	0.87%	Sand-Slime Tailin	0.059	119.0	0.62	0.22	0.40	1	1.70	14.399	200.15	16.89	20	0.93%	2.5	47%
11.155	5598.48	6.3	0.099	6.2	15.1	6.52	1.58%	Slime Tailings	0.057	113.1	0.63	0.22	0.41	1	1.70	10.489	145.80	12.37	14	1.76%	2.8	71%
11.319	5598.31	5.1	0.105	5.0	18.6	8.07	2.06%	Slime Tailings	0.057	113.1	0.64	0.23	0.41	1	1.70	8.449	117.44	10.04	11	2.36%	2.9	71%
11.483	5598.15	4.3	0.115	4.1	26.9	11.65	2.67%	Slime Tailings	0.057	113.1	0.65	0.23	0.42	1	1.70	7.038	97.83	8.51	9	3.14%	3.1	71%
11.647	5597.98	7.3	0.094	7.1	44.1	19.13	1.28%	Slime Tailings	0.057	113.1	0.66	0.24	0.42	1	1.70	12.019	167.06	14.50	16	1.41%	2.6	71%
11.811	5597.82	9.0	0.165	8.8	27.6	11.97	1.84%	Slime Tailings	0.057	113.1	0.67	0.24	0.42	1	1.70	14.943	207.71	17.70	20	1.99%	2.7	71%
11.975	5597.66	8.6	0.084	8.5	20.2	8.75	0.98%	Sand-Slime Tailin	0.059	119.0	0.68	0.25	0.43	1	1.70	14.416	200.38	16.99	19	1.06%	2.5	47%
12.139	5597.49	10.5	0.047	10.4	14.1	6.11	0.45%	Sand-Slime Tailin	0.059	119.0	0.69	0.25	0.43	1	1.70	17.663	245.52	20.69	23	0.48%	2.3	47%
12.303	5597.33	10.3	0.077	10.2	9.8	4.26	0.75%	Sand-Slime Tailin	0.059	119.0	0.70	0.26	0.44	1	1.70	17.362	241.32	20.29	22	0.80%	2.4	47%
12.467	5597.16	6.7	0.073	6.6	12.8	5.56	1.09%	Slime Tailings	0.057	113.1	0.71	0.26	0.44	1	1.68	11.118	154.55	13.07	14	1.22%	2.7	71%
12.631	5597.00	8.2	0.034	8.1	16.4	7.12	0.41%	Sand-Slime Tailin	0.059	119.0	0.71	0.27	0.45	1	1.67	13.584	188.82	15.98	17	0.45%	2.4	47%
12.795	5596.83	9.3	0.032	9.2	15.5	6.73	0.34%	Sand-Slime Tailin	0.059	119.0	0.72	0.27	0.45	1	1.66	15.282	212.42	17.94	19	0.37%	2.3	47%
12.959	5596.67	9.4	0.034	9.3	15.5	6.73	0.36%	Sand-Slime Tailin	0.059	119.0	0.73	0.28	0.46	1	1.64	15.259	212.10	17.91	19	0.39%	2.3	47%
13.123	5596.51	9.5	0.043	9.4	15.8	6.83	0.45%	Sand-Slime Tailin	0.059	119.0	0.74	0.28	0.46	1	1.63	15.350	213.37	18.02	19	0.49%	2.4	47%
13.287	5596.34	9.1	0.054	9.0	16.3	7.05	0.59%	Sand-Slime Tailin	0.059	119.0	0.75	0.29	0.47	1	1.62	14.632	203.38	17.18	18	0.64%	2.4	47%
13.451	5596.18	9.2	0.068	9.1	17.0	7.36	0.74%	Sand-Slime Tailin	0.059	119.0	0.76	0.29	0.47	1	1.61	14.615	203.15	17.17	18	0.81%	2.5	47%
13.615	5596.01	9.3	0.080	9.2	17.0	7.38	0.86%	Sand-Slime Tailin	0.059	119.0	0.77	0.30	0.47	1	1.59	14.710	204.47	17.28	18	0.93%	2.5	47%
13.779	5595.85	11.2	0.068	11.1	17.5	7.60	0.61%	Sand-Slime Tailin	0.059	119.0	0.78	0.30	0.48	1	1.58	17.525	243.59	20.55	22	0.65%	2.4	47%
13.943	5595.69	14.4	0.082	14.3	15.5	6.70	0.57%	Sand-Slime Tailin	0.059	119.0	0.79	0.31	0.48	1	1.54	22.107	307.29	25.85	28	0.60%	2.3	47%
14.107	5595.52	11.4	0.115	11.3	15.5	6.72	1.01%	Sand-Slime Tailin	0.059	119.0	0.80	0.31	0.49	1	1.56	17.669	245.60	20.70	22	1.08%	2.5	47%
14.271	5595.36	8.1	0.115	8.0	17.0	7.37	1.43%	Slime Tailings	0.057	113.1	0.81	0.32	0.49	1	1.55	12.321	171.26	14.50	15	1.59%	2.7	71%
14.436	5595.19	7.0	0.051	6.9	19.3	8.34	0.73%	Sand-Slime Tailin	0.059	119.0	0.82	0.32	0.50	1	1.54	10.571	146.94	12.49	12	0.83%	2.6	47%
14.600	5595.03	6.4	0.033	6.3	17.8	7.71	0.52%	Sand-Slime Tailin	0.059	119.0	0.83	0.33	0.50	1	1.53	9.534	132.52	11.27	11	0.60%	2.6	47%
14.764	5594.87	5.4	0.063	5.2	20.0	8.68	1.18%	Slime Tailings	0.057	113.1	0.84	0.33	0.51	1	1.52	7.926	110.18	9.43	9	1.40%	2.9	71%
14.928	5594.70	4.8	0.108	4.6	28.3	12.24	2.27%	Slime Tailings	0.057	113.1	0.85	0.34	0.51	1	1.51	6.912	96.08	8.34	8	2.76%	3.1	71%
15.092	5594.54	4.8	0.126	4.7	28.1	12.16	2.60%	Slime Tailings	0.057	113.1	0.86	0.35	0.51	1	1.50	6.988	97.13	8.42	8	3.16%	3.1	71%
15.256	5594.37	5.7	0.083	5.6	15.5	6.72	1.45%	Slime Tailings	0.057	113.1	0.87	0.35	0.52	1	1.49	8.357	116.16	9.87	9	1.71%	2.9	71%
15.420	5594.21	8.3	0.060	8.2	16.1	6.98	0.72%	Sand-Slime Tailin	0.059	119.0	0.88	0.36	0.52	1	1.48	12.153	168.92	14.29	14	0.81%	2.6	47%
15.584	5594.05	8.5	0.058	8.4	8.8	3.83	0.68%	Sand-Slime Tailin	0.059	119.0	0.89	0.36	0.53	1	1.47	12.348	171.63	14.44	14	0.76%	2.6	47%
15.748	5593.88	7.7	0.056	7.6	10.8	4.66	0.73%	Sand-Slime Tailin	0.059	119.0	0.90	0.37	0.53	1	1.46	11.084	154.06	12.99	13	0.83%	2.6	47%
15.912	5593.72	8.0	0.059	7.9	13.9	6.00	0.74%	Sand-Slime Tailin	0.059	119.0	0.91	0.37	0.54	1	1.45	11.457	159.25	13.45	13	0.83%	2.6	47%
16.076	5593.55	8.8	0.072	8.7	17.5	7.57	0.82%	Sand-Slime Tailin	0.059	119.0	0.92	0.38	0.54	1	1.44	12.487	173.57	14.68	15	0.91%	2.6	47%
16.240	5593.39	9.7	0.120	9.5	20.4	8.83	1.24%	Sand-Slime Tailin	0.059	119.0	0.93	0.38	0.55	1	1.43	13.603	189.08	16.01	16	1.37%	2.6	47%
16.404	5593.23	8.3	0.200	8.1	21.3	9.25	2.42%	Slime Tailings	0.057	113.1	0.94	0.39	0.55	1	1.42	11.536	160.35	13.62	13	2.73%	2.9	71%
16.568	5593.06	7.0	0.183	6.9	21.4	9.27	2.60%	Slime Tailings	0.057	113.1	0.95	0.39	0.55	1	1.41	9.747	135.49	11.54	11	3.00%	3.0	71%
16.732	5592.90	6.2	0.154	6.1	20.6	8.92	2.48%	Slime Tailings	0.057	113.1	0.95	0.40	0.56	1	1.40	8.540	118.71	10.13	9	2.93%	3.0	71%
16.896	5592.73	6.9	0.091	6.7	28.8	12.50	1.32%	Slime Tailings	0.057	113.1	0.96	0.40	0.56	1	1.39	9.383	130.43	11.19	11	1.53%	2.8	71%
17.060	5592.57	9.6	0.063	9.5	22.1	9.56	0.66%	Sand-Slime Tailin	0.059	119.0	0.97	0.41	0.57	1	1.39	13.119	182.36	15.46	15	0.73%	2.5	47%
17.224	5592.41	11.3	0.052	11.2	22.1	9.56	0.46%	Sand-Slime Tailin	0.059	119.0	0.98	0.41	0.57	1	1.38	15.417	214.30	18.13	18	0.50%	2.4	47%

Conditions at t_1 / Liquefaction Triggering Analyses (Idriss & Boulanger (2008); Youd et al. (2001))

Depth at time of CPT (ft)	Total Stress at t_1 (tsf)	Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No	I&B r_d	I&B C_σ	I&B K_σ	I&B K_α	I&B CSR M=7.5 σ'v=1atm	I&B Δq_{c1n}	I&B q_{c1n-cs}	I&B (CRR) M=7.5 σ'v=1atm	I&B FoS	Youd r_d	Youd D_r	Youd f	Youd K_σ	Youd K_α	Youd CSR M=7.5	Youd Kc	Youd q_{c1n-cs}	Youd (CRR) M=7.5 σ'v=1atm	Youd FoS	Avg FoS	Liquefiable? 1=Yes 2=No
0.164	0.60	0.00	0.60	0	1.00	0.06	1.02	1.0	0.059	39.92	67.29	0.096	1.63	0.97	0.30	0.80	2.53	1.0	0.017	1.00	27.36	0.073	176.61	89.12	2
0.328	0.61	0.00	0.61	0	1.00	0.06	1.02	1.0	0.059	43.07	79.38	0.112	1.89	0.97	0.35	0.80	2.20	1.0	0.019	1.00	36.32	0.080	97.39	49.64	2
0.492	0.62	0.00	0.62	0	1.00	0.12	1.04	1.0	0.060	70.90	186.52	0.662	11.01	0.97	0.62	0.69	3.01	1.0	0.014	1.00	115.62	0.224	181.10	96.05	2
0.656	0.63	0.00	0.63	0	1.00	0.15	1.05	1.0	0.061	81.14	225.95	1.000	16.49	0.97	0.69	0.65	3.10	1.0	0.014	1.00	144.81	0.362	220.09	118.29	2
0.820	0.63	0.00	0.63	0	1.00	0.18	1.05	1.0	0.061	86.75	247.56	1.000	16.41	0.97	0.73	0.63	3.04	1.0	0.014	1.00	160.81	1.000	486.00	251.21	2
0.984	0.64	0.00	0.64	0	1.00	0.19	1.05	1.0	0.061	88.65	254.87	1.000	16.41	0.97	0.74	0.62	2.89	1.0	0.015	1.00	166.22	1.000	405.16	210.78	2
1.148	0.65	0.00	0.65	0	1.00	0.19	1.05	1.0	0.061	89.00	256.21	1.000	16.43	0.97	0.75	0.63	2.74	1.0	0.016	1.00	167.21	1.000	347.42	181.93	2
1.312	0.66	0.00	0.66	0	1.00	0.15	1.04	1.0	0.061	80.87	224.93	1.000	16.62	0.97	0.69	0.65	2.43	1.0	0.018	1.00	144.05	0.358	108.87	62.75	2
1.476	0.67	0.00	0.67	0	1.00	0.15	1.04	1.0	0.060	79.63	220.13	1.000	16.67	0.97	0.68	0.66	2.31	1.0	0.019	1.00	140.50	0.338	91.39	54.03	2
1.640	0.67	0.00	0.67	0	1.00	0.11	1.03	1.0	0.059	68.56	177.51	0.498	8.38	0.97	0.60	0.70	2.03	1.0	0.021	1.00	108.96	0.200	48.77	28.57	2
1.804	0.68	0.00	0.68	0	1.00	0.11	1.03	1.0	0.059	68.68	177.99	0.505	8.50	0.97	0.60	0.70	1.97	1.0	0.022	1.00	109.31	0.201	44.61	26.56	2
1.968	0.69	0.00	0.69	0	1.00	0.11	1.02	1.0	0.059	68.19	176.12	0.478	8.08	0.97	0.60	0.70	1.91	1.0	0.022	1.00	107.92	0.197	39.98	24.03	2
2.133	0.70	0.00	0.70	0	1.00	0.11	1.02	1.0	0.059	67.21	172.33	0.432	7.32	0.97	0.59	0.70	1.85	1.0	0.023	1.00	105.12	0.188	35.26	21.29	2
2.297	0.71	0.00	0.71	0	1.00	0.10	1.02	1.0	0.059	62.76	155.19	0.297	5.06	0.97	0.56	0.72	1.75	1.0	0.024	1.00	92.43	0.153	26.73	15.89	2
2.461	0.72	0.00	0.72	0	1.00	0.12	1.02	1.0	0.059	71.29	188.02	0.698	11.85	0.97	0.62	0.69	1.83	1.0	0.023	1.13	131.98	0.294	47.78	29.82	2
2.625	0.72	0.00	0.72	0	1.00	0.15	1.03	1.0	0.059	79.02	217.77	1.000	16.95	0.97	0.68	0.66	1.89	1.0	0.023	1.00	138.76	0.328	50.10	33.52	2
2.789	0.73	0.00	0.73	0	0.99	0.30	1.05	1.0	0.060	#####	368.33	1.000	16.58	0.97	0.91	0.60	2.07	1.0	0.021	1.00	250.20	1.000	143.62	80.10	2
2.953	0.74	0.00	0.74	0	0.99	0.14	1.02	1.0	0.059	78.12	214.32	1.000	17.04	0.97	0.67	0.66	1.81	1.0	0.024	1.00	136.20	0.315	42.74	29.89	2
3.117	0.75	0.00	0.75	0	0.99	0.18	1.03	1.0	0.059	88.35	253.72	1.000	16.98	0.97	0.74	0.63	1.88	1.0	0.023	1.00	165.37	1.000	128.60	72.79	2
3.281	0.76	0.00	0.76	0	0.99	0.10	1.01	1.0	0.058	46.85	143.68	0.245	4.22	0.97	0.57	0.72	1.60	1.0	0.027	1.00	96.84	0.164	20.08	12.15	2
3.445	0.77	0.00	0.77	0	0.99	0.10	1.01	1.0	0.058	45.69	139.01	0.229	3.95	0.97	0.56	0.72	1.56	1.0	0.027	1.00	93.12	0.155	18.02	10.99	2
3.609	0.77	0.00	0.77	0	0.99	0.10	1.01	1.0	0.058	45.48	136.96	0.223	3.85	0.97	0.55	0.72	1.54	1.0	0.028	1.00	91.48	0.151	16.77	10.31	2
3.773	0.78	0.00	0.78	0	0.99	0.11	1.01	1.0	0.058	50.02	159.25	0.321	5.56	0.97	0.60	0.70	1.58	1.0	0.027	1.00	109.24	0.201	21.33	13.45	2
3.937	0.79	0.00	0.79	0	0.99	0.17	1.01	1.0	0.058	62.69	221.52	1.000	17.25	0.97	0.73	0.64	1.70	1.0	0.025	1.00	158.82	0.453	45.97	31.61	2
4.101	0.80	0.00	0.80	0	0.99	0.16	1.01	1.0	0.058	81.77	228.51	1.000	17.32	0.97	0.70	0.65	1.65	1.0	0.026	1.11	163.40	1.000	97.90	57.61	2
4.265	0.81	0.00	0.81	0	0.99	0.11	1.01	1.0	0.058	66.80	170.86	0.416	7.25	0.96	0.59	0.71	1.51	1.0	0.028	1.38	143.17	0.353	33.80	20.53	2
4.429	0.82	0.00	0.82	0	0.99	0.14	1.01	1.0	0.057	78.81	217.11	1.000	17.43	0.96	0.68	0.66	1.60	1.0	0.027	1.21	167.80	1.000	93.77	55.60	2
4.593	0.83	0.00	0.83	0	0.98	0.25	1.01	1.0	0.057	71.75	266.00	1.000	17.41	0.96	0.80	0.60	1.72	1.0	0.025	1.00	194.25	1.000	91.68	54.55	2
4.757	0.84	0.00	0.84	0	0.98	0.23	1.01	1.0	0.057	70.29	258.83	1.000	17.48	0.96	0.79	0.60	1.70	1.0	0.025	1.00	188.54	1.000	89.68	53.58	2
4.921	0.85	0.00	0.85	0	0.98	0.17	1.00	1.0	0.057	61.96	217.92	1.000	17.56	0.96	0.72	0.64	1.61	1.0	0.026	1.00	155.96	0.433	37.99	27.78	2
5.085	0.86	0.00	0.86	0	0.98	0.17	1.00	1.0	0.057	62.16	218.91	1.000	17.61	0.96	0.72	0.64	1.59	1.0	0.027	1.00	156.75	0.438	37.66	27.64	2
5.249	0.87	0.00	0.87	0	0.98	0.18	1.00	1.0	0.057	64.16	228.74	1.000	17.67	0.96	0.74	0.63	1.60	1.0	0.026	1.00	164.58	1.000	84.19	50.93	2
5.413	0.88	0.00	0.88	0	0.98	0.15	1.00	1.0	0.056	58.45	200.70	1.000	17.71	0.96	0.69	0.66	1.54	1.0	0.028	1.00	142.25	0.348	28.69	23.20	2
5.577	0.89	0.00	0.89	0	0.98	0.13	1.00	1.0	0.056	55.01	183.79	0.604	10.72	0.96	0.66	0.67	1.50	1.0	0.028	1.00	128.78	0.279	22.54	16.63	2
5.741	0.90	0.00	0.90	0	0.98	0.12	0.99	1.0	0.056	50.73	162.76	0.345	6.14	0.96	0.61	0.69	1.45	1.0	0.029	1.00	112.03	0.211	16.72	11.43	2
5.905	0.91	0.00	0.91	0	0.98	0.10	0.99	1.0	0.056	46.74	143.17	0.243	4.34	0.96	0.57	0.72	1.40	1.0	0.030	1.00	96.43	0.163	12.72	8.53	2
6.069	0.92	0.00	0.92	0	0.98	0.08	0.99	1.0	0.056	52.65	115.98	0.171	3.05	0.96	0.46	0.77	1.31	1.0	0.032	1.07	67.96	0.109	8.36	5.70	2
6.234	0.93	0.00	0.93	0	0.98	0.08	0.99	1.0	0.056	50.22	107.02	0.154	2.76	0.96	0.44	0.78	1.29	1.0	0.033	1.11	62.92	0.103	7.76	5.26	2
6.398	0.94	0.00	0.94	0	0.97	0.08	0.99	1.0	0.056	53.38	119.19	0.178	3.16	0.96	0.47	0.77	1.31	1.0	0.032	1.08	71.27	0.114	8.41	5.80	2
6.562	0.95	0.00	0.95	0	0.97	0.07	0.99	1.0	0.056	46.05	93.02	0.133	2.37	0.96	0.40	0.80	1.25	1.0	0.034	1.34	62.78	0.103	7.50	4.94	2
6.726	0.96	0.00	0.96	0	0.97	0.06	0.99	1.0	0.056	42.88	78.75	0.111	1.99	0.96	0.35	0.80	1.25	1.0	0.034	1.55	55.52	0.096	6.87	4.43	2
6.890	0.97	0.00	0.97	0	0.97	0.05	0.99	1.0	0.056	38.47	61.77	0.090	1.61	0.96	0.28	0.80	1.24	1.0	0.034	1.94	45.17	0.088	6.18	3.90	2
7.054	0.98	0.00	0.98	0	0.97	0.05	0.99	1.0	0.056	36.74	54.94	0.082	1.48	0.96	0.25	0.80	1.24	1.0	0.034	2.36	42.97	0.086	5.96	3.72	2
7.218	0.99	0.00	0.99	0	0.97	0.05	0.99	1.0	0.056	36.64	54.71	0.082	1.47	0.96	0.25	0.80	1.23	1.0	0.034	2.11	38.20	0.082	5.59	3.54	2
7.382	1.00	0.00	1.00	0	0.97	0.05	0.99	1.0	0.056	37.17	56.75	0.084	1.52	0.96	0.26	0.80	1.23	1.0	0.034	2.05	40.20	0.083	5.62	3.57	2
7.546	1.01	0.00	1.01	0	0.97	0.05	0.99	1.0	0.055	36.20	53.04	0.080	1.45	0.96	0.24	0.80	1.23	1.0	0.034	2.24	37.68	0.081	5.40	3.43	2
7.710	1.02	0.00	1.02	0	0.97	0.05	0.99	1.0	0.055	37.36	57.50	0.085	1.54	0.96	0.26	0.80	1.23	1.0	0.034	1.78	35.77	0.080	5.22	3.38	2
7.874	1.03	0.00	1.03	0	0.96	0.05	0.99	1.0	0.055	36.17	52.91	0.080	1.45	0.96	0.24	0.80	1.22	1.0	0.035	2.07	34.68	0.079	5.09	3.27	2
8.038	1.04	0.00	1.04	0	0.96	0.05	0.99	1.0	0.055	35.58	50.64	0.078	1.41	0.96	0.22	0.80	1.22	1.0	0.035	2.41	36.22	0.080	5.10	3.26	2
8.202	1.05	0.00	1.05	0	0.96	0.05	0.99	1.0	0.055	35.92	51.94	0.079	1.44	0.96	0.23	0.80	1.21	1.0	0.035	2.42	38.81	0.082	5.16	3.30	2
8.366	1.06	0.00	1.06	0	0.96	0.05	0.99	1.0	0.055	36.52	54.24	0.082	1.49	0.96	0.24	0.80	1.21	1.0	0.035	2.46	43.59	0.086	5.34	3.41	2
8.530	1.07	0.00	1.07	0	0.96	0.05	0.99	1.0	0.055	36.70	55.69	0.083	1.52	0.95	0.25	0.80	1.21	1.0	0.035	3.18	60.45	0.101	6.14	3.83	2
8.694	1.08	0.00	1.08	0	0.96	0.05	0.99	1.0	0.055	36.59	55.26	0.083	1.51	0.95	0.25	0.80	1.20	1.0	0.035	3.29	61.47	0.102	6.13	3.82	2
8.858	1.09	0.00	1.09	0	0.96	0.06	0.99	1.0	0.055	39.63	66.24	0.095	1.74	0.95	0.30	0.80	1.20	1.0	0.035	2.09	55.72	0.096	5.72	3.73	2
9.022	1.10	0.00	1.10	0	0.96	0.05	0.99	1.0	0.055	36.26	53.99	0.081	1.49	0.95	0.24	0.80	1.20	1.0	0.035	3.17	56.22	0.097	5.68	3.59	2
9.186	1.10	0.00	1.10	0	0.96	0.05	0.99	1.0	0.055	34.94	48.86	0.076	1.40	0.95	0.22	0.80	1.20	1.0	0.035	4.35	60.51	0.101	5.86	3.63	2
9.350	1.11	0.00	1.11	0	0.96	0.06	0.99	1.0	0.054	38.87	63.30	0.092	1.68	0.95	0.29	0.80	1.19	1.0	0.035	1.87	45.60	0.088	5.06	3.37	2
9.514	1.12	0.00	1.12	0	0.95	0.06	0.98	1.0	0.054	40.94	71.27	0.101	1.86	0.95	0.32	0.80	1.19	1.0	0.035	1.50	45.61	0.088	4.99	3.43	2
9.678	1.13	0.00	1.13	0	0.95	0.06	0.98	1.0	0.054	40.74	70.52	0.100	1.85	0.95	0.32	0.80	1.19	1.0	0.035	1.46	43.48	0.086	4.83	3.34	2
9.842	1.14	0.00	1.14	0	0.95	0.07	0.98	1.0	0.054	46.15	91.34	0.129	2.39	0.95	0.39	0.80	1.18	1.0	0.035	1.23	55.64	0.096	5.32	3.85	2
10.006	1.15	0.00	1.15	0	0.95	0.06	0.98	1.0	0.054	43.08	79.52	0.112	2.07	0.95	0.35	0.80	1.18	1.0	0.036	1.35	49.19	0.091	4.98	3.53	2
10.170	1.16	0.00	1.16	0	0.95	0.06	0.98	1.0	0.054	41.75	74.41	0.105	1.95	0.95	0.33	0.80	1.18	1.0	0.036	1.40	45.68	0.088	4.76	3.36	2
10.335	1.17	0.00	1.17	0	0.95	0.05	0.98	1.0	0.054	38.26	60.96	0.089	1.65	0.95	0.28	0.80	1.18	1.0	0.036	1.87	42.42	0.085	4.56	3.10	2
10.499	1.18	0.00	1.18	0	0.95	0.05	0.98	1.0	0.054	35.97	52.15	0.080	1.48	0.95	0.23	0.80	1.17	1.0	0.036	2.78	45.02	0.087	4.62	3.05	2
10.663	1.19	0.00	1.19	0	0.95	0.05	0.98	1.0	0.054	36.07	52.51	0.080	1.49	0.95	0.23	0.80	1.17	1.0	0.036	2.24	36.81	0.081	4.21	2.85	2
10.827	1.20	0.00	1.20	0	0.95	0.05	0.98	1.0	0.054	36.70	54.93	0.082	1.53	0.95	0.25	0.80	1.17	1.0	0.036	1.76	32.06	0.077	3.96	2.75	2
10.991	1.21	0.00	1.21	0	0.94	0.05	0.98	1.0	0.054	36.22	53.11	0.081	1.50	0.95	0.24	0.80	1.16	1.0	0.036	2.67	45.07	0.088	4.47	2.99	2
11.155	1.22	0.00	1.22	0	0.94	0.05	0.98	1.0	0.054	34.39	46.76	0.074	1.39	0.95	0.20	0.80	1.16	1.0	0.036	4.38	54.23	0.095	4.79	3.09	2
11.319	1.23	0.00	1.23	0	0.94	0.05	0.98	1.0	0.054	33.58	43.63	0.072	1.34	0.95	0.18	0.80	1.16	1.0	0.036	5.80	58.28	0.098	4.93	3.13	2
11.483	1.24	0.00	1.24	0	0.94	0.04	0.98	1.0	0.054	33.05	41.56	0.070	1.31	0.95	0.17	0.80	1.16	1.0	0.036	7.36	62.61	0.103	5.10	3.20	2
11.647	1.25	0.00	1.25	0	0.94	0.05	0.98	1.0	0.053	35.14	49.64	0.077	1.45	0.95	0.22	0.80	1.15	1.0	0.036	3.63	52.71	0.094	4.60	3.02	2
11.811	1.26	0.00	1.26	0	0.94	0.05	0.98	1.0	0.053	36.25	53.95	0.081	1.53	0.95	0.24	0.80	1.15	1.0	0.036	3.68	65.18	0.106	5.15	3.34	2
11.975	1.27	0.00	1.27	0	0.94	0.05	0.98	1.0	0.053	36.26	53.25	0.081	1.52	0.95	0.24	0.80	1.15	1.0	0.036	2.93	49.71	0.091	4.40	2.96	2
12.139	1.28	0.00	1.28	0	0.94	0.05	0.98	1.0	0.053	37.56	58.25	0.086	1.62	0.95	0.26	0.80	1.15	1.0	0.036	1.95	40.29	0.084	3.98	2.80	2
12.303	1.29	0.00	1.29	0	0.94	0.05	0.98	1.0	0.053	37.42	57.70	0.085	1.61	0.95	0.26	0.80	1.14	1.0	0.036	2.34	47.56	0.090	4.23	2.92	2
12.467	1.30	0.00	1.30	0	0.93	0.05	0.98	1.0	0.053	34.64	47.71	0.075	1.42	0.95	0.21	0.80	1.14	1.0	0.036	3.85	50.30	0.092	4.29	2.86	2
12.631	1.31	0.00	1.31	0	0.93	0.05	0.98	1.0	0.053	35.90	51.88	0.079	1.50	0.95	0.23	0.80	1.14	1.0	0.037	2.35	37.50	0.081	3.76	2.63	2
12.795	1.32	0.00	1.32	0	0.93	0.05	0.98	1.0	0.053	36.59	54.53	0.082	1.56	0.94	0.24	0.80	1.14	1.0	0.037	2.04	36.66	0.081	3.69	2.62	2
12.959	1.33	0.00	1.33	0	0.93	0.05	0.98	1.0	0.053	36.58	54.49	0.082	1.56	0.94	0.24	0.80	1.14	1.0	0.037	2.08	37.23	0.081	3.68	2.62	2
13.123	1.34	0.00	1.34	0	0.93	0.05	0.98	1.0	0.053	36.62	54.63	0.082	1.56	0.94	0.25	0.80	1.13	1.0	0.037	2.20	39.68	0.083	3.73	2.65	2
13.287	1.35	0.00	1.35	0	0.93	0.05	0.98	1.0	0.052	36.33	53.51	0.081	1.54	0.94	0.24	0.80	1.13	1.0	0.037	2.49	42.76	0.086	3.81	2.68	2
13.451	1.36	0.00	1.36	0	0.93	0.05	0.98	1.0	0.052	36.32	53.50	0.081	1.55	0.94	0.24	0.80	1.13	1.0	0.037	2.69	46.27	0.089	3.90	2.72	2
13.615	1.37	0.00	1.37	0	0.93	0.05	0.98	1.0	0.052	36.36	53.64	0.081	1.55	0.94	0.24	0.80	1.13	1.0	0.037	2.84	49.02	0.091	3.97	2.76	2
13.779	1.38	0.00	1.38	0	0.92	0.05	0.98	1.0	0.052	37.51	58.07	0.086	1.65	0.94	0.26	0.80	1.12	1.0	0.037	2.20	45.17	0.088	3.79	2.72	2
13.943	1.39	0.00	1.39	0	0.92	0.06	0.97	1.0	0.052	39.37	65.22	0.094	1.81	0.94	0.29	0.80	1.12	1.0	0.037	1.81	46.71	0.089	3.81	2.81	2
14.107	1.39	0.00	1.39	0	0.92	0.05	0.97	1.0	0.052	37.56	58.26	0.086	1.65	0.94	0.26	0.80	1.12	1.0	0.037	2.64	54.59	0.095	4.04	2.85	2
14.271	1.40	0.00	1.40	0	0.92	0.05	0.98	1.0	0.052	35.14	49.64	0.077	1.48	0.94	0.22	0.80	1.12	1.0	0.037	4.03	58.43	0.099	4.15	2.82	2
14.436	1.41	0.00	1.41	0	0.92	0.05	0.98	1.0	0.052	34.68	47.17	0.075	1.44	0.94	0.20	0.80	1.12	1.0	0.037	3.54	44.20	0.087	3.62	2.53	2
14.600	1.42	0.00	1.42	0	0.92	0.05	0.98	1.0	0.052	34.25	45.52	0.073	1.41	0.94	0.19	0.80	1.11	1.0	0.037	3.48	39.19	0.083	3.42	2.42	2
14.764	1.43	0.00	1.43	0	0.92	0.04	0.98	1.0	0.052	33.37	42.80	0.071	1.37	0.94	0.18	0.80	1.11	1.0	0.037	5.37	50.59	0.092	3.78	2.57	2
14.928	1.44	0.00	1.44	0	0.92	0.04	0.98	1.0	0.052	32.99	41.33	0.070	1.35	0.94	0.17	0.80	1.11	1.0	0.037	7.58	63.21	0.103	4.22	2.78	2
15.092	1.45	0.00	1.45	0	0.91	0.04	0.98	1.0	0.052	33.02	41.44	0.070	1.35	0.94	0.17	0.80	1.11	1.0	0.037	7.94	66.87	0.108	4.36	2.85	2
15.256	1.46	0.00	1.46	0	0.91	0.05	0.98	1.0	0.052	33.53	43.40	0.071	1.39	0.94	0.18	0.80	1.11	1.0	0.037	5.61	55.39	0.096	3.84	2.62	2
15.420	1.47	0.00	1.47	0	0.91	0.05	0.97	1.0	0.051	35.31	49.60	0.077	1.50	0.94	0.22	0.80	1.10	1.0	0.037	3.18	45.42	0.088	3.49	2.50	2
15.584	1.48	0.00	1.48	0	0.91	0.05	0.97	1.0	0.051	35.36	49.80	0.077	1.51	0.94	0.22	0.80	1.10	1.0	0.038	3.10	44.78	0.087	3.44	2.48	2
15.748	1.49	0.00	1.49	0	0.91	0.05	0.97	1.0	0.051	34.86	47.84	0.075	1.47	0.94	0.21	0.80	1.10	1.0	0.038	3.48	45.16	0.088	3.43	2.45	2
15.912	1.50	0.00	1.50	0	0.91	0.05	0.97	1.0	0.051	35.02	48.47	0.076	1.49	0.94	0.21	0.80	1.10	1.0	0.038	3.39	45.63	0.088	3.41	2.45	2
16.076	1.51	0.00	1.51	0	0.91	0.05	0.97	1.0	0.051	35.45	50.14	0.078	1.52	0.94	0.22	0.80	1.10	1.0	0.038	3.28	48.10	0.090	3.47	2.49	2
16.240	1.52	0.00	1.52	0	0.91	0.05	0.97	1.0	0.051	35.92	51.93	0.079	1.56	0.94	0.23	0.80	1.10	1.0	0.038	3.59	57.55	0.098	3.73	2.64	2
16.404	1.53	0.00	1.53	0	0.90	0.05	0.97	1.0	0.051	34.83	48.45	0.076	1.49	0.94	0.21	0.80	1.09	1.0	0.038	5.42	73.86	0.117	4.45	2.97	2
16.568	1.54	0.00	1.54	0	0.90	0.05	0.97	1.0	0.051	34.11	45.65	0.073	1.45	0.94	0.20	0.80	1.09	1.0	0.038	6.34	73.18	0.116	4.38	2.91	2
16.732	1.55	0.00	1.55	0	0.90	0.05	0.97	1.0	0.051	33.61	43.74	0.072	1.41	0.94	0.18	0.80	1.09	1.0	0.038	6.88	69.68	0.111	4.16	2.79	2
16.896	1.56	0.00	1.56	0	0.90	0.05	0.97	1.0	0.051	33.98	45.17	0.073	1.44	0.94	0.19	0.80	1.09	1.0	0.038	4.96	55.55	0.096	3.56	2.50	2
17.060	1.57	0.00	1.57	0	0.90	0.05	0.97	1.0	0.050	35.72	51.18	0.079	1.56	0.93	0.23	0.80	1.09	1.0	0.038	2.93	45.31	0.088	3.23	2.39	2
17.224	1.58	0.00	1.58	0	0.90	0.05	0.97	1.0	0.050	36.66	54.79	0.082	1.63	0.93	0.25	0.80	1.09	1.0	0.038	2.30	41.65	0.085	3.09	2.36	2

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.414

Depth at time of CPT (ft)	Depth at t_1, z_1 (m)	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Maximum Shear Strain Modulus, G_{max} (tsf)	P = $\gamma_{eff}(G_{eff}/G_{max})$ (tsf)	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, $\varepsilon_{v,15}$ (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
0.164	3.36	594	1.6E-03	5.5E+02	1.1E-04	11	0.178	9740	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.328	3.41	594	1.6E-03	5.5E+02	1.1E-04	11	0.179	9685	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.492	3.46	594	1.6E-03	5.5E+02	1.1E-04	11	0.179	9631	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.656	3.51	594	1.6E-03	5.5E+02	1.1E-04	11	0.180	9578	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.820	3.56	594	1.6E-03	5.5E+02	1.1E-04	11	0.181	9526	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.984	3.61	594	1.6E-03	5.5E+02	1.1E-04	11	0.181	9475	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.148	3.66	594	1.6E-03	5.5E+02	1.1E-04	11	0.182	9425	0.01%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.312	3.71	594	1.6E-03	5.5E+02	1.1E-04	11	0.182	9375	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.476	3.76	594	1.6E-03	5.5E+02	1.2E-04	11	0.183	9327	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.640	3.81	594	1.6E-03	5.5E+02	1.2E-04	11	0.184	9279	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.804	3.86	594	1.6E-03	5.5E+02	1.2E-04	11	0.184	9233	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.968	3.91	594	1.6E-03	5.5E+02	1.2E-04	11	0.185	9187	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.133	3.96	594	1.6E-03	5.5E+02	1.2E-04	11	0.185	9141	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.297	4.01	594	1.6E-03	5.5E+02	1.3E-04	11	0.186	9097	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.461	4.06	594	1.6E-03	5.5E+02	1.3E-04	11	0.186	9053	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.625	4.11	594	1.6E-03	5.5E+02	1.3E-04	11	0.187	9010	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.789	4.16	594	1.6E-03	5.5E+02	1.3E-04	11	0.187	8968	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.953	4.21	594	1.6E-03	5.5E+02	1.3E-04	11	0.188	8926	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.117	4.26	594	1.6E-03	5.5E+02	1.3E-04	11	0.189	8885	0.03%	2.00	0.65	0.03%	0.002	0.34	0.079	0.765	0.31%	0.0005
3.281	4.31	495	1.6E-03	3.9E+02	1.9E-04	0	0.193	11435	0.04%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.04%	0.0001
3.445	4.36	495	1.6E-03	3.9E+02	1.9E-04	0	0.194	11383	0.04%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.04%	0.0001
3.609	4.41	495	1.6E-03	3.9E+02	1.9E-04	0	0.194	11332	0.04%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.05%	0.0001
3.773	4.46	495	1.6E-03	3.9E+02	2.0E-04	0	0.195	11282	0.05%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.05%	0.0001
3.937	4.51	495	1.6E-03	3.9E+02	2.0E-04	0	0.195	11232	0.05%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.05%	0.0001
4.101	4.56	495	1.8E-03	4.5E+02	1.7E-04	10	0.192	8872	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
4.265	4.61	495	1.8E-03	4.5E+02	1.8E-04	10	0.193	8827	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
4.429	4.66	495	1.8E-03	4.5E+02	1.8E-04	10	0.193	8784	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
4.593	4.71	495	1.9E-03	4.7E+02	1.7E-04	0	0.197	11011	0.03%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.01%	0.0000
4.757	4.76	495	1.9E-03	4.7E+02	1.7E-04	0	0.198	10956	0.03%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.01%	0.0000
4.921	4.81	495	1.9E-03	4.7E+02	1.8E-04	0	0.198	10903	0.03%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.02%	0.0000
5.085	4.86	495	1.9E-03	4.7E+02	1.8E-04	0	0.199	10850	0.04%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.02%	0.0000
5.249	4.91	495	1.9E-03	4.7E+02	1.8E-04	0	0.200	10798	0.04%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.02%	0.0000
5.413	4.96	495	1.9E-03	4.7E+02	1.8E-04	0	0.200	10747	0.04%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.02%	0.0000
5.577	5.01	495	1.9E-03	4.7E+02	1.9E-04	0	0.201	10697	0.04%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.03%	0.0000
5.741	5.06	495	1.9E-03	4.7E+02	1.9E-04	0	0.201	10643	0.04%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.03%	0.0000
5.905	5.11	495	1.9E-03	4.7E+02	1.9E-04	0	0.202	10599	0.04%	2.20	1.00	0.03%	0.000	0.34	0.079	0.765	0.03%	0.0001
6.069	5.16	495	1.8E-03	4.5E+02	2.0E-04	10	0.199	8371	0.03%	2.00	0.65	0.03%	0.002	0.34	0.079	0.765	0.42%	0.0007
6.234	5.21	495	1.8E-03	4.5E+02	2.0E-04	10	0.200	8335	0.03%	2.00	0.65	0.03%	0.003	0.34	0.079	0.765	0.46%	0.0007
6.398	5.26	495	1.8E-03	4.5E+02	2.0E-04	10	0.200	8299	0.04%	2.00	0.65	0.03%	0.003	0.34	0.079	0.765	0.49%	0.0008
6.562	5.31	495	1.8E-03	4.5E+02	2.0E-04	10	0.201	8263	0.04%	2.00	0.65	0.03%	0.003	0.34	0.079	0.765	0.53%	0.0009
6.726	5.36	495	1.8E-03	4.5E+02	2.1E-04	10	0.201	8228	0.04%	2.00	0.65	0.03%	0.004	0.34	0.079	0.765	0.57%	0.0009
6.890	5.41	495	1.8E-03	4.5E+02	2.1E-04	10	0.202	8194	0.04%	2.00	0.65	0.03%	0.004	0.34	0.079	0.765	0.60%	0.0010
7.054	5.46	495	1.8E-03	4.5E+02	2.1E-04	10	0.202	8160	0.04%	2.00	0.65	0.03%	0.004	0.34	0.079	0.765	0.63%	0.0010
7.218	5.51	495	1.8E-03	4.5E+02	2.1E-04	10	0.203	8127	0.04%	2.00	0.65	0.03%	0.004	0.34	0.079	0.765	0.67%	0.0011
7.382	5.56	495	1.8E-03	4.5E+02	2.2E-04	10	0.203	8094	0.04%	2.00	0.65	0.03%	0.005	0.34	0.079	0.765	0.70%	0.0011
7.546	5.61	495	1.8E-03	4.5E+02	2.2E-04	10	0.204	8061	0.04%	2.00	0.65	0.03%	0.005	0.34	0.079	0.765	0.73%	0.0012
7.710	5.66	495	1.8E-03	4.5E+02	2.2E-04	10	0.204	8029	0.04%	2.00	0.65	0.03%	0.005	0.34	0.079	0.765	0.76%	0.0013
7.874	5.71	495	1.8E-03	4.5E+02	2.2E-04	10	0.205	7997	0.04%	2.00	0.65	0.03%	0.005	0.34	0.079	0.765	0.80%	0.0013
8.038	5.76	495	1.8E-03	4.5E+02	2.2E-04	10	0.205	7966	0.04%	2.00	0.65	0.03%	0.005	0.34	0.079	0.765	0.83%	0.0014
8.202	5.81	495	1.8E-03	4.5E+02	2.3E-04	10	0.206	7935	0.04%	2.00	0.65	0.03%	0.006	0.34	0.079	0.765	0.86%	0.0014
8.366	5.86	495	1.8E-03	4.5E+02	2.3E-04	10	0.206	7905	0.04%	2.00	0.65	0.03%	0.006	0.34	0.079	0.765	0.89%	0.0015
8.530	5.91	495	1.8E-03	4.3E+02	2.4E-04	16	0.458	6484	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.32%	0.0022
8.694	5.96	495	1.8E-03	4.3E+02	2.4E-04	16	0.459	6461	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.35%	0.0022
8.858	6.01	495	1.8E-03	4.5E+02	2.3E-04	10	0.208	7819	0.04%	2.00	0.65	0.03%	0.006	0.34	0.079	0.765	0.98%	0.0016
9.022	6.06	495	1.8E-03	4.3E+02	2.5E-04	16	0.460	6414	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.41%	0.0023
9.186	6.11	495	1.8E-03	4.3E+02	2.5E-04	16	0.460	6392	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.44%	0.0024
9.350	6.16	460	1.8E-03	3.9E+02	2.8E-04	10	0.209	7736	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.71%	0.0028
9.514	6.21	460	1.8E-03	3.9E+02	2.8E-04	10	0.209	7708	0.07%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.75%	0.0029
9.678	6.26	460	1.8E-03	3.9E+02	2.8E-04	10	0.210	7680	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.78%	0.0029
9.842	6.31	460	1.8E-03	3.9E+02	2.9E-04	10	0.210	7653	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.82%	0.0030
10.006	6.36	460	1.8E-03	3.9E+02	2.9E-04	10	0.211	7626	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.85%	0.0030
10.170	6.41	460	1.8E-03	3.9E+02	2.9E-04	10	0.211	7600	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.89%	0.0031
10.335	6.46	460	1.8E-03	3.9E+02	2.9E-04	10	0.212	7573	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.92%	0.0032
10.499	6.51	460	1.8E-03	3.9E+02	3.0E-04	10	0.212	7547	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.96%	0.0032
10.663	6.56	460	1.8E-03	3.9E+02	3.0E-04	10	0.213	7522	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.99%	0.0033
10.827	6.61	460	1.8E-03	3.9E+02	3.0E-04	10	0.213	7496	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.03%	0.0033
10.991	6.66	460	1.8E-03	3.9E+02	3.0E-04	10	0.213	7471	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.07%	0.0034
11.155	6.71	460	1.8E-03	3.7E+02	3.2E-04	16	0.465	6133	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.58%	0.0042
11.319	6.76	460	1.8E-03	3.7E+02	3.2E-04	16	0.466	6114	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.62%	0.0043
11.483	6.81	460	1.8E-03	3.7E+02	3.3E-04	16	0.466	6095	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.65%	0.0044
11.647	6.86	460	1.8E-03	3.7E+02	3.3E-04	16	0.467	6077	0.10%	2.00	0.65	0.03%	0.018	0.34	0.079	0.765	2.69%	0.0044
11.811	6.91	460	1.8E-03	3.7E+02	3.3E-04	16	0.467	6058	0.10%	2.00	0.65	0.03%	0.018	0.34	0.079	0.765	2.73%	0.0045
11.975	6.96	460	1.8E-03	3.9E+02	3.2E-04	10	0.216	7332	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.28%	0.0037
12.139	7.01	460	1.8E-03	3.9E+02	3.2E-04	10	0.216	7309	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.31%	0.0038
12.303	7.06	460	1.8E-03	3.9E+02	3.2E-04	10	0.217	7286	0.09%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.35%	0.0039
12.467	7.11	460	1.8E-03	3.7E+02	3.4E-04	16	0.469	5983	0.11%	2.00	0.65	0.03%	0.019	0.34	0.079	0.765	2.88%	0.0047
12.631	7.16	460	1.8E-03	3.9E+02	3.3E-04	10	0.218	7242	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.42%	0.0040
12.795	7.21	460	1.8E-03	3.9E+02	3.3E-04	10	0.218	7219	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.46%	0.0040
12.959	7.26	460	1.8E-03	3.9E+02	3.3E-04	10	0.218	7197	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.50%	0.0041
13.123	7.31	460	1.8E-03	3.9E+02	3.3E-04	10	0.219	7176	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.53%	0.0042
13.287	7.36	460	1.8E-03	3.9E+02	3.4E-04	10	0.219	7154	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.57%	0.0042
13.451	7.41	460	1.8E-03	3.9E+02	3.4E-04	10	0.220	7133	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.61%	0.0043
13.615	7.46	460	1.8E-03	3.9E+02	3.4E-04	10	0.220	7111	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.65%	0.0043
13.779	7.51	460	1.8E-03	3.9E+02	3.4E-04	10	0.220	7090	0.10%	2.00	0.65	0.03%	0.018	0.34	0.079	0.765	2.69%	0.0044
13.943	7.56	460	1.8E-03	3.9E+02	3.5E-04	10	0.221	7070	0.10%	2.00	0.65	0.03%	0.018	0.34	0.079	0.765	2.72%	0.0045
14.107	7.61	460	1.8E-03	3.9E+02	3.5E-04	10	0.221	7049	0.10%	2.00	0.65	0.03%	0.018	0.34	0.079	0.765	2.76%	0.0045
14.271	7.66	460	1.8E-03	3.7E+02	3.7E-04	16	0.473	5792	0.12%	2.00	0.65	0.03%	0.022	0.34	0.079	0.765	3.31%	0.0054
14.436	7.71	460	1.8E-03	3.9E+02	3.5E-04	10	0.222	7010	0.10%	2.00	0.65	0.03%	0.019	0.34	0.079	0.765	2.84%	0.0047
14.600	7.76	500	1.8E-03	4.6E+02	3.0E-04	10	0.222	6990	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.87%	0.0031
14.764	7.81	500	1.8E-03	4.4E+02	3.2E-04	16	0.474	5743	0.09%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.33%	0.0038
14.928	7.86	500	1.8E-03	4.4E+02	3.2E-04	16	0.474	5728	0.09%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.36%	0.0039
15.092	7.91	500	1.8E-03	4.4E+02	3.2E-04	16	0.475	5713	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.39%	0.0039
15.256	7.96	500	1.8E-03	4.4E+02	3.2E-04	16	0.475	5698	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.42%	0.0040
15.420	8.01	500	1.8E-03	4.6E+02	3.1E-04	10	0.224	6896	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.00%	0.0033
15.584	8.06	500	1.8E-03	4.6E+02	3.1E-04	10	0.224	6878	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.03%	0.0033
15.748	8.11	500	1.8E-03	4.6E+02	3.1E-04	10	0.225	6859	0.08%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.06%	0.0034
15.912	8.16	500	1.8E-03	4.6E+02	3.2E-04	10	0.225	6840	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.09%	0.0034
16.076	8.21	500	1.8E-03	4.6E+02	3.2E-04	10	0.226	6822	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.12%	0.0035
16.240	8.26	500	1.8E-03	4.6E+02	3.2E-04	10	0.226	6804	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.15%	0.0035
16.404	8.31	500	1.8E-03	4.4E+02	3.4E-04	16	0.477	5593	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.62%	0.0043
16.568	8.36	500	1.8E-03	4.4E+02	3.4E-04	16	0.478	5579	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.65%	0.0044
16.732	8.41	500	1.8E-03	4.4E+02	3.4E-04	16	0.478	5565	0.10%	2.00	0.65	0.03%	0.018	0.34	0.079	0.765	2.68%	0.0044
16.896	8.46	500	1.8E-03	4.4E+02	3.5E-04	16	0.478	5552	0.10%	2.00	0.65	0.03%	0.018	0.34	0.079	0.765	2.71%	0.0044
17.060	8.51	500	1.8E-03	4.6E+02	3.3E-04	10	0.228	6719	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.28%	0.0037
17.224	8.56	500	1.8E-03	4.6E+02	3.3E-04	10	0.228	6701	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.31%	0.0038

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-3S

Data File: 13-52106_SP3-3S-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Dat

Legend:
- Tailings Sands
- Tailings Sand-Slimes
- Tailings Slimes
- Interim Cover
- Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69

Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Parameter
5605.60	Water surface elevation during CPT investigation (ft
5601.35	Water surface elevation at t_0 (ft amsl)
5582.14	Water surface elevation at t_1 (ft amsl)
5577.14	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Eart
7.51	Equiv. Number of Uniform Strain Cycles, N

Value	Parameter
5609.63	Ground Surface Elevation at time of CPT (ft amsl)
5620.49	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pla
3.50	Thickness of Water Storage/Rooting Zone (ft)
3.50	Thickness of High Compaction Layer (ft)
3.36	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1184.24	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5577.14	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer	Total Stress at Midpoint of Layer	Equil Pore Pressure at Bottom of Layer	Equil Pore Pressure at Midpoint of Layer (tsf)	Effective Stress at Bottom of Layer	Effective Stress at Midpoint of Layer	Midpoint Depth at t_1, z_1	Shear Wave Velocity, V_s	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
Erosion Protection Layer	######	5620.24	5619.99	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014	0.08	508	1.7E-03	4.4E+02	3.0E-06	11	0.068	46696	0.00%	1.20	0.80	0.04%	0.000	0.32	0.133	0.778	0.00%	0.0000
Water Storage/Rooting Zone Layer	######	5618.24	5616.49	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121	0.69	508	1.7E-03	4.3E+02	2.8E-05	11	0.118	18930	0.00%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
High Compaction Layer	######	5614.74	5612.99	3.50	0.060	120	0.424	0.320	0.00	0.00	0.424	0.320	1.75	508	1.9E-03	4.8E+02	6.5E-05	11	0.152	12657	0.01%	0.65	0.75	0.02%	0.000	0.34	0.079	0.765	0.00%	0.0000
Platform/Random Fill Layer	######	5611.31	5609.63	3.36	0.050	101	0.593	0.509	0.00	0.00	0.593	0.509	2.80	508	1.6E-03	4.0E+02	1.2E-04	11	0.171	10433	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000

2013 CPT Data from ConeTec / CPT Data Interpretations

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No
17.388	5592.24	12.6	0.071	12.4	21.2	9.17	0.57%	Sand-Slime Tailin	0.059	119.0	0.99	0.42	0.58	1
17.552	5592.08	13.7	0.092	13.6	19.3	8.35	0.67%	Sand-Slime Tailin	0.059	119.0	1.00	0.42	0.58	1
17.716	5591.91	13.7	0.124	13.6	19.8	8.56	0.91%	Sand-Slime Tailin	0.059	119.0	1.01	0.43	0.59	1
17.880	5591.75	11.4	0.157	11.3	19.8	8.58	1.38%	Sand-Slime Tailin	0.059	119.0	1.02	0.43	0.59	1
18.044	5591.59	10.6	0.162	10.5	21.3	9.25	1.52%	Sand-Slime Tailin	0.059	119.0	1.03	0.44	0.60	1
18.208	5591.42	9.0	0.183	8.9	21.8	9.45	2.03%	Slime Tailings	0.057	113.1	1.04	0.44	0.60	1
18.372	5591.26	8.4	0.100	8.2	27.4	11.89	1.19%	Sand-Slime Tailin	0.059	119.0	1.05	0.45	0.60	1
18.537	5591.09	13.5	0.095	13.4	21.3	9.22	0.70%	Sand-Slime Tailin	0.059	119.0	1.06	0.45	0.61	1
18.701	5590.93	10.1	0.120	10.0	17.8	7.69	1.19%	Sand-Slime Tailin	0.059	119.0	1.07	0.46	0.61	1
18.865	5590.77	9.9	0.116	9.8	18.7	8.10	1.17%	Sand-Slime Tailin	0.059	119.0	1.08	0.46	0.62	1
19.029	5590.60	14.0	0.163	13.9	13.3	5.75	1.17%	Sand-Slime Tailin	0.059	119.0	1.09	0.47	0.62	1
19.193	5590.44	13.6	0.284	13.5	11.7	5.08	2.09%	Sand-Slime Tailin	0.059	119.0	1.10	0.47	0.63	1
19.357	5590.27	10.2	0.200	10.1	14.7	6.36	1.96%	Slime Tailings	0.057	113.1	1.11	0.48	0.63	1
19.521	5590.11	17.8	0.357	17.7	18.6	8.07	2.00%	Sand-Slime Tailin	0.059	119.0	1.12	0.48	0.64	1
19.685	5589.95	22.3	0.302	22.2	25.3	10.96	1.35%	Sand-Slime Tailin	0.059	119.0	1.13	0.49	0.64	1
19.849	5589.78	22.1	0.259	21.8	57.2	24.79	1.17%	Sand-Slime Tailin	0.059	119.0	1.14	0.49	0.65	1
20.013	5589.62	20.9	0.204	20.3	100.3	43.47	0.98%	Sand-Slime Tailin	0.059	119.0	1.15	0.50	0.65	1
20.177	5589.45	18.6	0.237	17.7	151.5	65.65	1.27%	Sand-Slime Tailin	0.059	119.0	1.16	0.50	0.65	1
20.341	5589.29	19.8	0.274	18.9	136.1	58.99	1.39%	Sand-Slime Tailin	0.059	119.0	1.17	0.51	0.66	1
20.505	5589.13	25.1	0.237	24.5	96.6	41.86	0.95%	Sand-Slime Tailin	0.059	119.0	1.18	0.51	0.66	1
20.669	5588.96	31.4	0.092	31.0	58.2	25.23	0.29%	Sand Tailings	0.062	123.5	1.19	0.52	0.67	1
20.833	5588.80	32.9	0.194	32.7	35.6	15.43	0.59%	Sand Tailings	0.062	123.5	1.20	0.52	0.67	1
20.997	5588.63	22.6	0.202	22.3	42.9	18.60	0.90%	Sand-Slime Tailin	0.059	119.0	1.21	0.53	0.68	1
21.161	5588.47	21.0	0.114	20.8	20.1	8.70	0.54%	Sand-Slime Tailin	0.059	119.0	1.22	0.53	0.68	1
21.325	5588.30	21.1	0.201	20.9	37.0	16.04	0.95%	Sand-Slime Tailin	0.059	119.0	1.23	0.54	0.69	1
21.489	5588.14	22.3	0.267	21.9	66.8	28.93	1.20%	Sand-Slime Tailin	0.059	119.0	1.24	0.54	0.69	1
21.653	5587.98	18.5	0.419	18.0	91.4	39.59	2.26%	Sand-Slime Tailin	0.059	119.0	1.25	0.55	0.70	1
21.817	5587.81	22.9	0.248	22.0	149.4	64.72	1.08%	Sand-Slime Tailin	0.059	119.0	1.26	0.55	0.70	1
21.981	5587.65	28.4	0.235	27.8	83.5	36.19	0.83%	Sand-Slime Tailin	0.059	119.0	1.27	0.56	0.71	1
22.145	5587.48	22.2	0.322	21.0	195.5	84.71	1.45%	Sand-Slime Tailin	0.059	119.0	1.28	0.57	0.71	1
22.309	5587.32	25.0	0.216	23.6	231.9	100.47	0.86%	Sand-Slime Tailin	0.059	119.0	1.29	0.57	0.72	1
22.473	5587.16	25.7	0.237	24.6	172.5	74.75	0.92%	Sand-Slime Tailin	0.059	119.0	1.30	0.58	0.72	1
22.638	5586.99	25.4	0.261	24.2	200.2	86.77	1.03%	Sand-Slime Tailin	0.059	119.0	1.31	0.58	0.72	1
22.802	5586.83	25.6	0.229	24.5	184.7	80.05	0.89%	Sand-Slime Tailin	0.059	119.0	1.32	0.59	0.73	1
22.966	5586.66	28.5	0.145	27.4	181.5	78.63	0.51%	Sand-Slime Tailin	0.059	119.0	1.33	0.59	0.73	1
23.130	5586.50	30.4	0.223	29.5	150.3	65.13	0.73%	Sand-Slime Tailin	0.059	119.0	1.33	0.60	0.74	1
23.294	5586.34	35.2	0.314	34.0	190.1	82.37	0.89%	Sand-Slime Tailin	0.059	119.0	1.34	0.60	0.74	1
23.458	5586.17	38.3	0.271	37.3	170.9	74.04	0.71%	Sand Tailings	0.062	123.5	1.35	0.61	0.75	1
23.622	5586.01	38.4	0.271	37.3	171.7	74.40	0.71%	Sand Tailings	0.062	123.5	1.36	0.61	0.75	1
23.786	5585.84	41.4	0.271	40.3	174.7	75.68	0.66%	Sand Tailings	0.062	123.5	1.37	0.62	0.76	1
32.490	5577.14							Sand Tailings	0.062	123.5				

CPT Data Interpretations (cont.) / Conditions at t_1

Depth at time of CPT (ft)	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
17.388	1.37	16.989	236.15	19.94	20	0.61%	2.4	47%	1.59	0.00	1.59	0
17.552	1.36	18.404	255.82	21.57	22	0.73%	2.4	47%	1.60	0.00	1.60	0
17.716	1.35	18.297	254.32	21.44	22	0.98%	2.5	47%	1.61	0.00	1.61	0
17.880	1.34	15.145	210.51	17.78	18	1.51%	2.6	47%	1.61	0.00	1.61	0
18.044	1.33	14.025	194.94	16.50	16	1.69%	2.7	47%	1.62	0.00	1.62	0
18.208	1.33	11.759	163.45	13.87	13	2.30%	2.8	71%	1.63	0.00	1.63	0
18.372	1.32	10.844	150.73	12.86	12	1.36%	2.7	47%	1.64	0.00	1.64	0
18.537	1.31	17.559	244.07	20.60	20	0.76%	2.4	47%	1.65	0.00	1.65	0
18.701	1.30	12.971	180.29	15.23	15	1.33%	2.7	47%	1.66	0.00	1.66	0
18.865	1.30	12.648	175.81	14.87	14	1.32%	2.7	47%	1.67	0.00	1.67	0
19.029	1.29	17.870	248.39	20.88	21	1.27%	2.5	47%	1.68	0.00	1.68	0
19.193	1.28	17.279	240.18	20.18	20	2.28%	2.7	47%	1.69	0.00	1.69	0
19.357	1.27	12.883	179.08	15.10	14	2.20%	2.8	71%	1.70	0.00	1.70	0
19.521	1.25	22.210	308.72	25.96	26	2.14%	2.6	47%	1.71	0.00	1.71	0
19.685	1.24	27.383	380.62	32.03	33	1.43%	2.4	47%	1.72	0.00	1.72	0
19.849	1.23	26.790	372.39	31.63	33	1.23%	2.4	47%	1.73	0.00	1.73	0
20.013	1.23	24.850	345.41	29.75	30	1.03%	2.3	47%	1.74	0.00	1.74	0
20.177	1.23	21.715	301.84	26.57	27	1.36%	2.5	47%	1.75	0.00	1.75	0
20.341	1.22	23.028	320.09	27.95	28	1.47%	2.5	47%	1.76	0.00	1.76	0
20.505	1.20	29.354	408.02	34.93	36	0.99%	2.3	47%	1.77	0.00	1.77	0
20.669	1.18	36.693	510.03	43.12	45	0.30%	1.9	18%	1.78	0.00	1.78	0
20.833	1.17	38.397	533.72	44.90	47	0.61%	2.1	18%	1.79	0.00	1.79	0
20.997	1.19	26.475	368.01	31.12	31	0.95%	2.3	47%	1.80	0.00	1.80	0
21.161	1.18	24.679	343.04	28.84	29	0.58%	2.2	47%	1.81	0.00	1.81	0
21.325	1.18	24.625	342.29	28.92	29	1.01%	2.4	47%	1.82	0.00	1.82	0
21.489	1.17	25.657	356.63	30.37	30	1.27%	2.4	47%	1.83	0.00	1.83	0
21.653	1.17	21.059	292.72	25.24	25	2.42%	2.6	47%	1.84	0.00	1.84	0
21.817	1.16	25.478	354.15	30.85	31	1.15%	2.4	47%	1.85	0.00	1.85	0
21.981	1.15	31.904	443.46	37.75	38	0.87%	2.2	47%	1.86	0.00	1.86	0
22.145	1.15	24.097	334.94	29.62	29	1.54%	2.4	47%	1.87	0.00	1.87	0
22.309	1.14	26.878	373.60	33.13	33	0.91%	2.3	47%	1.88	0.00	1.88	0
22.473	1.13	27.896	387.75	33.82	34	0.97%	2.3	47%	1.89	0.00	1.89	0
22.638	1.13	27.284	379.24	33.33	33	1.08%	2.3	47%	1.90	0.00	1.90	0
22.802	1.12	27.506	382.34	33.45	33	0.94%	2.3	47%	1.91	0.00	1.91	0
22.966	1.12	30.592	425.22	37.00	37	0.53%	2.1	47%	1.92	0.00	1.92	0
23.130	1.11	32.742	455.12	39.24	39	0.77%	2.2	47%	1.93	0.00	1.93	0
23.294	1.10	37.465	520.76	45.03	46	0.93%	2.2	47%	1.94	0.00	1.94	0
23.458	1.09	40.792	567.01	48.73	49	0.73%	2.1	18%	1.95	0.00	1.95	0
23.622	1.09	40.621	564.64	48.54	49	0.73%	2.1	18%	1.96	0.00	1.96	0
23.786	1.08	43.621	606.34	52.04	53	0.68%	2.0	18%	1.97	0.00	1.97	0
32.490									2.50	0.02	2.48	1

Liquefaction Triggering Analyses

Depth at time of CPT (ft)	I&B (2008) r_d	C_σ	K_σ	K_a	CSR (M=7.5, s'v=1atm)	Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Youd (2001) r_d	D_r	f	K_σ	K_a	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No
17.388	0.90	0.05	0.97	1.0	0.050	37.30	57.24	0.085	1.69	0.93	0.26	0.80	1.08	1.0	0.038	2.28	45.39	0.088	3.18	2.44	2
17.552	0.90	0.05	0.97	1.0	0.050	37.86	59.43	0.087	1.74	0.93	0.27	0.80	1.08	1.0	0.038	2.27	48.98	0.091	3.27	2.50	2
17.716	0.89	0.05	0.97	1.0	0.050	37.82	59.27	0.087	1.74	0.93	0.27	0.80	1.08	1.0	0.038	2.55	54.65	0.095	3.40	2.57	2
17.880	0.89	0.05	0.97	1.0	0.050	36.54	54.32	0.082	1.64	0.93	0.24	0.80	1.08	1.0	0.038	3.51	62.37	0.103	3.63	2.64	2
18.044	0.89	0.05	0.97	1.0	0.050	36.09	52.58	0.080	1.60	0.93	0.23	0.80	1.08	1.0	0.038	3.89	64.15	0.105	3.68	2.64	2
18.208	0.89	0.05	0.97	1.0	0.050	34.92	48.78	0.076	1.53	0.93	0.21	0.80	1.08	1.0	0.038	5.05	70.01	0.112	3.91	2.72	2
18.372	0.89	0.05	0.97	1.0	0.050	34.81	47.67	0.075	1.51	0.93	0.21	0.80	1.07	1.0	0.038	4.32	55.55	0.096	3.33	2.42	2
18.537	0.89	0.05	0.97	1.0	0.050	37.52	58.12	0.086	1.73	0.93	0.26	0.80	1.07	1.0	0.038	2.41	49.69	0.091	3.15	2.44	2
18.701	0.89	0.05	0.97	1.0	0.050	35.64	50.88	0.078	1.58	0.93	0.23	0.80	1.07	1.0	0.038	3.77	57.42	0.098	3.34	2.46	2
18.865	0.89	0.05	0.97	1.0	0.050	35.52	50.38	0.078	1.57	0.93	0.22	0.80	1.07	1.0	0.038	3.83	56.90	0.097	3.30	2.44	2
19.029	0.88	0.05	0.96	1.0	0.049	37.62	58.50	0.086	1.75	0.93	0.26	0.80	1.07	1.0	0.038	2.92	60.91	0.101	3.41	2.58	2
19.193	0.88	0.05	0.96	1.0	0.049	37.38	57.56	0.085	1.73	0.93	0.26	0.80	1.07	1.0	0.038	3.88	78.37	0.125	4.18	2.96	2
19.357	0.88	0.05	0.97	1.0	0.049	35.35	50.44	0.078	1.58	0.93	0.22	0.80	1.06	1.0	0.038	4.70	70.98	0.113	3.77	2.68	2
19.521	0.88	0.05	0.96	1.0	0.049	39.41	65.37	0.094	1.92	0.93	0.29	0.80	1.06	1.0	0.038	3.15	81.85	0.131	4.34	3.13	2
19.685	0.88	0.06	0.96	1.0	0.049	41.53	73.56	0.104	2.14	0.93	0.33	0.80	1.06	1.0	0.038	2.26	72.25	0.115	3.79	2.96	2
19.849	0.88	0.06	0.96	1.0	0.049	41.39	73.02	0.103	2.13	0.92	0.32	0.80	1.06	1.0	0.038	2.14	67.74	0.109	3.57	2.85	2
20.013	0.88	0.06	0.96	1.0	0.049	40.74	70.49	0.100	2.06	0.92	0.31	0.80	1.06	1.0	0.038	2.08	62.00	0.102	3.33	2.69	2
20.177	0.87	0.06	0.96	1.0	0.049	39.62	66.19	0.095	1.96	0.92	0.30	0.80	1.06	1.0	0.038	2.53	67.18	0.108	3.50	2.73	2
20.341	0.87	0.06	0.96	1.0	0.048	40.10	68.05	0.097	2.01	0.92	0.31	0.80	1.05	1.0	0.038	2.53	70.78	0.113	3.64	2.82	2
20.505	0.87	0.06	0.96	1.0	0.048	42.55	77.49	0.109	2.27	0.92	0.34	0.80	1.05	1.0	0.038	1.85	64.63	0.105	3.36	2.82	2
20.669	0.87	0.07	0.95	1.0	0.048	33.11	76.23	0.108	2.25	0.92	0.38	0.80	1.05	1.0	0.038	1.24	53.32	0.094	2.99	2.62	2
20.833	0.87	0.07	0.95	1.0	0.048	33.57	78.47	0.111	2.31	0.92	0.39	0.80	1.05	1.0	0.038	1.39	62.28	0.102	3.24	2.78	2
20.997	0.87	0.06	0.96	1.0	0.048	41.22	72.33	0.103	2.14	0.91	0.32	0.80	1.05	1.0	0.038	1.97	61.27	0.101	3.19	2.66	2
21.161	0.87	0.06	0.96	1.0	0.048	40.41	69.25	0.099	2.06	0.91	0.31	0.80	1.05	1.0	0.038	1.76	50.76	0.092	2.88	2.47	2
21.325	0.87	0.06	0.96	1.0	0.048	40.44	69.36	0.099	2.06	0.91	0.31	0.80	1.05	1.0	0.038	2.13	61.57	0.102	3.17	2.62	2
21.489	0.86	0.06	0.96	1.0	0.048	40.95	71.32	0.101	2.12	0.91	0.32	0.80	1.04	1.0	0.038	2.26	68.55	0.110	3.40	2.76	2
21.653	0.86	0.06	0.96	1.0	0.048	39.15	64.39	0.093	1.94	0.91	0.29	0.80	1.04	1.0	0.038	3.47	87.68	0.143	4.39	3.17	2
21.817	0.86	0.06	0.95	1.0	0.048	41.12	71.97	0.102	2.15	0.91	0.32	0.80	1.04	1.0	0.038	2.15	66.25	0.107	3.28	2.71	2
21.981	0.86	0.06	0.95	1.0	0.047	43.54	81.29	0.114	2.42	0.91	0.35	0.80	1.04	1.0	0.038	1.70	64.18	0.105	3.19	2.80	2
22.145	0.86	0.06	0.95	1.0	0.047	40.69	70.30	0.100	2.11	0.91	0.31	0.80	1.04	1.0	0.038	2.51	74.48	0.118	3.59	2.85	2
22.309	0.86	0.06	0.95	1.0	0.047	41.92	75.06	0.106	2.25	0.90	0.33	0.80	1.04	1.0	0.038	1.88	62.32	0.103	3.09	2.67	2
22.473	0.86	0.06	0.95	1.0	0.047	42.16	75.98	0.107	2.28	0.90	0.34	0.80	1.04	1.0	0.038	1.90	64.40	0.105	3.15	2.71	2
22.638	0.85	0.06	0.95	1.0	0.047	41.99	75.32	0.106	2.26	0.90	0.33	0.80	1.03	1.0	0.038	2.01	66.86	0.108	3.22	2.74	2
22.802	0.85	0.06	0.95	1.0	0.047	42.03	75.49	0.107	2.27	0.90	0.33	0.80	1.03	1.0	0.038	1.90	63.56	0.104	3.09	2.68	2
22.966	0.85	0.06	0.95	1.0	0.047	43.28	80.28	0.113	2.42	0.90	0.35	0.80	1.03	1.0	0.038	1.50	55.48	0.096	2.84	2.63	2
23.130	0.85	0.06	0.95	1.0	0.047	44.06	83.30	0.117	2.51	0.90	0.36	0.80	1.03	1.0	0.038	1.61	63.15	0.103	3.05	2.78	2
23.294	0.85	0.07	0.94	1.0	0.046	46.09	91.13	0.129	2.77	0.90	0.39	0.80	1.03	1.0	0.038	1.59	71.48	0.114	3.34	3.06	2
23.458	0.85	0.07	0.94	1.0	0.046	34.55	83.28	0.117	2.54	0.89	0.40	0.80	1.03	1.0	0.038	1.42	69.29	0.111	3.23	2.88	2
23.622	0.85	0.07	0.94	1.0	0.046	34.50	83.03	0.117	2.53	0.89	0.40	0.80	1.03	1.0	0.038	1.43	69.22	0.111	3.22	2.87	2
23.786	0.85	0.07	0.94	1.0	0.046	35.39	87.43	0.123	2.68	0.89	0.42	0.79	1.03	1.0	0.038	1.36	70.53	0.113	3.25	2.96	2

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.414

Depth at time of CPT (ft)	Depth at t_1, z_1 m	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Maximum Shear Strain Modulus, G_{max} tsf	P = γ_{eff}*(G_{eff}/G_{max}) tsf	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
17.388	8.61	500	1.8E-03	4.6E+02	3.3E-04	10	0.228	6684	0.09%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.34%	0.0038
17.552	8.66	500	1.8E-03	4.6E+02	3.4E-04	10	0.229	6667	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.37%	0.0039
17.716	8.71	500	1.8E-03	4.6E+02	3.4E-04	10	0.229	6650	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.40%	0.0039
17.880	8.76	500	1.8E-03	4.6E+02	3.4E-04	10	0.229	6634	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.43%	0.0040
18.044	8.81	500	1.8E-03	4.6E+02	3.4E-04	10	0.230	6617	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.46%	0.0040
18.208	8.86	500	1.8E-03	4.4E+02	3.6E-04	16	0.481	5442	0.11%	2.00	0.65	0.03%	0.019	0.34	0.079	0.765	2.95%	0.0048
18.372	8.91	500	1.8E-03	4.6E+02	3.5E-04	10	0.231	6585	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.52%	0.0041
18.537	8.96	500	1.8E-03	4.6E+02	3.5E-04	10	0.231	6569	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.55%	0.0042
18.701	9.01	500	1.8E-03	4.6E+02	3.5E-04	10	0.231	6553	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.58%	0.0042
18.865	9.06	500	1.8E-03	4.6E+02	3.5E-04	10	0.232	6537	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.61%	0.0043
19.029	9.11	500	1.8E-03	4.6E+02	3.6E-04	10	0.232	6521	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.64%	0.0043
19.193	9.16	500	1.8E-03	4.6E+02	3.6E-04	10	0.232	6506	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.67%	0.0044
19.357	9.21	500	1.8E-03	4.4E+02	3.8E-04	16	0.484	5351	0.12%	2.00	0.65	0.03%	0.021	0.34	0.079	0.765	3.17%	0.0052
19.521	9.26	500	1.8E-03	4.6E+02	3.6E-04	10	0.233	6476	0.10%	2.00	0.65	0.03%	0.018	0.34	0.079	0.765	2.73%	0.0045
19.685	9.31	538	1.8E-03	5.3E+02	3.1E-04	10	0.233	6460	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.91%	0.0031
19.849	9.36	538	1.8E-03	5.3E+02	3.2E-04	10	0.234	6445	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.93%	0.0032
20.013	9.41	538	1.8E-03	5.3E+02	3.2E-04	10	0.234	6430	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.95%	0.0032
20.177	9.46	538	1.8E-03	5.3E+02	3.2E-04	10	0.234	6415	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.98%	0.0032
20.341	9.51	538	1.8E-03	5.3E+02	3.2E-04	10	0.235	6401	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.00%	0.0033
20.505	9.56	538	1.8E-03	5.3E+02	3.2E-04	10	0.235	6386	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.02%	0.0033
20.669	9.61	538	1.9E-03	5.5E+02	3.1E-04	0	0.235	8055	0.10%	2.20	1.00	0.03%	0.002	0.34	0.079	0.765	0.23%	0.0004
20.833	9.66	538	1.9E-03	5.5E+02	3.1E-04	0	0.236	8037	0.10%	2.20	1.00	0.03%	0.002	0.34	0.079	0.765	0.24%	0.0004
20.997	9.71	538	1.8E-03	5.3E+02	3.3E-04	10	0.236	6342	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.09%	0.0034
21.161	9.76	538	1.8E-03	5.3E+02	3.3E-04	10	0.236	6327	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.12%	0.0035
21.325	9.81	538	1.8E-03	5.3E+02	3.3E-04	10	0.237	6313	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.14%	0.0035
21.489	9.86	538	1.8E-03	5.3E+02	3.3E-04	10	0.237	6299	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.16%	0.0036
21.653	9.91	538	1.8E-03	5.3E+02	3.4E-04	10	0.237	6285	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.19%	0.0036
21.817	9.96	538	1.8E-03	5.3E+02	3.4E-04	10	0.238	6272	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.21%	0.0036
21.981	10.01	538	1.8E-03	5.3E+02	3.4E-04	10	0.238	6258	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.23%	0.0037
22.145	10.06	538	1.8E-03	5.3E+02	3.4E-04	10	0.238	6244	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.26%	0.0037
22.309	10.11	538	1.8E-03	5.3E+02	3.4E-04	10	0.238	6231	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.28%	0.0037
22.473	10.16	538	1.8E-03	5.3E+02	3.4E-04	10	0.239	6218	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.30%	0.0038
22.638	10.21	538	1.8E-03	5.3E+02	3.5E-04	10	0.239	6204	0.09%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.33%	0.0038
22.802	10.26	538	1.8E-03	5.3E+02	3.5E-04	10	0.239	6191	0.09%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.35%	0.0039
22.966	10.31	538	1.8E-03	5.3E+02	3.5E-04	10	0.240	6178	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.38%	0.0039
23.130	10.36	538	1.8E-03	5.3E+02	3.5E-04	10	0.240	6165	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.40%	0.0039
23.294	10.41	538	1.8E-03	5.3E+02	3.5E-04	10	0.240	6152	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.42%	0.0040
23.458	10.46	538	1.9E-03	5.5E+02	3.4E-04	0	0.240	7765	0.12%	2.20	1.00	0.03%	0.002	0.34	0.079	0.765	0.31%	0.0005
23.622	10.51	538	1.9E-03	5.5E+02	3.4E-04	0	0.241	7749	0.12%	2.20	1.00	0.03%	0.002	0.34	0.079	0.765	0.31%	0.0005
23.786	10.56	538	1.9E-03	5.5E+02	3.5E-04	0	0.241	7732	0.12%	2.20	1.00	0.03%	0.002	0.34	0.079	0.765	0.32%	0.0005
32.490	13.21	594	1.9E-03	6.8E+02	3.6E-04	0	0.254	7027	0.12%	5.00	1.00	0.03%	0.005	0.34	0.079	0.765	0.70%	0.0607

Extra layer added to analyze seismic settlement of tailings below the bottom of CPT investigation.

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-4N

Data File: 13-52106_SP3-4N-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Dat

- Tailings Sands
- Tailings Sand-Slimes
- Tailings Slimes
- Interim Cover
- Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Description
5606.00	Water surface elevation during CPT investigation (ft
5600.42	Water surface elevation at t_0 (ft amsl)
5583.71	Water surface elevation at t_1 (ft amsl)
5578.71	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Eart
7.51	Equiv. Number of Uniform Strain Cycles, N
5608.70	Ground Surface Elevation at time of CPT (ft amsl)
5623.35	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pl
3.50	Thickness of Water Storage/Rooting Zone (ft)
3.50	Thickness of High Compaction Layer (ft)
7.15	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1565.99	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5578.71	Elevation of bottom of tailings (liner) (ft amsl)

2013 CPT Data from ConeTec

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)
0.164	5608.54	29.3	0.127	29.3	1.0	0.44	0.43%	Interim Cover
0.328	5608.37	57.0	0.266	57.0	1.3	0.55	0.47%	Interim Cover
0.492	5608.21	65.8	0.294	65.8	3.7	1.58	0.45%	Interim Cover
0.656	5608.04	65.5	0.343	65.4	1.6	0.71	0.52%	Interim Cover
0.820	5607.88	64.9	0.350	64.9	2.1	0.89	0.54%	Interim Cover
0.984	5607.72	63.6	0.317	63.6	-0.1	-0.04	0.50%	Interim Cover
1.148	5607.55	65.1	0.361	65.1	0.3	0.12	0.55%	Interim Cover
1.312	5607.39	54.3	0.552	54.3	0.6	0.24	1.02%	Interim Cover
1.476	5607.22	52.5	0.448	52.5	1.4	0.61	0.85%	Interim Cover
1.640	5607.06	62.6	0.320	62.6	0.2	0.10	0.51%	Interim Cover
1.804	5606.90	50.3	0.452	50.3	0.5	0.20	0.90%	Interim Cover
1.968	5606.73	47.8	0.549	47.8	1.6	0.68	1.15%	Interim Cover
2.133	5606.57	63.2	0.574	63.2	4.1	1.77	0.91%	Interim Cover
2.297	5606.40	106.2	0.582	106.2	6.9	2.99	0.55%	Interim Cover
2.461	5606.24	97.4	0.552	97.4	1.7	0.72	0.57%	Interim Cover
2.625	5606.08	86.1	0.510	86.1	0.3	0.11	0.59%	Interim Cover
2.789	5605.91	76.9	0.485	76.9	0.2	0.09	0.63%	Interim Cover
2.953	5605.75	71.5	0.471	71.5	0.3	0.11	0.66%	Interim Cover
3.117	5605.58	59.8	0.416	59.8	-0.4	-0.18	0.70%	Interim Cover
3.281	5605.42	51.6	0.323	51.6	-0.5	-0.22	0.63%	Sand Tailings
3.445	5605.26	44.7	0.266	44.7	-0.6	-0.26	0.60%	Sand Tailings
3.609	5605.09	39.4	0.205	39.4	-0.5	-0.22	0.52%	Sand Tailings
3.773	5604.93	37.6	0.191	37.6	-0.5	-0.22	0.51%	Sand Tailings
3.937	5604.76	39.1	0.168	39.1	1.0	0.43	0.43%	Sand Tailings
4.101	5604.60	40.3	0.180	40.4	-0.4	-0.16	0.45%	Sand Tailings
4.265	5604.43	39.7	0.206	39.7	0.2	0.07	0.52%	Sand Tailings
4.429	5604.27	38.6	0.225	38.6	0.9	0.39	0.58%	Sand Tailings
4.593	5604.11	38.4	0.229	38.4	1.2	0.52	0.60%	Sand Tailings
4.757	5603.94	38.8	0.235	38.8	1.1	0.48	0.61%	Sand Tailings
4.921	5603.78	37.7	0.214	37.7	1.2	0.54	0.57%	Sand Tailings
5.085	5603.61	35.6	0.246	35.6	1.2	0.52	0.69%	Sand Tailings
5.249	5603.45	30.5	0.236	30.5	0.3	0.13	0.77%	Sand-Slime Tailing
5.413	5603.29	27.1	0.216	27.1	1.1	0.48	0.80%	Sand-Slime Tailing
5.577	5603.12	26.7	0.176	26.7	1.6	0.68	0.66%	Sand-Slime Tailing
5.741	5602.96	25.2	0.169	25.2	1.8	0.76	0.67%	Sand-Slime Tailing
5.905	5602.79	22.4	0.156	22.3	1.8	0.78	0.70%	Sand-Slime Tailing
6.069	5602.63	20.9	0.135	20.9	2.6	1.11	0.64%	Sand-Slime Tailing
6.234	5602.47	20.2	0.127	20.2	2.1	0.93	0.63%	Sand-Slime Tailing
6.398	5602.30	20.6	0.117	20.6	2.6	1.13	0.57%	Sand-Slime Tailing
6.562	5602.14	22.3	0.113	22.3	2.7	1.16	0.51%	Sand-Slime Tailing
6.726	5601.97	22.1	0.120	22.1	2.6	1.14	0.54%	Sand-Slime Tailing
6.890	5601.81	21.1	0.125	21.1	3.5	1.52	0.59%	Sand-Slime Tailing
7.054	5601.65	19.4	0.130	19.3	4.1	1.77	0.67%	Sand-Slime Tailing
7.218	5601.48	18.3	0.128	18.3	4.2	1.81	0.70%	Sand-Slime Tailing
7.382	5601.32	17.3	0.127	17.3	4.7	2.05	0.73%	Sand-Slime Tailing
7.546	5601.15	16.0	0.118	16.0	4.7	2.05	0.74%	Sand-Slime Tailing
7.710	5600.99	15.9	0.100	15.8	4.8	2.10	0.63%	Sand-Slime Tailing
7.874	5600.83	14.1	0.079	14.0	5.5	2.40	0.56%	Sand-Slime Tailing
8.038	5600.66	12.3	0.079	12.3	7.0	3.05	0.64%	Sand-Slime Tailing
8.202	5600.50	10.1	0.079	10.1	7.8	3.40	0.78%	Sand-Slime Tailing
8.366	5600.33	10.5	0.074	10.5	7.9	3.42	0.70%	Sand-Slime Tailing
8.530	5600.17	11.2	0.094	11.1	7.1	3.07	0.84%	Sand-Slime Tailing
8.694	5600.01	9.4	0.107	9.4	7.9	3.44	1.13%	Sand-Slime Tailing
8.858	5599.84	8.8	0.081	8.7	12.4	5.35	0.92%	Sand-Slime Tailing
9.022	5599.68	11.1	0.076	11.1	5.6	2.43	0.68%	Sand-Slime Tailing
9.186	5599.51	9.6	0.061	9.6	2.1	0.91	0.63%	Sand-Slime Tailing
9.350	5599.35	12.2	0.050	12.2	2.4	1.04	0.41%	Sand-Slime Tailing
9.514	5599.19	10.4	0.053	10.4	2.6	1.12	0.51%	Sand-Slime Tailing
9.678	5599.02	8.2	0.072	8.2	6.3	2.75	0.87%	Sand-Slime Tailing
9.842	5598.86	6.7	0.056	6.7	7.3	3.18	0.83%	Slime Tailings
10.006	5598.69	5.1	0.106	5.0	9.4	4.07	2.09%	Slime Tailings
10.170	5598.53	3.9	0.092	3.9	4.9	2.13	2.36%	Slime Tailings
10.335	5598.37	5.5	0.171	5.5	6.9	2.99	3.11%	Slime Tailings
10.499	5598.20	10.4	0.222	10.4	3.4	1.48	2.14%	Slime Tailings
10.663	5598.04	4.3	0.241	4.2	13.2	5.72	5.67%	Slime Tailings
10.827	5597.87	5.7	0.239	5.6	23.2	10.07	4.17%	Slime Tailings
10.991	5597.71	11.2	0.225	11.1	15.4	6.69	2.01%	Slime Tailings
11.155	5597.55	3.0	0.253	2.9	12.9	5.59	8.49%	Slime Tailings
11.319	5597.38	2.8	0.251	2.7	7.9	3.44	9.10%	Slime Tailings
11.483	5597.22	12.0	0.174	12.0	3.9	1.69	1.45%	Sand-Slime Tailing
11.647	5597.05	28.9	0.523	28.8	10.2	4.41	1.81%	Sand-Slime Tailing
11.811	5596.89	85.4	0.752	85.2	32.0	13.87	0.88%	Sand Tailings
11.975	5596.73	141.3	0.619	140.6	118.3	51.27	0.44%	Sand Tailings
12.139	5596.56	153.1	1.039	152.7	76.3	33.05	0.68%	Sand Tailings
12.303	5596.40	126.4	0.970	126.3	17.7	7.67	0.77%	Sand Tailings
12.467	5596.23	12.1	0.808	12.0	22.2	9.64	6.66%	Slime Tailings
12.631	5596.07	18.2	0.402	18.1	12.5	5.41	2.21%	Sand-Slime Tailing
12.795	5595.90	26.5	0.286	26.5	1.9	0.81	1.08%	Sand-Slime Tailing
12.959	5595.74	36.4	0.258	36.4	1.4	0.59	0.71%	Sand Tailings
13.123	5595.58	11.0	0.376	10.9	16.2	7.02	3.43%	Slime Tailings
13.287	5595.41	24.7	0.375	24.6	16.4	7.12	1.52%	Sand-Slime Tailing
13.451	5595.25	8.9	0.177	8.8	15.2	6.59	1.99%	Slime Tailings
13.615	5595.08	3.6	0.140	3.4	36.3	15.72	3.88%	Slime Tailings
13.779	5594.92	4.3	0.102	4.0	46.1	19.97	2.37%	Slime Tailings
13.943	5594.76	4.7	0.064	4.4	49.6	21.48	1.35%	Slime Tailings
14.107	5594.59	5.1	0.026	4.8	50.7	21.98	0.51%	Slime Tailings
14.271	5594.43	9.8	0.045	9.6	29.9	12.96	0.46%	Sand-Slime Tailing
14.436	5594.26	8.9	0.082	8.9	8.8	3.82	0.92%	Sand-Slime Tailing
14.600	5594.10	6.1	0.065	6.0	10.0	4.33	1.07%	Slime Tailings
14.764	5593.94	6.3	0.071	6.2	13.9	6.00	1.13%	Slime Tailings
14.928	5593.77	9.5	0.050	9.4	12.9	5.57	0.53%	Sand-Slime Tailing
15.092	5593.61	8.2	0.031	8.1	11.9	5.14	0.38%	Sand-Slime Tailing
15.256	5593.44	12.5	0.026	12.4	11.9	5.14	0.21%	Sand-Slime Tailing
15.420	5593.28	13.4	0.032	13.4	10.3	4.47	0.24%	Sand-Slime Tailing
15.584	5593.12	13.2	0.032	13.1	11.4	4.95	0.24%	Sand-Slime Tailing
15.748	5592.95	12.9	0.034	12.9	12.5	5.42	0.26%	Sand-Slime Tailing
15.912	5592.79	13.3	0.033	13.2	12.9	5.61	0.25%	Sand-Slime Tailing
16.076	5592.62	12.7	0.033	12.6	12.9	5.58	0.26%	Sand-Slime Tailing
16.240	5592.46	12.7	0.036	12.6	13.1	5.68	0.28%	Sand-Slime Tailing
16.404	5592.30	13.4	0.038	13.3	13.6	5.91	0.28%	Sand-Slime Tailing
16.568	5592.13	14.1	0.045	14.0	13.7	5.93	0.32%	Sand-Slime Tailing
16.732	5591.97	13.5	0.052	13.4	13.7	5.93	0.39%	Sand-Slime Tailing
16.896	5591.80	13.5	0.050	13.5	14.1	6.13	0.37%	Sand-Slime Tailing
17.060	5591.64	14.2	0.052	14.1	14.4	6.25	0.37%	Sand-Slime Tailing
17.224	5591.48	15.7	0.057	15.6	14.5	6.26	0.36%	Sand-Slime Tailing

CPT Data Interpretations

Conditions at t_1

Liquefaction Triggering Analyses

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.623

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-4N

Data File: 13-52106_SP3-4N-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Dat

Legend:
- Tailings Sands
- Tailings Sand-Slimes
- Tailings Slimes
- Interim Cover
- Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69

Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

5606.00	Water surface elevation during CPT investigation (ft
5600.42	Water surface elevation at t_0 (ft amsl)
5583.71	Water surface elevation at t_1 (ft amsl)
5578.71	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Eart
7.51	Equiv. Number of Uniform Strain Cycles, N

5608.70	Ground Surface Elevation at time of CPT (ft amsl)
5623.35	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pla
3.50	Thickness of Water Storage/Rooting Zone (ft)
3.50	Thickness of High Compaction Layer (ft)
7.15	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1565.99	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5578.71	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer	Total Stress at Midpoint of Layer	Equil Pore Pressure at Bottom of Layer	Equil Pore Pressure at Midpoint of Layer (tsf)	Effective Stress at Bottom of Layer	Effective Stress at Midpoint of Layer	Midpoint Depth at t_1, z_1	Shear Wave Velocity, V_s	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
Erosion Protection Layer	######	5623.1	5622.85	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014	0.08	508	1.7E-03	4.4E+02	3.0E-06	11	0.068	46696	0.00%	1.20	0.80	0.04%	0.000	0.32	0.133	0.778	0.00%	0.0000
Water Storage/Rooting Zone Layer	######	5621.1	5619.35	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121	0.69	508	1.7E-03	4.3E+02	2.8E-05	11	0.118	18930	0.00%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
High Compaction Layer	######	5617.6	5615.85	3.50	0.060	120	0.424	0.320	0.00	0.00	0.424	0.320	1.75	508	1.9E-03	4.8E+02	6.5E-05	11	0.152	12657	0.01%	0.65	0.75	0.02%	0.000	0.34	0.079	0.765	0.00%	0.0000
Platform/Random Fill Layer	######	5612.28	5608.70	7.15	0.050	101	0.784	0.604	0.00	0.00	0.784	0.604	3.38	508	1.6E-03	4.0E+02	1.5E-04	11	0.178	9715	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000

2013 CPT Data from ConeTec / Material Type / CPT Data Interpretations

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of CPT (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No
17.388	5591.31	16.7	0.068	16.6	14.7	6.37	0.41%	Sand-Slime Tailin	0.059	119.0	1.00	0.46	0.54	1
17.552	5591.15	17.4	0.079	17.3	15.0	6.49	0.45%	Sand-Slime Tailin	0.059	119.0	1.01	0.46	0.55	1
17.716	5590.98	17.4	0.085	17.3	15.1	6.52	0.49%	Sand-Slime Tailin	0.059	119.0	1.02	0.47	0.55	1
17.880	5590.82	16.7	0.082	16.7	15.2	6.57	0.49%	Sand-Slime Tailin	0.059	119.0	1.03	0.47	0.56	1
18.044	5590.66	15.6	0.083	15.5	15.5	6.70	0.53%	Sand-Slime Tailin	0.059	119.0	1.04	0.48	0.56	1
18.208	5590.49	15.5	0.082	15.4	15.8	6.83	0.53%	Sand-Slime Tailin	0.059	119.0	1.05	0.48	0.57	1
18.372	5590.33	15.5	0.076	15.4	15.9	6.89	0.49%	Sand-Slime Tailin	0.059	119.0	1.06	0.49	0.57	1
18.537	5590.16	15.0	0.075	14.9	15.9	6.90	0.50%	Sand-Slime Tailin	0.059	119.0	1.07	0.49	0.58	1
18.701	5590.00	14.3	0.060	14.2	15.9	6.90	0.42%	Sand-Slime Tailin	0.059	119.0	1.08	0.50	0.58	1
18.865	5589.84	14.4	0.060	14.3	15.9	6.90	0.42%	Sand-Slime Tailin	0.059	119.0	1.09	0.50	0.59	1
19.029	5589.67	13.4	0.061	13.3	15.9	6.87	0.46%	Sand-Slime Tailin	0.059	119.0	1.10	0.51	0.59	1
19.193	5589.51	13.3	0.066	13.2	16.5	7.15	0.50%	Sand-Slime Tailin	0.059	119.0	1.11	0.51	0.60	1
19.357	5589.34	13.3	0.073	13.2	16.6	7.18	0.55%	Sand-Slime Tailin	0.059	119.0	1.12	0.52	0.60	1
19.521	5589.18	13.2	0.076	13.1	16.9	7.33	0.58%	Sand-Slime Tailin	0.059	119.0	1.13	0.52	0.61	1
19.685	5589.02	13.3	0.078	13.2	17.3	7.51	0.59%	Sand-Slime Tailin	0.059	119.0	1.14	0.53	0.61	1
19.849	5588.85	14.4	0.075	14.3	17.5	7.57	0.52%	Sand-Slime Tailin	0.059	119.0	1.15	0.54	0.61	1
20.013	5588.69	17.2	0.080	17.1	18.1	7.83	0.47%	Sand-Slime Tailin	0.059	119.0	1.16	0.54	0.62	1
20.177	5588.52	20.3	0.100	20.2	18.0	7.79	0.49%	Sand-Slime Tailin	0.059	119.0	1.17	0.55	0.62	1
20.341	5588.36	21.7	0.131	21.6	18.0	7.79	0.60%	Sand-Slime Tailin	0.059	119.0	1.18	0.55	0.63	1
20.505	5588.20	22.7	0.153	22.6	18.4	7.99	0.67%	Sand-Slime Tailin	0.059	119.0	1.19	0.56	0.63	1
20.669	5588.03	23.1	0.172	23.0	18.7	8.09	0.74%	Sand-Slime Tailin	0.059	119.0	1.20	0.56	0.64	1
20.833	5587.87	23.6	0.180	23.5	18.7	8.09	0.76%	Sand-Slime Tailin	0.059	119.0	1.21	0.57	0.64	1
20.997	5587.70	23.1	0.180	23.0	18.8	8.16	0.78%	Sand-Slime Tailin	0.059	119.0	1.22	0.57	0.65	1
21.161	5587.54	23.7	0.180	23.6	19.2	8.33	0.76%	Sand-Slime Tailin	0.059	119.0	1.23	0.58	0.65	1
29.990	5578.71							Sand-Slime Tailin	0.059	119.0				

CPT Data Interpretations (continued) / Conditions at t_1

Depth at time of CPT (ft)	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
17.388	1.40	23.276	323.53	27.18	29	0.43%	2.2	47%	1.79	0.00	1.79	0
17.552	1.39	24.051	334.31	28.09	30	0.48%	2.2	47%	1.80	0.00	1.80	0
17.716	1.38	24.003	333.64	28.03	30	0.52%	2.2	47%	1.81	0.00	1.81	0
17.880	1.38	22.974	319.34	26.83	28	0.52%	2.2	47%	1.82	0.00	1.82	0
18.044	1.38	21.358	296.87	24.96	26	0.57%	2.3	47%	1.83	0.00	1.83	0
18.208	1.37	21.066	292.82	24.62	25	0.57%	2.3	47%	1.83	0.00	1.83	0
18.372	1.36	21.021	292.19	24.57	25	0.53%	2.3	47%	1.84	0.00	1.84	0
18.537	1.36	20.261	281.63	23.69	24	0.54%	2.3	47%	1.85	0.00	1.85	0
18.701	1.35	19.251	267.59	22.51	23	0.45%	2.3	47%	1.86	0.00	1.86	0
18.865	1.34	19.229	267.28	22.49	23	0.45%	2.3	47%	1.87	0.00	1.87	0
19.029	1.34	17.843	248.02	20.88	21	0.50%	2.3	47%	1.88	0.00	1.88	0
19.193	1.33	17.561	244.10	20.56	20	0.54%	2.4	47%	1.89	0.00	1.89	0
19.357	1.33	17.469	242.81	20.45	20	0.60%	2.4	47%	1.90	0.00	1.90	0
19.521	1.32	17.192	238.98	20.13	20	0.63%	2.4	47%	1.91	0.00	1.91	0
19.685	1.31	17.260	239.92	20.21	20	0.64%	2.4	47%	1.92	0.00	1.92	0
19.849	1.30	18.534	257.63	21.69	22	0.57%	2.3	47%	1.93	0.00	1.93	0
20.013	1.28	21.877	304.09	25.58	26	0.50%	2.3	47%	1.94	0.00	1.94	0
20.177	1.26	25.566	355.37	29.86	31	0.52%	2.2	47%	1.95	0.00	1.95	0
20.341	1.25	27.037	375.81	31.57	33	0.64%	2.2	47%	1.96	0.00	1.96	0
20.505	1.24	28.112	390.75	32.82	34	0.71%	2.2	47%	1.97	0.00	1.97	0
20.669	1.24	28.492	396.03	33.26	34	0.78%	2.2	47%	1.98	0.00	1.98	0
20.833	1.23	28.892	401.60	33.72	35	0.80%	2.2	47%	1.99	0.00	1.99	0
20.997	1.23	28.155	391.36	32.87	34	0.82%	2.2	47%	2.00	0.00	2.00	0
21.161	1.22	28.695	398.86	33.50	34	0.80%	2.2	47%	2.01	0.00	2.01	0
29.990									2.54	0.02	2.52	1

Liquefaction Triggering Analyses — Idriss & Boulanger (2008)

Depth at time of CPT (ft)	Cyclic Stress Ratio r_d	C_σ	K_σ	K_α	CSR M=7.5, s'v=1atm	Cyclic Resistance Ratio Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS
17.388	0.90	0.06	0.96	1.0	0.050	39.84	67.02	0.096	1.93
17.552	0.90	0.06	0.96	1.0	0.050	40.15	68.24	0.097	1.96
17.716	0.89	0.06	0.96	1.0	0.050	40.13	68.16	0.097	1.97
17.880	0.89	0.06	0.96	1.0	0.049	39.71	66.55	0.095	1.93
18.044	0.89	0.06	0.96	1.0	0.049	39.06	64.02	0.092	1.87
18.208	0.89	0.06	0.96	1.0	0.049	38.94	63.56	0.092	1.86
18.372	0.89	0.06	0.96	1.0	0.049	38.92	63.49	0.092	1.86
18.537	0.89	0.05	0.96	1.0	0.049	38.61	62.30	0.090	1.84
18.701	0.89	0.05	0.96	1.0	0.049	38.20	60.71	0.089	1.80
18.865	0.89	0.05	0.96	1.0	0.049	38.19	60.68	0.089	1.81
19.029	0.88	0.05	0.96	1.0	0.049	37.62	58.50	0.086	1.76
19.193	0.88	0.05	0.96	1.0	0.049	37.51	58.07	0.086	1.75
19.357	0.88	0.05	0.96	1.0	0.049	37.47	57.92	0.086	1.75
19.521	0.88	0.05	0.96	1.0	0.049	37.36	57.49	0.085	1.75
19.685	0.88	0.05	0.96	1.0	0.049	37.39	57.60	0.085	1.75
19.849	0.88	0.05	0.96	1.0	0.049	37.91	59.60	0.087	1.80
20.013	0.88	0.06	0.95	1.0	0.048	39.27	64.85	0.093	1.93
20.177	0.87	0.06	0.95	1.0	0.048	40.77	70.63	0.100	2.09
20.341	0.87	0.06	0.95	1.0	0.048	41.37	72.94	0.103	2.15
20.505	0.87	0.06	0.95	1.0	0.048	41.81	74.63	0.105	2.20
20.669	0.87	0.06	0.95	1.0	0.048	41.97	75.22	0.106	2.22
20.833	0.87	0.06	0.95	1.0	0.048	42.13	75.85	0.107	2.24
20.997	0.87	0.06	0.95	1.0	0.048	41.83	74.70	0.106	2.22
21.161	0.87	0.06	0.95	1.0	0.048	42.05	75.55	0.107	2.24

Liquefaction Triggering Analyses — Youd et al. (2001)

Depth at time of CPT (ft)	Cyclic Stress Ratio r_d	D_r	f	K_σ	K_α	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No
17.388	0.91	0.30	0.80	1.10	1.0	0.037	1.63	44.44	0.087	3.42	2.67	2
17.552	0.91	0.31	0.80	1.09	1.0	0.037	1.65	46.24	0.089	3.45	2.71	2
17.716	0.91	0.31	0.80	1.09	1.0	0.037	1.68	47.14	0.089	3.45	2.71	2
17.880	0.91	0.30	0.80	1.09	1.0	0.037	1.74	46.63	0.089	3.42	2.67	2
18.044	0.91	0.29	0.80	1.09	1.0	0.037	1.88	46.89	0.089	3.40	2.64	2
18.208	0.91	0.29	0.80	1.09	1.0	0.037	1.90	46.75	0.089	3.37	2.62	2
18.372	0.91	0.29	0.80	1.08	1.0	0.037	1.86	45.70	0.088	3.32	2.59	2
18.537	0.90	0.28	0.80	1.08	1.0	0.037	1.93	45.62	0.088	3.29	2.57	2
18.701	0.90	0.27	0.80	1.08	1.0	0.037	1.91	42.96	0.086	3.19	2.50	2
18.865	0.90	0.27	0.80	1.08	1.0	0.037	1.91	42.95	0.086	3.17	2.49	2
19.029	0.90	0.26	0.80	1.08	1.0	0.037	2.08	43.40	0.086	3.16	2.46	2
19.193	0.90	0.26	0.80	1.08	1.0	0.037	2.16	44.45	0.087	3.17	2.46	2
19.357	0.90	0.26	0.80	1.07	1.0	0.037	2.24	45.86	0.088	3.20	2.47	2
19.521	0.90	0.26	0.80	1.07	1.0	0.037	2.31	46.52	0.089	3.20	2.47	2
19.685	0.89	0.26	0.80	1.07	1.0	0.037	2.32	46.87	0.089	3.19	2.47	2
19.849	0.89	0.27	0.80	1.07	1.0	0.037	2.11	45.87	0.088	3.14	2.47	2
20.013	0.89	0.29	0.80	1.07	1.0	0.037	1.81	46.18	0.088	3.13	2.53	2
20.177	0.89	0.32	0.80	1.07	1.0	0.037	1.65	49.26	0.091	3.20	2.64	2
20.341	0.89	0.32	0.80	1.07	1.0	0.037	1.69	53.33	0.094	3.29	2.72	2
20.505	0.89	0.33	0.80	1.06	1.0	0.037	1.71	55.97	0.096	3.35	2.77	2
20.669	0.89	0.33	0.80	1.06	1.0	0.037	1.75	58.12	0.098	3.39	2.81	2
20.833	0.89	0.34	0.80	1.06	1.0	0.037	1.75	58.98	0.099	3.40	2.82	2
20.997	0.88	0.33	0.80	1.06	1.0	0.037	1.79	58.98	0.099	3.38	2.80	2
21.161	0.88	0.33	0.80	1.06	1.0	0.037	1.76	58.94	0.099	3.36	2.80	2

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.623

Depth at time of CPT (ft)	Depth at t_1, z_1 m	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Maximum Shear Strain Modulus, G_{max} tsf	P = γ_{eff}*(G_{eff}/G_{max}) tsf	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
17.388	9.76	500	1.8E-03	4.6E+02	3.8E-04	10	0.235	6362	0.11%	2.00	0.65	0.03%	0.019	0.34	0.079	0.765	2.96%	0.0049
17.552	9.81	500	1.8E-03	4.6E+02	3.8E-04	10	0.236	6348	0.11%	2.00	0.65	0.03%	0.020	0.34	0.079	0.765	2.99%	0.0049
17.716	9.86	500	1.8E-03	4.6E+02	3.8E-04	10	0.236	6334	0.11%	2.00	0.65	0.03%	0.020	0.34	0.079	0.765	3.02%	0.0050
17.880	9.91	500	1.8E-03	4.6E+02	3.8E-04	10	0.236	6319	0.11%	2.00	0.65	0.03%	0.020	0.34	0.079	0.765	3.05%	0.0050
18.044	9.96	500	1.8E-03	4.6E+02	3.9E-04	10	0.237	6305	0.11%	2.00	0.65	0.03%	0.020	0.34	0.079	0.765	3.09%	0.0051
18.208	10.01	500	1.8E-03	4.6E+02	3.9E-04	10	0.237	6291	0.12%	2.00	0.65	0.03%	0.020	0.34	0.079	0.765	3.12%	0.0051
18.372	10.06	500	1.8E-03	4.6E+02	3.9E-04	10	0.237	6278	0.12%	2.00	0.65	0.03%	0.021	0.34	0.079	0.765	3.15%	0.0052
18.537	10.11	500	1.8E-03	4.6E+02	3.9E-04	10	0.238	6264	0.12%	2.00	0.65	0.03%	0.021	0.34	0.079	0.765	3.18%	0.0052
18.701	10.16	500	1.8E-03	4.6E+02	3.9E-04	10	0.238	6250	0.12%	2.00	0.65	0.03%	0.021	0.34	0.079	0.765	3.21%	0.0053
18.865	10.21	500	1.8E-03	4.6E+02	4.0E-04	10	0.238	6237	0.12%	2.00	0.65	0.03%	0.021	0.34	0.079	0.765	3.24%	0.0053
19.029	10.26	500	1.8E-03	4.6E+02	4.0E-04	10	0.239	6223	0.12%	2.00	0.65	0.03%	0.021	0.34	0.079	0.765	3.28%	0.0054
19.193	10.31	500	1.8E-03	4.6E+02	4.0E-04	10	0.239	6210	0.12%	2.00	0.65	0.03%	0.022	0.34	0.079	0.765	3.31%	0.0054
19.357	10.36	500	1.8E-03	4.6E+02	4.0E-04	10	0.239	6197	0.13%	2.00	0.65	0.03%	0.022	0.34	0.079	0.765	3.34%	0.0055
19.521	10.41	500	1.8E-03	4.6E+02	4.0E-04	10	0.240	6184	0.13%	2.00	0.65	0.03%	0.022	0.34	0.079	0.765	3.37%	0.0055
19.685	10.46	538	1.8E-03	5.3E+02	3.5E-04	10	0.240	6171	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.39%	0.0039
19.849	10.51	538	1.8E-03	5.3E+02	3.5E-04	10	0.240	6158	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.41%	0.0040
20.013	10.56	538	1.8E-03	5.3E+02	3.5E-04	10	0.240	6145	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.44%	0.0040
20.177	10.61	538	1.8E-03	5.3E+02	3.6E-04	10	0.241	6132	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.46%	0.0040
20.341	10.66	538	1.8E-03	5.3E+02	3.6E-04	10	0.241	6119	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.48%	0.0041
20.505	10.71	538	1.8E-03	5.3E+02	3.6E-04	10	0.241	6107	0.09%	2.00	0.65	0.03%	0.016	0.34	0.079	0.765	2.51%	0.0041
20.669	10.76	538	1.8E-03	5.3E+02	3.6E-04	10	0.242	6094	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.53%	0.0042
20.833	10.81	538	1.8E-03	5.3E+02	3.6E-04	10	0.242	6082	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.56%	0.0042
20.997	10.86	538	1.8E-03	5.3E+02	3.6E-04	10	0.242	6070	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.58%	0.0042
21.161	10.91	538	1.8E-03	5.3E+02	3.7E-04	10	0.243	6057	0.10%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.61%	0.0043
29.990	13.61	594	1.8E-03	6.5E+02	3.8E-04	10	0.257	5518	0.09%	2.00	0.65	0.03%	0.017	0.34	0.079	0.765	2.54%	0.2245

Extra layer added to analyze seismic settlement of tailings below the bottom of CPT investigation.

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-6N

Data File: 13-52106_SP3-6N-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Tailings Sands
Tailings Sand-Slimes
Tailings Slimes
Interim Cover
Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Description
5604.20	Water surface elevation during CPT investigation (ft amsl)
5599.16	Water surface elevation at t_0 (ft amsl)
5590.44	Water surface elevation at t_1 (ft amsl)
5585.44	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ratio, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earthq
7.51	Equiv. Number of Uniform Strain Cycles, N
5607.44	Ground Surface Elevation at time of CPT (ft amsl)
5623.62	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after plac
3.50	Thickness of Water Storage/Rooting Zone (ft)
3.50	Thickness of High Compaction Layer (ft)
8.68	Thickness of Random/Platform Fill on top of existing interim cover (ft)
1720.10	Additional Stress due to Final Cover Placement, $\Delta\sigma_v$ (psf)
5585.44	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer	Total Stress at Midpoint of Layer	Equil Pore Pressure at Bottom of Layer	Equil Pore Pressure at Midpoint of Layer (tsf)	Effective Stress at Bottom of Layer	Effective Stress at Midpoint of Layer	Midpoint Depth at t_1, z_1	Shear Wave Velocity, V_s	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	P = $\gamma_{eff}(G_{eff}/G_{max})$ (tsf)	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshold Shear Strain, γ_t (%)	Volumetric Strain at 15 Cycles, $\varepsilon_{v,15}$ (%)	R	c	C_N	Volumetric Strain for Design Event, ε_c (%)	Incremental Consolidation (ft)
Erosion Protection Layer	######	5623.37	5623.12	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014	0.08	508	1.7E-03	4.4E+02	3.0E-06	11	0.068	46696	0.00%	1.20	0.80	0.04%	0.000	0.32	0.133	0.778	0.00%	0.0000
Water Storage/Rooting Zone Layer	######	5621.37	5619.62	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121	0.69	508	1.7E-03	4.3E+02	2.8E-05	11	0.118	18930	0.00%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
High Compaction Layer	######	5617.87	5616.12	3.50	0.060	120	0.424	0.320	0.00	0.00	0.424	0.320	1.75	508	1.9E-03	4.8E+02	6.5E-05	11	0.152	12657	0.01%	0.65	0.75	0.02%	0.000	0.34	0.079	0.765	0.00%	0.0000
Platform/Random Fill Layer	######	5611.78	5607.44	8.68	0.050	101	0.861	0.643	0.00	0.00	0.861	0.643	3.61	508	1.6E-03	4.0E+02	1.6E-04	11	0.181	9468	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000

2013 CPT Data from ConeTec / CPT Data Interpretations

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil. Pore Pressure at time of CPT (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Qt	Normalized Friction Ratio, F, (%)	Type Index, Ic	FC %
0.164	5607.28	10.8	0.029	10.8	8.7	3.75	0.27%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0	1.70	18.326	254.73	21.39	1310	0.27%	0.7	51%
0.328	5607.11	17.1	0.110	17.0	4.0	1.74	0.64%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	28.968	402.66	33.69	1032	0.65%	1.1	51%
0.492	5606.95	38.1	0.119	38.1	2.8	1.21	0.31%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	64.804	900.78	75.30	1538	0.31%	0.8	51%
0.656	5606.78	56.7	0.134	56.7	2.8	1.21	0.24%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0	1.70	96.339	1339.11	111.93	1714	0.24%	0.6	51%
0.820	5606.62	78.5	0.600	78.5	2.0	0.88	0.76%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0	1.70	133.399	1854.25	154.96	1899	0.76%	1.1	51%
0.984	5606.46	88.8	0.411	88.8	7.3	3.17	0.46%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0	1.70	150.909	2097.64	175.36	1791	0.46%	0.9	51%
1.148	5606.29	97.1	0.455	97.1	6.7	2.89	0.47%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0	1.70	165.002	2293.53	191.72	1678	0.47%	0.9	51%
1.312	5606.13	120.3	0.621	120.3	5.6	2.42	0.52%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	204.459	2841.98	237.54	1819	0.52%	1.0	51%
1.476	5605.96	117.5	1.100	117.5	6.9	2.99	0.94%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	199.682	2775.58	232.00	1579	0.94%	1.2	51%
1.640	5605.80	118.4	1.817	118.4	11.4	4.95	1.53%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0	1.70	201.212	2796.85	233.84	1433	1.54%	1.4	51%
1.804	5605.64	123.5	2.268	123.4	21.1	9.14	1.84%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0	1.70	209.780	2915.94	243.91	1358	1.84%	1.5	51%
1.968	5605.47	160.8	1.984	160.8	3.6	1.57	1.23%	Interim Cover	0.050	100.7	0.10	0.00	0.10	0	1.70	273.394	3800.18	317.58	1621	1.23%	1.3	51%
2.133	5605.31	176.8	1.510	176.8	2.1	0.90	0.85%	Interim Cover	0.050	100.7	0.11	0.00	0.11	0	1.70	300.577	4178.02	349.13	1645	0.85%	1.2	51%
2.297	5605.14	139.6	1.524	139.6	6.6	2.87	1.09%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	236.977	3293.98	275.32	1206	1.09%	1.3	51%
2.461	5604.98	107.1	1.707	107.0	5.4	2.32	1.59%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	181.951	2529.12	211.39	863	1.60%	1.5	51%
2.625	5604.82	84.4	1.333	84.4	6.6	2.87	1.58%	Interim Cover	0.050	100.7	0.13	0.00	0.13	0	1.70	143.480	1994.37	166.72	638	1.58%	1.6	51%
2.789	5604.65	89.6	1.432	89.6	-4.7	-2.02	1.60%	Interim Cover	0.050	100.7	0.14	0.00	0.14	0	1.70	152.388	2118.19	176.93	637	1.60%	1.6	51%
2.953	5604.49	77.3	1.421	77.3	-4.6	-2.00	1.84%	Interim Cover	0.050	100.7	0.15	0.00	0.15	0	1.70	131.376	1826.13	152.53	518	1.84%	1.7	51%
3.117	5604.32	57.2	1.269	57.2	-3.2	-1.37	2.22%	Interim Cover	0.050	100.7	0.16	0.00	0.16	0	1.70	97.240	1351.64	112.90	363	2.23%	1.8	51%
3.281	5604.16	57.1	1.231	57.1	-3.1	-1.33	2.16%	Sand-Slime Tailings	0.059	119.0	0.17	0.00	0.17	1	1.70	97.019	1348.56	112.64	344	2.16%	1.8	47%
3.445	5604.00	105.1	0.904	105.1	-2.7	-1.16	0.86%	Sand Tailings	0.062	123.5	0.18	0.00	0.18	1	1.68	177.110	2461.83	205.67	616	0.86%	1.3	18%
3.609	5603.83	60.4	0.451	60.5	-1.3	-0.55	0.75%	Sand Tailings	0.062	123.5	0.19	0.00	0.19	1	1.70	102.765	1428.43	119.34	343	0.75%	1.4	18%
3.773	5603.67	36.8	0.568	36.8	-6.9	-2.99	1.55%	Sand-Slime Tailings	0.059	119.0	0.20	0.02	0.18	1	1.70	62.560	869.58	72.57	203	1.55%	1.8	47%
3.937	5603.50	18.3	0.393	18.4	-6.8	-2.95	2.14%	Sand-Slime Tailings	0.059	119.0	0.21	0.02	0.18	1	1.70	31.246	434.32	36.21	98	2.17%	2.1	47%
4.101	5603.34	6.8	0.370	6.8	-1.7	-0.72	5.47%	Slime Tailings	0.057	113.1	0.22	0.03	0.19	1	1.70	11.526	160.21	13.37	35	5.65%	2.8	71%
4.265	5603.17	7.9	0.213	7.9	1.0	0.42	2.69%	Slime Tailings	0.057	113.1	0.23	0.03	0.19	1	1.70	13.481	187.39	15.67	40	2.76%	2.5	71%
4.429	5603.01	9.1	0.198	9.1	0.7	0.29	2.18%	Slime Tailings	0.057	113.1	0.23	0.03	0.20	1	1.70	15.436	214.56	17.94	45	2.24%	2.4	71%
4.593	5602.85	7.9	0.200	7.9	1.4	0.59	2.54%	Slime Tailings	0.057	113.1	0.24	0.04	0.20	1	1.70	13.362	185.73	15.54	38	2.62%	2.5	71%
4.757	5602.68	14.7	0.112	14.6	6.6	2.87	0.76%	Sand-Slime Tailings	0.059	119.0	0.25	0.04	0.21	1	1.70	24.837	345.23	28.93	70	0.78%	2.0	47%
4.921	5602.52	29.5	0.077	29.5	0.6	0.26	0.26%	Sand-Slime Tailings	0.059	119.0	0.26	0.05	0.21	1	1.70	50.201	697.79	58.31	139	0.26%	1.5	47%
5.085	5602.35	24.5	0.105	24.5	-1.1	-0.49	0.43%	Sand-Slime Tailings	0.059	119.0	0.27	0.06	0.22	1	1.70	41.633	578.70	48.34	112	0.43%	1.7	47%
5.249	5602.19	21.8	0.186	21.8	2.1	0.91	0.85%	Sand-Slime Tailings	0.059	119.0	0.28	0.06	0.22	1	1.70	37.094	515.61	43.11	98	0.86%	1.9	47%
5.413	5602.03	13.2	0.258	13.2	3.3	1.43	1.95%	Sand-Slime Tailings	0.059	119.0	0.29	0.07	0.22	1	1.70	22.474	312.39	26.14	58	1.99%	2.3	47%
5.577	5601.86	10.1	0.292	10.0	11.1	4.81	2.89%	Slime Tailings	0.057	113.1	0.30	0.07	0.23	1	1.70	17.068	237.25	19.86	43	2.98%	2.5	71%
5.741	5601.70	8.4	0.248	8.3	11.7	5.07	2.95%	Slime Tailings	0.057	113.1	0.31	0.08	0.23	1	1.70	14.144	196.60	16.57	35	3.07%	2.6	71%
5.905	5601.53	7.3	0.202	7.2	12.6	5.46	2.76%	Slime Tailings	0.057	113.1	0.32	0.08	0.24	1	1.70	12.308	171.08	14.45	30	2.89%	2.6	71%
6.069	5601.37	11.4	0.159	11.3	23.0	9.95	1.40%	Sand-Slime Tailings	0.059	119.0	0.33	0.09	0.24	1	1.70	19.125	265.84	22.50	46	1.44%	2.3	47%
6.234	5601.21	13.4	0.202	13.4	8.1	3.51	1.51%	Sand-Slime Tailings	0.059	119.0	0.34	0.09	0.25	1	1.70	22.712	315.70	26.48	53	1.55%	2.2	47%
6.398	5601.04	17.4	0.135	17.4	8.8	3.83	0.77%	Sand-Slime Tailings	0.059	119.0	0.35	0.10	0.25	1	1.70	29.529	410.45	34.41	68	0.79%	2.0	47%
6.562	5600.88	33.6	0.152	33.5	8.1	3.50	0.45%	Sand Tailings	0.062	123.5	0.36	0.10	0.26	1	1.70	56.967	791.84	66.26	130	0.46%	1.6	18%
6.726	5600.71	25.5	0.167	25.5	1.3	0.57	0.65%	Sand-Slime Tailings	0.059	119.0	0.37	0.11	0.26	1	1.70	43.418	603.51	50.44	97	0.66%	1.8	47%
6.890	5600.55	13.1	0.130	13.1	2.1	0.90	0.99%	Sand-Slime Tailings	0.059	119.0	0.38	0.11	0.27	1	1.70	22.287	309.79	25.91	48	1.02%	2.2	47%
7.054	5600.39	6.0	0.125	5.9	15.6	6.76	2.08%	Slime Tailings	0.057	113.1	0.39	0.12	0.27	1	1.70	10.047	139.65	11.86	21	2.22%	2.7	71%
7.218	5600.22	6.6	0.062	6.4	28.5	12.36	0.94%	Slime Tailings	0.057	113.1	0.40	0.12	0.27	1	1.70	10.914	151.70	13.03	23	1.00%	2.6	71%
7.382	5600.06	19.6	0.120	19.5	19.3	8.36	0.61%	Sand-Slime Tailings	0.059	119.0	0.41	0.13	0.28	1	1.70	33.133	460.55	38.72	69	0.62%	1.9	47%
7.546	5599.89	11.8	0.165	11.8	7.7	3.32	1.40%	Sand-Slime Tailings	0.059	119.0	0.42	0.13	0.28	1	1.70	20.009	278.13	23.33	40	1.45%	2.3	47%
7.710	5599.73	11.2	0.230	11.1	15.6	6.75	2.06%	Slime Tailings	0.057	113.1	0.43	0.14	0.29	1	1.70	18.819	261.58	22.05	37	2.14%	2.5	71%
7.874	5599.57	9.4	0.185	9.3	9.2	4.00	1.98%	Slime Tailings	0.057	113.1	0.44	0.14	0.29	1	1.70	15.810	219.76	18.48	31	2.07%	2.5	71%
8.038	5599.40	7.2	0.119	7.1	13.2	5.73	1.66%	Slime Tailings	0.057	113.1	0.45	0.15	0.30	1	1.70	12.019	167.06	14.12	23	1.77%	2.6	71%
8.202	5599.24	6.0	0.067	5.9	26.0	11.28	1.11%	Slime Tailings	0.057	113.1	0.45	0.15	0.30	1	1.70	9.962	138.47	11.89	19	1.20%	2.6	71%
8.366	5599.07	6.1	0.081	5.9	31.3	13.56	1.34%	Slime Tailings	0.057	113.1	0.46	0.16	0.30	1	1.70	9.962	138.47	11.96	18	1.45%	2.6	71%
8.530	5598.91	13.2	0.065	12.9	48.6	21.04	0.49%	Sand-Slime Tailings	0.059	119.0	0.47	0.17	0.31	1	1.70	21.981	305.54	26.13	41	0.51%	2.1	47%
8.694	5598.75	13.3	0.116	13.3	8.9	3.84	0.87%	Sand-Slime Tailings	0.059	119.0	0.48	0.17	0.31	1	1.70	22.525	313.10	26.27	41	0.90%	2.2	47%
8.858	5598.58	6.7	0.132	6.6	9.6	4.14	1.98%	Slime Tailings	0.057	113.1	0.49	0.18	0.32	1	1.70	11.254	156.43	13.19	20	2.13%	2.7	71%
9.022	5598.42	3.7	0.117	3.6	7.2	3.11	3.20%	Slime Tailings	0.057	113.1	0.50	0.18	0.32	1	1.70	6.137	85.30	7.22	10	3.71%	3.1	71%
9.186	5598.25	2.3	0.054	2.2	18.5	8.01	2.32%	Slime Tailings	0.057	113.1	0.51	0.19	0.33	1	1.70	3.757	52.22	4.59	6	2.98%	3.2	71%
9.350	5598.09	2.4	0.024	2.2	24.5	10.62	1.02%	Slime Tailings	0.057	113.1	0.52	0.19	0.33	1	1.70	3.757	52.22	4.67	6	1.30%	3.0	71%
9.514	5597.93	2.6	0.011	2.4	34.3	14.85	0.42%	Slime Tailings	0.057	113.1	0.53	0.20	0.33	1	1.70	4.080	56.71	5.16	6	0.53%	2.8	71%
9.678	5597.76	2.8	0.016	2.6	37.8	16.39	0.57%	Slime Tailings	0.057	113.1	0.54	0.20	0.34	1	1.70	4.403	61.20	5.58	7	0.70%	2.8	71%
9.842	5597.60	3.2	0.010	2.9	39.6	17.14	0.32%	Slime Tailings	0.057	113.1	0.55	0.21	0.34	1	1.70	4.947	68.76	6.23	8	0.38%	2.7	71%
10.006	5597.43	4.5	0.016	4.3	44.0	19.08	0.35%	Slime Tailings	0.057	113.1	0.56	0.21	0.35	1	1.70	7.225	100.43	8.93	11	0.40%	2.5	71%
10.170	5597.27	22.4	0.010	22.4	7.4	3.19	0.04%	Sand-Slime Tailings	0.059	119.0	0.57	0.22	0.35	1	1.70	37.995	528.13	44.22	62	0.05%	1.7	47%
10.335	5597.11	9.5	0.106	9.4	6.7	2.89	1.12%	Sand-Slime Tailings	0.059	119.0	0.58	0.22	0.36	1	1.70	15.997	222.36	18.66	25	1.19%	2.4	47%
10.499	5596.94	7.7	0.177	7.6	9.0	3.88	2.30%	Slime Tailings	0.057	113.1	0.59	0.23	0.36	1	1.70	12.971	180.30	15.18	20	2.49%	2.7	71%
10.663	5596.78	6.4	0.128	6.3	17.8	7.70	2.00%	Slime Tailings	0.057	113.1	0.60	0.23	0.36	1	1.70	10.693	148.63	12.64	16	2.20%	2.8	71%
10.827	5596.61	4.4	0.090	4.2	34.3	14.84	2.04%	Slime Tailings	0.057	113.1	0.60	0.24	0.37	1	1.70	7.123	99.01	8.70	10	2.37%	2.9	71%
10.991	5596.45	5.0	0.031	4.7	52.3	22.65	0.62%	Slime Tailings	0.057	113.1	0.61	0.24	0.37	1	1.70	7.990	111.06	9.92	12	0.70%	2.6	71%
11.155	5596.29	3.9	0.027	3.6	49.3	21.35	0.70%	Slime Tailings	0.057	113.1	0.62	0.25	0.38	1	1.70	6.052	84.12	7.64	9	0.83%	2.8	71%
11.319	5596.12	3.6	0.014	3.2	58.6	25.37	0.39%	Slime Tailings	0.057	113.1	0.63	0.25	0.38	1	1.70	5.508	76.56	7.12	8	0.47%	2.7	71%
11.483	5595.96	3.7	0.010	3.3	65.7	28.48	0.27%	Slime Tailings	0.057	113.1	0.64	0.26	0.38	1	1.70	5.610	77.98	7.33	8	0.33%	2.7	71%
11.647	5595.79	3.5	0.010	3.1	63.3	27.45	0.29%	Slime Tailings	0.057	113.1	0.65	0.26	0.39	1	1.70	5.270	73.25	6.90	7	0.35%	2.7	71%
11.811	5595.63	3.3	0.010	2.9	65.8	28.52	0.31%	Slime Tailings	0.057	113.1	0.66	0.27	0.39	1	1.70	4.862	67.58	6.46	7	0.38%	2.8	71%
11.975	5595.47	3.0	0.010	2.6	62.5	27.10	0.33%	Slime Tailings	0.057	113.1	0.67	0.27	0.40	1	1.70	4.420	61.44	5.90	6	0.43%	2.8	71%
12.139	5595.30	3.0	0.010	2.6	63.4	27.46	0.33%	Slime Tailings	0.057	113.1	0.68	0.28	0.40	1	1.70	4.420	61.44	5.91	6	0.43%	2.8	71%
12.303	5595.14	3.8	0.019	3.3	76.0	32.92	0.50%	Slime Tailings	0.057	113.1	0.69	0.28	0.41	1	1.70	5.610	77.98	7.45	8	0.62%	2.8	71%
12.467	5594.97	8.7	0.151	8.2	74.0	32.08	1.74%	Slime Tailings	0.057	113.1	0.70	0.29	0.41	1	1.70	13.957	194.00	17.12	19	1.89%	2.6	71%
12.631	5594.81	7.3	0.133	7.1	27.0	11.70	1.82%	Slime Tailings	0.057	113.1	0.71	0.29	0.41	1	1.70	12.121	168.48	14.41	16	2.02%	2.7	71%
12.795	5594.64	3.8	0.056	3.5	42.3	18.33	1.49%	Slime Tailings	0.057	113.1	0.72	0.30	0.42	1	1.70	5.950	82.71	7.43	7	1.84%	3.0	71%
12.959	5594.48	3.5	0.039	3.2	47.7	20.68	1.12%	Slime Tailings	0.057	113.1	0.73	0.30	0.42	1	1.70	5.423	75.38	6.89	7	1.41%	3.0	71%
13.123	5594.32	3.6	0.039	3.3	47.0	20.38	1.08%	Slime Tailings	0.057	113.1	0.73	0.31	0.43	1	1.70	5.627	78.22	7.12	7	1.36%	3.0	71%
13.287	5594.15	3.8	0.053	3.5	53.2	23.07	1.38%	Slime Tailings	0.057	113.1	0.74	0.31	0.43	1	1.70	5.950	82.71	7.57	7	1.72%	3.0	71%
13.451	5593.99	4.6	0.055	4.3	58.0	25.13	1.19%	Slime Tailings	0.057	113.1	0.75	0.32	0.43	1	1.70	7.259	100.90	9.15	9	1.42%	2.9	71%
13.615	5593.82	5.4	0.050	5.1	51.5	22.33	0.92%	Slime Tailings	0.057	113.1	0.76	0.32	0.44	1	1.69	8.639	120.08	10.67	11	1.07%	2.7	71%
13.779	5593.66	4.7	0.059	4.3	53.8	23.30	1.26%	Slime Tailings	0.057	113.1	0.77	0.33	0.44	1	1.68	7.298	101.44	9.13	9	1.51%	2.9	71%
13.943	5593.50	4.5	0.065	4.2	53.8	23.33	1.45%	Slime Tailings	0.057	113.1	0.78	0.33	0.45	1	1.67	6.927	96.29	8.70	8	1.75%	2.9	71%
14.107	5593.33	4.6	0.067	4.3	54.2	23.47	1.45%	Slime Tailings	0.057	113.1	0.79	0.34	0.45	1	1.66	7.093	98.59	8.89	8	1.75%	2.9	71%
14.271	5593.17	4.6	0.064	4.3	55.3	23.95	1.38%	Slime Tailings	0.057	113.1	0.80	0.34	0.46	1	1.65	7.042	97.88	8.84	8	1.67%	2.9	71%
14.436	5593.00	4.7	0.050	4.3	52.5	22.75	1.07%	Slime Tailings	0.057	113.1	0.81	0.35	0.46	1	1.63	7.090	98.55	8.86	8	1.30%	2.9	71%
14.600	5592.84	3.9	0.045	3.6	48.9	21.19	1.14%	Slime Tailings	0.057	113.1	0.82	0.35	0.46	1	1.62	5.905	82.08	7.43	7	1.44%	3.0	71%
14.764	5592.68	3.7	0.025	3.4	47.0	20.37	0.68%	Slime Tailings	0.057	113.1	0.83	0.36	0.47	1	1.61	5.477	76.13	6.91	6	0.87%	2.9	71%
14.928	5592.51	3.7	0.014	3.5	43.2	18.70	0.38%	Slime Tailings	0.057	113.1	0.84	0.36	0.47	1	1.60	5.535	76.94	6.93	6	0.48%	2.8	71%
15.092	5592.35	4.0	0.031	3.7	46.9	20.31	0.77%	Slime Tailings	0.057	113.1	0.85	0.37	0.48	1	1.59	5.911	82.16	7.40	7	0.98%	2.9	71%
15.256	5592.18	6.6	0.057	6.5	28.1	12.19	0.86%	Slime Tailings	0.057	113.1	0.86	0.37	0.48	1	1.58	10.179	141.48	12.14	12	0.99%	2.7	71%
15.420	5592.02	6.4	0.065	6.1	51.6	22.37	1.02%	Slime Tailings	0.057	113.1	0.86	0.38	0.48	1	1.57	9.515	132.25	11.64	11	1.18%	2.7	71%
15.584	5591.86	6.4	0.063	6.0	64.8	28.06	0.98%	Slime Tailings	0.057	113.1	0.87	0.39	0.49	1	1.56	9.358	130.07	11.60	11	1.14%	2.7	71%
15.748	5591.69	6.6	0.049	6.2	68.5	29.69	0.74%	Sand-Slime Tailings	0.059	119.0	0.88	0.39	0.49	1	1.55	9.583	133.20	11.90	12	0.85%	2.7	47%
15.912	5591.53	7.0	0.046	6.5	70.8	30.66	0.66%	Sand-Slime Tailings	0.059	119.0	0.89	0.40	0.50	1	1.53	10.004	139.05	12.41	12	0.76%	2.6	47%
16.076	5591.36	7.2	0.048	6.7	83.5	36.19	0.67%	Sand-Slime Tailings	0.059	119.0	0.90	0.40	0.50	1	1.52	10.129	140.80	12.69	12	0.77%	2.6	47%
16.240	5591.20	7.2	0.050	6.7	88.8	38.47	0.69%	Sand-Slime Tailings	0.059	119.0	0.91	0.41	0.51	1	1.51	10.072	140.00	12.67	12	0.79%	2.6	47%
16.404	5591.04	9.0	0.044	8.4	98.8	42.80	0.49%	Sand-Slime Tailings	0.059	119.0	0.92	0.41	0.51	1	1.50	12.583	174.91	15.69	16	0.54%	2.5	47%
16.568	5590.87	9.0	0.056	8.4	104.5	45.27	0.62%	Sand-Slime Tailings	0.059	119.0	0.93	0.42	0.52	1	1.49	12.495	173.68	15.64	16	0.69%	2.5	47%
16.732	5590.71	8.9	0.052	8.3	94.1	40.78	0.58%	Sand-Slime Tailings	0.059	119.0	0.94	0.42	0.52	1	1.48	12.319	171.23	15.32	15	0.65%	2.5	47%
16.896	5590.54	8.2	0.074	7.6	99.3	43.01	0.90%	Sand-Slime Tailings	0.059	119.0	0.95	0.43	0.53	1	1.47	11.205	155.74	14.07	14	1.02%	2.6	47%
17.060	5590.38	8.3	0.057	7.7	101.1	43.83	0.68%	Sand-Slime Tailings	0.059	119.0	0.96	0.43	0.53	1	1.46	11.230	156.10	14.11	14	0.77%	2.6	47%
17.224	5590.22	8.1	0.045	7.5	92.6	40.14	0.56%	Sand-Slime Tailings	0.059	119.0	0.97	0.44	0.54	1	1.45	10.878	151.21	13.61	13	0.63%	2.6	47%

Conditions at t_1 / Liquefaction Triggering Analyses

Depth at time of CPT (ft)	Total Stress at t_1 (tsf)	Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No	I&B (2008) r_d	I&B C_σ	I&B K_σ	I&B K_α	I&B CSR M=7.5, s'v=1atm	I&B Δq_{c1n}	I&B $q_{c1n\text{-}cs}$	I&B (CRR) M=7.5, s'v=1atm	I&B FoS	Youd (2001) r_d	Youd D_r	Youd f	Youd K_σ	Youd K_α	Youd CSR M=7.5, s'v=1atm	Youd Kc	Youd $q_{c1n\text{-}cs}$	Youd (CRR) M=7.5	Youd FoS	Avg FoS	Liquefiable? 1=Yes 2=No
0.164	0.87	0.00	0.87	0	1.00	0.05	1.00	1.0	0.058	37.83	59.22	0.087	1.51	0.96	0.27	0.80	2.53	1.0	0.017	1.00	21.39	0.068	166.66	84.08	2
0.328	0.88	0.00	0.88	0	1.00	0.06	1.00	1.0	0.058	42.14	75.84	0.107	1.85	0.96	0.34	0.80	2.20	1.0	0.017	1.00	33.69	0.078	95.96	48.91	2
0.492	0.88	0.00	0.88	0	1.00	0.09	1.00	1.0	0.058	56.75	132.05	0.208	3.61	0.96	0.50	0.75	2.43	1.0	0.017	1.00	75.30	0.168	98.14	50.88	2
0.656	0.89	0.00	0.89	0	1.00	0.12	1.00	1.0	0.058	69.60	181.53	0.561	9.75	0.96	0.61	0.69	2.71	1.0	0.016	1.00	111.93	0.210	129.42	69.59	2
0.820	0.90	0.00	0.90	0	1.00	0.17	0.99	1.0	0.057	84.70	239.66	1.000	17.43	0.96	0.72	0.64	2.98	1.0	0.014	1.00	154.96	0.426	209.74	113.58	2
0.984	0.91	0.00	0.91	0	1.00	0.20	0.99	1.0	0.057	91.86	267.22	1.000	17.49	0.96	0.76	0.62	2.98	1.0	0.014	1.00	175.36	1.000	410.39	213.94	2
1.148	0.92	0.00	0.92	0	1.00	0.24	0.98	1.0	0.057	97.60	289.32	1.000	17.57	0.96	0.80	0.60	2.94	1.0	0.014	1.00	191.72	1.000	351.91	184.74	2
1.312	0.93	0.00	0.93	0	1.00	0.30	0.98	1.0	0.057	113.68	351.21	1.000	17.69	0.96	0.89	0.60	2.79	1.0	0.015	1.00	237.54	1.000	308.04	162.86	2
1.476	0.93	0.00	0.93	0	1.00	0.30	0.98	1.0	0.056	111.74	343.74	1.000	17.73	0.96	0.88	0.60	2.66	1.0	0.016	1.00	232.00	1.000	273.92	145.83	2
1.640	0.94	0.00	0.94	0	1.00	0.30	0.97	1.0	0.056	112.38	346.22	1.000	17.78	0.96	0.88	0.60	2.55	1.0	0.017	1.00	233.84	1.000	246.63	132.21	2
1.804	0.95	0.00	0.95	0	1.00	0.30	0.97	1.0	0.056	115.92	359.82	1.000	17.83	0.96	0.90	0.60	2.46	1.0	0.017	1.00	243.91	1.000	224.30	121.06	2
1.968	0.96	0.00	0.96	0	1.00	0.30	0.97	1.0	0.056	141.77	459.34	1.000	17.89	0.96	1.03	0.60	2.37	1.0	0.018	1.00	317.58	1.000	205.69	111.79	2
2.133	0.97	0.00	0.97	0	1.00	0.30	0.97	1.0	0.056	152.84	501.97	1.000	17.96	0.96	1.08	0.60	2.30	1.0	0.018	1.00	349.13	1.000	189.94	103.95	2
2.297	0.98	0.00	0.98	0	1.00	0.30	0.96	1.0	0.056	126.94	402.25	1.000	18.02	0.96	0.96	0.60	2.23	1.0	0.019	1.00	275.32	1.000	176.45	97.23	2
2.461	0.98	0.00	0.98	0	1.00	0.30	0.96	1.0	0.055	104.50	315.90	1.000	18.08	0.96	0.84	0.60	2.17	1.0	0.019	1.00	211.39	1.000	164.75	91.41	2
2.625	0.99	0.00	0.99	0	1.00	0.19	0.97	1.0	0.056	86.83	255.55	1.000	17.84	0.96	0.75	0.63	2.11	1.0	0.021	1.00	166.72	1.000	154.51	86.18	2
2.789	1.00	0.00	1.00	0	0.99	0.21	0.97	1.0	0.056	92.41	269.34	1.000	17.94	0.96	0.77	0.62	2.01	1.0	0.021	1.00	176.93	1.000	145.48	81.71	2
2.953	1.01	0.00	1.01	0	0.99	0.16	0.97	1.0	0.056	83.85	236.38	1.000	17.87	0.96	0.71	0.64	1.87	1.0	0.023	1.01	154.81	0.425	58.42	38.14	2
3.117	1.02	0.00	1.02	0	0.99	0.12	0.98	1.0	0.056	69.81	182.45	0.585	10.40	0.96	0.61	0.69	1.69	1.0	0.025	1.12	125.96	0.266	34.64	22.52	2
3.281	1.03	0.00	1.03	0	0.99	0.12	0.98	1.0	0.056	69.81	182.45	0.578	10.29	0.96	0.61	0.69	1.66	1.0	0.025	1.12	125.82	0.265	32.80	21.54	2
3.445	1.04	0.00	1.04	0	0.99	0.28	0.95	1.0	0.054	74.67	280.34	1.000	18.41	0.95	0.83	0.60	1.91	1.0	0.022	1.00	205.67	1.000	120.06	69.23	2
3.609	1.05	0.00	1.05	0	0.99	0.12	0.98	1.0	0.056	52.60	171.94	0.428	7.66	0.95	0.63	0.68	1.65	1.0	0.026	1.00	119.34	0.238	27.78	17.72	2
3.773	1.06	0.00	1.06	0	0.99	0.09	0.98	1.0	0.056	55.75	128.33	0.199	3.54	0.95	0.49	0.75	1.47	1.0	0.029	1.13	81.86	0.131	14.90	9.22	2
3.937	1.07	0.00	1.07	0	0.99	0.06	0.99	1.0	0.056	43.00	79.21	0.112	1.98	0.95	0.35	0.80	1.36	1.0	0.031	1.54	55.93	0.096	10.68	6.33	2
4.101	1.08	0.00	1.08	0	0.99	0.05	0.99	1.0	0.056	34.74	48.11	0.076	1.34	0.95	0.21	0.80	1.35	1.0	0.031	4.45	59.42	0.100	10.80	6.07	2
4.265	1.09	0.00	1.09	0	0.99	0.05	0.99	1.0	0.056	35.54	51.21	0.079	1.40	0.95	0.23	0.80	1.35	1.0	0.031	2.77	43.40	0.086	9.15	5.27	2
4.429	1.09	0.00	1.09	0	0.99	0.05	0.99	1.0	0.056	36.33	54.27	0.082	1.45	0.95	0.24	0.80	1.34	1.0	0.031	2.32	41.62	0.085	8.81	5.13	2
4.593	1.10	0.00	1.10	0	0.98	0.05	0.99	1.0	0.056	35.50	51.03	0.078	1.40	0.95	0.23	0.80	1.34	1.0	0.031	2.78	43.24	0.086	8.77	5.08	2
4.757	1.11	0.00	1.11	0	0.98	0.06	0.99	1.0	0.056	40.45	69.38	0.099	1.76	0.95	0.31	0.80	1.33	1.0	0.032	1.26	36.49	0.080	8.01	4.89	2
4.921	1.12	0.00	1.12	0	0.98	0.08	0.98	1.0	0.056	50.75	109.07	0.158	2.84	0.95	0.44	0.78	1.36	1.0	0.031	1.00	58.31	0.098	9.60	6.22	2
5.085	1.13	0.00	1.13	0	0.98	0.07	0.98	1.0	0.056	47.26	95.60	0.135	2.43	0.95	0.40	0.80	1.32	1.0	0.032	1.01	48.77	0.091	8.65	5.54	2
5.249	1.14	0.00	1.14	0	0.98	0.07	0.98	1.0	0.056	45.42	88.53	0.125	2.24	0.95	0.38	0.80	1.31	1.0	0.032	1.09	46.77	0.089	8.59	5.41	2
5.413	1.15	0.00	1.15	0	0.98	0.06	0.98	1.0	0.056	39.47	65.61	0.094	1.69	0.95	0.30	0.80	1.31	1.0	0.032	1.91	49.87	0.092	8.38	5.04	2
5.577	1.16	0.00	1.16	0	0.98	0.05	0.98	1.0	0.056	37.04	57.00	0.085	1.52	0.95	0.26	0.80	1.30	1.0	0.032	2.76	55.19	0.096	8.60	5.06	2
5.741	1.17	0.00	1.17	0	0.98	0.05	0.98	1.0	0.056	35.86	52.43	0.080	1.43	0.95	0.24	0.80	1.30	1.0	0.032	3.18	52.77	0.094	8.28	4.86	2
5.905	1.18	0.00	1.18	0	0.98	0.05	0.98	1.0	0.056	35.12	49.57	0.077	1.39	0.95	0.22	0.80	1.29	1.0	0.032	3.40	49.16	0.091	7.90	4.64	2
6.069	1.19	0.00	1.19	0	0.98	0.05	0.98	1.0	0.056	38.19	60.69	0.089	1.60	0.95	0.27	0.80	1.29	1.0	0.032	1.87	42.03	0.085	7.24	4.42	2
6.234	1.20	0.00	1.20	0	0.98	0.06	0.98	1.0	0.055	39.59	66.07	0.095	1.71	0.95	0.30	0.80	1.28	1.0	0.033	1.78	47.10	0.089	7.46	4.59	2
6.398	1.21	0.00	1.21	0	0.97	0.06	0.98	1.0	0.055	42.37	76.77	0.108	1.96	0.95	0.34	0.80	1.28	1.0	0.033	1.28	43.97	0.087	7.11	4.54	2
6.562	1.22	0.00	1.22	0	0.97	0.08	0.97	1.0	0.055	39.03	105.29	0.151	2.77	0.95	0.47	0.77	1.33	1.0	0.033	1.00	66.26	0.107	8.62	5.70	2
6.726	1.23	0.00	1.23	0	0.97	0.07	0.97	1.0	0.055	47.99	98.44	0.140	2.56	0.95	0.41	0.79	1.28	1.0	0.033	1.12	56.34	0.097	7.65	5.10	2
6.890	1.24	0.00	1.24	0	0.97	0.06	0.98	1.0	0.055	39.39	65.30	0.094	1.71	0.95	0.29	0.80	1.27	1.0	0.033	1.60	41.35	0.084	6.57	4.14	2
7.054	1.25	0.00	1.25	0	0.97	0.05	0.98	1.0	0.055	34.22	46.08	0.074	1.34	0.95	0.20	0.80	1.26	1.0	0.033	3.72	44.16	0.087	6.65	3.99	2
7.218	1.26	0.00	1.26	0	0.97	0.05	0.98	1.0	0.055	34.62	47.65	0.075	1.37	0.95	0.21	0.80	1.26	1.0	0.033	2.49	32.43	0.077	5.81	3.59	2
7.382	1.27	0.00	1.27	0	0.97	0.06	0.98	1.0	0.055	43.88	82.60	0.116	2.13	0.95	0.36	0.80	1.25	1.0	0.033	1.21	46.84	0.089	6.61	4.37	2
7.546	1.28	0.00	1.28	0	0.97	0.05	0.98	1.0	0.055	38.48	61.82	0.090	1.64	0.94	0.28	0.80	1.25	1.0	0.033	2.02	47.02	0.089	6.52	4.08	2
7.710	1.29	0.00	1.29	0	0.97	0.05	0.98	1.0	0.055	37.77	59.82	0.088	1.60	0.94	0.27	0.80	1.25	1.0	0.033	2.53	55.75	0.096	6.92	4.26	2
7.874	1.30	0.00	1.30	0	0.96	0.05	0.98	1.0	0.055	36.52	55.00	0.082	1.51	0.94	0.25	0.80	1.24	1.0	0.034	2.82	52.03	0.093	6.61	4.06	2
8.038	1.31	0.00	1.31	0	0.96	0.05	0.98	1.0	0.055	35.01	49.13	0.077	1.40	0.94	0.22	0.80	1.24	1.0	0.034	3.17	44.79	0.087	6.12	3.76	2
8.202	1.31	0.00	1.31	0	0.96	0.05	0.98	1.0	0.055	34.23	46.12	0.074	1.35	0.94	0.20	0.80	1.24	1.0	0.034	3.07	36.49	0.080	5.56	3.46	2
8.366	1.32	0.00	1.32	0	0.96	0.05	0.98	1.0	0.054	34.25	46.21	0.074	1.36	0.94	0.20	0.80	1.23	1.0	0.034	3.34	39.89	0.083	5.68	3.52	2
8.530	1.33	0.00	1.33	0	0.96	0.06	0.98	1.0	0.054	39.47	65.59	0.094	1.74	0.94	0.30	0.80	1.23	1.0	0.034	1.41	36.75	0.081	5.42	3.58	2
8.694	1.34	0.00	1.34	0	0.96	0.06	0.97	1.0	0.054	39.52	65.79	0.094	1.75	0.94	0.30	0.80	1.22	1.0	0.034	1.66	43.71	0.086	5.72	3.74	2
8.858	1.35	0.00	1.35	0	0.96	0.05	0.98	1.0	0.054	34.68	47.87	0.075	1.39	0.94	0.21	0.80	1.22	1.0	0.034	3.81	50.27	0.092	6.00	3.70	2
9.022	1.36	0.00	1.36	0	0.96	0.04	0.98	1.0	0.054	32.60	39.82	0.068	1.26	0.94	0.16	0.80	1.22	1.0	0.034	7.40	53.38	0.094	6.08	3.67	2
9.186	1.37	0.00	1.37	0	0.96	0.04	0.98	1.0	0.054	31.69	36.28	0.066	1.21	0.94	0.12	0.80	1.21	1.0	0.034	9.35	42.94	0.086	5.47	3.34	2
9.350	1.38	0.00	1.38	0	0.96	0.04	0.98	1.0	0.054	31.71	36.38	0.066	1.21	0.94	0.12	0.80	1.21	1.0	0.034	7.11	33.17	0.078	4.89	3.05	2
9.514	1.39	0.00	1.39	0	0.95	0.04	0.98	1.0	0.054	31.88	37.05	0.066	1.23	0.94	0.13	0.80	1.21	1.0	0.034	5.10	26.30	0.072	4.48	2.85	2
9.678	1.40	0.00	1.40	0	0.95	0.04	0.98	1.0	0.054	32.03	37.61	0.067	1.24	0.94	0.14	0.80	1.21	1.0	0.034	5.19	28.96	0.074	4.56	2.90	2
9.842	1.41	0.00	1.41	0	0.95	0.04	0.98	1.0	0.054	32.26	38.49	0.067	1.25	0.94	0.14	0.80	1.20	1.0	0.034	4.07	25.35	0.071	4.32	2.79	2
10.006	1.42	0.00	1.42	0	0.95	0.04	0.98	1.0	0.054	33.20	42.13	0.070	1.31	0.94	0.17	0.80	1.20	1.0	0.035	3.02	27.02	0.073	4.36	2.83	2
10.170	1.43	0.00	1.43	0	0.95	0.07	0.97	1.0	0.053	45.81	90.03	0.127	2.39	0.94	0.38	0.80	1.20	1.0	0.035	1.02	45.30	0.088	5.20	3.80	2
10.335	1.44	0.00	1.44	0	0.95	0.05	0.97	1.0	0.053	36.85	55.51	0.083	1.55	0.94	0.25	0.80	1.19	1.0	0.035	2.51	46.77	0.089	5.21	3.38	2
10.499	1.45	0.00	1.45	0	0.95	0.05	0.97	1.0	0.053	35.37	50.55	0.078	1.46	0.94	0.22	0.80	1.19	1.0	0.035	4.07	61.73	0.102	5.90	3.68	2
10.663	1.46	0.00	1.46	0	0.95	0.05	0.98	1.0	0.053	34.49	47.13	0.075	1.40	0.94	0.21	0.80	1.19	1.0	0.035	4.41	55.68	0.096	5.50	3.45	2
10.827	1.46	0.00	1.46	0	0.95	0.04	0.98	1.0	0.053	33.12	41.81	0.070	1.31	0.94	0.17	0.80	1.19	1.0	0.035	5.98	52.01	0.093	5.27	3.29	2
10.991	1.47	0.00	1.47	0	0.94	0.05	0.98	1.0	0.053	33.54	43.47	0.072	1.34	0.94	0.18	0.80	1.18	1.0	0.035	3.47	34.43	0.079	4.41	2.88	2
11.155	1.48	0.00	1.48	0	0.94	0.04	0.98	1.0	0.053	32.75	40.38	0.069	1.29	0.94	0.16	0.80	1.18	1.0	0.035	4.61	35.20	0.079	4.40	2.85	2
11.319	1.49	0.00	1.49	0	0.94	0.04	0.98	1.0	0.053	32.57	39.69	0.068	1.29	0.94	0.15	0.80	1.18	1.0	0.035	4.20	29.90	0.075	4.11	2.70	2
11.483	1.50	0.00	1.50	0	0.94	0.04	0.98	1.0	0.053	32.64	39.96	0.069	1.29	0.94	0.16	0.80	1.17	1.0	0.035	3.79	27.75	0.073	3.97	2.63	2
11.647	1.51	0.00	1.51	0	0.94	0.04	0.98	1.0	0.053	32.49	39.39	0.068	1.28	0.94	0.15	0.80	1.17	1.0	0.035	4.11	28.39	0.074	3.96	2.62	2
11.811	1.52	0.00	1.52	0	0.94	0.04	0.98	1.0	0.053	32.34	38.79	0.068	1.28	0.93	0.15	0.80	1.17	1.0	0.035	4.51	29.12	0.074	3.95	2.61	2
11.975	1.53	0.00	1.53	0	0.94	0.04	0.98	1.0	0.053	32.14	38.05	0.067	1.27	0.93	0.14	0.80	1.17	1.0	0.035	5.09	30.06	0.075	3.95	2.61	2
12.139	1.54	0.00	1.54	0	0.94	0.04	0.98	1.0	0.053	32.15	38.06	0.067	1.27	0.93	0.14	0.80	1.16	1.0	0.035	5.14	30.39	0.075	3.92	2.60	2
12.303	1.55	0.00	1.55	0	0.94	0.04	0.97	1.0	0.053	32.68	40.13	0.069	1.30	0.93	0.16	0.80	1.16	1.0	0.035	4.60	34.31	0.079	4.05	2.68	2
12.467	1.56	0.00	1.56	0	0.93	0.05	0.97	1.0	0.052	36.05	53.17	0.081	1.54	0.93	0.24	0.80	1.16	1.0	0.035	3.62	61.90	0.102	5.21	3.38	2
12.631	1.57	0.00	1.57	0	0.93	0.05	0.97	1.0	0.052	35.11	49.52	0.077	1.47	0.93	0.22	0.80	1.16	1.0	0.036	4.24	61.11	0.101	5.12	3.30	2
12.795	1.58	0.00	1.58	0	0.93	0.04	0.97	1.0	0.052	32.68	40.11	0.069	1.31	0.93	0.16	0.80	1.16	1.0	0.036	6.74	50.12	0.092	4.60	2.95	2
12.959	1.59	0.00	1.59	0	0.93	0.04	0.97	1.0	0.052	32.49	39.37	0.068	1.30	0.93	0.15	0.80	1.15	1.0	0.036	6.60	45.43	0.088	4.36	2.83	2
13.123	1.59	0.00	1.59	0	0.93	0.04	0.97	1.0	0.052	32.57	39.68	0.068	1.31	0.93	0.15	0.80	1.15	1.0	0.036	6.40	45.53	0.088	4.32	2.82	2
13.287	1.60	0.00	1.60	0	0.93	0.04	0.97	1.0	0.052	32.72	40.29	0.069	1.32	0.93	0.16	0.80	1.15	1.0	0.036	6.65	50.32	0.092	4.47	2.90	2
13.451	1.61	0.00	1.61	0	0.93	0.04	0.97	1.0	0.052	33.27	42.42	0.071	1.36	0.93	0.17	0.80	1.15	1.0	0.036	5.40	49.36	0.091	4.40	2.88	2
13.615	1.62	0.00	1.62	0	0.93	0.05	0.97	1.0	0.052	33.80	44.47	0.072	1.39	0.93	0.19	0.80	1.14	1.0	0.036	4.34	46.27	0.089	4.24	2.81	2
13.779	1.63	0.00	1.63	0	0.92	0.04	0.97	1.0	0.052	33.27	42.40	0.071	1.36	0.93	0.17	0.80	1.14	1.0	0.036	5.57	50.85	0.092	4.37	2.87	2
13.943	1.64	0.00	1.64	0	0.92	0.04	0.97	1.0	0.052	33.12	41.81	0.070	1.35	0.93	0.17	0.80	1.14	1.0	0.036	6.12	53.22	0.094	4.42	2.89	2
14.107	1.65	0.00	1.65	0	0.92	0.04	0.97	1.0	0.052	33.18	42.07	0.070	1.36	0.93	0.17	0.80	1.14	1.0	0.036	6.02	53.54	0.094	4.40	2.88	2
14.271	1.66	0.00	1.66	0	0.92	0.04	0.97	1.0	0.052	33.17	42.00	0.070	1.36	0.93	0.17	0.80	1.14	1.0	0.036	5.96	52.69	0.094	4.33	2.85	2
14.436	1.67	0.00	1.67	0	0.92	0.04	0.97	1.0	0.052	33.17	42.03	0.070	1.36	0.92	0.17	0.80	1.13	1.0	0.036	5.44	48.21	0.090	4.14	2.75	2
14.600	1.68	0.00	1.68	0	0.92	0.04	0.97	1.0	0.052	32.68	40.11	0.069	1.33	0.92	0.16	0.80	1.13	1.0	0.036	6.51	48.41	0.090	4.12	2.73	2
14.764	1.69	0.00	1.69	0	0.92	0.04	0.97	1.0	0.051	32.49	39.40	0.068	1.32	0.92	0.15	0.80	1.13	1.0	0.036	5.93	40.97	0.084	3.81	2.57	2
14.928	1.70	0.00	1.70	0	0.92	0.04	0.97	1.0	0.051	32.50	39.43	0.068	1.33	0.92	0.15	0.80	1.13	1.0	0.036	5.06	35.03	0.079	3.56	2.44	2
15.092	1.71	0.00	1.71	0	0.91	0.04	0.97	1.0	0.051	32.67	40.07	0.069	1.34	0.92	0.16	0.80	1.13	1.0	0.036	5.81	42.99	0.086	3.83	2.58	2
15.256	1.72	0.00	1.72	0	0.91	0.05	0.97	1.0	0.051	34.32	46.46	0.074	1.45	0.92	0.20	0.80	1.12	1.0	0.036	3.86	46.90	0.089	3.94	2.70	2
15.420	1.72	0.00	1.72	0	0.91	0.05	0.97	1.0	0.051	34.14	45.78	0.074	1.44	0.92	0.20	0.80	1.12	1.0	0.036	4.27	49.65	0.091	4.02	2.73	2
15.584	1.73	0.00	1.73	0	0.91	0.05	0.97	1.0	0.051	34.13	45.73	0.074	1.44	0.92	0.20	0.80	1.12	1.0	0.036	4.23	49.10	0.091	3.97	2.71	2
15.748	1.74	0.00	1.74	0	0.91	0.05	0.97	1.0	0.051	34.47	46.37	0.074	1.46	0.91	0.20	0.80	1.12	1.0	0.036	3.75	44.62	0.087	3.77	2.62	2
15.912	1.75	0.00	1.75	0	0.91	0.05	0.97	1.0	0.051	34.65	47.06	0.075	1.47	0.91	0.20	0.80	1.12	1.0	0.036	3.49	43.25	0.086	3.70	2.58	2
16.076	1.76	0.00	1.76	0	0.91	0.05	0.97	1.0	0.051	34.75	47.44	0.075	1.48	0.91	0.21	0.80	1.11	1.0	0.036	3.44	43.65	0.086	3.68	2.58	2
16.240	1.77	0.00	1.77	0	0.91	0.05	0.97	1.0	0.051	34.75	47.42	0.075	1.48	0.91	0.21	0.80	1.11	1.0	0.036	3.49	44.25	0.087	3.67	2.58	2
16.404	1.78	0.00	1.78	0	0.90	0.05	0.96	1.0	0.050	35.80	51.49	0.079	1.57	0.91	0.23	0.80	1.11	1.0	0.036	2.60	40.77	0.084	3.52	2.55	2
16.568	1.79	0.00	1.79	0	0.90	0.05	0.96	1.0	0.050	35.79	51.43	0.079	1.57	0.91	0.23	0.80	1.11	1.0	0.036	2.82	44.05	0.087	3.61	2.59	2
16.732	1.80	0.00	1.80	0	0.90	0.05	0.96	1.0	0.050	35.67	50.99	0.078	1.56	0.91	0.23	0.80	1.11	1.0	0.036	2.81	43.12	0.086	3.55	2.56	2
16.896	1.81	0.00	1.81	0	0.90	0.05	0.96	1.0	0.050	35.24	49.31	0.077	1.53	0.90	0.22	0.80	1.10	1.0	0.036	3.53	49.61	0.091	3.75	2.64	2
17.060	1.82	0.00	1.82	1	0.90	0.05	0.96	1.0	0.050	35.25	49.37	0.077	1.53	0.90	0.22	0.80	1.10	1.0	0.036	3.20	45.13	0.088	3.57	2.55	2
17.224	1.83	0.01	1.82	1	0.90	0.05	0.96	1.0	0.050	35.07	48.68	0.076	1.52	0.90	0.21	0.80	1.10	1.0	0.036	3.09	42.01	0.085	3.43	2.47	2

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.539

Depth at time of CPT (ft)	Depth at t_1, z_1 (m)	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Maximum Shear Modulus, G_{max} (tsf)	P = $\gamma_{eff}(G_{eff}/G_{max})$ (tsf)	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshold Shear Strain, γ_t (%)	Volumetric Strain at 15 Cycles, $\varepsilon_{v,15}$ (%)	R	c	C_N	Volumetric Strain for Design Event, ε_c (%)	Incremental Consolidation (ft)
0.164	4.98	594	1.6E-03	5.5E+02	1.5E-04	11	0.196	8357	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.328	5.03	594	1.6E-03	5.5E+02	1.5E-04	11	0.196	8324	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.492	5.08	594	1.6E-03	5.5E+02	1.5E-04	11	0.197	8291	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.656	5.13	594	1.6E-03	5.5E+02	1.6E-04	11	0.197	8260	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.820	5.18	594	1.6E-03	5.5E+02	1.6E-04	11	0.198	8228	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.984	5.23	594	1.6E-03	5.5E+02	1.6E-04	11	0.198	8197	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.148	5.28	594	1.6E-03	5.5E+02	1.6E-04	11	0.199	8166	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.312	5.33	594	1.6E-03	5.5E+02	1.6E-04	11	0.199	8136	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.476	5.38	594	1.6E-03	5.5E+02	1.7E-04	11	0.199	8106	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.640	5.43	594	1.6E-03	5.5E+02	1.7E-04	11	0.200	8076	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.804	5.48	594	1.6E-03	5.5E+02	1.7E-04	11	0.200	8047	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.968	5.53	594	1.6E-03	5.5E+02	1.7E-04	11	0.201	8018	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.133	5.58	594	1.6E-03	5.5E+02	1.7E-04	11	0.201	7990	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.297	5.63	594	1.6E-03	5.5E+02	1.7E-04	11	0.202	7962	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.461	5.68	594	1.6E-03	5.5E+02	1.7E-04	11	0.202	7934	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.625	5.73	594	1.6E-03	5.5E+02	1.8E-04	11	0.203	7906	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.789	5.78	594	1.6E-03	5.5E+02	1.8E-04	11	0.203	7879	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
2.953	5.83	594	1.6E-03	5.5E+02	1.8E-04	11	0.203	7852	0.03%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
3.117	5.88	495	1.8E-03	4.5E+02	2.6E-04	10	0.204	7826	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.38%	0.0023
3.281	5.93	495	1.8E-03	4.5E+02	2.2E-04	10	0.205	8004	0.04%	2.00	0.65	0.03%	0.005	0.34	0.079	0.765	0.79%	0.0013
3.445	5.98	495	1.9E-03	4.7E+02	2.2E-04	0	0.208	10054	0.05%	2.20	1.00	0.03%	0.005	0.34	0.079	0.765	0.07%	0.0001
3.609	6.03	495	1.9E-03	4.7E+02	2.2E-04	0	0.208	10014	0.05%	2.20	1.00	0.03%	0.005	0.34	0.079	0.765	0.07%	0.0001
3.773	6.08	495	1.8E-03	4.5E+02	2.3E-04	10	0.206	7909	0.04%	2.00	0.65	0.03%	0.006	0.34	0.079	0.765	0.88%	0.0015
3.937	6.13	495	1.8E-03	4.5E+02	2.3E-04	10	0.207	7879	0.04%	2.00	0.65	0.03%	0.006	0.34	0.079	0.765	0.91%	0.0015
4.101	6.18	495	1.8E-03	4.3E+02	2.4E-04	16	0.459	6462	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.35%	0.0022
4.265	6.23	495	1.8E-03	4.3E+02	2.4E-04	16	0.460	6440	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.38%	0.0023
4.429	6.28	495	1.8E-03	4.3E+02	2.5E-04	16	0.460	6417	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.40%	0.0023
4.593	6.33	495	1.8E-03	4.3E+02	2.5E-04	16	0.460	6395	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.43%	0.0024
4.757	6.38	495	1.8E-03	4.5E+02	2.4E-04	10	0.209	7739	0.05%	2.00	0.65	0.03%	0.007	0.34	0.079	0.765	1.06%	0.0017
4.921	6.43	495	1.8E-03	4.5E+02	2.4E-04	10	0.209	7711	0.05%	2.00	0.65	0.03%	0.007	0.34	0.079	0.765	1.09%	0.0018
5.085	6.48	495	1.8E-03	4.5E+02	2.4E-04	10	0.210	7684	0.05%	2.00	0.65	0.03%	0.007	0.34	0.079	0.765	1.12%	0.0018
5.249	6.53	495	1.8E-03	4.5E+02	2.5E-04	10	0.210	7657	0.05%	2.00	0.65	0.03%	0.007	0.34	0.079	0.765	1.15%	0.0019
5.413	6.58	495	1.8E-03	4.5E+02	2.5E-04	10	0.211	7630	0.05%	2.00	0.65	0.03%	0.007	0.34	0.079	0.765	1.17%	0.0019
5.577	6.63	495	1.8E-03	4.3E+02	2.6E-04	16	0.463	6261	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.64%	0.0027
5.741	6.68	495	1.8E-03	4.3E+02	2.6E-04	16	0.463	6241	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.64%	0.0027
5.905	6.73	495	1.8E-03	4.3E+02	2.7E-04	16	0.464	6220	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.67%	0.0027
6.069	6.78	495	1.8E-03	4.5E+02	2.6E-04	10	0.212	7529	0.05%	2.00	0.65	0.03%	0.008	0.34	0.079	0.765	1.29%	0.0021
6.234	6.83	495	1.8E-03	4.5E+02	2.6E-04	10	0.213	7503	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.31%	0.0022
6.398	6.88	495	1.8E-03	4.5E+02	2.6E-04	10	0.213	7478	0.05%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.34%	0.0022
6.562	6.93	495	1.9E-03	4.7E+02	2.5E-04	0	0.216	9406	0.07%	2.20	1.00	0.03%	0.001	0.34	0.079	0.765	0.13%	0.0002
6.726	6.98	495	1.8E-03	4.5E+02	2.6E-04	10	0.214	7428	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.40%	0.0023
6.890	7.03	495	1.8E-03	4.5E+02	2.6E-04	10	0.215	7403	0.06%	2.00	0.65	0.03%	0.009	0.34	0.079	0.765	1.43%	0.0023
7.054	7.08	495	1.8E-03	4.3E+02	2.8E-04	16	0.466	6078	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.88%	0.0031
7.218	7.13	495	1.8E-03	4.3E+02	2.8E-04	16	0.467	6060	0.07%	2.00	0.65	0.03%	0.012	0.34	0.079	0.765	1.90%	0.0031
7.382	7.18	495	1.8E-03	4.5E+02	2.7E-04	10	0.216	7334	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.51%	0.0025
7.546	7.23	495	1.8E-03	4.5E+02	2.8E-04	10	0.216	7311	0.06%	2.00	0.65	0.03%	0.010	0.34	0.079	0.765	1.54%	0.0025
7.710	7.28	495	1.8E-03	4.3E+02	2.9E-04	16	0.468	6004	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	1.99%	0.0033
7.874	7.33	495	1.8E-03	4.3E+02	2.9E-04	16	0.468	5986	0.07%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.02%	0.0033
8.038	7.38	495	1.8E-03	4.3E+02	3.0E-04	16	0.469	5968	0.08%	2.00	0.65	0.03%	0.013	0.34	0.079	0.765	2.05%	0.0034
8.202	7.43	495	1.8E-03	4.3E+02	3.0E-04	16	0.469	5951	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.08%	0.0034
8.366	7.48	495	1.8E-03	4.3E+02	3.0E-04	16	0.470	5934	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.11%	0.0035
8.530	7.53	495	1.8E-03	4.5E+02	2.9E-04	10	0.219	7182	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.71%	0.0028
8.694	7.58	495	1.8E-03	4.5E+02	2.9E-04	10	0.219	7160	0.06%	2.00	0.65	0.03%	0.011	0.34	0.079	0.765	1.73%	0.0028
8.858	7.63	495	1.8E-03	4.3E+02	3.1E-04	16	0.471	5881	0.08%	2.00	0.65	0.03%	0.014	0.34	0.079	0.765	2.19%	0.0036
9.022	7.68	495	1.8E-03	4.3E+02	3.1E-04	16	0.471	5865	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.22%	0.0036
9.186	7.73	495	1.8E-03	4.3E+02	3.1E-04	16	0.471	5849	0.08%	2.00	0.65	0.03%	0.015	0.34	0.079	0.765	2.25%	0.0037
9.350	7.78	460	1.8E-03	3.7E+02	3.6E-04	16	0.472	5832	0.12%	2.00	0.65	0.03%	0.021	0.34	0.079	0.765	3.22%	0.0053
9.514	7.83	460	1.8E-03	3.7E+02	3.6E-04	16	0.472	5816	0.12%	2.00	0.65	0.03%	0.021	0.34	0.079	0.765	3.25%	0.0053
9.678	7.88	460	1.8E-03	3.7E+02	3.7E-04	16	0.473	5800	0.12%	2.00	0.65	0.03%	0.022	0.34	0.079	0.765	3.29%	0.0054
9.842	7.93	460	1.8E-03	3.7E+02	3.7E-04	16	0.473	5785	0.13%	2.00	0.65	0.03%	0.022	0.34	0.079	0.765	3.33%	0.0055
10.006	7.98	460	1.8E-03	3.7E+02	3.7E-04	16	0.473	5769	0.13%	2.00	0.65	0.03%	0.022	0.34	0.079	0.765	3.37%	0.0055
10.170	8.03	460	1.8E-03	3.9E+02	3.6E-04	10	0.222	6982	0.11%	2.00	0.65	0.03%	0.019	0.34	0.079	0.765	2.89%	0.0047
10.335	8.08	460	1.8E-03	3.9E+02	3.6E-04	10	0.223	6963	0.11%	2.00	0.65	0.03%	0.019	0.34	0.079	0.765	2.93%	0.0048
10.499	8.13	460	1.8E-03	3.7E+02	3.8E-04	16	0.474	5722	0.13%	2.00	0.65	0.03%	0.023	0.34	0.079	0.765	3.49%	0.0057
10.663	8.18	460	1.8E-03	3.7E+02	3.8E-04	16	0.475	5707	0.13%	2.00	0.65	0.03%	0.023	0.34	0.079	0.765	3.53%	0.0058
10.827	8.23	460	1.8E-03	3.7E+02	3.8E-04	16	0.475	5692	0.14%	2.00	0.65	0.03%	0.023	0.34	0.079	0.765	3.57%	0.0059
10.991	8.28	460	1.8E-03	3.7E+02	3.9E-04	16	0.475	5677	0.14%	2.00	0.65	0.03%	0.024	0.34	0.079	0.765	3.61%	0.0059
11.155	8.33	460	1.8E-03	3.7E+02	3.9E-04	16	0.476	5662	0.14%	2.00	0.65	0.03%	0.024	0.34	0.079	0.765	3.65%	0.0060
11.319	8.38	460	1.8E-03	3.7E+02	3.9E-04	16	0.476	5648	0.14%	2.00	0.65	0.03%	0.024	0.34	0.079	0.765	3.69%	0.0061
11.483	8.43	460	1.8E-03	3.7E+02	3.9E-04	16	0.476	5633	0.14%	2.00	0.65	0.03%	0.024	0.34	0.079	0.765	3.73%	0.0061
11.647	8.48	460	1.8E-03	3.7E+02	4.0E-04	16	0.477	5619	0.15%	2.00	0.65	0.03%	0.025	0.34	0.079	0.765	3.77%	0.0062
11.811	8.53	460	1.8E-03	3.7E+02	4.0E-04	16	0.477	5605	0.15%	2.00	0.65	0.03%	0.025	0.34	0.079	0.765	3.81%	0.0063
11.975	8.58	460	1.8E-03	3.7E+02	4.0E-04	16	0.478	5591	0.15%	2.00	0.65	0.03%	0.025	0.34	0.079	0.765	3.85%	0.0063
12.139	8.63	460	1.8E-03	3.7E+02	4.0E-04	16	0.478	5577	0.15%	2.00	0.65	0.03%	0.025	0.34	0.079	0.765	3.89%	0.0064
12.303	8.68	460	1.8E-03	3.7E+02	4.1E-04	16	0.478	5563	0.15%	2.00	0.65	0.03%	0.026	0.34	0.079	0.765	3.93%	0.0065
12.467	8.73	460	1.8E-03	3.7E+02	4.1E-04	16	0.479	5550	0.16%	2.00	0.65	0.03%	0.026	0.34	0.079	0.765	3.97%	0.0065
12.631	8.78	460	1.8E-03	3.7E+02	4.1E-04	16	0.479	5536	0.16%	2.00	0.65	0.03%	0.026	0.34	0.079	0.765	4.01%	0.0066
12.795	8.83	460	1.8E-03	3.7E+02	4.1E-04	16	0.479	5523	0.16%	2.00	0.65	0.03%	0.027	0.34	0.079	0.765	4.06%	0.0067
12.959	8.88	460	1.8E-03	3.7E+02	4.2E-04	16	0.480	5510	0.16%	2.00	0.65	0.03%	0.027	0.34	0.079	0.765	4.10%	0.0067
13.123	8.93	460	1.8E-03	3.7E+02	4.2E-04	16	0.480	5496	0.16%	2.00	0.65	0.03%	0.027	0.34	0.079	0.765	4.14%	0.0068
13.287	8.98	460	1.8E-03	3.7E+02	4.2E-04	16	0.480	5483	0.17%	2.00	0.65	0.03%	0.027	0.34	0.079	0.765	4.18%	0.0069
13.451	9.03	460	1.8E-03	3.7E+02	4.2E-04	16	0.481	5470	0.17%	2.00	0.65	0.03%	0.028	0.34	0.079	0.765	4.22%	0.0069
13.615	9.08	460	1.8E-03	3.7E+02	4.3E-04	16	0.481	5457	0.17%	2.00	0.65	0.03%	0.028	0.34	0.079	0.765	4.27%	0.0070
13.779	9.13	460	1.8E-03	3.7E+02	4.3E-04	16	0.481	5445	0.17%	2.00	0.65	0.03%	0.028	0.34	0.079	0.765	4.31%	0.0071
13.943	9.18	460	1.8E-03	3.7E+02	4.3E-04	16	0.481	5432	0.17%	2.00	0.65	0.03%	0.028	0.34	0.079	0.765	4.35%	0.0071
14.107	9.23	460	1.8E-03	3.7E+02	4.3E-04	16	0.482	5419	0.18%	2.00	0.65	0.03%	0.029	0.34	0.079	0.765	4.39%	0.0072
14.271	9.28	460	1.8E-03	3.7E+02	4.4E-04	16	0.482	5407	0.18%	2.00	0.65	0.03%	0.029	0.34	0.079	0.765	4.44%	0.0073
14.436	9.33	460	1.8E-03	3.7E+02	4.4E-04	16	0.482	5395	0.18%	2.00	0.65	0.03%	0.029	0.34	0.079	0.765	4.48%	0.0073
14.600	9.38	500	1.8E-03	4.4E+02	3.7E-04	16	0.483	5382	0.12%	2.00	0.65	0.03%	0.020	0.34	0.079	0.765	3.09%	0.0051
14.764	9.43	500	1.8E-03	4.4E+02	3.7E-04	16	0.483	5370	0.12%	2.00	0.65	0.03%	0.020	0.34	0.079	0.765	3.12%	0.0051
14.928	9.48	500	1.8E-03	4.4E+02	3.8E-04	16	0.483	5358	0.12%	2.00	0.65	0.03%	0.021	0.34	0.079	0.765	3.15%	0.0052
15.092	9.53	500	1.8E-03	4.4E+02	3.8E-04	16	0.484	5346	0.12%	2.00	0.65	0.03%	0.021	0.34	0.079	0.765	3.18%	0.0052
15.256	9.58	500	1.8E-03	4.4E+02	3.8E-04	16	0.484	5334	0.12%	2.00	0.65	0.03%	0.021	0.34	0.079	0.765	3.21%	0.0053
15.420	9.63	500	1.8E-03	4.4E+02	3.8E-04	16	0.484	5322	0.12%	2.00	0.65	0.03%	0.021	0.34	0.079	0.765	3.24%	0.0053
15.584	9.68	500	1.8E-03	4.4E+02	3.8E-04	16	0.485	5311	0.12%	2.00	0.65	0.03%	0.021	0.34	0.079	0.765	3.27%	0.0054
15.748	9.73	500	1.8E-03	4.6E+02	3.7E-04	10	0.234	6426	0.10%	2.00	0.65	0.03%	0.018	0.34	0.079	0.765	2.83%	0.0046
15.912	9.78	500	1.8E-03	4.6E+02	3.7E-04	10	0.234	6411	0.11%	2.00	0.65	0.03%	0.019	0.34	0.079	0.765	2.86%	0.0047
16.076	9.83	500	1.8E-03	4.6E+02	3.7E-04	10	0.235	6396	0.11%	2.00	0.65	0.03%	0.019	0.34	0.079	0.765	2.89%	0.0047
16.240	9.88	500	1.8E-03	4.6E+02	3.7E-04	10	0.235	6382	0.11%	2.00	0.65	0.03%	0.019	0.34	0.079	0.765	2.92%	0.0048
16.404	9.93	500	1.8E-03	4.6E+02	3.8E-04	10	0.235	6367	0.11%	2.00	0.65	0.03%	0.019	0.34	0.079	0.765	2.95%	0.0048
16.568	9.98	500	1.8E-03	4.6E+02	3.8E-04	10	0.236	6353	0.11%	2.00	0.65	0.03%	0.019	0.34	0.079	0.765	2.98%	0.0049
16.732	10.03	500	1.8E-03	4.6E+02	3.8E-04	10	0.236	6339	0.11%	2.00	0.65	0.03%	0.020	0.34	0.079	0.765	3.01%	0.0049
16.896	10.08	500	1.8E-03	4.6E+02	3.8E-04	10	0.236	6324	0.11%	2.00	0.65	0.03%	0.020	0.34	0.079	0.765	3.04%	0.0050
17.060	10.13	500	1.8E-03	4.6E+02	3.8E-04	10	0.237	6313	0.11%	2.00	0.65	0.03%	0.020	0.34	0.079	0.765	3.08%	0.0050
17.224	10.18	500	1.8E-03	4.6E+02	3.9E-04	10	0.237	6306	0.12%	2.00	0.65	0.03%	0.020	0.34	0.079	0.765	3.11%	0.0051

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-6N

Data File: 13-52106_SP3-6N-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Dat

Legend:
- Tailings Sands
- Tailings Sand-Slimes
- Tailings Slimes
- Interim Cover
- Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Parameter
5604.20	Water surface elevation during CPT investigation (ft ar
5599.16	Water surface elevation at t_0 (ft amsl)
5590.44	Water surface elevation at t_1 (ft amsl)
5585.44	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Eartho
7.51	Equiv. Number of Uniform Strain Cycles, N

Value	Parameter
5607.44	Ground Surface Elevation at time of CPT (ft amsl)
5623.62	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after plac
3.50	Thickness of Water Storage/Rooting Zone (ft)
3.50	Thickness of High Compaction Layer (ft)
8.68	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1720.10	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5585.44	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer	Total Stress at Midpoint of Layer	Equil Pore Pressure at Bottom of Layer	Equil Pore Pressure at Midpoint of Layer (tsf)	Effective Stress at Bottom of Layer	Effective Stress at Midpoint of Layer
Erosion Protection Layer	######	5623.37	5623.12	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
Water Storage/Rooting Zone Layer	######	5621.37	5619.62	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5617.87	5616.12	3.50	0.060	120	0.424	0.320	0.00	0.00	0.424	0.320
Platform/Random Fill Layer	######	5611.78	5607.44	8.68	0.050	101	0.861	0.643	0.00	0.00	0.861	0.643

FINAL COVER	Midpoint Depth at t_1, z_1	Shear Wave Velocity, V_s	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
Erosion Protection Layer	0.08	508	1.7E-03	4.4E+02	3.0E-06	11	0.068	46696	0.00%	1.20	0.80	0.04%	0.000	0.32	0.133	0.778	0.00%	0.0000
Water Storage/Rooting Zone Layer	0.69	508	1.7E-03	4.3E+02	2.8E-05	11	0.118	18930	0.00%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
High Compaction Layer	1.75	508	1.9E-03	4.8E+02	6.5E-05	11	0.152	12657	0.01%	0.65	0.75	0.02%	0.000	0.34	0.079	0.765	0.00%	0.0000
Platform/Random Fill Layer	3.61	508	1.6E-03	4.0E+02	1.6E-04	11	0.181	9468	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000

2013 CPT Data from ConeTec / CPT Data Interpretations

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No
17.388	5590.05	6.7	0.047	6.0	104.9	45.45	0.70%	Sand-Slime Tailin	0.059	119.0	0.98	0.44	0.54	1
17.552	5589.89	6.6	0.046	6.0	96.3	41.71	0.70%	Sand-Slime Tailin	0.059	119.0	0.99	0.45	0.54	1
17.716	5589.72	6.0	0.052	5.5	92.4	40.06	0.86%	Slime Tailings	0.057	113.1	1.00	0.45	0.55	1
17.880	5589.56	5.7	0.042	5.2	93.9	40.69	0.73%	Slime Tailings	0.057	113.1	1.01	0.46	0.55	1
18.044	5589.40	6.1	0.034	5.6	77.5	33.57	0.56%	Slime Tailings	0.057	113.1	1.02	0.46	0.56	1
18.208	5589.23	5.2	0.036	4.7	84.2	36.50	0.69%	Slime Tailings	0.057	113.1	1.03	0.47	0.56	1
18.372	5589.07	5.4	0.036	4.9	84.8	36.76	0.66%	Slime Tailings	0.057	113.1	1.04	0.47	0.57	1
18.537	5588.90	6.0	0.036	5.4	86.7	37.59	0.60%	Slime Tailings	0.057	113.1	1.05	0.48	0.57	1
22.000	5585.44							Slime Tailings	0.057	113.1				

Depth at time of CPT (ft)	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
17.388	1.44	8.687	120.75	11.19	11	0.82%	2.7	47%	1.84	0.01	1.83	1
17.552	1.43	8.544	118.76	10.92	10	0.82%	2.7	47%	1.85	0.02	1.83	1
17.716	1.42	7.782	108.16	9.99	9	1.03%	2.8	71%	1.86	0.02	1.84	1
17.880	1.41	7.283	101.24	9.42	9	0.89%	2.8	71%	1.87	0.03	1.84	1
18.044	1.41	7.873	109.44	9.93	9	0.67%	2.7	71%	1.88	0.03	1.85	1
18.208	1.40	6.570	91.32	8.48	7	0.86%	2.8	71%	1.89	0.04	1.85	1
18.372	1.39	6.824	94.85	8.78	8	0.82%	2.8	71%	1.90	0.04	1.85	1
18.537	1.38	7.489	104.10	9.57	9	0.73%	2.8	71%	1.91	0.05	1.86	1
22.000									2.10	0.10	2.00	1

Liquefaction Triggering Analyses

Idriss & Boulanger (2008)

Depth at time of CPT (ft)	r_d	C_σ	K_σ	K_a	CSR M=7.5, s'v=1atm	Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS
17.388	0.90	0.05	0.97	1.0	0.050	34.22	45.41	0.073	1.45
17.552	0.90	0.05	0.97	1.0	0.050	34.13	45.05	0.073	1.45
17.716	0.89	0.05	0.97	1.0	0.051	33.57	43.56	0.072	1.42
17.880	0.89	0.04	0.97	1.0	0.051	33.37	42.79	0.071	1.40
18.044	0.89	0.05	0.97	1.0	0.051	33.55	43.48	0.072	1.41
18.208	0.89	0.04	0.97	1.0	0.051	33.04	41.53	0.070	1.38
18.372	0.89	0.04	0.97	1.0	0.051	33.15	41.93	0.070	1.38
18.537	0.89	0.04	0.97	1.0	0.051	33.42	42.99	0.071	1.40

Youd et al. (2001)

Depth at time of CPT (ft)	r_d	D_r	f	K_σ	K_a	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No
17.388	0.90	0.19	0.80	1.10	1.0	0.036	3.97	44.45	0.087	3.47	2.46	2
17.552	0.90	0.19	0.80	1.10	1.0	0.037	4.06	44.36	0.087	3.44	2.44	2
17.716	0.90	0.18	0.80	1.09	1.0	0.037	4.73	47.21	0.089	3.50	2.46	2
17.880	0.90	0.18	0.80	1.09	1.0	0.037	4.73	44.60	0.087	3.38	2.39	2
18.044	0.90	0.18	0.80	1.09	1.0	0.037	4.15	41.21	0.084	3.25	2.33	2
18.208	0.89	0.17	0.80	1.09	1.0	0.037	5.14	43.60	0.086	3.29	2.33	2
18.372	0.89	0.17	0.80	1.09	1.0	0.037	4.92	43.24	0.086	3.25	2.32	2
18.537	0.89	0.18	0.80	1.09	1.0	0.037	4.42	42.33	0.085	3.20	2.30	2

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.539

Depth at t_1, z_1 m	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Maximum Shear Strain Modulus, G_{max} tsf	P = γ_{eff}*(G_{eff}/G_{max}) tsf	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
10.23	500	1.8E-03	4.6E+02	3.9E-04	10	0.237	6300	0.12%	2.00	0.65	0.03%	0.021	0.34	0.079	0.765	3.15%	0.0052
10.28	500	1.8E-03	4.6E+02	3.9E-04	10	0.237	6293	0.12%	2.00	0.65	0.03%	0.021	0.34	0.079	0.765	3.18%	0.0052
10.33	500	1.8E-03	4.4E+02	4.1E-04	16	0.488	5185	0.14%	2.00	0.65	0.03%	0.024	0.34	0.079	0.765	3.72%	0.0061
10.38	500	1.8E-03	4.4E+02	4.2E-04	16	0.488	5180	0.14%	2.00	0.65	0.03%	0.025	0.34	0.079	0.765	3.75%	0.0062
10.43	500	1.8E-03	4.4E+02	4.2E-04	16	0.488	5175	0.15%	2.00	0.65	0.03%	0.025	0.34	0.079	0.765	3.79%	0.0062
10.48	500	1.8E-03	4.4E+02	4.2E-04	16	0.488	5171	0.15%	2.00	0.65	0.03%	0.025	0.34	0.079	0.765	3.83%	0.0063
10.53	500	1.8E-03	4.4E+02	4.2E-04	16	0.489	5166	0.15%	2.00	0.65	0.03%	0.025	0.34	0.079	0.765	3.87%	0.0063
10.58	500	1.8E-03	4.4E+02	4.2E-04	16	0.489	5161	0.15%	2.00	0.65	0.03%	0.026	0.34	0.079	0.765	3.90%	0.0064
11.64	538	1.8E-03	5.1E+02	4.0E-04	16	0.493	5008	0.13%	2.00	0.65	0.03%	0.022	0.34	0.079	0.765	3.37%	0.1167

Extra layer added to analyze seismic settlement of tailings below the bottom of CPT investigation.

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-8N

Data File: 13-52106_SP3-8N-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3 Field Data\2013 Field Investigation\Conetec Dat

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Description
5604.90	Water surface elevation during CPT investigation (ft amsl)
5600.09	Water surface elevation at t_0 (ft amsl)
5595.24	Water surface elevation at t_1 (ft amsl)
5590.24	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Ear
7.51	Equiv. Number of Uniform Strain Cycles, N
5608.37	Ground Surface Elevation at time of CPT (ft amsl)
5623.82	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after plac
3.50	Thickness of Water Storage/Rooting Zone (ft)
3.50	Thickness of High Compaction Layer (ft)
7.95	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1646.57	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5590.24	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer	Total Stress at Midpoint of Layer	Equil Pore Pressure at Bottom of Layer	Equil Pore Pressure at Midpoint of Layer (tsf)	Effective Stress at Bottom of Layer	Effective Stress at Midpoint of Layer	Midpoint Depth at t_1, z_1	Shear Wave Velocity, V_s	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
Erosion Protection Layer	######	5623.57	5623.32	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014	0.08	508	1.7E-03	4.4E+02	3.0E-06	11	0.068	46696	0.00%	1.20	0.80	0.04%	0.000	0.32	0.133	0.778	0.00%	0.0000
Water Storage/Rooting Zone Layer	######	5621.57	5619.82	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121	0.69	508	1.7E-03	4.3E+02	2.8E-05	11	0.118	18930	0.00%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
High Compaction Layer	######	5618.07	5616.32	3.50	0.060	120	0.424	0.320	0.00	0.00	0.424	0.320	1.75	508	1.9E-03	4.8E+02	6.5E-05	11	0.152	12657	0.01%	0.65	0.75	0.02%	0.000	0.34	0.079	0.765	0.00%	0.0000
Platform/Random Fill Layer	######	5612.35	5608.37	7.95	0.050	101	0.825	0.624	0.00	0.00	0.825	0.624	3.50	508	1.6E-03	4.0E+02	1.5E-04	11	0.180	9583	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
0.164	5608.21	4.6	0.040	4.6	1.7	0.73	0.87%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0	1.70	7.837	108.93	9.12	558	0.87%	1.4	51%	0.83	0.00	0.83	0
0.328	5608.04	22.0	0.044	22.0	2.8	1.22	0.20%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	37.315	518.68	43.37	1329	0.20%	0.6	51%	0.84	0.00	0.84	0
0.492	5607.88	41.2	0.114	41.1	4.2	1.81	0.28%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	69.938	972.14	81.28	1660	0.28%	0.7	51%	0.85	0.00	0.85	0
0.656	5607.71	59.5	0.362	59.4	4.7	2.05	0.61%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0	1.70	101.031	######	117.40	1798	0.61%	1.0	51%	0.86	0.00	0.86	0
0.820	5607.55	65.8	0.430	65.7	4.5	1.93	0.65%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0	1.70	111.758	######	129.86	1591	0.65%	1.1	51%	0.86	0.00	0.86	0
0.984	5607.39	69.7	0.402	69.6	3.8	1.66	0.58%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0	1.70	118.371	######	137.53	1404	0.58%	1.0	51%	0.87	0.00	0.87	0
1.148	5607.22	68.4	0.655	68.4	3.8	1.64	0.96%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0	1.70	116.314	######	135.14	1183	0.96%	1.3	51%	0.88	0.00	0.88	0
1.312	5607.06	77.9	0.651	77.9	3.0	1.29	0.84%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	132.464	######	153.89	1178	0.84%	1.2	51%	0.89	0.00	0.89	0

Liquefaction Triggering Analyses

Depth at time of CPT (ft)	Idriss & Boulanger (2008) Cyclic Stress Ratio r_d	C_σ	K_σ	K_α	CSR M=7.5, s'v=1atm	Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Youd et al. (2001) r_d	D_r	f	K_σ	K_α	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No
0.164	1.00	0.04	1.00	1.0	0.058	33.52	42.65	0.071	1.22	0.96	0.17	0.80	2.53	1.0	0.017	1.00	9.12	0.058	141.30	71.26	2
0.328	1.00	0.07	1.00	1.0	0.058	45.54	88.92	0.125	2.16	0.96	0.38	0.80	2.20	1.0	0.019	1.00	43.37	0.086	105.69	53.93	2
0.492	1.00	0.09	1.00	1.0	0.058	58.84	140.12	0.233	4.02	0.96	0.52	0.74	2.52	1.0	0.017	1.00	81.28	0.130	106.34	55.18	2
0.656	1.00	0.12	1.00	1.0	0.058	71.52	188.92	0.721	12.47	0.96	0.63	0.69	2.77	1.0	0.015	1.00	117.40	0.230	141.52	76.99	2
0.820	1.00	0.13	1.00	1.0	0.058	75.89	205.75	1.000	17.31	0.96	0.66	0.67	2.72	1.0	0.016	1.00	129.86	0.284	139.38	78.34	2
0.984	1.00	0.14	1.00	1.0	0.058	78.58	216.11	1.000	17.33	0.96	0.68	0.66	2.63	1.0	0.016	1.00	137.53	0.322	131.88	74.60	2
1.148	1.00	0.14	1.00	1.0	0.058	77.74	212.88	1.000	17.35	0.96	0.67	0.66	2.48	1.0	0.017	1.00	135.14	0.310	108.73	63.04	2
1.312	1.00	0.17	0.99	1.0	0.057	84.32	238.21	1.000	17.39	0.96	0.72	0.64	2.51	1.0	0.017	1.00	153.89	0.419	128.81	73.10	2

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.341

Depth at time of CPT (ft)	Depth at t_1, z_1 m	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Maximum Shear Strain Modulus, G_{max} tsf	P = γ_{eff}*(G_{eff}/G_{max}) tsf	Plasticity Index, PI	g_1	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
0.164	4.76	594	1.6E-03	5.5E+02	1.5E-04	11	0.194	8508	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.328	4.81	594	1.6E-03	5.5E+02	1.5E-04	11	0.194	8473	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.492	4.86	594	1.6E-03	5.5E+02	1.5E-04	11	0.195	8439	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.656	4.91	594	1.6E-03	5.5E+02	1.5E-04	11	0.195	8405	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.820	4.96	594	1.6E-03	5.5E+02	1.5E-04	11	0.196	8372	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
0.984	5.01	594	1.6E-03	5.5E+02	1.5E-04	11	0.196	8339	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.148	5.06	594	1.6E-03	5.5E+02	1.6E-04	11	0.196	8306	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000
1.312	5.11	594	1.6E-03	5.5E+02	1.6E-04	11	0.197	8274	0.02%	2.00	0.65	0.03%	0.000	0.34	0.079	0.765	0.00%	0.0000

Extra layer added to analyze seismic settlement of tailings below the bottom of CPT investigation.

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-8S

Data File: 13-52106_SP3-8S-BSC-CPT
Location: White Mesa 2013 CPT Investigation

Idriss and Boulanger (2008)
Max. Horiz. Acceleration, Amax/g: 0.15
Earthquake Moment Magnitude, M: 5.5
Magnitude Scaling Factor, MSF: 1.69

Youd, et al (2001)
Max. Horiz. Acceleration, Amax/g: 0.15
Earthquake Moment Magnitude, M: 5.5
Magnitude Scaling Factor, MSF: 2.21

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

2013 CPT Data from ConeTec / CPT Data Interpretations

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil. Pore Pressure at time of CPT (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No
0.164	5608.54	17.2	0.175	17.2	1.2	0.54	1.02%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0
0.328	5608.37	63.5	0.285	63.5	10.1	4.36	0.45%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0
0.492	5608.21	90.9	0.503	90.8	10.4	4.50	0.55%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0
0.656	5608.04	111.9	0.700	111.9	7.7	3.35	0.63%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0
0.820	5607.88	126.5	0.864	126.4	5.8	2.51	0.68%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0
0.984	5607.72	125.0	0.813	125.0	3.0	1.31	0.65%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0
1.148	5607.55	117.6	0.695	117.6	1.1	0.48	0.59%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0
1.312	5607.39	104.2	0.601	104.2	1.5	0.66	0.58%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0
1.476	5607.22	81.5	0.591	81.5	0.0	0.01	0.73%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0
1.640	5607.06	72.9	0.416	72.9	-0.0	-0.01	0.57%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0
1.804	5606.90	64.8	0.713	64.8	0.1	0.05	1.10%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0
1.968	5606.73	61.1	0.519	61.1	0.6	0.27	0.85%	Interim Cover	0.050	100.7	0.10	0.00	0.10	0
2.133	5606.57	57.5	0.435	57.5	2.3	0.98	0.76%	Interim Cover	0.050	100.7	0.11	0.00	0.11	0
2.297	5606.40	54.3	0.512	54.3	5.3	2.29	0.94%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0
2.461	5606.24	53.3	1.269	53.3	2.3	0.99	2.38%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0
2.625	5606.08	76.9	1.662	76.9	5.5	2.37	2.16%	Interim Cover	0.050	100.7	0.13	0.00	0.13	0
2.789	5605.91	222.0	2.940	221.9	14.3	6.21	1.32%	Interim Cover	0.050	100.7	0.14	0.00	0.14	0
2.953	5605.75	222.9	2.175	222.9	15.8	6.86	0.98%	Interim Cover	0.050	100.7	0.15	0.00	0.15	0
3.117	5605.58	213.5	2.265	213.3	28.9	12.50	1.06%	Interim Cover	0.050	100.7	0.16	0.00	0.16	0
3.281	5605.42	207.8	1.697	207.7	13.6	5.90	0.82%	Sand Tailings	0.051	102.8	0.17	0.00	0.17	0
3.445	5605.26	155.2	1.444	155.1	11.4	4.92	0.93%	Sand Tailings	0.051	102.8	0.17	0.00	0.17	0
3.609	5605.09	125.3	1.613	125.3	6.9	2.98	1.29%	Sand Tailings	0.051	102.8	0.18	0.00	0.18	0
3.773	5604.93	100.1	0.839	100.1	7.6	3.29	0.84%	Sand Tailings	0.051	102.8	0.19	0.00	0.19	0
3.937	5604.76	82.6	1.213	82.5	16.4	7.12	1.47%	Sand Tailings	0.051	102.8	0.20	0.00	0.20	0
4.101	5604.60	116.5	1.585	116.5	3.6	1.57	1.36%	Sand Tailings	0.051	102.8	0.21	0.00	0.21	0
4.265	5604.43	95.5	1.860	95.4	10.8	4.68	1.95%	Sand Tailings	0.051	102.8	0.22	0.00	0.22	0
4.429	5604.27	82.7	1.658	82.6	23.5	10.20	2.00%	Sand-Slime Tailings	0.047	93.3	0.22	0.00	0.22	0
4.593	5604.11	86.3	1.621	85.5	118.1	51.17	1.88%	Sand-Slime Tailings	0.047	93.3	0.23	0.00	0.23	0
4.757	5603.94	76.9	1.353	76.5	64.1	27.77	1.76%	Sand Tailings	0.051	102.8	0.24	0.00	0.24	0
4.921	5603.78	61.2	1.819	60.2	164.5	71.28	2.97%	Sand-Slime Tailings	0.047	93.3	0.25	0.00	0.25	0
5.085	5603.61	58.0	1.686	56.9	179.6	77.81	2.91%	Sand-Slime Tailings	0.047	93.3	0.26	0.00	0.26	0
5.249	5603.45	60.7	1.440	60.7	-1.3	-0.55	2.37%	Sand-Slime Tailings	0.059	119.0	0.26	0.00	0.26	1
5.413	5603.29	46.9	1.368	46.8	16.1	6.96	2.92%	Sand-Slime Tailings	0.059	119.0	0.27	0.01	0.27	1
5.577	5603.12	43.9	1.137	43.5	70.6	30.59	2.59%	Sand-Slime Tailings	0.059	119.0	0.28	0.01	0.27	1
5.741	5602.96	101.5	1.244	99.3	344.3	#####	1.23%	Sand Tailings	0.062	123.5	0.29	0.02	0.28	1
5.905	5602.79	130.7	1.385	130.5	35.7	15.48	1.06%	Sand Tailings	0.062	123.5	0.30	0.02	0.28	1
6.069	5602.63	99.5	1.248	99.5	9.3	4.02	1.25%	Sand Tailings	0.062	123.5	0.31	0.03	0.29	1
6.234	5602.47	80.3	0.821	80.3	4.9	2.11	1.02%	Sand Tailings	0.062	123.5	0.32	0.03	0.29	1
6.398	5602.30	62.4	0.678	62.4	1.2	0.50	1.09%	Sand Tailings	0.062	123.5	0.33	0.04	0.30	1
6.562	5602.14	65.4	0.430	65.4	1.8	0.78	0.66%	Sand Tailings	0.062	123.5	0.35	0.04	0.30	1
6.726	5601.97	100.8	0.407	100.8	5.9	2.54	0.40%	Sand Tailings	0.062	123.5	0.36	0.05	0.31	1
6.890	5601.81	94.6	0.393	94.5	3.2	1.37	0.42%	Sand Tailings	0.062	123.5	0.37	0.05	0.31	1
7.054	5601.65	89.5	0.390	89.5	2.8	1.22	0.44%	Sand Tailings	0.062	123.5	0.38	0.06	0.32	1
7.218	5601.48	87.6	0.521	87.5	3.6	1.56	0.60%	Sand Tailings	0.062	123.5	0.39	0.06	0.32	1
7.382	5601.32	81.6	0.625	81.5	3.4	1.48	0.77%	Sand Tailings	0.062	123.5	0.40	0.07	0.33	1
7.546	5601.15	73.8	0.669	73.8	2.8	1.20	0.91%	Sand Tailings	0.062	123.5	0.41	0.07	0.33	1
7.710	5600.99	67.0	0.509	67.0	2.8	1.20	0.76%	Sand Tailings	0.062	123.5	0.42	0.08	0.34	1
7.874	5600.83	74.0	0.388	74.0	2.7	1.16	0.52%	Sand Tailings	0.062	123.5	0.43	0.08	0.34	1
8.038	5600.66	73.6	0.370	73.6	3.4	1.48	0.50%	Sand Tailings	0.062	123.5	0.44	0.09	0.35	1
8.202	5600.50	70.8	0.387	70.8	3.7	1.61	0.55%	Sand Tailings	0.062	123.5	0.45	0.09	0.35	1
8.366	5600.33	61.3	0.408	61.3	4.3	1.88	0.67%	Sand Tailings	0.062	123.5	0.46	0.10	0.36	1
8.530	5600.17	54.8	0.384	54.8	3.9	1.69	0.70%	Sand Tailings	0.062	123.5	0.47	0.10	0.36	1
8.694	5600.01	51.9	0.384	51.9	4.9	2.12	0.74%	Sand Tailings	0.062	123.5	0.48	0.11	0.37	1
8.858	5599.84	50.9	0.369	50.9	5.6	2.43	0.73%	Sand Tailings	0.062	123.5	0.49	0.11	0.37	1
9.022	5599.68	49.7	0.378	49.7	5.8	2.50	0.76%	Sand Tailings	0.062	123.5	0.50	0.12	0.38	1
9.186	5599.51	42.3	0.401	42.3	5.9	2.56	0.95%	Sand Tailings	0.062	123.5	0.51	0.12	0.38	1
9.350	5599.35	35.3	0.359	35.3	5.1	2.19	1.02%	Sand-Slime Tailings	0.059	119.0	0.52	0.13	0.39	1
9.514	5599.19	31.3	0.268	31.2	5.2	2.24	0.86%	Sand-Slime Tailings	0.059	119.0	0.53	0.13	0.39	1
9.678	5599.02	41.5	0.241	41.4	6.6	2.87	0.58%	Sand Tailings	0.062	123.5	0.54	0.14	0.40	1
9.842	5598.86	40.4	0.177	40.3	6.1	2.63	0.44%	Sand Tailings	0.062	123.5	0.55	0.14	0.40	1
10.006	5598.69	28.6	0.177	28.5	5.9	2.55	0.62%	Sand-Slime Tailings	0.059	119.0	0.56	0.15	0.41	1
10.170	5598.53	30.6	0.160	30.5	5.3	2.29	0.52%	Sand-Slime Tailings	0.059	119.0	0.57	0.16	0.41	1
10.335	5598.37	30.2	0.173	30.1	5.8	2.51	0.57%	Sand-Slime Tailings	0.059	119.0	0.58	0.16	0.42	1
10.499	5598.20	28.4	0.178	28.4	6.7	2.89	0.63%	Sand-Slime Tailings	0.059	119.0	0.59	0.17	0.42	1
10.663	5598.04	24.0	0.188	24.0	6.8	2.94	0.78%	Sand-Slime Tailings	0.059	119.0	0.60	0.17	0.43	1
10.827	5597.87	22.1	0.178	22.0	7.3	3.16	0.81%	Sand-Slime Tailings	0.059	119.0	0.61	0.18	0.43	1
10.991	5597.71	19.0	0.177	19.0	8.1	3.53	0.93%	Sand-Slime Tailings	0.059	119.0	0.62	0.18	0.43	1
11.155	5597.55	14.9	0.165	14.8	11.6	5.03	1.11%	Sand-Slime Tailings	0.059	119.0	0.62	0.19	0.44	1
11.319	5597.38	13.9	0.096	13.8	17.0	7.37	0.69%	Sand-Slime Tailings	0.059	119.0	0.63	0.19	0.44	1
11.483	5597.22	19.1	0.146	19.1	12.4	5.36	0.76%	Sand-Slime Tailings	0.059	119.0	0.64	0.20	0.45	1
11.647	5597.05	13.8	0.173	13.8	11.9	5.15	1.25%	Sand-Slime Tailings	0.059	119.0	0.65	0.20	0.45	1
11.811	5596.89	11.6	0.154	11.5	16.0	6.92	1.33%	Sand-Slime Tailings	0.059	119.0	0.66	0.21	0.46	1
11.975	5596.73	15.5	0.105	15.4	21.0	9.12	0.68%	Sand-Slime Tailings	0.059	119.0	0.67	0.21	0.46	1
12.139	5596.56	15.7	0.104	15.6	11.4	4.93	0.66%	Sand-Slime Tailings	0.059	119.0	0.68	0.22	0.47	1
12.303	5596.40	14.7	0.073	14.6	11.8	5.11	0.50%	Sand-Slime Tailings	0.059	119.0	0.69	0.22	0.47	1
12.467	5596.23	12.9	0.081	12.8	12.1	5.25	0.63%	Sand-Slime Tailings	0.059	119.0	0.70	0.23	0.48	1
12.631	5596.07	13.9	0.074	13.8	9.8	4.25	0.53%	Sand-Slime Tailings	0.059	119.0	0.71	0.23	0.48	1
12.795	5595.90	13.8	0.074	13.8	10.5	4.55	0.53%	Sand-Slime Tailings	0.059	119.0	0.72	0.24	0.49	1
12.959	5595.74	14.6	0.071	14.5	12.1	5.22	0.49%	Sand-Slime Tailings	0.059	119.0	0.73	0.24	0.49	1
13.123	5595.58	15.1	0.085	15.0	12.9	5.59	0.56%	Sand-Slime Tailings	0.059	119.0	0.74	0.25	0.49	1
13.287	5595.41	18.1	0.188	18.0	15.1	6.54	1.04%	Sand-Slime Tailings	0.059	119.0	0.75	0.25	0.50	1
13.451	5595.25	14.3	0.276	14.2	17.2	7.45	1.93%	Sand-Slime Tailings	0.059	119.0	0.76	0.26	0.50	1
13.615	5595.08	12.3	0.228	12.1	23.3	10.08	1.86%	Sand-Slime Tailings	0.059	119.0	0.77	0.26	0.51	1
13.779	5594.92	10.8	0.190	10.7	27.0	11.70	1.75%	Sand-Slime Tailings	0.059	119.0	0.78	0.27	0.51	1
13.943	5594.76	8.0	0.181	7.7	47.3	20.48	2.26%	Slime Tailings	0.057	113.1	0.79	0.27	0.52	1
14.107	5594.59	10.0	0.115	9.6	60.9	26.40	1.15%	Sand-Slime Tailings	0.059	119.0	0.80	0.28	0.52	1
14.271	5594.43	12.7	0.137	12.5	34.5	14.95	1.08%	Sand-Slime Tailings	0.059	119.0	0.81	0.28	0.53	1
14.436	5594.26	8.1	0.129	7.9	39.8	17.23	1.59%	Slime Tailings	0.057	113.1	0.82	0.29	0.53	1
14.600	5594.10	6.3	0.101	6.0	61.5	26.64	1.59%	Slime Tailings	0.057	113.1	0.83	0.29	0.54	1
14.764	5593.94	6.0	0.095	5.6	71.3	30.89	1.58%	Slime Tailings	0.057	113.1	0.84	0.30	0.54	1
14.928	5593.77	5.9	0.056	5.5	66.0	28.61	0.95%	Slime Tailings	0.057	113.1	0.85	0.30	0.54	1
15.092	5593.61	6.8	0.056	6.5	47.2	20.44	0.82%	Sand-Slime Tailings	0.059	119.0	0.86	0.31	0.55	1
15.256	5593.44	9.0	0.056	8.7	40.6	17.59	0.63%	Sand-Slime Tailings	0.059	119.0	0.87	0.31	0.55	1
23.070	5585.63							Sand-Slime Tailings	0.059	119.0				

Extra layer added to analyze seismic settlement of tailings below the bottom of CPT investigation.

ATTACHMENT F.4

LIQUEFACTION CALCULATIONS

Notes

t_0 corresponds to beginning of final cover placement — Assumes 99% of consolidation due to existing stress conditions has taken place
t_1 corresponds to dewatering of the tailings to a level 5 feet above the liner
t_2 corresponds to completion of dewatering

SOIL PROPERTIES

TAILINGS

Specific Gravity, G_s		
2.70	Specific gravity of tailing sands, $G_{s\text{-}TSand}$	Based on testing performed on other uranium tailings and presented in Keshian and Rager (1988)
2.80	Specific gravity of tailing sand-slimes, $G_{s\text{-}TS\text{-}S}$	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015b)
2.86	Specific gravity of tailing slimes, $G_{s\text{-}TSlime}$	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015b)
Fines Content		
18%	Fines content of tailings sands (%)	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015b)
47%	Fines content of tailings sand-slimes (%)	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015b)
71%	Fines content of tailings slimes (%)	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015b)
Dry Unit Weight, γ_d		
97	In-situ dry unit weight of tailings sands at t_0, $\gamma_{d0\text{-}Tsand}$ (pcf)	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015b)
88	In-situ dry unit weight of tailings sand-slimes at t_0, $\gamma_{d0\text{-}TS\text{-}S}$ (pcf)	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015b)
78	In-situ dry unit weight of tailings slimes at t_0, $\gamma_{d0\text{-}Tslime}$ (pcf)	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015b)
Saturated Unit Weight, γ_{sat}		
123	In-situ saturated unit weight of tailings sands at t_0, $\gamma_{sat0\text{-}Tsand}$ (pcf)	Calculated
119	In-situ saturated unit weight of tailings sand-slimes at t_0, $\gamma_{sat0\text{-}TS\text{-}S}$ (pcf)	Calculated
113	In-situ saturated unit weight of tailings slimes at t_0, $\gamma_{sat0\text{-}Tslime}$ (pcf)	Calculated
Moist Unit Weight, γ_m		
103	Moist unit weight of tailings sands, $\gamma_{m\text{-}Tsand}$ (pcf)	Calculated, assuming long-term water content from laboratory testing (Tailings Data Analysis Report. MWH, 2015b)
93	Moist unit weight of tailings sand-slimes, $\gamma_{m\text{-}TS\text{-}S}$ (pcf)	Calculated, assuming long-term water content from laboratory testing (Tailings Data Analysis Report. MWH, 2015b)
83	Moist unit weight of tailings slimes, $\gamma_{m\text{-}Tslime}$ (pcf)	Calculated, assuming long-term water content from laboratory testing (Tailings Data Analysis Report. MWH, 2015b)
Void Ratio, e		
0.74	Void ratio of tailing sands at t_0, $e_{0\text{-}TSand}$	Calculated
0.99	Void ratio of tailing sand-slimes at t_0, $e_{0\text{-}TS\text{-}S}$	Calculated
1.29	Void ratio of tailing slimes at t_0, $e_{0\text{-}TSlime}$	Calculated
Saturated Water Content, w_{Sat}		
27%	Saturated water content of tailings sands at t_0, $w_{sat0\text{-}TSand}$ (%)	Calculated
35%	Saturated water content of tailings sand-slimes at t_0, $w_{sat0\text{-}TS\text{-}S}$ (%)	Calculated
45%	Saturated water content of tailings slimes at t_0, $w_{sat0\text{-}TSlime}$ (%)	Calculated
Water Content of Moist Tailings, $w_{m\text{-}T}$		
6%	Water content of moist tailings sands, $w_{m\text{-}TSand}$ (%)	From Attachment H - Radon Emanation Modeling including with this submittal
6%	Water content of moist tailings sand-slimes, $w_{m\text{-}TS\text{-}S}$ (%)	From Attachment H - Radon Emanation Modeling including with this submittal
6%	Water content of moist tailings slimes, $w_{m\text{-}TSlime}$ (%)	From Attachment H - Radon Emanation Modeling including with this submittal
Plasticity Index, PI		
0	Plasticity index of tailings sands, PI_{TSand}	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015b)
10	Plasticity index of tailings sand-slimes, $PI_{TS\text{-}S}$	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015b)
16	Plasticity index of tailings slimes, PI_{TSlime}	Average value from lab testing of samples obtained on-site (Tailings Data Analysis Report. MWH, 2015b)
Seismic Settlement Coefficients		
2.2	Coefficient "a" of Unsaturated Sand Tailings	From Stewart, et al (2004), page 86, Figure 6.5
5.0	Coefficient "a" of Saturated Sand Tailings	From Stewart, et al (2004), page 86, Figure 6.5
2.0	Coefficient "a" of Sand-Slime Tailings	From Stewart, et al (2004), page 89, Figure 6.7
2.0	Coefficient "a" of Slime Tailings	From Stewart, et al (2004), page 89, Figure 6.7
1.00	Coefficient "b" of Sand Tailings	From Stewart, et al (2004), page 86, Figure 6.5
0.65	Coefficient "b" of Sand-Slime Tailings	From Stewart, et al (2004), page 89, Figure 6.7
0.65	Coefficient "b" of Slime Tailings	From Stewart, et al (2004), page 89, Figure 6.7
0.01%	Strain threshold value of Sand Tailings, γtv	From Stewart, et al (2004), page 86, Figure 6.5
0.03%	Strain threshold value of Sand-Slime Tailings, γtv	From Stewart, et al (2004), page 89, Figure 6.7
0.03%	Strain threshold value of Slime Tailings, γtv	From Stewart, et al (2004), page 89, Figure 6.7
0.36	Coefficient "R" of Sand Tailings	From Stewart, et al (2004), page 86, for soils with non-plastic fines
0.34	Coefficient "R" of Sand-Slime Tailings	From Stewart, et al (2004), page 89, for soils with medium plasticity fines
0.34	Coefficient "R" of Slime Tailings	From Stewart, et al (2004), page 89, for soils with medium plasticity fines

Other

5.0	Height of water table above liner at t_1, H_{sat-1} (ft)	Assumed for end of active maintenance
0.0	Height of water table above liner at t_2, H_{sat-2} (ft)	
6.0%	Long-term moisture content of tailings, $w_{tailings}$ (%)	From Attachment H - Radon Emanation Modeling including with this submittal
508	Shear Wave Velocity of Tailings, V_s (ft/sec)	Conservatively assumed to be the average of the shear wave velocities measured in Cell 2 tailings

COVER SOIL

Specific Gravity, G_s

2.61	Specific gravity of topsoil, $G_{s\text{-}Topsoil}$	From Attachment H - Radon Emanation Modeling including with this submittal
2.62	Specific gravity of rock mulch, $G_{s\text{-}mulch}$	From Attachment H - Radon Emanation Modeling including with this submittal
2.63	Specific gravity of cover soil, $G_{s\text{-}cover}$	From Attachment H - Radon Emanation Modeling including with this submittal

Unit Weight, γ

118.0	Maximum dry unit weight of cover soil $\gamma_{cover\text{-}max}$ (pcf)	Average calculated from laboratory testing results (UWM, 2012)
100.7	Moist unit weight of cover soil at 80% relative compaction, $\gamma_{cover80}$ (pcf)	Calculated
107.0	Moist unit weight of cover soil at 85% relative compaction, $\gamma_{cover85}$ (pcf)	Calculated
119.6	Moist unit weight of cover soil at 95% relative compaction, $\gamma_{cover95}$ (pcf)	Calculated
100	Dry unit weight of topsoil layer at 85% relative compaction, $\gamma_{topsoil5}$ (pcf)	From Attachment H - Radon Emanation Modeling including with this submittal
105	Moist unit weight of topsoil layer at 85% relative compaction, $\gamma_{topsoil5}$ (pcf)	Calculated
106	Dry unit weight of rock mulch layer at 85% relative compaction, $\gamma_{mulch85}$ (pcf)	Calculated
110	Moist unit weight of rock mulch layer at 85% relative compaction, $\gamma_{mulch85}$ (pcf)	From Attachment H - Radon Emanation Modeling including with this submittal

Void Ratio, e

0.74	Void Ratio of cover soil at 80% relative compaction, $e_{cover80}$	Calculated
0.64	Void Ratio of cover soil at 85% relative compaction, $e_{cover85}$	Calculated
0.46	Void Ratio of cover soil at 95% relative compaction, $e_{cover95}$	Calculated
0.61	Void Ratio of topsoil at 85% relative compaction, $e_{topsoil85}$	Calculated from porosity presented in Attachment H - Radon Emanation Modeling including with this submittal
0.54	Void Ratio of rock mulch at 85% relative compaction, $e_{mulch85}$	Calculated from porosity presented in Attachment H - Radon Emanation Modeling including with this submittal

Seismic Settlement Coefficients

1.2	Coefficient "a" of Erosion Protection/Topsoil Cover	From Stewart, et al (2004), page 88, Figure 6.6
2.0	Coefficient "a" of General Cover Soil	From Stewart, et al (2004), page 89, Figure 6.7
0.65	Coefficient "a" of High-Compaction Layer	From Stewart, et al (2004), page 89, Figure 6.7
0.80	Coefficient "b" of Erosion Protection/Topsoil Cover	From Stewart, et al (2004), page 88, Figure 6.6
0.65	Coefficient "b" of General Cover Soil	From Stewart, et al (2004), page 89, Figure 6.7
0.75	Coefficient "b" of High-Compaction Layer	From Stewart, et al (2004), page 89, Figure 6.7
0.04%	Strain threshold value of Erosion Protection/Topsoil Cover, γtv	From Stewart, et al (2004), page 88, Figure 6.6
0.03%	Strain threshold value of General Cover Soil, γtv	From Stewart, et al (2004), page 89, Figure 6.7
0.02%	Strain threshold value of High-Compaction Layer, γtv	From Stewart, et al (2004), page 89, Figure 6.7
0.32	Coefficient "R" of Erosion Protection/Topsoil Cover	From Stewart, et al (2004), page 88, for soils with low plasticity fines
0.34	Coefficient "R" of General Cover Soil	From Stewart, et al (2004), page 89, for soils with medium plasticity fines
0.34	Coefficient "R" of High-Compaction Layer	From Stewart, et al (2004), page 89, for soils with medium plasticity fines

Other

6.7%	Long-term moisture content of cover soil, w_{cover} (%)	Estimated based on measured 15bar water content. (UWM, 2012)
5.2%	Long-term moisture content of topsoil, $w_{topsoil}$ (%)	From Attachment H - Radon Emanation Modeling including with this submittal
4.0%	Long-term moisture content of rock mulch, $w_{rockmulch}$ (%)	From Attachment H - Radon Emanation Modeling including with this submittal
0.14	Compression index of cover soil, $C_{c\text{-}cover}$	Calculated from empirical equation presented in Holtz and Kovacs, 1981. Page 341. $C_c = 0.30*(e_0\text{-}0.27)$
51%	Fines content of cover soil (%)	Mean value from laboratory analyses presented in previous response to interrogatories (EFRI, 2012)
11	Plasticity Index of cover soil, PI	Weighted Average from 2010 and 2012 laboratory testing (laboratory results presented in EFRI, 2012)
508	Shear Wave Velocity of Cover Soil, V_s (ft/sec)	Conservatively assumed to be the average of the shear wave velocities measured in Cell 2 tailings

SEISMIC PARAMETERS

0.15	Maximum horizontal acceleration at the ground surface, a_{max}/g	From Probabilistic Seismic Hazard Analysis (MWH, 2015a)
5.5	Magnitude of Design Event, M	From Probabilistic Seismic Hazard Analysis (MWH, 2015a)
20	Site-Source Distance, r (km)	From Probabilistic Seismic Hazard Analysis (MWH, 2015a)
1.00	Stress reduction factor, r_d	Conservatively assumed.
7.51	Equiv. Number of Uniform Strain Cycles, N	Calculated from Stewart, et al (2004), Equation 6.11, page 79, S parameter =0 since shallow soil and rock underlie the tailings (<20m) below tailings
594	Average shear wave velocity for cover, Vs (ft/s)	Conservatively estimated as upper bound average Vs for tailings in Cell 2 in October 2013 (Tailings Data Analysis Report. MWH, 2015b)
495	Average shear wave velocity for tailings (3' - 9.4'), Vs (ft/s)	Conservatively estimated as average Vs over depth range for tailings in Cell 2 in October 2013 (Tailings Data Analysis Report. MWH, 2015b)
460	Average shear wave velocity for tailings (9.4' - 14.4'), Vs (ft/s)	Conservatively estimated as average Vs over depth range for tailings in Cell 2 in October 2013 (Tailings Data Analysis Report. MWH, 2015b)
500	Average shear wave velocity for tailings (14.4' - 19.6'), Vs (ft/s)	Conservatively estimated as average Vs over depth range for tailings in Cell 2 in October 2013 (Tailings Data Analysis Report. MWH, 2015b)
538	Average shear wave velocity for tailings (19.6' - 24.7'), Vs (ft/s)	Conservatively estimated as average Vs over depth range for tailings in Cell 2 in October 2013 (Tailings Data Analysis Report. MWH, 2015b)
594	Average shear wave velocity for tailings (24.7' - liner), Vs (ft/s)	Conservatively estimated as average Vs over depth range for tailings in Cell 2 in October 2013 (Tailings Data Analysis Report. MWH, 2015b)

MISCELLANEOUS PARAMETERS

62.4	Unit Weight of Water, γ_W	
82.4	Atmospheric Pressure, P_a (kPa)	Calculated assuming elev=5600' amsl. http://www.engineeringtoolbox.com/air-altitude-pressure-d_462.html
1722.0	Atmospheric Pressure, P_a (psf)	Unit conversion calculation

REFERENCES

Energy Fuels Resources (USA) Inc. (EFRI), 2012. Responses to Interrogatories – Round 1 for Reclamation Plan, Revision 5.0, March 2012. August 15.

Holtz, R.D. and Kovacs, W.D., 1981. An Introduction to Geotechnical Engineering. Prentice Hall, Inc. New Jersey

Keshian, B., and Rager, R. 1988. Geotechnical Properties of Hydraulically Placed Uranium Mill Tailings, in Hydraulically Fill Structures, Geotechnical Special Publication No. 21, Eds. Van Zyl, D., and Vick, S., ASCE, August

MWH Americas, Inc. (MWH), 2015a. White Mesa Mill Probabilistic Seismic Hazard Analysis Report. Prepared for Energy Fuels Resources (USA) Inc. April.

MWH Americas, Inc. (MWH), 2015b. White Mesa Mill Tailings Data Analysis Report. Prepared for Energy Fuels Resources (USA) Inc. April.

Stewart, J.P., D. Whang, M.Moyneur, and P.Duku, 2004. Seismic Compression of As-Compacted Fill Soils With Variable Levels of Fines Content and Fines Plasticity. CUREE Publication No.EDA-05. July.

Terzaghi, K., R. Peck, and G. Mesri, 1996. Soil Mechanics in Engineering Practice, Third Edition. John Wiley and Sons, Inc. New York

University of Wisconsin-Madison (UWM), Wisconsin Geotechnics Laboratory, 2012. Compaction and Hydraulic Properties of Soils from Banding, Utah. Geotechnics Report NO. 12-41 by C.H. Benson and X. Wang. July 24.

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W2

Data File: 13-52106_SP2W2-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\.\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69

Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Parameter
5613.10	Water surface elevation during CPT investigation (ft
5607.57	Water surface elevation at t_0 (ft amsl)
5598.51	Water surface elevation at t_1 (ft amsl)
5593.51	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Eart
7.51	Equiv. Number of Uniform Strain Cycles, N

Value	Parameter
5615.85	Ground Surface Elevation at time of CPT (ft amsl)
5625.87	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pla
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
2.02	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1111.60	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5593.51	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	######	5625.62	5625.37	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	######	5623.62	5621.87	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5619.87	5617.87	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334
Platform/Random Fill Layer	######	5616.86	5615.85	2.02	0.050	101	0.556	0.505	0.00	0.00	0.556	0.505

2013 CPT Data from ConeTec								CPT Data Interpretations															Conditions at t_1			
Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
0.164	5615.69	19.0	0.292	19.0	2.8	1.22	1.53%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0	1.70	32.317	449.21	37.57	2302	1.54%	1.4	51%	0.56	0.00	0.56	0
0.328	5615.52	27.6	0.767	27.6	3.0	1.32	2.78%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	46.937	652.42	54.55	1671	2.78%	1.7	51%	0.57	0.00	0.57	0
0.492	5615.36	63.0	1.250	63.0	2.6	1.13	1.98%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	107.100	######	124.42	2542	1.98%	1.5	51%	0.58	0.00	0.58	0
0.656	5615.19	130.6	1.407	130.6	1.2	0.53	1.08%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0	1.70	221.952	######	257.80	3950	1.08%	1.3	51%	0.59	0.00	0.59	0
0.820	5615.03	202.3	0.922	202.3	2.2	0.96	0.46%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0	1.70	343.859	######	399.40	4896	0.46%	0.9	51%	0.60	0.00	0.60	0
0.984	5614.87	189.1	1.391	189.0	4.1	1.77	0.74%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0	1.70	321.351	######	373.28	3813	0.74%	1.1	51%	0.61	0.00	0.61	0
1.148	5614.70	207.8	1.514	207.8	0.1	0.04	0.73%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0	1.70	353.311	######	410.35	3593	0.73%	1.1	51%	0.61	0.00	0.61	0
1.312	5614.54	81.3	1.745	81.3	0.7	0.29	2.15%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	138.142	######	160.45	1229	2.15%	1.6	51%	0.62	0.00	0.62	0
1.476	5614.37	52.5	1.382	52.5	-0.3	-0.14	2.63%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	89.284	######	103.69	705	2.64%	1.8	51%	0.63	0.00	0.63	0
1.640	5614.21	40.7	1.041	40.7	0.1	0.02	2.56%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0	1.70	69.241	962.45	80.42	492	2.56%	1.8	51%	0.64	0.00	0.64	0
1.804	5614.05	34.3	0.916	34.3	-0.7	-0.29	2.67%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0	1.70	58.310	810.51	67.72	376	2.68%	1.9	51%	0.65	0.00	0.65	0
1.968	5613.88	64.5	1.005	64.5	0.8	0.33	1.56%	Interim Cover	0.050	100.7	0.10	0.00	0.10	0	1.70	109.582	######	127.28	649	1.56%	1.6	51%	0.65	0.00	0.65	0
2.133	5613.72	88.7	1.082	88.7	0.0	0.00	1.22%	Interim Cover	0.050	100.7	0.11	0.00	0.11	0	1.70	150.858	######	175.21	825	1.22%	1.4	51%	0.66	0.00	0.66	0
2.297	5613.55	88.1	1.355	88.1	0.0	0.00	1.54%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	149.685	######	173.85	760	1.54%	1.5	51%	0.67	0.00	0.67	0
2.461	5613.39	81.2	1.017	81.2	0.2	0.08	1.25%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	138.091	######	160.39	655	1.25%	1.5	51%	0.68	0.00	0.68	0
2.625	5613.23	71.1	0.910	71.1	0.7	0.32	1.28%	Interim Cover	0.050	100.7	0.13	0.00	0.13	0	1.70	120.887	######	140.41	537	1.28%	1.5	51%	0.69	0.00	0.69	0
2.789	5613.06	61.0	0.753	61.0	-0.9	-0.37	1.24%	Interim Cover	0.050	100.7	0.14	0.00	0.14	1	1.70	103.632	######	120.35	437	1.24%	1.6	51%	0.70	0.00	0.70	0
2.953	5612.90	57.1	0.690	57.1	-0.9	-0.37	1.21%	Interim Cover	0.050	100.7	0.15	0.01	0.14	1	1.70	97.036	######	112.69	400	1.21%	1.6	51%	0.70	0.00	0.70	0
3.117	5612.73	50.5	0.655	50.5	-0.1	-0.05	1.30%	Interim Cover	0.050	100.7	0.16	0.01	0.15	1	1.70	85.782	######	99.63	346	1.30%	1.6	51%	0.71	0.00	0.71	0
3.281	5612.57	52.1	0.800	52.1	-0.1	-0.06	1.53%	Sand-Slime Tailing	0.059	119.0	0.17	0.02	0.15	1	1.70	88.604	######	102.91	346	1.54%	1.7	47%	0.72	0.00	0.72	0
3.445	5612.41	55.0	0.793	55.0	0.1	0.03	1.44%	Sand-Slime Tailing	0.059	119.0	0.18	0.02	0.15	1	1.70	93.449	######	108.54	354	1.45%	1.7	47%	0.73	0.00	0.73	0
3.609	5612.24	40.3	0.780	40.3	-1.0	-0.44	1.93%	Sand-Slime Tailing	0.059	119.0	0.19	0.03	0.16	1	1.70	68.544	952.76	79.60	252	1.94%	1.8	47%	0.74	0.00	0.74	0
3.773	5612.08	31.5	0.543	31.5	0.5	0.23	1.72%	Sand-Slime Tailing	0.059	119.0	0.20	0.03	0.16	1	1.70	53.584	744.82	62.24	191	1.73%	1.9	47%	0.75	0.00	0.75	0
3.937	5611.91	30.6	0.621	30.6	-0.2	-0.08	2.03%	Sand-Slime Tailing	0.059	119.0	0.21	0.04	0.17	1	1.70	52.088	724.02	60.49	180	2.04%	2.0	47%	0.76	0.00	0.76	0
4.101	5611.75	25.9	0.747	25.9	1.3	0.55	2.89%	Sand-Slime Tailing	0.059	119.0	0.22	0.04	0.17	1	1.70	43.962	611.07	51.07	148	2.91%	2.1	47%	0.77	0.00	0.77	0
4.265	5611.58	25.9	0.883	25.9	7.3	3.14	3.41%	Slime Tailings	0.057	113.1	0.22	0.05	0.18	1	1.70	43.979	611.31	51.17	145	3.44%	2.2	71%	0.78	0.00	0.78	0
4.429	5611.42	89.9	1.190	89.6	44.0	19.08	1.32%	Sand Tailings	0.062	123.5	0.23	0.05	0.18	1	1.70	152.354	######	177.49	491	1.33%	1.6	18%	0.79	0.00	0.79	0
4.593	5611.26	84.3	1.536	84.2	21.1	9.16	1.82%	Sand Tailings	0.062	123.5	0.25	0.06	0.19	1	1.70	143.140	######	166.51	448	1.83%	1.7	18%	0.80	0.00	0.80	0
4.757	5611.09	45.9	1.208	45.9	6.9	3.00	2.63%	Sand-Slime Tailing	0.059	119.0	0.25	0.06	0.19	1	1.70	78.030	######	90.71	238	2.64%	2.0	47%	0.81	0.00	0.81	0
4.921	5610.93	20.0	0.909	20.0	1.7	0.72	4.54%	Slime Tailings	0.057	113.1	0.26	0.07	0.20	1	1.70	34.051	473.31	39.57	101	4.60%	2.4	71%	0.82	0.00	0.82	0
5.085	5610.76	10.4	0.273	10.4	2.2	0.96	2.62%	Slime Tailings	0.057	113.1	0.27	0.07	0.20	1	1.70	17.697	245.99	20.58	51	2.69%	2.4	71%	0.83	0.00	0.83	0
5.249	5610.60	7.0	0.186	7.0	4.3	1.87	2.65%	Slime Tailings	0.057	113.1	0.28	0.08	0.20	1	1.70	11.866	164.94	13.83	33	2.77%	2.6	71%	0.84	0.00	0.84	0
5.413	5610.44	5.8	0.170	5.8	4.1	1.77	2.93%	Slime Tailings	0.057	113.1	0.29	0.08	0.21	1	1.70	9.809	136.35	11.44	26	3.09%	2.7	71%	0.85	0.00	0.85	0
5.577	5610.27	5.5	0.100	5.5	4.8	2.09	1.81%	Slime Tailings	0.057	113.1	0.30	0.09	0.21	1	1.70	9.367	130.20	10.94	25	1.91%	2.6	71%	0.86	0.00	0.86	0
5.741	5610.11	10.8	0.134	10.8	6.8	2.96	1.24%	Sand-Slime Tailing	0.059	119.0	0.31	0.09	0.22	1	1.70	18.360	255.20	21.41	48	1.27%	2.2	47%	0.87	0.00	0.87	0
5.905	5609.94	7.7	0.162	7.6	3.3	1.43	2.12%	Slime Tailings	0.057	113.1	0.32	0.10	0.22	1	1.70	12.971	180.30	15.11	33	2.21%	2.5	71%	0.88	0.00	0.88	0
6.069	5609.78	6.6	0.117	6.6	3.7	1.61	1.76%	Slime Tailings	0.057	113.1	0.33	0.10	0.23	1	1.70	11.254	156.43	13.12	28	1.85%	2.5	71%	0.89	0.00	0.89	0
6.234	5609.62	7.5	0.098	7.5	4.8	2.07	1.30%	Slime Tailings	0.057	113.1	0.34	0.11	0.23	1	1.70	12.767	177.46	14.89	31	1.36%	2.4	71%	0.89	0.00	0.89	0
6.398	5609.45	8.5	0.058	8.5	5.5	2.39	0.68%	Sand-Slime Tailing	0.059	119.0	0.35	0.11	0.23	1	1.70	14.399	200.15	16.79	35	0.71%	2.2	47%	0.90	0.00	0.90	0
6.562	5609.29	11.8	0.109	11.7	5.3	2.29	0.93%	Sand-Slime Tailing	0.059	119.0	0.36	0.12	0.24	1	1.70	19.941	277.18	23.23	48	0.96%	2.2	47%	0.91	0.00	0.91	0
6.726	5609.12	9.5	0.147	9.5	5.2	2.27	1.54%	Sand-Slime Tailing	0.059	119.0	0.37	0.12	0.24	1	1.70	16.150	224.49	18.82	38	1.60%	2.4	47%	0.92	0.00	0.92	0
6.890	5608.96	7.6	0.165	7.5	7.0	3.04	2.18%	Slime Tailings	0.057	113.1	0.38	0.13	0.25	1	1.70	12.801	177.93	14.95	29	2.29%	2.6	71%	0.93	0.00	0.93	0
7.054	5608.80	5.6	0.138	5.5	9.3	4.03	2.48%	Slime Tailings	0.057	113.1	0.39	0.13	0.25	1	1.70	9.350	129.97	10.97	20	2.67%	2.7	71%	0.94	0.00	0.94	0
7.218	5608.63	5.1	0.118	5.0	12.3	5.33	2.33%	Slime Tailings	0.057	113.1	0.40	0.14	0.26	1	1.70	8.483	117.91	10.00	18	2.53%	2.7	71%	0.95	0.00	0.95	0
7.382	5608.47	4.8	0.099	4.7	14.7	6.38	2.05%	Slime Tailings	0.057	113.1	0.41	0.14	0.26	1	1.70	8.058	112.01	9.54	17	2.24%	2.7	71%	0.96	0.00	0.96	0
7.546	5608.30	4.8	0.131	4.7	16.7	7.23	2.74%	Slime Tailings	0.057	113.1	0.41	0.15	0.26	1	1.70	7.956	110.59	9.45	16	3.00%	2.8	71%	0.97	0.00	0.97	0
7.710	5608.14	5.1	0.119	5.0	19.0	8.22	2.35%	Slime Tailings	0.057	113.1	0.42	0.15	0.27	1	1.70	8.415	116.97	10.01	17	2.56%	2.8	71%	0.98	0.00	0.98	0
7.874	5607.98	6.7	0.130	6.5	20.7	8.95	1.95%	Slime Tailings	0.057	113.1	0.43	0.16	0.27	1	1.70	11.118	154.54	13.17	23	2.08%	2.6	71%	0.99	0.00	0.99	0
8.038	5607.81	7.3	0.077	7.3	16.0	6.91	1.05%	Sand-Slime Tailing	0.059	119.0	0.44	0.16	0.28	1	1.70	12.325	171.32	14.51	25	1.11%	2.4	47%	1.00	0.00	1.00	0
8.202	5607.65	8.5	0.080	8.4	14.3	6.19	0.94%	Sand-Slime Tailing	0.059	119.0	0.45	0.17	0.28	1	1.70	14.297	198.73	16.78	28	0.99%	2.4	47%	1.01	0.00	1.01	0
8.366	5607.48	6.1	0.091	6.1	11.4	4.95	1.49%	Slime Tailings	0.057	113.1	0.46	0.18	0.29	1	1.70	10.285	142.96	12.09	20	1.61%	2.6	71%	1.02	0.00	1.02	0
8.530	5607.32	4.7	0.067	4.7	13.0	5.62	1.41%	Slime Tailings	0.057	113.1	0.47	0.18	0.29	1	1.70	7.922	110.12	9.36	15	1.57%	2.7	71%	1.03	0.00	1.03	0
8.694	5607.16	5.0	0.101	4.9	16.1	6.98	2.04%	Slime Tailings	0.057	113.1	0.48	0.19	0.29	1	1.70	8.245	114.61	9.77	15	2.26%	2.8	71%	1.04	0.00	1.04	0
8.858	5606.99	5.0	0.075	4.9	20.4	8.84	1.49%	Slime Tailings	0.057	113.1	0.49	0.19	0.30	1	1.70	8.364	116.26	9.97	15	1.65%	2.7	71%	1.05	0.00	1.05	0
9.022	5606.83	7.8	0.111	7.7	23.6	10.24	1.42%	Slime Tailings	0.057	113.1	0.50	0.20	0.30	1	1.70	13.022	181.01	15.42	24	1.52%	2.5	71%	1.05	0.00	1.05	0
9.186	5606.66	8.8	0.109	8.7	14.2	6.17	1.24%	Sand-Slime Tailing	0.059	119.0	0.51	0.20	0.31	1	1.70	14.739	204.87	17.29	27	1.32%	2.4	47%	1.06	0.00	1.06	0
9.350	5606.50	11.9	0.108	11.8	12.8	5.55	0.91%	Sand-Slime Tailing	0.059	119.0	0.52	0.21	0.31	1	1.70	20.043	278.60	23.44	36	0.95%	2.3	47%	1.07	0.00	1.07	0
9.514	5606.34	10.3	0.138	10.2	9.1	3.92	1.35%	Sand-Slime Tailing	0.059	119.0	0.53	0.21	0.32	1	1.70	17.340	241.03	20.25	31	1.42%	2.4	47%	1.08	0.00	1.08	0
9.678	5606.17	8.8	0.125	8.7	12.4	5.39	1.42%	Sand-Slime Tailing	0.059	119.0	0.54	0.22	0.32	1	1.70	14.858	206.53	17.41	26	1.51%	2.5	47%	1.09	0.00	1.09	0
9.842	5606.01	7.8	0.130	7.7	15.8	6.85	1.68%	Slime Tailings	0.057	113.1	0.55	0.22	0.33	1	1.70	13.022	181.01	15.32	22	1.80%	2.6	71%	1.10	0.00	1.10	0
10.006	5605.84	5.8	0.162	5.7	21.9	9.49	2.79%	Slime Tailings	0.057	113.1	0.56	0.23	0.33	1	1.70	9.656	134.22	11.48	16	3.08%	2.8	71%	1.11	0.00	1.11	0
10.170	5605.68	6.7	0.084	6.5	21.8	9.43	1.26%	Slime Tailings	0.057	113.1	0.57	0.23	0.33	1	1.70	11.101	154.30	13.16	18	1.38%	2.6	71%	1.12	0.00	1.12	0
10.335	5605.52	10.0	0.096	9.8	21.2	9.19	0.96%	Sand-Slime Tailing	0.059	119.0	0.58	0.24	0.34	1	1.70	16.728	232.52	19.69	28	1.02%	2.4	47%	1.13	0.00	1.13	0
10.499	5605.35	8.9	0.103	8.8	20.2	8.74	1.16%	Sand-Slime Tailing	0.059	119.0	0.59	0.24	0.34	1	1.70	14.892	207.00	17.54	24	1.24%	2.5	47%	1.14	0.00	1.14	0
10.663	5605.19	7.0	0.126	6.9	26.1	11.32	1.79%	Slime Tailings	0.057	113.1	0.59	0.25	0.35	1	1.70	11.662	162.10	13.87	18	1.96%	2.7	71%	1.15	0.00	1.15	0
10.827	5605.02	7.3	0.113	7.1	29.0	12.55	1.55%	Slime Tailings	0.057	113.1	0.60	0.25	0.35	1	1.70	12.087	168.01	14.40	19	1.69%	2.6	71%	1.16	0.00	1.16	0
10.991	5604.86	8.8	0.076	8.6	29.8	12.92	0.87%	Sand-Slime Tailing	0.059	119.0	0.61	0.26	0.36	1	1.70	14.586	202.75	17.31	23	0.93%	2.4	47%	1.17	0.00	1.17	0
11.155	5604.70	10.2	0.109	10.0	19.3	8.38	1.07%	Sand-Slime Tailing	0.059	119.0	0.62	0.26	0.36	1	1.70	17.068	237.25	20.06	26	1.14%	2.4	47%	1.18	0.00	1.18	0
11.319	5604.53	8.3	0.156	8.2	20.1	8.71	1.87%	Slime Tailings	0.057	113.1	0.63	0.27	0.37	1	1.70	13.940	193.77	16.44	21	2.03%	2.6	71%	1.19	0.00	1.19	0
11.483	5604.37	7.8	0.195	7.6	32.3	13.99	2.49%	Slime Tailings	0.057	113.1	0.64	0.27	0.37	1	1.70	12.971	180.30	15.46	19	2.71%	2.7	71%	1.20	0.00	1.20	0
11.647	5604.20	8.0	0.126	7.8	34.4	14.89	1.57%	Slime Tailings	0.057	113.1	0.65	0.28	0.37	1	1.70	13.311	185.02	15.88	20	1.70%	2.6	71%	1.21	0.00	1.21	0
11.811	5604.04	9.1	0.108	8.9	32.1	13.92	1.19%	Sand-Slime Tailing	0.059	119.0	0.66	0.28	0.38	1	1.70	15.045	209.13	17.87	22	1.29%	2.5	47%	1.22	0.00	1.22	0
11.975	5603.88	8.0	0.097	7.8	31.7	13.74	1.21%	Sand-Slime Tailing	0.059	119.0	0.67	0.29	0.38	1	1.70	13.311	185.02	15.85	19	1.32%	2.6	47%	1.23	0.00	1.23	0

Liquefaction Triggering Analyses

Depth at time of CPT (ft)	Idriss & Boulanger (2008) Cyclic Stress Ratio					Cyclic Resistance Ratio				Youd et al. (2001) Cyclic Stress Ratio												Idriss & Boulanger (2008)			
	r_d	C_σ	K_σ	K_α	CSR M=7.5, s'v=1atm	Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	r_d	D_r	f	K_σ	K_α	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No	CN	qc1 TSF	qc1 MPa	qc1N
0.164	1.00	0.06	1.03	1.0	0.059	43.50	81.07	0.114	1.92	0.98	0.35	0.80	2.53	1.0	0.017	1.00	37.57	0.081	196.84	99.38	2	1.7	32.347	3.0969	37.569
0.328	1.00	0.07	1.03	1.0	0.060	49.46	104.02	0.149	2.51	0.98	0.43	0.79	2.32	1.0	0.019	1.03	55.95	0.096	116.62	59.56	2	1.7	46.969	4.4968	54.552
0.492	1.00	0.13	1.05	1.0	0.061	73.98	198.41	1.000	16.46	0.98	0.64	0.68	3.13	1.0	0.014	1.00	124.42	0.259	209.31	112.89	2	1.7	107.13	10.256	124.422
0.656	1.00	0.30	1.10	1.0	0.064	120.79	378.59	1.000	15.73	0.98	0.93	0.60	3.68	1.0	0.012	1.00	257.80	1.000	606.04	310.88	2	1.7	221.97	21.251	257.799
0.820	1.00	0.30	1.10	1.0	0.064	170.48	569.88	1.000	15.73	0.97	1.15	0.60	3.37	1.0	0.013	1.00	399.40	1.000	485.02	250.37	2	1.7	343.88	32.923	399.399
0.984	1.00	0.30	1.10	1.0	0.064	161.32	534.60	1.000	15.73	0.97	1.12	0.60	3.13	1.0	0.014	1.00	373.28	1.000	404.34	210.03	2	1.7	321.39	30.77	373.280
1.148	1.00	0.30	1.10	1.0	0.064	174.33	584.68	1.000	15.73	0.97	1.17	0.60	2.95	1.0	0.015	1.00	410.35	1.000	346.72	181.22	2	1.7	353.31	33.826	410.351
1.312	1.00	0.18	1.06	1.0	0.061	86.63	247.08	1.000	16.36	0.97	0.73	0.63	2.56	1.0	0.017	1.00	160.45	1.000	303.50	159.93	2	1.7	138.15	13.226	160.452
1.476	1.00	0.11	1.03	1.0	0.060	66.71	170.40	0.412	6.88	0.97	0.59	0.71	2.05	1.0	0.021	1.07	111.44	0.209	56.33	31.61	2	1.7	89.281	8.5477	103.694
1.640	1.00	0.09	1.03	1.0	0.059	58.54	138.96	0.229	3.86	0.97	0.52	0.74	1.83	1.0	0.023	1.11	89.28	0.146	35.52	19.69	2	1.7	69.242	6.6292	80.420
1.804	1.00	0.08	1.02	1.0	0.059	54.08	121.80	0.183	3.10	0.97	0.48	0.76	1.71	1.0	0.025	1.17	78.96	0.126	27.80	15.45	2	1.7	58.303	5.5819	67.715
1.968	1.00	0.13	1.04	1.0	0.060	74.99	202.27	1.000	16.71	0.97	0.65	0.67	2.02	1.0	0.021	1.00	127.28	0.272	55.07	35.89	2	1.7	109.59	10.492	127.282
2.133	1.00	0.20	1.05	1.0	0.061	91.81	267.02	1.000	16.46	0.97	0.76	0.62	2.22	1.0	0.019	1.00	175.21	1.000	187.13	101.80	2	1.7	150.86	14.443	175.213
2.297	1.00	0.20	1.05	1.0	0.061	91.33	265.18	1.000	16.52	0.97	0.76	0.62	2.15	1.0	0.020	1.00	173.85	1.000	173.84	95.18	2	1.7	149.69	14.331	173.850
2.461	1.00	0.18	1.04	1.0	0.060	86.61	246.99	1.000	16.67	0.97	0.73	0.63	2.03	1.0	0.021	1.00	160.39	1.000	162.31	89.49	2	1.7	138.09	13.221	160.387
2.625	1.00	0.15	1.03	1.0	0.059	79.60	220.01	1.000	16.82	0.97	0.68	0.66	1.90	1.0	0.023	1.00	140.41	0.337	51.37	34.09	2	1.7	120.89	11.574	140.412
2.789	0.99	0.12	1.03	1.0	0.059	72.56	192.91	0.840	14.23	0.97	0.63	0.68	1.78	1.0	0.024	1.00	120.35	0.242	35.00	24.61	2	1.7	103.62	9.9209	120.352
2.953	0.99	0.12	1.02	1.0	0.059	69.87	182.56	0.580	9.86	0.97	0.61	0.69	1.74	1.0	0.025	1.00	112.69	0.213	30.14	20.00	2	1.7	97.027	9.2894	112.691
3.117	0.99	0.11	1.02	1.0	0.059	65.28	164.91	0.362	6.18	0.97	0.58	0.71	1.67	1.0	0.026	1.00	99.63	0.172	23.81	14.99	2	1.7	85.781	8.2126	99.629
3.281	0.99	0.11	1.02	1.0	0.058	66.39	169.30	0.401	6.85	0.97	0.59	0.71	1.67	1.0	0.026	1.03	105.93	0.191	25.57	16.21	2	1.7	88.603	8.4828	102.907
3.445	0.99	0.11	1.02	1.0	0.058	68.37	176.90	0.489	8.38	0.97	0.60	0.70	1.68	1.0	0.025	1.01	109.63	0.203	26.38	17.38	2	1.7	93.45	8.9469	108.536
3.609	0.99	0.09	1.01	1.0	0.058	58.22	137.81	0.225	3.88	0.97	0.52	0.74	1.54	1.0	0.028	1.14	91.09	0.150	19.01	11.45	2	1.7	68.533	6.5614	79.597
3.773	0.99	0.08	1.01	1.0	0.058	52.13	114.37	0.168	2.91	0.97	0.46	0.77	1.46	1.0	0.029	1.17	72.98	0.116	14.28	8.59	2	1.7	53.59	5.1307	62.241
3.937	0.99	0.08	1.01	1.0	0.058	51.52	112.01	0.164	2.84	0.97	0.45	0.78	1.44	1.0	0.030	1.24	75.19	0.120	14.30	8.57	2	1.7	52.086	4.9867	60.495
4.101	0.99	0.07	1.01	1.0	0.058	48.21	99.29	0.141	2.46	0.97	0.41	0.79	1.39	1.0	0.031	1.51	76.95	0.122	14.26	8.36	2	1.7	43.975	4.2102	51.075
4.265	0.99	0.07	1.01	1.0	0.057	47.91	99.07	0.141	2.45	0.97	0.41	0.79	1.39	1.0	0.031	1.64	84.13	0.135	15.41	8.93	2	1.7	44.056	4.2179	51.168
4.429	0.99	0.21	1.02	1.0	0.058	67.47	244.96	1.000	17.24	0.97	0.77	0.62	1.82	1.0	0.023	1.00	177.49	1.000	110.72	63.98	2	1.7	152.82	14.631	177.493
4.593	0.98	0.19	1.01	1.0	0.058	64.66	231.17	1.000	17.33	0.97	0.75	0.63	1.76	1.0	0.024	1.03	171.98	1.000	107.80	62.57	2	1.7	143.36	13.726	166.509
4.757	0.98	0.10	1.01	1.0	0.057	62.12	152.83	0.285	4.98	0.97	0.55	0.73	1.51	1.0	0.028	1.27	114.89	0.221	23.26	14.12	2	1.7	78.104	7.4776	90.713
4.921	0.98	0.06	1.00	1.0	0.057	43.87	83.44	0.117	2.06	0.97	0.36	0.80	1.34	1.0	0.032	2.26	89.35	0.146	15.08	8.57	2	1.7	34.069	3.2617	39.569
5.085	0.98	0.05	1.00	1.0	0.057	37.25	57.84	0.085	1.50	0.96	0.26	0.80	1.34	1.0	0.032	2.38	48.99	0.091	9.17	5.34	2	1.7	17.721	1.6966	20.581
5.249	0.98	0.05	1.00	1.0	0.057	34.91	48.74	0.076	1.34	0.96	0.21	0.80	1.33	1.0	0.032	3.12	43.13	0.086	8.50	4.92	2	1.7	11.912	1.1404	13.835
5.413	0.98	0.05	1.00	1.0	0.057	34.07	45.52	0.073	1.29	0.96	0.20	0.80	1.33	1.0	0.032	3.77	43.19	0.086	8.34	4.82	2	1.7	9.8523	0.9433	11.443
5.577	0.98	0.05	1.00	1.0	0.057	33.90	44.84	0.073	1.28	0.96	0.19	0.80	1.32	1.0	0.032	3.11	34.07	0.078	7.46	4.37	2	1.7	9.4182	0.9017	10.939
5.741	0.98	0.05	1.00	1.0	0.057	37.81	59.22	0.087	1.54	0.96	0.27	0.80	1.32	1.0	0.032	1.72	36.93	0.081	7.52	4.53	2	1.7	18.432	1.7647	21.408
5.905	0.98	0.05	1.00	1.0	0.056	35.35	50.45	0.078	1.38	0.96	0.22	0.80	1.31	1.0	0.032	2.77	41.86	0.085	7.76	4.57	2	1.7	13.006	1.2452	15.106
6.069	0.98	0.05	1.00	1.0	0.056	34.66	47.77	0.075	1.34	0.96	0.21	0.80	1.31	1.0	0.032	2.83	37.11	0.081	7.27	4.30	2	1.7	11.293	1.0812	13.117
6.234	0.98	0.05	1.00	1.0	0.056	35.27	50.16	0.078	1.38	0.96	0.22	0.80	1.30	1.0	0.033	2.29	34.07	0.078	6.91	4.15	2	1.7	12.818	1.2272	14.887
6.398	0.97	0.05	1.00	1.0	0.056	36.19	52.98	0.080	1.43	0.96	0.24	0.80	1.30	1.0	0.033	1.68	28.28	0.074	6.36	3.90	2	1.7	14.458	1.3842	16.792
6.562	0.97	0.05	1.00	1.0	0.056	38.45	61.67	0.090	1.60	0.96	0.28	0.80	1.29	1.0	0.033	1.57	36.41	0.080	6.82	4.21	2	1.7	19.997	1.9145	23.225
6.726	0.97	0.05	1.00	1.0	0.056	36.90	55.72	0.083	1.49	0.96	0.25	0.80	1.29	1.0	0.033	2.20	41.40	0.084	7.04	4.26	2	1.7	16.206	1.5515	18.822
6.890	0.97	0.05	1.00	1.0	0.056	35.30	50.25	0.078	1.39	0.96	0.22	0.80	1.28	1.0	0.033	3.06	45.80	0.088	7.22	4.31	2	1.7	12.875	1.2327	14.954
7.054	0.97	0.05	1.00	1.0	0.056	33.91	44.88	0.073	1.30	0.96	0.19	0.80	1.28	1.0	0.033	4.10	45.03	0.088	7.05	4.18	2	1.7	9.4487	0.9046	10.974
7.218	0.97	0.05	1.00	1.0	0.056	33.57	43.58	0.072	1.28	0.96	0.18	0.80	1.27	1.0	0.033	4.31	43.09	0.086	6.81	4.05	2	1.7	8.6134	0.8246	10.004
7.382	0.97	0.04	1.00	1.0	0.056	33.41	42.95	0.071	1.28	0.96	0.18	0.80	1.27	1.0	0.033	4.26	40.64	0.084	6.55	3.91	2	1.7	8.2142	0.7864	9.540
7.546	0.97	0.04	0.99	1.0	0.056	33.38	42.82	0.071	1.28	0.96	0.18	0.80	1.27	1.0	0.033	4.96	46.83	0.089	6.84	4.06	2	1.7	8.133	0.7787	9.446
7.710	0.97	0.05	0.99	1.0	0.056	33.57	43.58	0.072	1.29	0.96	0.18	0.80	1.26	1.0	0.033	4.48	44.87	0.087	6.62	3.95	2	1.7	8.6163	0.8249	10.007
7.874	0.96	0.05	0.99	1.0	0.055	34.67	47.84	0.075	1.36	0.96	0.21	0.80	1.26	1.0	0.034	3.41	44.85	0.087	6.52	3.94	2	1.7	11.337	1.0854	13.167
8.038	0.96	0.05	0.99	1.0	0.055	35.39	49.90	0.077	1.40	0.96	0.22	0.80	1.25	1.0	0.034	2.44	35.45	0.080	5.84	3.62	2	1.7	12.494	1.1962	14.511
8.202	0.96	0.05	0.99	1.0	0.055	36.19	52.97	0.080	1.46	0.96	0.24	0.80	1.25	1.0	0.034	2.14	35.85	0.080	5.77	3.61	2	1.7	14.449	1.3833	16.781
8.366	0.96	0.05	0.99	1.0	0.055	34.30	46.38	0.074	1.34	0.96	0.20	0.80	1.25	1.0	0.034	3.33	40.24	0.084	5.95	3.64	2	1.7	10.406	0.9963	12.086
8.530	0.96	0.04	0.99	1.0	0.055	33.35	42.71	0.071	1.29	0.96	0.18	0.80	1.24	1.0	0.034	4.02	37.64	0.081	5.71	3.50	2	1.7	8.0596	0.7716	9.361
8.694	0.96	0.05	0.99	1.0	0.055	33.49	43.27	0.071	1.30	0.96	0.18	0.80	1.24	1.0	0.034	4.60	44.99	0.087	6.06	3.68	2	1.7	8.4159	0.8057	9.775
8.858	0.96	0.05	0.99	1.0	0.055	33.56	43.52	0.072	1.30	0.96	0.18	0.80	1.24	1.0	0.034	4.00	39.87	0.083	5.68	3.49	2	1.7	8.5806	0.8215	9.966
9.022	0.96	0.05	0.99	1.0	0.055	35.46	50.87	0.078	1.43	0.96	0.23	0.80	1.23	1.0	0.034	2.84	43.84	0.087	5.83	3.63	2	1.7	13.273	1.2707	15.416
9.186	0.96	0.05	0.99	1.0	0.055	36.37	53.66	0.081	1.48	0.96	0.24	0.80	1.23	1.0	0.034	2.50	43.16	0.086	5.71	3.60	2	1.7	14.89	1.4256	17.294
9.350	0.96	0.05	0.99	1.0	0.055	38.52	61.96	0.090	1.65	0.95	0.28	0.80	1.22	1.0	0.034	1.81	42.45	0.085	5.59	3.62	2	1.7	20.179	1.9319	23.437
9.514	0.95	0.05	0.99	1.0	0.054	37.40	57.65	0.085	1.57	0.95	0.26	0.80	1.22	1.0	0.034	2.36	47.79	0.090	5.79	3.68	2	1.7	17.436	1.6693	20.251
9.678	0.95	0.05	0.99	1.0	0.054	36.41	53.82	0.081	1.49	0.95	0.24	0.80	1.22	1.0	0.035	2.72	47.30	0.089	5.69	3.59	2	1.7	14.99	1.4351	17.410
9.842	0.95	0.05	0.99	1.0	0.054	35.42	50.74	0.078	1.44	0.95	0.23	0.80	1.21	1.0	0.035	3.25	49.79	0.091	5.75	3.59	2	1.7	13.19	1.2628	15.319
10.006	0.95	0.05	0.99	1.0	0.054	34.09	45.57	0.073	1.35	0.95	0.20	0.80	1.21	1.0	0.035	5.13	58.89	0.099	6.14	3.75	2	1.7	9.8884	0.9467	11.485
10.170	0.95	0.05	0.99	1.0	0.054	34.67	47.83	0.075	1.39	0.95	0.21	0.80	1.21	1.0	0.035	3.29	43.25	0.086	5.27	3.33	2	1.7	11.332	1.0849	13.161
10.335	0.95	0.05	0.99	1.0	0.054	37.21	56.90	0.084	1.56	0.95	0.26	0.80	1.20	1.0	0.035	2.20	43.26	0.086	5.20	3.38	2	1.7	16.953	1.6231	19.690
10.499	0.95	0.05	0.99	1.0	0.054	36.45	54.00	0.081	1.51	0.95	0.24	0.80	1.20	1.0	0.035	2.60	45.66	0.088	5.26	3.38	2	1.7	15.106	1.4462	17.545
10.663	0.95	0.05	0.99	1.0	0.054	34.92	48.78	0.076	1.41	0.95	0.21	0.80	1.20	1.0	0.035	3.80	52.67	0.094	5.52	3.47	2	1.7	11.939	1.1431	13.867
10.827	0.95	0.05	0.99	1.0	0.054	35.10	49.50	0.077	1.43	0.95	0.22	0.80	1.20	1.0	0.035	3.49	50.26	0.092	5.36	3.39	2	1.7	12.394	1.1866	14.395
10.991	0.94	0.05	0.98	1.0	0.054	36.37	53.68	0.081	1.51	0.95	0.24	0.80	1.19	1.0	0.035	2.41	41.68	0.085	4.88	3.19	2	1.7	14.902	1.4268	17.308
11.155	0.94	0.05	0.98	1.0	0.054	37.34	57.40	0.085	1.59	0.95	0.26	0.80	1.19	1.0	0.035	2.37	47.58	0.090	5.10	3.34	2	1.7	17.273	1.6537	20.062
11.319	0.94	0.05	0.98	1.0	0.054	35.81	52.25	0.080	1.49	0.95	0.23	0.80	1.19	1.0	0.035	3.54	58.25	0.098	5.53	3.51	2	1.7	14.153	1.355	16.438
11.483	0.94	0.05	0.98	1.0	0.054	35.47	50.94	0.078	1.47	0.95	0.23	0.80	1.18	1.0	0.035	4.27	66.05	0.107	5.94	3.70	2	1.7	13.314	1.2747	15.463
11.647	0.94	0.05	0.98	1.0	0.053	35.62	51.50	0.079	1.48	0.95	0.23	0.80	1.18	1.0	0.035	3.41	54.19	0.095	5.22	3.35	2	1.7	13.676	1.3093	15.883
11.811	0.94	0.05	0.98	1.0	0.053	36.57	54.44	0.082	1.54	0.95	0.24	0.80	1.18	1.0	0.035	2.80	50.01	0.092	4.98	3.26	2	1.7	15.386	1.4731	17.870
11.975	0.94	0.05	0.98	1.0	0.053	35.86	51.71	0.079	1.49	0.95	0.23	0.80	1.18	1.0	0.036	3.12	49.38	0.091	4.90	3.19	2	1.7	13.648	1.3066	15.851

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W2

Data File: 13-52106_SP2W2-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Parameter
5613.10	Water surface elevation during CPT investigation (ft
5607.57	Water surface elevation at t_0 (ft amsl)
5598.51	Water surface elevation at t_1 (ft amsl)
5593.51	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Eartl
7.51	Equiv. Number of Uniform Strain Cycles, N
5615.85	Ground Surface Elevation at time of CPT (ft amsl)
5625.87	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pla
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
2.02	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1111.60	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5593.51	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	######	5625.62	5625.37	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	######	5623.62	5621.87	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5619.87	5617.87	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334
Platform/Random Fill Layer	######	5616.86	5615.85	2.02	0.050	101	0.556	0.505	0.00	0.00	0.556	0.505

2013 CPT Data from ConeTec

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines
12.139	5603.71	7.7	0.106	7.5	40.4	17.50	1.37%	Slime Tailings
12.303	5603.55	7.1	0.110	6.8	39.6	17.17	1.56%	Slime Tailings
12.467	5603.38	6.8	0.107	6.6	37.4	16.22	1.57%	Slime Tailings
12.631	5603.22	7.0	0.092	6.8	30.6	13.25	1.32%	Slime Tailings
12.795	5603.05	6.2	0.105	6.0	36.6	15.85	1.68%	Slime Tailings
12.959	5602.89	7.8	0.124	7.5	43.8	18.98	1.60%	Slime Tailings
13.123	5602.73	10.5	0.147	10.3	32.1	13.89	1.40%	Sand-Slime Tailin
13.287	5602.56	8.1	0.177	8.0	30.0	13.02	2.18%	Slime Tailings
13.451	5602.40	6.8	0.135	6.6	34.3	14.86	1.98%	Slime Tailings
13.615	5602.23	7.9	0.138	7.7	36.4	15.78	1.74%	Slime Tailings
13.779	5602.07	6.3	0.125	6.2	26.0	11.28	1.97%	Slime Tailings
13.943	5601.91	8.1	0.120	7.9	29.9	12.95	1.49%	Slime Tailings
14.107	5601.74	16.0	0.167	16.0	7.3	3.14	1.04%	Sand-Slime Tailin
14.271	5601.58	12.3	0.154	12.2	9.6	4.16	1.25%	Sand-Slime Tailin
14.436	5601.41	9.4	0.143	9.3	15.0	6.48	1.52%	Sand-Slime Tailin
14.600	5601.25	7.8	0.109	7.7	29.2	12.64	1.39%	Slime Tailings
14.764	5601.09	7.9	0.092	7.6	52.5	22.75	1.16%	Sand-Slime Tailin
14.928	5600.92	7.5	0.153	7.1	63.0	27.30	2.03%	Slime Tailings
15.092	5600.76	7.7	0.237	7.3	69.8	30.26	3.08%	Slime Tailings
15.256	5600.59	9.1	0.255	9.0	23.2	10.06	2.79%	Slime Tailings
15.420	5600.43	10.0	0.246	9.8	31.0	13.41	2.45%	Slime Tailings
15.584	5600.27	9.3	0.199	9.1	28.5	12.35	2.14%	Slime Tailings
15.748	5600.10	9.5	0.138	9.2	48.8	21.16	1.45%	Sand-Slime Tailin
15.912	5599.94	9.5	0.075	9.3	47.2	20.47	0.79%	Sand-Slime Tailin
16.076	5599.77	10.5	0.072	10.3	43.2	18.73	0.68%	Sand-Slime Tailin
16.240	5599.61	29.3	0.191	29.0	50.3	21.81	0.65%	Sand-Slime Tailin
16.404	5599.45	22.6	0.359	22.6	8.2	3.54	1.59%	Sand-Slime Tailin
16.568	5599.28	14.1	0.339	14.0	14.0	6.07	2.40%	Slime Tailings
16.732	5599.12	8.8	0.276	8.7	23.2	10.05	3.13%	Slime Tailings
16.896	5598.95	8.5	0.184	8.2	42.7	18.51	2.17%	Slime Tailings
17.060	5598.79	8.5	0.183	8.2	54.7	23.72	2.15%	Slime Tailings
17.224	5598.63	8.3	0.174	7.9	66.5	28.82	2.09%	Slime Tailings
17.388	5598.46	9.6	0.196	9.2	57.7	25.02	2.05%	Slime Tailings
17.552	5598.30	8.9	0.209	8.4	74.2	32.14	2.35%	Slime Tailings
17.716	5598.13	9.1	0.199	8.7	67.5	29.25	2.19%	Slime Tailings
17.880	5597.97	9.1	0.170	8.7	60.5	26.22	1.88%	Slime Tailings
18.044	5597.81	9.4	0.142	9.0	57.5	24.92	1.52%	Sand-Slime Tailin
18.208	5597.64	8.7	0.209	8.3	57.7	25.02	2.41%	Slime Tailings
18.372	5597.48	10.0	0.260	9.5	72.0	31.20	2.61%	Slime Tailings
18.537	5597.31	10.6	0.320	10.3	54.3	23.51	3.02%	Slime Tailings
18.701	5597.15	12.3	0.297	12.1	37.1	16.09	2.42%	Slime Tailings
18.865	5596.99	17.2	0.199	17.1	20.4	8.85	1.16%	Sand-Slime Tailin
19.029	5596.82	16.8	0.219	16.7	20.1	8.71	1.31%	Sand-Slime Tailin
19.193	5596.66	15.5	0.212	15.4	19.4	8.42	1.37%	Sand-Slime Tailin
19.357	5596.49	11.9	0.188	11.8	28.4	12.32	1.58%	Sand-Slime Tailin
19.521	5596.33	10.5	0.213	10.3	42.0	18.18	2.02%	Slime Tailings
19.685	5596.17	10.7	0.236	10.3	60.5	26.21	2.21%	Slime Tailings
19.849	5596.00	13.4	0.216	13.1	40.2	17.42	1.62%	Sand-Slime Tailin
20.013	5595.84	12.8	0.185	12.6	40.5	17.54	1.44%	Sand-Slime Tailin
20.177	5595.67	14.7	0.185	14.4	48.7	21.12	1.26%	Sand-Slime Tailin
20.341	5595.51	13.5	0.185	13.4	28.8	12.46	1.37%	Sand-Slime Tailin

CPT Data Interpretations

Depth (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %
12.139	0.057	113.1	0.68	0.29	0.39	1	1.70	12.682	176.28	15.23	18	1.51%	2.6	71%
12.303	0.057	113.1	0.69	0.30	0.39	1	1.70	11.594	161.16	13.95	16	1.72%	2.7	71%
12.467	0.057	113.1	0.70	0.30	0.40	1	1.70	11.169	155.25	13.43	15	1.75%	2.7	71%
12.631	0.057	113.1	0.71	0.31	0.40	1	1.70	11.543	160.45	13.78	16	1.47%	2.7	71%
12.795	0.057	113.1	0.72	0.31	0.40	1	1.70	10.234	142.25	12.34	14	1.90%	2.8	71%
12.959	0.057	113.1	0.73	0.32	0.41	1	1.70	12.733	176.99	15.33	17	1.76%	2.7	71%
13.123	0.059	119.0	0.74	0.32	0.41	1	1.70	17.493	243.15	20.71	24	1.51%	2.5	47%
13.287	0.057	113.1	0.75	0.33	0.42	1	1.70	13.515	187.86	16.07	18	2.39%	2.7	71%
13.451	0.057	113.1	0.75	0.33	0.42	1	1.70	11.237	156.19	13.47	14	2.22%	2.8	71%
13.615	0.057	113.1	0.76	0.34	0.43	1	1.70	13.073	181.71	15.63	17	1.93%	2.7	71%
13.779	0.057	113.1	0.77	0.34	0.43	1	1.70	10.489	145.80	12.50	13	2.25%	2.8	71%
13.943	0.057	113.1	0.78	0.35	0.43	1	1.70	13.413	186.44	15.95	17	1.65%	2.7	71%
14.107	0.059	119.0	0.79	0.35	0.44	1	1.63	26.112	362.96	30.41	35	1.09%	2.3	47%
14.271	0.059	119.0	0.80	0.36	0.44	1	1.66	20.342	282.76	23.74	26	1.34%	2.5	47%
14.436	0.059	119.0	0.81	0.36	0.45	1	1.67	15.535	215.94	18.22	19	1.66%	2.6	47%
14.600	0.057	113.1	0.82	0.37	0.45	1	1.66	12.673	176.16	15.07	16	1.55%	2.7	71%
14.764	0.059	119.0	0.83	0.37	0.46	1	1.64	12.474	173.39	15.11	16	1.30%	2.6	47%
14.928	0.057	113.1	0.84	0.38	0.46	1	1.63	11.651	161.95	14.28	15	2.29%	2.8	71%
15.092	0.057	113.1	0.85	0.39	0.46	1	1.62	11.780	163.74	14.50	15	3.46%	2.9	71%
15.256	0.057	113.1	0.86	0.39	0.47	1	1.61	14.482	201.30	17.09	18	3.08%	2.8	71%
15.420	0.057	113.1	0.87	0.40	0.47	1	1.60	15.709	218.35	18.60	19	2.69%	2.7	71%
15.584	0.057	113.1	0.88	0.40	0.48	1	1.59	14.475	201.20	17.14	18	2.36%	2.7	71%
15.748	0.059	119.0	0.89	0.41	0.48	1	1.58	14.476	201.21	17.37	18	1.60%	2.6	47%
15.912	0.059	119.0	0.90	0.41	0.49	1	1.56	14.461	201.01	17.33	18	0.87%	2.5	47%
16.076	0.059	119.0	0.91	0.42	0.49	1	1.55	15.937	221.53	19.00	20	0.75%	2.4	47%
16.240	0.059	119.0	0.92	0.42	0.50	1	1.43	41.329	574.48	48.52	57	0.67%	2.0	47%
16.404	0.059	119.0	0.93	0.43	0.50	1	1.45	32.779	455.63	38.16	43	1.65%	2.3	47%
16.568	0.057	113.1	0.94	0.43	0.50	1	1.50	21.048	292.57	24.60	26	2.57%	2.6	71%
16.732	0.057	113.1	0.94	0.44	0.51	1	1.51	13.104	182.14	15.47	16	3.50%	2.9	71%
16.896	0.057	113.1	0.95	0.44	0.51	1	1.50	12.346	171.60	14.80	15	2.44%	2.8	71%
17.060	0.057	113.1	0.96	0.45	0.52	1	1.49	12.178	169.28	14.74	15	2.42%	2.8	71%
17.224	0.057	113.1	0.97	0.45	0.52	1	1.48	11.717	162.87	14.32	14	2.37%	2.8	71%
17.388	0.057	113.1	0.98	0.46	0.53	1	1.47	13.529	188.05	16.33	16	2.29%	2.8	71%
17.552	0.057	113.1	0.99	0.46	0.53	1	1.46	12.319	171.23	15.09	15	2.65%	2.8	71%
17.716	0.057	113.1	1.00	0.47	0.53	1	1.45	12.622	175.44	15.37	15	2.46%	2.8	71%
17.880	0.057	113.1	1.01	0.47	0.54	1	1.45	12.545	174.38	15.20	15	2.11%	2.8	71%
18.044	0.059	119.0	1.02	0.48	0.54	1	1.44	12.921	179.60	15.61	15	1.70%	2.7	47%
18.208	0.057	113.1	1.03	0.48	0.55	1	1.43	11.845	164.64	14.35	14	2.74%	2.9	71%
18.372	0.057	113.1	1.04	0.49	0.55	1	1.42	13.491	187.53	16.41	16	2.91%	2.8	71%
18.537	0.057	113.1	1.05	0.49	0.55	1	1.41	14.484	201.33	17.38	17	3.35%	2.8	71%
18.701	0.057	113.1	1.06	0.50	0.56	1	1.40	16.910	235.04	20.02	20	2.64%	2.7	71%
18.865	0.059	119.0	1.07	0.50	0.56	1	1.37	23.404	325.31	27.38	29	1.23%	2.4	47%
19.029	0.059	119.0	1.08	0.51	0.57	1	1.36	22.707	315.63	26.57	28	1.39%	2.4	47%
19.193	0.059	119.0	1.09	0.51	0.57	1	1.36	20.954	291.26	24.53	25	1.47%	2.5	47%
19.357	0.059	119.0	1.10	0.52	0.58	1	1.37	16.059	223.22	18.93	19	1.74%	2.6	47%
19.521	0.057	113.1	1.10	0.52	0.58	1	1.36	13.972	194.20	16.64	16	2.26%	2.8	71%
19.685	0.057	113.1	1.11	0.53	0.59	1	1.35	13.907	193.31	16.75	16	2.47%	2.8	71%
19.849	0.059	119.0	1.12	0.53	0.59	1	1.34	17.596	244.59	20.83	21	1.77%	2.6	47%
20.013	0.059	119.0	1.13	0.54	0.59	1	1.34	16.808	233.63	19.91	20	1.58%	2.6	47%
20.177	0.059	119.0	1.14	0.54	0.60	1	1.32	18.997	264.05	22.53	23	1.37%	2.5	47%
20.341	0.059	119.0	1.15	0.55	0.60	1	1.32	17.608	244.76	20.73	20	1.49%	2.6	47%

Conditions at t_1 / Liquefaction Triggering Analyses – Idriss & Boulanger (2008)

Depth (ft)	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No	r_d	C_σ	K_σ	K_α	CSR M=7.5, s'v=1atm	Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS
12.139	1.24	0.00	1.24	0	0.94	0.05	0.98	1.0	0.053	35.39	50.62	0.078	1.47
12.303	1.25	0.00	1.25	0	0.94	0.05	0.98	1.0	0.053	34.95	48.90	0.076	1.44
12.467	1.25	0.00	1.25	0	0.93	0.05	0.98	1.0	0.053	34.77	48.20	0.076	1.43
12.631	1.26	0.00	1.26	0	0.93	0.05	0.98	1.0	0.053	34.89	48.67	0.076	1.44
12.795	1.27	0.00	1.27	0	0.93	0.05	0.98	1.0	0.053	34.38	46.72	0.074	1.41
12.959	1.28	0.00	1.28	0	0.93	0.05	0.98	1.0	0.053	35.43	50.75	0.078	1.48
13.123	1.29	0.00	1.29	0	0.93	0.05	0.98	1.0	0.053	37.57	58.28	0.086	1.64
13.287	1.30	0.00	1.30	0	0.93	0.05	0.98	1.0	0.053	35.68	51.75	0.079	1.51
13.451	1.31	0.00	1.31	0	0.93	0.05	0.98	1.0	0.052	34.78	48.25	0.076	1.44
13.615	1.32	0.00	1.32	0	0.93	0.05	0.98	1.0	0.052	35.53	51.16	0.079	1.50
13.779	1.33	0.00	1.33	0	0.92	0.05	0.98	1.0	0.052	34.44	46.95	0.075	1.43
13.943	1.34	0.00	1.34	0	0.92	0.05	0.98	1.0	0.052	35.64	51.59	0.079	1.51
14.107	1.35	0.00	1.35	0	0.92	0.06	0.97	1.0	0.052	40.97	71.38	0.101	1.95
14.271	1.36	0.00	1.36	0	0.92	0.05	0.97	1.0	0.052	38.63	62.37	0.091	1.74
14.436	1.37	0.00	1.37	0	0.92	0.05	0.98	1.0	0.052	36.69	54.92	0.082	1.59
14.600	1.38	0.00	1.38	0	0.92	0.05	0.98	1.0	0.052	35.34	50.41	0.078	1.50
14.764	1.39	0.00	1.39	0	0.92	0.05	0.98	1.0	0.052	35.60	50.72	0.078	1.51
14.928	1.40	0.00	1.40	0	0.92	0.05	0.98	1.0	0.052	35.06	49.34	0.077	1.49
15.092	1.41	0.00	1.41	0	0.91	0.05	0.98	1.0	0.052	35.14	49.64	0.077	1.49
15.256	1.41	0.00	1.41	0	0.91	0.05	0.97	1.0	0.051	36.04	53.13	0.081	1.57
15.420	1.42	0.00	1.42	0	0.91	0.05	0.97	1.0	0.051	36.57	55.17	0.083	1.61
15.584	1.43	0.00	1.43	0	0.91	0.05	0.97	1.0	0.051	36.06	53.20	0.081	1.57
15.748	1.44	0.00	1.44	0	0.91	0.05	0.97	1.0	0.051	36.39	53.76	0.081	1.59
15.912	1.45	0.00	1.45	0	0.91	0.05	0.97	1.0	0.051	36.38	53.71	0.081	1.59
16.076	1.46	0.00	1.46	0	0.91	0.05	0.97	1.0	0.051	36.96	55.96	0.083	1.64
16.240	1.47	0.00	1.47	0	0.91	0.07	0.96	1.0	0.050	47.32	95.84	0.136	2.70
16.404	1.48	0.00	1.48	0	0.90	0.06	0.97	1.0	0.050	43.68	81.84	0.115	2.28
16.568	1.49	0.00	1.49	0	0.90	0.06	0.97	1.0	0.051	38.65	63.25	0.092	1.81
16.732	1.50	0.00	1.50	0	0.90	0.05	0.97	1.0	0.051	35.48	50.95	0.078	1.55
16.896	1.51	0.00	1.51	0	0.90	0.05	0.97	1.0	0.051	35.24	50.05	0.078	1.53
17.060	1.52	0.00	1.52	0	0.90	0.05	0.97	1.0	0.051	35.22	49.96	0.077	1.53
17.224	1.53	0.00	1.53	0	0.90	0.05	0.97	1.0	0.050	35.08	49.40	0.077	1.52
17.388	1.54	0.00	1.54	1	0.90	0.05	0.97	1.0	0.050	35.77	52.10	0.080	1.58
17.552	1.55	0.01	1.54	1	0.90	0.05	0.97	1.0	0.051	35.34	50.44	0.078	1.54
17.716	1.56	0.01	1.54	1	0.89	0.05	0.97	1.0	0.051	35.44	50.81	0.078	1.55
17.880	1.57	0.02	1.55	1	0.89	0.05	0.97	1.0	0.051	35.38	50.59	0.078	1.54
18.044	1.58	0.02	1.55	1	0.89	0.05	0.97	1.0	0.051	35.77	51.38	0.079	1.55
18.208	1.58	0.03	1.56	1	0.89	0.05	0.97	1.0	0.051	35.09	49.44	0.077	1.51
18.372	1.59	0.03	1.56	1	0.89	0.05	0.97	1.0	0.051	35.80	52.21	0.080	1.56
18.537	1.60	0.04	1.57	1	0.89	0.05	0.97	1.0	0.051	36.14	53.52	0.081	1.59
18.701	1.61	0.04	1.57	1	0.89	0.05	0.97	1.0	0.051	37.06	57.08	0.085	1.66
18.865	1.62	0.05	1.57	1	0.89	0.06	0.97	1.0	0.051	39.91	67.29	0.096	1.89
19.029	1.63	0.05	1.58	1	0.88	0.06	0.97	1.0	0.051	39.62	66.19	0.095	1.86
19.193	1.64	0.06	1.58	1	0.88	0.06	0.97	1.0	0.051	38.90	63.43	0.092	1.79
19.357	1.65	0.06	1.59	1	0.88	0.05	0.97	1.0	0.051	36.94	55.88	0.083	1.63
19.521	1.66	0.07	1.59	1	0.88	0.05	0.97	1.0	0.051	35.88	52.52	0.080	1.56
19.685	1.67	0.07	1.60	1	0.88	0.05	0.97	1.0	0.051	35.92	52.66	0.080	1.56
19.849	1.68	0.08	1.60	1	0.88	0.05	0.97	1.0	0.051	37.61	58.44	0.086	1.67
20.013	1.69	0.08	1.61	1	0.88	0.05	0.97	1.0	0.052	37.29	57.20	0.085	1.65
20.177	1.70	0.09	1.61	1	0.87	0.05	0.97	1.0	0.052	38.20	60.73	0.089	1.72
20.341	1.71	0.09	1.62	1	0.87	0.05	0.97	1.0	0.052	37.57	58.30	0.086	1.66

Liquefaction Triggering Analyses – Youd et al. (2001)

Depth (ft)	r_d	D_r	f	K_σ	K_α	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No
12.139	0.95	0.23	0.80	1.17	1.0	0.036	3.42	52.15	0.093	4.96	3.21	2
12.303	0.95	0.22	0.80	1.17	1.0	0.036	3.90	54.45	0.095	5.00	3.22	2
12.467	0.95	0.21	0.80	1.17	1.0	0.036	4.07	54.72	0.095	4.96	3.20	2
12.631	0.95	0.21	0.80	1.17	1.0	0.036	3.74	51.51	0.093	4.78	3.11	2
12.795	0.95	0.20	0.80	1.16	1.0	0.036	4.56	56.24	0.097	4.93	3.17	2
12.959	0.95	0.23	0.80	1.16	1.0	0.036	3.79	58.13	0.098	4.97	3.23	2
13.123	0.95	0.26	0.80	1.16	1.0	0.036	2.87	59.45	0.100	4.98	3.31	2
13.287	0.95	0.23	0.80	1.16	1.0	0.036	4.27	68.65	0.110	5.46	3.48	2
13.451	0.95	0.21	0.80	1.15	1.0	0.036	4.72	63.58	0.104	5.10	3.27	2
13.615	0.94	0.23	0.80	1.15	1.0	0.036	4.01	62.70	0.103	5.01	3.25	2
13.779	0.94	0.20	0.80	1.15	1.0	0.036	5.08	63.48	0.104	5.00	3.21	2
13.943	0.94	0.23	0.80	1.15	1.0	0.036	3.74	59.68	0.100	4.76	3.14	2
14.107	0.94	0.32	0.80	1.14	1.0	0.036	1.96	59.56	0.100	4.71	3.33	2
14.271	0.94	0.28	0.80	1.14	1.0	0.036	2.56	60.83	0.101	4.72	3.23	2
14.436	0.94	0.25	0.80	1.14	1.0	0.036	3.44	62.76	0.103	4.77	3.18	2
14.600	0.94	0.22	0.80	1.14	1.0	0.037	3.86	58.13	0.098	4.51	3.01	2
14.764	0.94	0.22	0.80	1.14	1.0	0.037	3.58	54.12	0.095	4.31	2.91	2
14.928	0.94	0.22	0.80	1.13	1.0	0.037	4.75	67.81	0.109	4.91	3.20	2
15.092	0.94	0.22	0.80	1.13	1.0	0.037	5.66	82.06	0.131	5.87	3.68	2
15.256	0.94	0.24	0.80	1.13	1.0	0.037	4.81	82.21	0.132	5.83	3.70	2
15.420	0.94	0.25	0.80	1.13	1.0	0.037	4.26	79.34	0.126	5.55	3.58	2
15.584	0.94	0.24	0.80	1.13	1.0	0.037	4.26	73.00	0.116	5.06	3.32	2
15.748	0.94	0.24	0.80	1.12	1.0	0.037	3.55	61.75	0.102	4.40	2.99	2
15.912	0.94	0.24	0.80	1.12	1.0	0.037	2.79	48.31	0.090	3.86	2.72	2
16.076	0.94	0.25	0.80	1.12	1.0	0.037	2.47	46.86	0.089	3.77	2.70	2
16.240	0.94	0.40	0.80	1.12	1.0	0.037	1.31	63.59	0.104	4.36	3.53	2
16.404	0.94	0.36	0.80	1.11	1.0	0.037	2.05	78.17	0.124	5.18	3.73	2
16.568	0.94	0.29	0.80	1.11	1.0	0.037	3.46	85.09	0.137	5.67	3.74	2
16.732	0.94	0.23	0.80	1.11	1.0	0.037	5.53	85.58	0.138	5.67	3.61	2
16.896	0.94	0.22	0.80	1.11	1.0	0.037	4.85	71.80	0.114	4.65	3.09	2
17.060	0.94	0.22	0.80	1.11	1.0	0.037	4.86	71.61	0.114	4.61	3.07	2
17.224	0.94	0.22	0.80	1.11	1.0	0.037	4.91	70.38	0.112	4.50	3.01	2
17.388	0.94	0.23	0.80	1.10	1.0	0.037	4.41	72.07	0.115	4.56	3.07	2
17.552	0.94	0.22	0.80	1.10	1.0	0.038	4.99	75.30	0.120	4.70	3.12	2
17.716	0.94	0.23	0.80	1.10	1.0	0.038	4.77	73.31	0.117	4.53	3.04	2
17.880	0.93	0.23	0.80	1.10	1.0	0.038	4.50	68.48	0.110	4.22	2.88	2
18.044	0.93	0.23	0.80	1.10	1.0	0.038	4.03	62.94	0.103	3.92	2.74	2
18.208	0.93	0.22	0.80	1.10	1.0	0.038	5.27	75.69	0.120	4.53	3.02	2
18.372	0.93	0.23	0.80	1.09	1.0	0.038	4.95	81.19	0.130	4.83	3.20	2
18.537	0.93	0.24	0.80	1.09	1.0	0.039	5.08	88.30	0.144	5.31	3.45	2
18.701	0.93	0.26	0.80	1.09	1.0	0.039	4.13	82.75	0.133	4.84	3.25	2
18.865	0.93	0.30	0.80	1.09	1.0	0.039	2.32	63.52	0.104	3.75	2.82	2
19.029	0.93	0.30	0.80	1.09	1.0	0.039	2.50	66.55	0.107	3.83	2.85	2
19.193	0.93	0.29	0.80	1.08	1.0	0.039	2.72	66.83	0.108	3.80	2.80	2
19.357	0.93	0.25	0.80	1.08	1.0	0.039	3.56	67.47	0.109	3.79	2.71	2
19.521	0.93	0.24	0.80	1.08	1.0	0.040	4.40	73.27	0.117	4.03	2.79	2
19.685	0.93	0.24	0.80	1.08	1.0	0.040	4.57	76.54	0.122	4.17	2.86	2
19.849	0.93	0.26	0.80	1.08	1.0	0.040	3.36	70.06	0.112	3.80	2.74	2
20.013	0.93	0.26	0.80	1.08	1.0	0.040	3.31	65.95	0.107	3.58	2.61	2
20.177	0.93	0.27	0.80	1.08	1.0	0.040	2.84	63.94	0.104	3.47	2.59	2
20.341	0.93	0.26	0.80	1.07	1.0	0.040	3.15	65.23	0.106	3.49	2.58	2

Idriss & Boulanger (2008)

Depth (ft)	CN	qc1 TSF	qc1 MPa	qc1N
12.139	1.7	13.111	1.2552	15.227
12.303	1.7	12.015	1.1503	13.954
12.467	1.7	11.566	1.1073	13.433
12.631	1.7	11.867	1.1362	13.783
12.795	1.7	10.622	1.017	12.337
12.959	1.7	13.198	1.2636	15.328
13.123	1.7	17.833	1.7073	20.712
13.287	1.7	13.834	1.3244	16.067
13.451	1.7	11.601	1.1107	13.474
13.615	1.7	13.459	1.2886	15.632
13.779	1.7	10.765	1.0307	12.503
13.943	1.7	13.73	1.3145	15.947
14.107	1.632	26.186	2.507	30.413
14.271	1.661961	20.442	1.9571	23.742
14.436	1.668682	15.691	1.5023	18.224
14.600	1.656647	12.975	1.2422	15.070
14.764	1.643455	13.012	1.2458	15.113
14.928	1.631828	12.293	1.1769	14.278
15.092	1.620387	12.486	1.1955	14.502
15.256	1.609127	14.715	1.4088	17.091
15.420	1.598044	16.018	1.5335	18.603
15.584	1.587134	14.757	1.4128	17.139
15.748	1.575164	14.956	1.4319	17.370
15.912	1.563399	14.922	1.4287	17.331
16.076	1.551831	16.356	1.5659	18.997
16.240	1.427613	41.778	3.9998	48.522
16.404	1.452341	32.853	3.1454	38.157
16.568	1.500236	21.179	2.0277	24.599
16.732	1.509668	13.323	1.2755	15.473
16.896	1.500079	12.746	1.2203	14.803
17.060	1.490627	12.688	1.2147	14.736
17.224	1.481311	12.332	1.1807	14.323
17.388	1.472126	14.059	1.346	16.329
17.552	1.463069	12.996	1.2443	15.095
17.716	1.454139	13.235	1.2671	15.371
17.880	1.445332	13.091	1.2534	15.205
18.044	1.435653	13.436	1.2864	15.605
18.208	1.427098	12.359	1.1833	14.354
18.372	1.418658	14.129	1.3527	16.410
18.537	1.410331	14.962	1.4324	17.377
18.701	1.402115	17.235	1.65	20.017
18.865	1.369428	23.578	2.2574	27.385
19.029	1.363804	22.878	2.1904	26.572
19.193	1.362408	21.119	2.0219	24.528
19.357	1.366753	16.302	1.5607	18.934
19.521	1.359102	14.327	1.3717	16.641
19.685	1.351548	14.418	1.3804	16.745
19.849	1.343236	17.933	1.717	20.829
20.013	1.335039	17.146	1.6415	19.913
20.177	1.321958	19.399	1.8572	22.531
20.341	1.318983	17.845	1.7085	20.726

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W3

Data File: 13-52106_SP2W3-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\.\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Tailings Sands
Tailings Sand-Slimes
Tailings Slimes
Interim Cover
Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)

Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69

Youd, et al (2001)

Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

5613.80	Water surface elevation during CPT investigation (f
5607.44	Water surface elevation at t_0 (ft amsl)
5597.74	Water surface elevation at t_1 (ft amsl)
5592.74	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Ea
7.51	Equiv. Number of Uniform Strain Cycles, N

5615.72	Ground Surface Elevation at time of CPT (ft amsl)
5626.27	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pla
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
2.55	Thickness of Random/Platform Fill on top of existing interim cover (ft)
1164.98	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5592.74	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	######	5626.02	5625.77	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	######	5624.02	5622.27	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5620.27	5618.27	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334
Platform/Random Fill Layer	######	5617	5615.72	2.55	0.050	101	0.582	0.518	0.00	0.00	0.582	0.518

2013 CPT Data from ConeTec															CPT Data Interpretations								Conditions at t_1				Liquefaction Triggering Analyses: Idriss & Boulanger (2008)									Youd et al. (2001)												Idriss & Boulanger (2008)			
Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of CPT (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No	r_d	C_σ	K_σ	K_α	CSR M=7.5, s'v=1atm	Δq_{c1n}	$q_{c1n\text{-}cs}$	(CRR) M=7.5, s'v=1atm	FoS	r_d	D_r	f	K_σ	K_α	CSR M=7.5, s'v=1atm	Kc	$q_{c1n\text{-}cs}$	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No	CN	qc1 TSF	qc1 MPa	qc1N
0.164	5615.56	7.7	0.125	7.7	1.9	0.82	1.62%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0	1.70	13.124	182.42	15.27	935	1.62%	1.5	51%	0.59	0.00	0.59	0	1.00	0.05	1.02	1.0	0.059	35.68	50.94	0.078	1.33	0.98	0.23	0.80	2.53	1.0	0.017	1.00	15.27	0.063	152.05	76.69	2	1.7	13.144	1.2584	15.266
0.328	5615.39	34.3	0.207	34.2	7.6	3.28	0.60%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	58.208	809.09	67.70	2074	0.60%	1.0	51%	0.60	0.00	0.60	0	1.00	0.08	1.03	1.0	0.060	54.08	121.78	0.183	3.08	0.97	0.48	0.76	2.56	1.0	0.017	1.00	67.70	0.109	132.00	67.54	2	1.7	58.288	5.5805	67.698
0.492	5615.23	60.2	0.548	60.2	5.7	2.48	0.91%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	102.306	######	118.89	2429	0.91%	1.2	51%	0.61	0.00	0.61	0	1.00	0.12	1.04	1.0	0.060	72.04	190.94	0.778	12.90	0.97	0.63	0.69	3.05	1.0	0.014	1.00	118.89	0.236	191.11	102.00	2	1.7	102.37	9.8006	118.893
0.656	5615.06	93.8	1.118	93.8	6.5	2.81	1.19%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0	1.70	159.409	######	185.22	2838	1.19%	1.3	51%	0.62	0.00	0.62	0	1.00	0.22	1.07	1.0	0.062	95.32	280.55	1.000	16.09	0.97	0.79	0.61	3.60	1.0	0.012	1.00	185.22	1.000	606.81	311.45	2	1.7	159.48	15.268	185.224
0.820	5614.90	158.1	1.774	158.0	7.2	3.13	1.12%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0	1.70	268.634	######	312.09	3826	1.12%	1.3	51%	0.62	0.00	0.62	0	1.00	0.30	1.10	1.0	0.063	139.84	451.93	1.000	15.77	0.97	1.02	0.60	3.37	1.0	0.013	1.00	312.09	1.000	485.64	250.71	2	1.7	268.71	25.726	312.091
0.984	5614.74	233.5	2.580	233.4	9.6	4.17	1.11%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0	1.70	396.814	######	460.99	4709	1.11%	1.3	51%	0.63	0.00	0.63	0	1.00	0.30	1.09	1.0	0.063	191.10	653.09	1.000	15.83	0.97	1.24	0.60	3.13	1.0	0.014	1.00	460.99	1.000	404.86	210.34	2	1.7	396.92	38.001	460.994
1.148	5614.57	321.1	3.237	321.1	4.7	2.05	1.01%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0	1.70	545.819	######	633.99	5551	1.01%	1.3	51%	0.64	0.00	0.64	0	1.00	0.30	1.09	1.0	0.063	252.81	886.80	1.000	15.89	0.97	1.45	0.60	2.95	1.0	0.015	1.00	633.99	1.000	347.16	181.52	2	1.7	545.87	52.262	633.994
1.312	5614.41	348.1	3.834	348.0	7.5	3.25	1.10%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	591.651	######	687.26	5266	1.10%	1.3	51%	0.65	0.00	0.65	0	1.00	0.30	1.08	1.0	0.063	271.50	958.76	1.000	15.94	0.97	1.51	0.60	2.79	1.0	0.015	1.00	687.26	1.000	303.88	159.91	2	1.7	591.73	56.652	687.259
1.476	5614.24	325.9	3.960	325.9	6.7	2.88	1.22%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	553.945	######	643.46	4382	1.22%	1.3	51%	0.66	0.00	0.66	0	1.00	0.30	1.08	1.0	0.063	256.13	899.58	1.000	16.00	0.97	1.46	0.60	2.66	1.0	0.016	1.00	643.46	1.000	270.22	143.11	2	1.7	554.02	53.041	643.456
1.640	5614.08	280.6	3.998	280.6	6.9	3.01	1.42%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0	1.70	477.020	######	554.12	3396	1.43%	1.4	51%	0.67	0.00	0.67	0	1.00	0.30	1.08	1.0	0.062	224.78	778.89	1.000	16.06	0.97	1.36	0.60	2.55	1.0	0.017	1.00	554.12	1.000	243.30	129.68	2	1.7	477.09	45.677	554.115
1.804	5613.92	244.2	3.918	244.1	3.6	1.54	1.60%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0	1.70	415.038	######	482.09	2686	1.61%	1.4	51%	0.67	0.00	0.67	0	1.00	0.30	1.07	1.0	0.062	199.80	681.58	1.000	16.11	0.97	1.27	0.60	2.46	1.0	0.017	1.00	482.09	1.000	221.27	118.69	2	1.7	415.08	39.739	482.085
1.968	5613.75	208.3	4.496	208.3	3.0	1.30	2.16%	Interim Cover	0.050	100.7	0.10	0.00	0.10	1	1.70	354.025	######	411.22	2132	2.16%	1.6	51%	0.68	0.00	0.68	0	1.00	0.30	1.07	1.0	0.062	174.63	585.84	1.000	16.18	0.97	1.17	0.60	2.39	1.0	0.018	1.00	411.22	1.000	206.05	111.11	2	1.7	354.06	33.897	411.216
2.133	5613.59	171.3	4.306	171.3	1.4	0.62	2.51%	Interim Cover	0.050	100.7	0.11	0.01	0.10	1	1.70	291.278	######	338.32	1699	2.51%	1.6	51%	0.69	0.00	0.69	0	1.00	0.30	1.07	1.0	0.062	149.05	487.37	1.000	16.25	0.97	1.06	0.60	2.36	1.0	0.018	1.00	338.32	1.000	199.70	107.97	2	1.7	291.29	27.888	338.319
2.297	5613.42	146.4	3.625	146.4	0.5	0.21	2.48%	Interim Cover	0.050	100.7	0.12	0.01	0.10	1	1.70	248.795	######	288.97	1407	2.48%	1.6	51%	0.70	0.00	0.70	0	1.00	0.30	1.06	1.0	0.061	131.73	420.69	1.000	16.32	0.97	0.98	0.60	2.33	1.0	0.018	1.00	289.10	1.000	193.74	105.03	2	1.7	248.8	23.82	288.966
2.461	5613.26	130.5	2.022	130.5	-0.0	-0.01	1.55%	Interim Cover	0.050	100.7	0.12	0.02	0.11	1	1.70	221.918	######	257.74	1218	1.55%	1.5	51%	0.71	0.00	0.71	0	1.00	0.30	1.06	1.0	0.061	120.77	378.52	1.000	16.38	0.97	0.93	0.60	2.30	1.0	0.019	1.00	257.74	1.000	188.12	102.25	2	1.7	221.92	21.246	257.744
2.625	5613.10	117.5	1.895	117.5	0.5	0.22	1.61%	Interim Cover	0.050	100.7	0.13	0.02	0.11	1	1.70	199.801	######	232.06	1065	1.61%	1.5	51%	0.71	0.00	0.71	0	1.00	0.30	1.06	1.0	0.061	111.76	343.82	1.000	16.45	0.97	0.88	0.60	2.28	1.0	0.019	1.00	232.06	1.000	182.83	99.64	2	1.7	199.81	19.129	232.063
2.789	5612.93	87.2	1.616	87.2	-0.2	-0.08	1.85%	Interim Cover	0.050	100.7	0.14	0.03	0.11	1	1.70	148.240	######	172.17	768	1.86%	1.6	51%	0.72	0.00	0.72	0	0.99	0.20	1.03	1.0	0.059	90.74	262.91	1.000	16.81	0.97	0.76	0.62	2.16	1.0	0.020	1.00	172.17	1.000	177.83	97.32	2	1.7	148.24	14.192	172.170
2.953	5612.77	56.6	1.213	56.6	-0.3	-0.11	2.14%	Interim Cover	0.050	100.7	0.15	0.03	0.12	1	1.70	96.186	######	111.71	484	2.15%	1.7	51%	0.73	0.00	0.73	0	0.99	0.12	1.02	1.0	0.059	69.52	181.23	0.556	9.50	0.97	0.61	0.69	1.84	1.0	0.023	1.06	118.91	0.236	40.91	25.21	2	1.7	96.183	9.2086	111.711
3.117	5612.60	41.8	0.990	41.8	-0.7	-0.32	2.37%	Interim Cover	0.050	100.7	0.16	0.04	0.12	1	1.70	71.043	987.50	82.50	348	2.38%	1.8	51%	0.74	0.00	0.74	0	0.99	0.09	1.01	1.0	0.058	59.27	141.78	0.238	4.10	0.97	0.52	0.74	1.68	1.0	0.025	1.14	94.25	0.158	26.62	15.36	2	1.7	71.035	6.8009	82.503
3.281	5612.44	29.4	0.781	29.4	-1.4	-0.59	2.66%	Sand-Slime Tailin	0.059	119.0	0.17	0.04	0.12	1	1.70	49.980	694.72	58.03	235	2.67%	2.0	47%	0.75	0.00	0.75	0	0.99	0.08	1.01	1.0	0.058	50.65	108.69	0.157	2.72	0.97	0.44	0.78	1.53	1.0	0.028	1.27	73.95	0.118	19.10	10.91	2	1.7	49.966	4.7837	58.032
3.445	5612.28	24.9	0.524	24.9	-1.2	-0.53	2.10%	Sand-Slime Tailin	0.059	119.0	0.18	0.05	0.13	1	1.70	42.364	588.86	49.19	192	2.12%	1.9	47%	0.76	0.00	0.76	0	0.99	0.07	1.01	1.0	0.058	47.55	96.74	0.137	2.37	0.97	0.40	0.80	1.47	1.0	0.029	1.24	60.94	0.101	15.82	9.10	2	1.7	42.351	4.0547	49.188
3.609	5612.11	21.4	0.387	21.4	-1.7	-0.72	1.81%	Sand-Slime Tailin	0.059	119.0	0.19	0.05	0.13	1	1.70	36.363	505.45	42.21	159	1.83%	2.0	47%	0.77	0.00	0.77	0	0.99	0.07	1.01	1.0	0.058	45.11	87.32	0.123	2.13	0.97	0.38	0.80	1.45	1.0	0.029	1.24	52.38	0.093	14.12	8.13	2	1.7	36.345	3.4797	42.213
3.773	5611.95	13.1	0.327	13.2	-2.1	-0.91	2.49%	Slime Tailings	0.057	113.1	0.20	0.06	0.14	1	1.70	22.355	310.73	25.94	94	2.53%	2.2	71%	0.78	0.00	0.78	0	0.99	0.06	1.00	1.0	0.058	39.12	65.06	0.094	1.63	0.97	0.29	0.80	1.44	1.0	0.030	1.69	43.72	0.086	12.68	7.15	2	1.7	22.333	2.1381	25.938
3.937	5611.78	9.9	0.171	10.0	-1.5	-0.64	1.72%	Sand-Slime Tailin	0.059	119.0	0.21	0.06	0.14	1	1.70	16.915	235.12	19.63	68	1.76%	2.2	47%	0.79	0.00	0.79	0	0.99	0.05	1.00	1.0	0.057	37.19	56.81	0.084	1.47	0.97	0.26	0.80	1.43	1.0	0.030	1.65	32.48	0.077	10.94	6.21	2	1.7	16.899	1.6179	19.628
4.101	5611.62	9.9	0.106	9.9	1.7	0.74	1.07%	Sand-Slime Tailin	0.059	119.0	0.22	0.07	0.15	1	1.70	16.881	234.65	19.63	66	1.09%	2.1	47%	0.80	0.00	0.80	0	0.99	0.05	1.00	1.0	0.057	37.19	56.81	0.084	1.47	0.97	0.26	0.80	1.42	1.0	0.030	1.41	27.67	0.073	10.05	5.76	2	1.7	16.899	1.6179	19.627
4.265	5611.45	13.3	0.031	13.3	3.7	1.60	0.23%	Sand-Slime Tailin	0.059	119.0	0.22	0.07	0.15	1	1.70	22.593	314.04	26.29	86	0.24%	1.6	47%	0.81	0.00	0.81	0	0.99	0.06	1.00	1.0	0.057	39.52	65.81	0.095	1.65	0.97	0.30	0.80	1.42	1.0	0.030	1.00	26.28	0.072	9.59	5.62	2	1.7	22.632	2.1668	26.286
4.429	5611.29	10.7	0.042	10.7	2.1	0.90	0.39%	Sand-Slime Tailin	0.059	119.0	0.23	0.08	0.16	1	1.70	18.241	253.55	21.21	67	0.40%	1.8	47%	0.82	0.00	0.82	0	0.99	0.05	1.00	1.0	0.057	37.74	58.95	0.087	1.52	0.97	0.27	0.80	1.41	1.0	0.030	1.13	24.06	0.070	9.07	5.29	2	1.7	18.263	1.7485	21.211
4.593	5611.13	8.5	0.048	8.4	6.1	2.62	0.57%	Sand-Slime Tailin	0.059	119.0	0.24	0.08	0.16	1	1.70	14.314	198.96	16.70	51	0.58%	2.0	47%	0.83	0.00	0.83	0	0.98	0.05	1.00	1.0	0.057	36.16	52.86	0.080	1.41	0.96	0.24	0.80	1.40	1.0	0.030	1.33	22.15	0.068	8.61	5.01	2	1.7	14.378	1.3766	16.699
4.757	5610.96	7.9	0.031	7.8	13.0	5.65	0.39%	Sand-Slime Tailin	0.059	119.0	0.25	0.09	0.17	1	1.70	13.311	185.02	15.62	46	0.40%	2.0	47%	0.84	0.00	0.84	0	0.98	0.05	1.00	1.0	0.057	35.78	51.40	0.079	1.38	0.96	0.23	0.80	1.39	1.0	0.031	1.28	20.02	0.067	8.16	4.77	2	1.7	13.449	1.2876	15.621
4.921	5610.80	7.2	0.093	7.1	20.3	8.78	1.30%	Slime Tailings	0.057	113.1	0.26	0.09	0.17	1	1.70	11.985	166.59	14.17	41	1.35%	2.3	71%	0.85	0.00	0.85	0	0.98	0.05	1.00	1.0	0.057	35.02	49.19	0.077	1.35	0.96	0.22	0.80	1.38	1.0	0.031	1.94	27.50	0.073	8.70	5.03	2	1.7	12.2	1.168	14.170
5.085	5610.63	7.1	0.130	7.0	25.9	11.21	1.82%	Slime Tailings	0.057	113.1	0.27	0.10	0.17	1	1.70	11.866	164.94	14.10	40	1.89%	2.4	71%	0.86	0.00	0.86	0	0.98	0.05	1.00	1.0	0.057	35.00	49.10	0.077	1.35	0.96	0.22	0.80	1.38	1.0	0.031	2.30	32.49	0.077	8.98	5.17	2	1.7	12.141	1.1623	14.101
5.249	5610.47	8.4	0.108	8.2	23.7	10.28	1.29%	Sand-Slime Tailin	0.059	119.0	0.28	0.10	0.18	1	1.70	14.008	194.71	16.56	45	1.33%	2.3	47%	0.86	0.00	0.86	0	0.98	0.05	1.00	1.0	0.057	36.11	52.67	0.080	1.41	0.96	0.23	0.80	1.37	1.0	0.031	1.82	30.12	0.075	8.53	4.97	2	1.7	14.26	1.3652	16.562
5.413	5610.31	18.2	0.125	18.1	15.6	6.76	0.69%	Sand-Slime Tailin	0.059	119.0	0.29	0.11	0.18	1	1.70	30.804	428.18	35.97	98	0.70%	1.8	47%	0.87	0.00	0.87	0	0.98	0.06	1.00	1.0	0.057	42.92	78.89	0.111	1.96	0.96	0.35	0.80	1.36	1.0	0.031	1.12	40.39	0.084	9.26	5.61	2	1.7	30.97	2.965	35.969
5.577	5610.14	20.7	0.144	20.7	2.2	0.94	0.69%	Sand-Slime Tailin	0.059	119.0	0.30	0.11	0.19	1	1.70	35.241	489.85	40.96	109	0.70%	1.8	47%	0.88	0.00	0.88	0	0.98	0.07	1.00	1.0	0.057	44.67	85.62	0.121	2.13	0.96	0.37	0.80	1.36	1.0	0.031	1.10	44.95	0.087	9.45	5.79	2	1.7	35.264	3.3762	40.957
5.741	5609.98	20.9	0.185	20.9	1.2	0.52	0.89%	Sand-Slime Tailin	0.059	119.0	0.31	0.12	0.19	1	1.70	35.462	492.92	41.20	107	0.90%	1.9	47%	0.89	0.00	0.89	0	0.98	0.07	1.00	1.0	0.056	44.75	85.95	0.121	2.14	0.96	0.37	0.80	1.35	1.0	0.031	1.15	47.49	0.090	9.45	5.80	2	1.7	35.475	3.3964	41.202
5.905	5609.81	17.0	0.216	17.0	-0.2	-0.07	1.27%	Sand-Slime Tailin	0.059	119.0	0.32	0.12	0.20	1	1.70	28.849	401.00	33.50	84	1.30%	2.0	47%	0.90	0.00	0.90	0	0.98	0.06	1.00	1.0	0.056	42.05	75.56	0.107	1.89	0.96	0.33	0.80	1.34	1.0	0.032	1.35	45.39	0.088	9.05	5.47	2	1.7	28.847	2.7618	33.504
6.069	5609.65	16.4	0.222	16.4	0.0	0.01	1.35%	Sand-Slime Tailin	0.059	119.0	0.33	0.13	0.20	1	1.70	27.880	387.53	32.38	80	1.38%	2.1	47%	0.91	0.00	0.91	0	0.98	0.06	1.00	1.0	0.056	41.66	74.04	0.105	1.86	0.96	0.33	0.80	1.34	1.0	0.032	1.41	45.77	0.088	8.88	5.37	2	1.7	27.88	2.6693	32.381
6.234	5609.49	12.5	0.167	12.5	0.5	0.23	1.33%	Sand-Slime Tailin	0.059	119.0	0.34	0.13	0.21	1	1.70	21.267	295.61	24.71	59	1.37%	2.2	47%	0.92	0.00	0.92	0	0.98	0.06	1.00	1.0	0.056	38.97	63.67	0.092	1.64	0.96	0.29	0.80	1.33	1.0	0.032	1.61	39.71	0.083	8.18	4.91	2	1.7	21.273	2.0366	24.707
6.398	5609.32	11.4	0.156	11.4	5.1	2.22	1.37%	Sand-Slime Tailin	0.059	119.0	0.35	0.14	0.21	1	1.70	19.312	268.44	22.49	52	1.41%	2.2	47%	0.93	0.00	0.93	0	0.97	0.05	1.00	1.0	0.056	38.19	60.68	0.089	1.58	0.96	0.27	0.80	1.32	1.0	0.032	1.73	38.83	0.082	7.94	4.76	2	1.7	19.366	1.8541	22.493
6.562	5609.16	8.9	0.092	8.8	14.8	6.41	1.03%	Sand-Slime Tailin	0.059	119.0	0.36	0.14	0.22	1	1.70	14.977	208.18	17.58	40	1.08%	2.3	47%	0.94	0.00	0.94	0	0.97	0.05	1.00	1.0	0.056	36.47	54.04	0.082	1.46	0.96	0.24	0.80	1.32	1.0	0.032	1.80	31.72	0.076	7.21	4.33	2	1.7	15.134	1.4489	17.577
6.726	5608.99	7.1	0.054	7.0	16.9	7.31	0.76%	Sand-Slime Tailin	0.059	119.0	0.37	0.15	0.22	1	1.70	11.832	164.46	13.95	30	0.81%	2.3	47%	0.95	0.00	0.95	0	0.97	0.05	1.00	1.0	0.056	35.19	49.14	0.077	1.37	0.96	0.22	0.80	1.31	1.0	0.032	1.90	26.50	0.072	6.66	4.01	2	1.7	12.011	1.1499	13.950
6.890	5608.83	6.9	0.094	6.8	23.9	10.34	1.36%	Slime Tailings	0.057	113.1	0.38	0.16	0.22	1	1.70	11.509	159.98	13.66	29	1.44%	2.4	71%	0.96	0.00	0.96	0	0.97	0.05	0.99	1.0	0.056	34.84	48.51	0.076	1.36	0.96	0.21	0.80	1.31	1.0	0.032	2.45	33.50	0.078	7.07	4.21	2	1.7	11.762	1.1261	13.661
7.054	5608.67	6.6	0.021	6.4	33.6	14.56	0.32%	Sand-Slime Tailin	0.059	119.0	0.39	0.16	0.23	1	1.70	10.880	151.23	13.05	27	0.34%	2.2	47%	0.97	0.00	0.97	0	0.97	0.05	0.99	1.0	0.056	34.88	47.93	0.076	1.35	0.96	0.21	0.80	1.30	1.0	0.032	1.59	20.81	0.067	5.99	3.67	2	1.7	11.237	1.0758	13.051
7.218	5608.50	8.6	0.044	8.4	29.9	12.94	0.51%	Sand-Slime Tailin	0.059	119.0	0.40	0.17	0.23	1	1.70	14.246	198.02	16.91	35	0.54%	2.1	47%	0.98	0.00	0.98	0	0.97	0.05	0.99	1.0	0.056	36.23	53.15	0.081	1.45	0.96	0.24	0.80	1.30	1.0	0.033	1.55	26.22	0.072	6.26	3.86	2	1.7	14.563	1.3942	16.914
7.382	5608.34	6.9	0.052	6.7	30.0	13.02	0.75%	Sand-Slime Tailin	0.059	119.0	0.41	0.17	0.24	1	1.70	11.424	158.79	13.64	27	0.80%	2.3	47%	0.99	0.00	0.99	0	0.97	0.05	0.99	1.0	0.056	35.08	48.72	0.076	1.37	0.96	0.21	0.80	1.29	1.0	0.033	2.03	27.65	0.073	6.25	3.81	2	1.7	11.743	1.1243	13.639
7.546	5608.17	6.5	0.057	6.3	35.9	15.54	0.88%	Slime Tailings	0.057	113.1	0.42	0.18	0.24	1	1.70	10.659	148.16	12.82	25	0.94%	2.4	71%	1.00	0.00	1.00	0	0.97	0.05	0.99	1.0	0.056	34.55	47.37	0.075	1.35	0.96	0.21	0.80	1.29	1.0	0.033	2.27	29.12	0.074	6.24	3.80	2	1.7	11.04	1.0569	12.822
7.710	5608.01	7.0	0.066	6.9	29.2	12.65	0.94%	Sand-Slime Tailin	0.059	119.0	0.43	0.18	0.25	1	1.70	11.645	161.87	13.88	27	1.00%	2.4	47%	1.01	0.00	1.01	0	0.97	0.05	0.99	1.0	0.055	35.17	49.06	0.077	1.38	0.96	0.22	0.80	1.28	1.0	0.033	2.23	30.97	0.076	6.26	3.82	2	1.7	11.955	1.1446	13.885
7.874	5607.85	6.7	0.068	6.5	36.4	15.76	1.02%	Slime Tailings	0.057	113.1	0.44	0.19	0.25	1	1.70	10.982	152.65	13.20	25	1.09%	2.4	71%	1.02	0.00	1.02	0	0.96	0.05	0.99	1.0	0.055	34.69	47.89	0.075	1.36	0.96	0.21	0.80	1.28	1.0	0.033	2.42	31.93	0.077	6.22	3.79	2	1.7	11.368	1.0884	13.203
8.038	5607.68	7.0	0.101	6.8	40.5	17.55	1.44%	Slime Tailings	0.057	113.1	0.45	0.19	0.26	1	1.70	11.526	160.21	13.89	26	1.53%	2.5	71%	1.03	0.00	1.03	0	0.96	0.05	0.99	1.0	0.055	34.92	48.81	0.076	1.38	0.96	0.22	0.80	1.28	1.0	0.033	2.73	37.94	0.082	6.52	3.95	2	1.7	11.956	1.1446	13.886
8.202	5607.52	7.2	0.053	7.0	32.9	14.27	0.74%	Sand-Slime Tailin	0.059	119.0	0.46	0.20	0.26	1	1.70	11.866	164.94	14.19	26	0.79%	2.3	47%	1.04	0.00	1.04	0	0.96	0.05	0.99	1.0	0.055	35.28	49.47	0.077	1.40	0.96	0.22	0.80	1.27	1.0	0.033	2.09	29.59	0.075	5.86	3.63	2	1.7	12.216	1.1695	14.188
8.366	5607.35	8.3	0.060	8.1	33.6	14.56	0.72%	Sand-Slime Tailin	0.059	119.0	0.47	0.20	0.26	1	1.70	13.719	190.69	16.35	30	0.77%	2.3	47%	1.05	0.00	1.05	0	0.96	0.05	0.99	1.0	0.055	36.04	52.38	0.080	1.45	0.96	0.23	0.80	1.27	1.0	0.033	1.90	31.09	0.076	5.86	3.65	2	1.7	14.076	1.3476	16.348
8.530	5607.19	8.4	0.039	8.2	29.3	12.71	0.47%	Sand-Slime Tailin	0.059	119.0	0.48	0.21	0.27	1	1.70	13.923	193.53	16.53	29	0.49%	2.2	47%	1.06	0.00	1.06	0	0.96	0.05	0.99	1.0	0.055	36.10	52.63	0.080	1.46	0.96	0.23	0.80	1.26	1.0	0.033	1.67	27.61	0.073	5.54	3.50	2	1.7	14.234	1.3628	16.532
8.694	5607.03	9.0	0.046	8.9	16.0	6.93	0.51%	Sand-Slime Tailin	0.059	119.0	0.49	0.21	0.27	1	1.70	15.130	210.31	17.77	31	0.54%	2.2	47%	1.07	0.00	1.07	0	0.96	0.05	0.99	1.0	0.055	36.53	54.30	0.082	1.49	0.96	0.24	0.80	1.26	1.0	0.033	1.65	29.41	0.074	5.56	3.52	2	1.7	15.3	1.4648	17.770
8.858	5606.86	8.9	0.043	8.8	19.3	8.37	0.48%	Sand-Slime Tailin	0.059	119.0	0.50	0.22	0.28	1	1.70	14.909	207.24	17.55	30	0.51%	2.2	47%	1.08	0.00	1.08	0	0.96	0.05	0.99	1.0	0.055	36.46	54.01	0.081	1.49	0.95	0.24	0.80	1.25	1.0	0.034	1.66	29.14	0.074	5.45	3.47	2	1.7	15.114	1.447	17.554
9.022	5606.70	9.0	0.081	8.9	11.3	4.91	0.90%	Sand-Slime Tailin	0.059	119.0	0.50	0.22	0.28	1	1.70	15.130	210.31	17.71	30	0.96%	2.3	47%	1.09	0.00	1.09	0	0.96	0.05	0.99	1.0	0.055	36.51	54.23	0.082	1.49	0.95	0.24	0.80	1.25	1.0	0.034	2.04	36.18	0.080	5.79	3.64	2	1.7	15.25	1.4601	17.712
9.186	5606.53	10.5	0.074	10.5	12.7	5.50	0.70%	Sand-Slime Tailin	0.059	119.0	0.51	0.23	0.29	1	1.70	17.782	247.17	20.81	35	0.74%	2.2	47%	1.10	0.00	1.10	0	0.96	0.05	0.99	1.0	0.055	37.60	58.41	0.086	1.58	0.95	0.26	0.80	1.24	1.0	0.034	1.70	35.42	0.080	5.65	3.61	2	1.7	17.917	1.7154	20.809
9.350	5606.37	8.8	0.087	8.8	6.6	2.84	0.98%	Sand-Slime Tailin	0.059	119.0	0.52	0.23	0.29	1	1.70	14.960	207.94	17.46	28	1.05%	2.4	47%	1.11	0.00	1.11	0	0.96	0.05	0.99	1.0	0.055	36.42	53.88	0.081	1.49	0.95	0.24	0.80	1.24	1.0	0.034	2.18	38.09	0.082	5.72	3.61	2	1.7	15.03	1.4389	17.456
9.514	5606.21	6.8	0.122	6.7	23.8	10.30	1.78%	Slime Tailings	0.057	113.1	0.53	0.24	0.30	1	1.70	11.390	158.32	13.52	21	1.93%	2.6	71%	1.12	0.00	1.12	0	0.95	0.05	0.99	1.0	0.054	34.80	48.32	0.076	1.39	0.95	0.21	0.80	1.24	1.0	0.034	3.44	46.54	0.089	6.13	3.76	2	1.7	11.642	1.1146	13.522
9.678	5606.04	8.3	0.124	8.0	40.2	17.44	1.50%	Slime Tailings	0.057	113.1	0.54	0.24	0.30	1	1.70	13.668	189.99	16.37	26	1.60%	2.5	71%	1.13	0.00	1.13	0	0.95	0.05	0.99	1.0	0.054	35.79	52.16	0.080	1.46	0.95	0.23	0.80	1.23	1.0	0.034	2.79	45.63	0.088	5.99	3.73	2	1.7	14.095	1.3495	16.371
9.842	5605.88	13.0	0.032	12.8	32.9	14.24	0.25%	Sand-Slime Tailin	0.059	119.0	0.55	0.25	0.31	1	1.70	21.794	302.94	25.72	41	0.26%	2.0	47%	1.14	0.00	1.14	0	0.95	0.06	0.98	1.0	0.054	39.32	65.04	0.094	1.73	0.95	0.29	0.80	1.23	1.0	0.034	1.25	32.26	0.077	5.16	3.44	2	1.7	22.143	2.1199	25.717
10.006	5605.71	14.0	0.141	13.9	7.1	3.09	1.01%	Sand-Slime Tailin	0.059	119.0	0.56	0.25	0.31	1	1.70	23.647	328.69	27.56	43	1.05%	2.2	47%	1.14	0.00	1.14	0	0.95	0.06	0.98	1.0	0.054	39.96	67.52	0.097	1.79	0.95	0.30	0.80	1.23	1.0	0.034	1.71	47.02	0.089	5.90	3.84	2	1.7	23.723	2.2712	27.553
10.170	5605.55	8.3	0.114	8.2	6.4	2.78	1.38%	Sand-Slime Tailin	0.059	119.0	0.57	0.26	0.31	1	1.70	13.957	194.00	16.29	24	1.48%	2.5	47%	1.15	0.00	1.15	0	0.95	0.05	0.99	1.0	0.054	36.01	52.30	0.080	1.47	0.95	0.23	0.80	1.22	1.0	0.034	2.79	45.51	0.088	5.73	3.60	2	1.7	14.025	1.3428	16.289
10.335	5605.39	8.7	0.102	8.7	10.1	4.39	1.17%	Sand-Slime Tailin	0.059	119.0	0.58	0.26	0.32	1	1.70	14.722	204.64	17.22	25	1.25%	2.4	47%	1.16	0.00	1.16	0	0.95	0.05	0.98	1.0	0.054	36.34	53.57	0.081	1.50	0.95	0.24	0.80	1.22	1.0	0.034	2.52	43.44	0.086	5.54	3.52	2	1.7	14.829	1.4198	17.223
10.499	5605.22	23.1	0.120	23.1	9.6	4.17	0.52%	Sand-Slime Tailin	0.059	119.0	0.59	0.27	0.32	1	1.70	39.219	545.14	45.67	70	0.53%	1.9	47%	1.17	0.00	1.17	0	0.95	0.07	0.98	1.0	0.054	45.99	91.66	0.130	2.42	0.95	0.39	0.80	1.22	1.0	0.034	1.17	53.57	0.094	5.98	4.20	2	1.7	39.321	3.7646	45.669
10.663	5605.06	24.0	0.124	23.9	8.7	3.75	0.52%	Sand-Slime Tailin	0.059	119.0	0.60	0.27	0.33	1	1.70	40.647	564.99	47.32	71	0.53%	1.9	47%	1.18	0.00	1.18	0	0.95	0.07	0.98	1.0	0.054	46.90	94.21	0.133	2.49	0.95	0.40	0.80	1.21	1.0	0.035	1.17	55.14	0.096	5.97	4.23	2	1.7	40.739	3.9003	47.316
10.827	5604.89	25.3	0.175	25.3	8.6	3.72	0.69%	Sand-Slime Tailin	0.059	119.0	0.61	0.28	0.33	1	1.70	42.925	596.66	49.96	74	0.71%	1.9	47%	1.19	0.00	1.19	0	0.95	0.07	0.98	1.0	0.053	47.82	97.78	0.139	2.60	0.95	0.41	0.80	1.21	1.0	0.035	1.21	60.64	0.101	6.21	4.41	2	1.7	43.016	4.1184	49.961
10.991	5604.73	28.0	0.202	28.0	8.4	3.62	0.72%	Sand-Slime Tailin	0.059	119.0	0.62	0.28	0.34	1	1.70	47.583	661.40	55.37	81	0.74%	1.9	47%	1.20	0.00	1.20	0	0.94	0.07	0.98	1.0	0.053	49.72	105.09	0.151	2.84	0.95	0.43	0.79	1.22	1.0	0.034	1.19	65.94	0.107	6.49	4.66	2	1.7	47.672	4.5641	55.368
11.155	5604.57	24.5	0.216	24.4	7.8	3.38	0.88%	Sand-Slime Tailin	0.059	119.0	0.63	0.29	0.34	1	1.70	41.514	577.04	48.31	70	0.91%	2.0	47%	1.21	0.00	1.21	0	0.94	0.07	0.98	1.0	0.053	47.25	95.56	0.135	2.54	0.95	0.40	0.80	1.20	1.0	0.035	1.31	63.36	0.104	6.22	4.38	2	1.7	41.597	3.9825	48.312
11.319	5604.40	20.2	0.227	20.2	7.1	3.09	1.12%	Sand-Slime Tailin	0.059	119.0	0.64	0.29	0.35	1	1.70	34.272	476.38	39.89	56	1.16%	2.1	47%	1.22	0.00	1.22	0	0.94	0.06	0.98	1.0	0.053	44.29	84.19	0.118	2.23	0.95	0.36	0.80	1.20	1.0	0.035	1.54	61.62	0.102	6.03	4.13	2	1.7	34.348	3.2884	39.893
11.483	5604.24	17.7	0.281	17.6	7.2	3.11	1.59%	Sand-Slime Tailin	0.059	119.0	0.65	0.30	0.35	1	1.70	29.937	416.12	34.86	48	1.65%	2.3	47%	1.23	0.00	1.23	0	0.94	0.06	0.98	1.0	0.053	42.53	77.39	0.109	2.05	0.95	0.34	0.80	1.20	1.0	0.035	1.93	67.15	0.108	6.33	4.19	2	1.7	30.013	2.8735	34.858
11.647	5604.07	17.7	0.326	17.7	8.6	3.74	1.84%	Sand-Slime Tailin	0.059	119.0	0.66	0.30	0.36	1	1.70	30.039	417.54	34.99	48	1.91%	2.3	47%	1.24	0.00	1.24	0	0.94	0.06	0.98	1.0	0.053	42.57	77.57	0.109	2.06	0.95	0.34	0.80	1.19	1.0	0.035	2.07	72.45	0.115	6.66	4.36	2	1.7	30.131	2.8847	34.995
11.811	5603.91	20.4	0.539	20.3	13.1	5.69	2.65%	Sand-Slime Tailin	0.059	119.0	0.67	0.31	0.36	1	1.70	34.493	479.45	40.22	55	2.74%	2.4	47%	1.25	0.00	1.25	0	0.94	0.07	0.98	1.0	0.053	44.41	84.63	0.119	2.25	0.95	0.37	0.80	1.19	1.0	0.035	2.30	92.67	0.154	8.78	5.52	2	1.7	34.632	3.3157	40.223
11.975	5603.75	17.7	0.579	17.6	13.2	5.71	3.27%	Slime Tailings	0.057	113.1	0.68	0.31	0.37	1	1.70	29.937	416.12	34.93	47	3.40%	2.5	71%	1.26	0.00	1.26	0	0.94	0.06	0.98	1.0	0.053	42.25	77.18	0.109	2.06	0.95	0.34	0.80	1.19	1.0	0.035	2.84	99.07	0.170	9.61	5.84	2	1.7	30.077	2.8795	34.932

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W3

Data File: 13-52106_SP2W3-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Legend:
- Tailings Sands
- Tailings Sand-Slimes
- Tailings Slimes
- Interim Cover
- Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69

Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

5613.80	Water surface elevation during CPT investigation (f
5607.44	Water surface elevation at t_0 (ft amsl)
5597.74	Water surface elevation at t_1 (ft amsl)
5592.74	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Ea
7.51	Equiv. Number of Uniform Strain Cycles, N

5615.72	Ground Surface Elevation at time of CPT (ft amsl)
5626.27	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pla
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
2.55	Thickness of Random/Platform Fill on top of existing interim cover (ft)
1164.98	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5592.74	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	######	5626.02	5625.77	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	######	5624.02	5622.27	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5620.27	5618.27	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334
Platform/Random Fill Layer	######	5617	5615.72	2.55	0.050	101	0.582	0.518	0.00	0.00	0.582	0.518

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of CPT (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
12.139	5603.58	11.5	0.499	11.4	15.5	6.73	4.33%	Slime Tailings	0.057	113.1	0.69	0.32	0.37	1	1.70	19.448	270.33	22.78	29	4.60%	2.7	71%	1.27	0.00	1.27	0
12.303	5603.42	10.9	0.321	10.7	30.3	13.15	2.94%	Slime Tailings	0.057	113.1	0.70	0.32	0.37	1	1.70	18.258	253.79	21.58	27	3.14%	2.7	71%	1.28	0.00	1.28	0
12.467	5603.25	10.3	0.339	10.0	56.2	24.35	3.28%	Slime Tailings	0.057	113.1	0.71	0.33	0.38	1	1.70	16.949	235.59	20.38	25	3.53%	2.7	71%	1.29	0.00	1.29	0
12.631	5603.09	8.7	0.195	8.6	16.5	7.14	2.25%	Slime Tailings	0.057	113.1	0.72	0.33	0.38	1	1.70	14.586	202.75	17.14	21	2.45%	2.7	71%	1.30	0.00	1.30	0
12.795	5602.92	9.5	0.203	9.3	29.1	12.59	2.13%	Slime Tailings	0.057	113.1	0.73	0.34	0.39	1	1.70	15.878	220.70	18.80	23	2.31%	2.6	71%	1.31	0.00	1.31	0
12.959	5602.76	8.1	0.206	7.9	33.3	14.44	2.53%	Slime Tailings	0.057	113.1	0.73	0.34	0.39	1	1.70	13.498	187.62	16.09	19	2.78%	2.8	71%	1.32	0.00	1.32	0
13.123	5602.60	7.2	0.183	6.9	46.1	19.99	2.54%	Slime Tailings	0.057	113.1	0.74	0.35	0.39	1	1.70	11.764	163.52	14.23	16	2.83%	2.8	71%	1.33	0.00	1.33	0
13.287	5602.43	10.7	0.106	10.4	37.6	16.29	0.99%	Sand-Slime Tailin	0.059	119.0	0.75	0.35	0.40	1	1.70	17.731	246.46	21.06	25	1.07%	2.4	47%	1.34	0.00	1.34	0
13.451	5602.27	16.7	0.102	16.7	10.8	4.70	0.61%	Sand-Slime Tailin	0.059	119.0	0.76	0.36	0.40	1	1.70	28.339	393.91	33.05	40	0.64%	2.1	47%	1.35	0.00	1.35	0
13.615	5602.10	17.2	0.121	17.1	10.8	4.69	0.70%	Sand-Slime Tailin	0.059	119.0	0.77	0.36	0.41	1	1.69	29.024	403.44	33.84	40	0.74%	2.2	47%	1.36	0.00	1.36	0
13.779	5601.94	17.2	0.165	17.1	13.8	5.99	0.96%	Sand-Slime Tailin	0.059	119.0	0.78	0.37	0.41	1	1.68	28.815	400.53	33.64	40	1.00%	2.2	47%	1.37	0.00	1.37	0
13.943	5601.78	17.7	0.203	17.6	15.3	6.65	1.15%	Sand-Slime Tailin	0.059	119.0	0.79	0.38	0.42	1	1.67	29.281	407.00	34.19	40	1.20%	2.3	47%	1.38	0.00	1.38	0
14.107	5601.61	19.0	0.286	18.9	16.8	7.30	1.50%	Sand-Slime Tailin	0.059	119.0	0.80	0.38	0.42	1	1.64	31.034	431.37	36.24	43	1.57%	2.3	47%	1.39	0.00	1.39	0
14.271	5601.45	18.8	0.300	18.7	17.6	7.62	1.59%	Sand-Slime Tailin	0.059	119.0	0.81	0.39	0.43	1	1.63	30.546	424.59	35.69	42	1.67%	2.3	47%	1.39	0.00	1.39	0
14.436	5601.28	21.0	0.318	20.9	18.2	7.88	1.51%	Sand-Slime Tailin	0.059	119.0	0.82	0.39	0.43	1	1.60	33.469	465.22	39.08	47	1.58%	2.3	47%	1.40	0.00	1.40	0
14.600	5601.12	18.5	0.163	18.5	9.1	3.93	0.88%	Sand-Slime Tailin	0.059	119.0	0.83	0.40	0.44	1	1.61	29.799	414.21	34.72	41	0.92%	2.2	47%	1.41	0.00	1.41	0
14.764	5600.96	15.4	0.117	15.4	3.3	1.43	0.76%	Sand-Slime Tailin	0.059	119.0	0.84	0.40	0.44	1	1.63	25.149	349.57	29.25	33	0.80%	2.3	47%	1.42	0.00	1.42	0
14.928	5600.79	12.2	0.162	12.2	9.3	4.03	1.32%	Sand-Slime Tailin	0.059	119.0	0.85	0.41	0.45	1	1.66	20.144	280.00	23.51	26	1.42%	2.5	47%	1.43	0.00	1.43	0
15.092	5600.63	11.5	0.194	11.3	27.6	11.96	1.69%	Sand-Slime Tailin	0.059	119.0	0.86	0.41	0.45	1	1.65	18.644	259.15	21.98	24	1.83%	2.6	47%	1.44	0.00	1.44	0
15.256	5600.46	10.0	0.206	9.9	14.5	6.29	2.06%	Slime Tailings	0.057	113.1	0.87	0.42	0.45	1	1.65	16.317	226.81	19.13	20	2.26%	2.7	71%	1.45	0.00	1.45	0
15.420	5600.30	8.6	0.137	8.4	31.8	13.77	1.60%	Slime Tailings	0.057	113.1	0.88	0.42	0.46	1	1.64	13.698	190.40	16.29	17	1.78%	2.7	71%	1.46	0.00	1.46	0
15.584	5600.14	9.3	0.108	9.1	29.9	12.95	1.16%	Sand-Slime Tailin	0.059	119.0	0.89	0.43	0.46	1	1.62	14.841	206.28	17.59	18	1.28%	2.6	47%	1.47	0.00	1.47	0
15.748	5599.97	8.4	0.114	8.2	29.4	12.75	1.36%	Sand-Slime Tailin	0.059	119.0	0.90	0.43	0.47	1	1.61	13.195	183.41	15.67	16	1.53%	2.7	47%	1.48	0.00	1.48	0
15.912	5599.81	7.3	0.150	7.0	43.6	18.89	2.07%	Slime Tailings	0.057	113.1	0.91	0.44	0.47	1	1.60	11.168	155.23	13.48	13	2.36%	2.8	71%	1.49	0.00	1.49	0
16.076	5599.64	6.8	0.155	6.5	59.5	25.76	2.27%	Slime Tailings	0.057	113.1	0.92	0.44	0.48	1	1.59	10.281	142.91	12.63	12	2.62%	2.9	71%	1.50	0.00	1.50	0
16.240	5599.48	6.4	0.150	6.0	55.9	24.23	2.36%	Slime Tailings	0.057	113.1	0.93	0.45	0.48	1	1.58	9.501	132.07	11.67	11	2.76%	2.9	71%	1.51	0.00	1.51	0
16.404	5599.32	6.2	0.155	5.8	62.4	27.06	2.49%	Slime Tailings	0.057	113.1	0.94	0.45	0.48	1	1.57	9.139	127.04	11.32	11	2.93%	3.0	71%	1.52	0.00	1.52	0
16.568	5599.15	6.4	0.156	6.0	61.6	26.67	2.43%	Slime Tailings	0.057	113.1	0.95	0.46	0.49	1	1.56	9.390	130.52	11.60	11	2.85%	2.9	71%	1.53	0.00	1.53	0
16.732	5598.99	6.5	0.127	6.1	59.1	25.59	1.96%	Slime Tailings	0.057	113.1	0.95	0.46	0.49	1	1.55	9.436	131.16	11.62	11	2.30%	2.9	71%	1.54	0.00	1.54	0
16.896	5598.82	6.4	0.116	6.1	51.0	22.11	1.81%	Slime Tailings	0.057	113.1	0.96	0.47	0.50	1	1.54	9.374	130.30	11.46	11	2.13%	2.9	71%	1.55	0.00	1.55	0
17.060	5598.66	5.5	0.121	5.1	60.9	26.40	2.22%	Slime Tailings	0.057	113.1	0.97	0.47	0.50	1	1.53	7.756	107.81	9.68	9	2.70%	3.0	71%	1.56	0.00	1.56	0
17.224	5598.50	5.3	0.143	4.9	60.8	26.34	2.71%	Slime Tailings	0.057	113.1	0.98	0.48	0.51	1	1.52	7.433	103.32	9.30	9	3.33%	3.1	71%	1.57	0.00	1.57	0
17.388	5598.33	5.4	0.167	5.0	60.4	26.17	3.09%	Slime Tailings	0.057	113.1	0.99	0.48	0.51	1	1.51	7.567	105.17	9.45	9	3.79%	3.1	71%	1.57	0.00	1.57	0
17.552	5598.17	8.1	0.153	7.8	49.8	21.59	1.90%	Slime Tailings	0.057	113.1	1.00	0.49	0.51	1	1.50	11.622	161.55	14.04	14	2.16%	2.8	71%	1.58	0.00	1.58	0
17.716	5598.00	12.1	0.146	11.9	23.4	10.13	1.21%	Sand-Slime Tailin	0.059	119.0	1.01	0.49	0.52	1	1.49	17.713	246.21	20.82	21	1.32%	2.5	47%	1.59	0.00	1.59	0
17.880	5597.84	14.1	0.132	14.0	21.9	9.47	0.94%	Sand-Slime Tailin	0.059	119.0	1.02	0.50	0.52	1	1.46	20.417	283.79	23.94	25	1.01%	2.4	47%	1.60	0.00	1.60	0
18.044	5597.68	14.0	0.074	13.9	17.3	7.51	0.53%	Sand-Slime Tailin	0.059	119.0	1.03	0.50	0.53	1	1.45	20.197	280.74	23.64	25	0.57%	2.3	47%	1.61	0.00	1.61	1
18.208	5597.51	11.8	0.070	11.7	17.2	7.43	0.59%	Sand-Slime Tailin	0.059	119.0	1.04	0.51	0.53	1	1.46	16.985	236.10	19.91	20	0.65%	2.4	47%	1.62	0.01	1.62	1
18.372	5597.35	9.1	0.178	8.9	23.4	10.12	1.96%	Slime Tailings	0.057	113.1	1.05	0.51	0.54	1	1.45	12.930	179.72	15.26	15	2.22%	2.8	71%	1.63	0.01	1.62	1
18.537	5597.18	6.8	0.214	6.6	44.6	19.31	3.12%	Slime Tailings	0.057	113.1	1.06	0.52	0.54	1	1.44	9.455	131.43	11.45	11	3.70%	3.0	71%	1.64	0.02	1.62	1
18.701	5597.02	12.2	0.207	12.1	17.2	7.44	1.70%	Sand-Slime Tailin	0.059	119.0	1.07	0.52	0.55	1	1.43	17.226	239.45	20.19	20	1.87%	2.6	47%	1.65	0.02	1.63	1
18.865	5596.86	12.4	0.172	12.2	21.3	9.23	1.39%	Sand-Slime Tailin	0.059	119.0	1.08	0.53	0.55	1	1.42	17.382	241.62	20.41	21	1.52%	2.6	47%	1.66	0.03	1.63	1
19.029	5596.69	14.4	0.138	14.3	22.3	9.64	0.96%	Sand-Slime Tailin	0.059	119.0	1.09	0.53	0.55	1	1.40	20.001	278.01	23.46	24	1.04%	2.4	47%	1.67	0.03	1.64	1
19.193	5596.53	15.7	0.130	15.6	20.8	8.99	0.83%	Sand-Slime Tailin	0.059	119.0	1.10	0.54	0.56	1	1.39	21.538	299.38	25.22	26	0.89%	2.4	47%	1.68	0.04	1.64	1
19.357	5596.36	16.7	0.123	16.5	23.1	9.99	0.74%	Sand-Slime Tailin	0.059	119.0	1.11	0.54	0.56	1	1.37	22.650	314.83	26.54	28	0.79%	2.3	47%	1.69	0.04	1.65	1
19.521	5596.20	16.7	0.112	16.5	24.3	10.52	0.67%	Sand-Slime Tailin	0.059	119.0	1.12	0.55	0.57	1	1.36	22.519	313.02	26.39	27	0.72%	2.3	47%	1.70	0.05	1.65	1
19.685	5596.04	16.2	0.142	16.1	26.1	11.31	0.88%	Sand-Slime Tailin	0.059	119.0	1.13	0.55	0.57	1	1.36	21.815	303.23	25.59	26	0.94%	2.4	47%	1.71	0.05	1.66	1
19.849	5595.87	13.7	0.203	13.5	30.3	13.14	1.48%	Sand-Slime Tailin	0.059	119.0	1.14	0.56	0.58	1	1.36	18.424	256.09	21.70	22	1.62%	2.6	47%	1.72	0.06	1.66	1
20.013	5595.71	9.9	0.190	9.6	41.6	18.02	1.92%	Slime Tailings	0.057	113.1	1.15	0.56	0.58	1	1.36	13.071	181.68	15.59	15	2.18%	2.8	71%	1.73	0.06	1.67	1
20.177	5595.54	8.7	0.172	8.3	65.6	28.43	1.98%	Slime Tailings	0.057	113.1	1.16	0.57	0.59	1	1.35	11.187	155.51	13.64	13	2.28%	2.8	71%	1.74	0.07	1.67	1
20.341	5595.38	8.9	0.207	8.5	67.9	29.41	2.32%	Slime Tailings	0.057	113.1	1.16	0.57	0.59	1	1.34	11.394	158.38	13.90	13	2.67%	2.9	71%	1.75	0.07	1.67	1
20.505	5595.22	9.3	0.168	8.9	65.7	28.45	1.81%	Slime Tailings	0.057	113.1	1.17	0.58	0.59	1	1.34	11.840	164.57	14.39	14	2.08%	2.8	71%	1.76	0.08	1.68	1
20.669	5595.05	12.9	0.090	12.6	43.1	18.67	0.70%	Sand-Slime Tailin	0.059	119.0	1.18	0.58	0.60	1	1.33	16.762	232.99	19.88	20	0.77%	2.4	47%	1.77	0.08	1.68	1
20.833	5594.89	13.2	0.156	13.1	27.5	11.92	1.18%	Sand-Slime Tailin	0.059	119.0	1.19	0.59	0.60	1	1.32	17.242	239.67	20.29	20	1.30%	2.5	47%	1.78	0.09	1.69	1
20.997	5594.72	9.7	0.180	9.2	68.8	29.83	1.86%	Slime Tailings	0.057	113.1	1.20	0.60	0.61	1	1.31	12.134	168.66	14.75	14	2.13%	2.8	71%	1.79	0.09	1.69	1
21.161	5594.56	9.1	0.158	8.5	91.2	39.53	1.73%	Slime Tailings	0.057	113.1	1.21	0.60	0.61	1	1.31	11.155	155.05	13.82	13	2.00%	2.8	71%	1.79	0.10	1.70	1
21.325	5594.39	9.1	0.173	8.5	87.2	37.78	1.90%	Slime Tailings	0.057	113.1	1.22	0.61	0.62	1	1.30	11.096	154.23	13.71	13	2.20%	2.8	71%	1.80	0.10	1.70	1
21.489	5594.23	10.0	0.173	9.4	103.1	44.66	1.73%	Sand-Slime Tailin	0.059	119.0	1.23	0.61	0.62	1	1.29	12.116	168.41	15.04	14	1.97%	2.8	47%	1.81	0.11	1.70	1
21.653	5594.07	11.1	0.173	10.5	102.2	44.29	1.56%	Sand-Slime Tailin	0.059	119.0	1.24	0.62	0.63	1	1.28	13.420	186.53	16.54	16	1.76%	2.7	47%	1.82	0.11	1.71	1

Liquefaction Triggering Analyses

Depth at time of CPT (ft)	Idriss & Boulanger (2008) Cyclic Stress Ratio r_d	C_σ	K_σ	K_α	CSR M=7.5, s'v=1atm	Cyclic Resistance Ratio Δq_{c1n}	q_{c1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Youd et al. (2001) Cyclic Stress Ratio r_d	D_r	f	K_σ	K_α	CSR M=7.5, s'v=1atm	Kc	q_{c1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No	Idriss & Boulanger (2008) CN	qc1 TSF	qc1 MPa	qc1N
12.139	0.94	0.05	0.98	1.0	0.053	38.02	60.80	0.089	1.68	0.95	0.28	0.80	1.18	1.0	0.035	4.36	99.37	0.171	9.56	5.62	2	1.7	19.613	1.8777	22.779
12.303	0.94	0.05	0.98	1.0	0.053	37.60	59.18	0.087	1.64	0.95	0.27	0.80	1.18	1.0	0.035	3.72	80.22	0.128	7.07	4.35	2	1.7	18.58	1.7788	21.580
12.467	0.93	0.05	0.98	1.0	0.053	37.18	57.56	0.085	1.61	0.95	0.26	0.80	1.18	1.0	0.035	4.13	84.08	0.135	7.39	4.50	2	1.7	17.545	1.6798	20.378
12.631	0.93	0.05	0.98	1.0	0.053	36.06	53.20	0.081	1.53	0.95	0.24	0.80	1.18	1.0	0.035	3.89	66.77	0.108	5.82	3.67	2	1.7	14.761	1.4132	17.144
12.795	0.93	0.05	0.98	1.0	0.053	36.63	55.43	0.083	1.57	0.95	0.25	0.80	1.17	1.0	0.036	3.58	67.31	0.108	5.79	3.68	2	1.7	16.186	1.5497	18.799
12.959	0.93	0.05	0.98	1.0	0.053	35.69	51.78	0.079	1.51	0.95	0.23	0.80	1.17	1.0	0.036	4.39	70.58	0.113	5.96	3.73	2	1.7	13.852	1.3262	16.088
13.123	0.93	0.05	0.98	1.0	0.053	35.04	49.28	0.077	1.46	0.94	0.22	0.80	1.17	1.0	0.036	4.85	69.02	0.111	5.79	3.63	2	1.7	12.254	1.1732	14.232
13.287	0.93	0.05	0.98	1.0	0.052	37.69	58.74	0.086	1.65	0.94	0.26	0.80	1.17	1.0	0.036	2.40	50.63	0.092	4.77	3.21	2	1.7	18.13	1.7358	21.057
13.451	0.93	0.06	0.97	1.0	0.052	41.89	74.94	0.106	2.03	0.94	0.33	0.80	1.16	1.0	0.036	1.52	50.29	0.092	4.70	3.37	2	1.7	28.454	2.7242	33.048
13.615	0.93	0.06	0.97	1.0	0.052	42.17	76.01	0.107	2.06	0.94	0.34	0.80	1.16	1.0	0.036	1.57	53.23	0.094	4.76	3.41	2	1.694353	29.139	2.7898	33.843
13.779	0.92	0.06	0.97	1.0	0.052	42.10	75.73	0.107	2.06	0.94	0.33	0.80	1.16	1.0	0.036	1.75	59.00	0.099	4.97	3.51	2	1.682138	28.96	2.7727	33.636
13.943	0.92	0.06	0.97	1.0	0.052	42.29	76.49	0.108	2.08	0.94	0.34	0.80	1.16	1.0	0.036	1.86	63.68	0.104	5.16	3.62	2	1.66558	29.44	2.8186	34.193
14.107	0.92	0.06	0.97	1.0	0.052	43.01	79.26	0.112	2.16	0.94	0.35	0.80	1.15	1.0	0.036	2.01	72.78	0.116	5.68	3.92	2	1.64115	31.207	2.9877	36.245
14.271	0.92	0.06	0.97	1.0	0.052	42.82	78.50	0.111	2.14	0.94	0.34	0.80	1.15	1.0	0.036	2.09	74.50	0.118	5.75	3.95	2	1.631735	30.725	2.9416	35.685
14.436	0.92	0.06	0.97	1.0	0.051	44.01	83.09	0.117	2.27	0.94	0.36	0.80	1.15	1.0	0.036	1.92	75.08	0.119	5.73	4.00	2	1.60217	33.651	3.2218	39.084
14.600	0.92	0.06	0.97	1.0	0.051	42.48	77.19	0.109	2.12	0.94	0.34	0.80	1.15	1.0	0.036	1.68	58.41	0.099	4.69	3.40	2	1.612498	29.89	2.8617	34.716
14.764	0.92	0.06	0.97	1.0	0.051	40.56	69.81	0.099	1.93	0.94	0.31	0.80	1.14	1.0	0.036	1.80	52.65	0.094	4.40	3.17	2	1.630934	25.183	2.411	29.248
14.928	0.92	0.05	0.97	1.0	0.051	38.55	62.05	0.090	1.75	0.94	0.28	0.80	1.14	1.0	0.036	2.66	62.56	0.103	4.79	3.27	2	1.655194	20.24	1.9378	23.507
15.092	0.91	0.05	0.97	1.0	0.051	38.01	60.00	0.088	1.71	0.94	0.27	0.80	1.14	1.0	0.036	3.15	69.15	0.111	5.11	3.41	2	1.652854	18.929	1.8123	21.985
15.256	0.91	0.05	0.97	1.0	0.051	36.75	55.87	0.083	1.62	0.94	0.25	0.80	1.14	1.0	0.036	3.84	73.49	0.117	5.35	3.49	2	1.648232	16.467	1.5765	19.125
15.420	0.91	0.05	0.97	1.0	0.051	35.76	52.05	0.079	1.55	0.94	0.23	0.80	1.13	1.0	0.037	3.88	63.25	0.104	4.69	3.12	2	1.636528	14.022	1.3425	16.286
15.584	0.91	0.05	0.97	1.0	0.051	36.47	54.06	0.082	1.59	0.94	0.24	0.80	1.13	1.0	0.037	3.19	56.14	0.096	4.33	2.96	2	1.623697	15.144	1.4498	17.588
15.748	0.91	0.05	0.97	1.0	0.051	35.80	51.47	0.079	1.54	0.94	0.23	0.80	1.13	1.0	0.037	3.75	58.82	0.099	4.40	2.97	2	1.611093	13.491	1.2916	15.669
15.912	0.91	0.05	0.97	1.0	0.051	34.78	48.26	0.076	1.48	0.94	0.21	0.80	1.13	1.0	0.037	5.07	68.29	0.110	4.83	3.16	2	1.599979	11.603	1.1109	13.476
16.076	0.91	0.05	0.97	1.0	0.051	34.48	47.11	0.075	1.46	0.94	0.21	0.80	1.13	1.0	0.037	5.55	70.12	0.112	4.90	3.18	2	1.589039	10.871	1.0408	12.626
16.240	0.91	0.05	0.97	1.0	0.051	34.15	45.83	0.074	1.44	0.94	0.20	0.80	1.12	1.0	0.037	6.01	70.18	0.112	4.86	3.15	2	1.578267	10.052	0.9624	11.675
16.404	0.90	0.05	0.97	1.0	0.051	34.03	45.36	0.073	1.44	0.94	0.19	0.80	1.12	1.0	0.037	6.31	71.49	0.114	4.90	3.17	2	1.56766	9.7505	0.9335	11.325
16.568	0.90	0.05	0.97	1.0	0.051	34.13	45.73	0.074	1.45	0.94	0.20	0.80	1.12	1.0	0.037	6.14	71.27	0.114	4.85	3.15	2	1.557215	9.9883	0.9563	11.601
16.732	0.90	0.05	0.97	1.0	0.051	34.13	45.76	0.074	1.45	0.94	0.20	0.80	1.12	1.0	0.037	5.62	65.37	0.106	4.49	2.97	2	1.546927	10.006	0.958	11.622
16.896	0.90	0.05	0.97	1.0	0.051	34.08	45.53	0.073	1.45	0.94	0.20	0.80	1.12	1.0	0.037	5.51	63.14	0.103	4.34	2.89	2	1.536792	9.864	0.9444	11.456
17.060	0.90	0.04	0.97	1.0	0.051	33.46	43.14	0.071	1.41	0.94	0.18	0.80	1.11	1.0	0.037	6.87	66.48	0.107	4.47	2.94	2	1.526807	8.3369	0.7982	9.683
17.224	0.90	0.04	0.97	1.0	0.051	33.33	42.63	0.071	1.40	0.94	0.18	0.80	1.11	1.0	0.037	7.68	71.47	0.114	4.71	3.05	2	1.516969	8.0087	0.7668	9.302
17.388	0.90	0.04	0.97	1.0	0.050	33.38	42.83	0.071	1.41	0.93	0.18	0.80	1.11	1.0	0.037	8.01	75.70	0.120	4.93	3.17	2	1.507275	8.1349	0.7788	9.448
17.552	0.90	0.05	0.97	1.0	0.050	34.98	49.02	0.077	1.52	0.93	0.22	0.80	1.11	1.0	0.037	4.80	67.46	0.109	4.42	2.97	2	1.49772	12.088	1.1573	14.040
17.716	0.89	0.05	0.97	1.0	0.050	37.61	58.43	0.086	1.72	0.93	0.26	0.80	1.11	1.0	0.037	2.91	60.54	0.101	4.06	2.89	2	1.487226	17.93	1.7166	20.824
17.880	0.89	0.06	0.97	1.0	0.050	38.70	62.64	0.091	1.82	0.93	0.28	0.80	1.10	1.0	0.037	2.34	56.01	0.096	3.85	2.84	2	1.462524	20.616	1.9738	23.945
18.044	0.89	0.05	0.97	1.0	0.050	38.59	62.23	0.090	1.81	0.93	0.28	0.80	1.10	1.0	0.037	1.94	45.86	0.088	3.49	2.65	2	1.454089	20.355	1.9488	23.641
18.208	0.89	0.05	0.97	1.0	0.050	37.28	57.19	0.085	1.70	0.93	0.26	0.80	1.10	1.0	0.038	2.31	46.04	0.088	3.46	2.58	2	1.456725	17.141	1.6411	19.909
18.372	0.89	0.05	0.97	1.0	0.050	35.40	50.66	0.078	1.56	0.93	0.23	0.80	1.10	1.0	0.038	4.60	70.24	0.112	4.35	2.95	2	1.447882	13.141	1.2581	15.262
18.537	0.89	0.05	0.97	1.0	0.050	34.07	45.52	0.073	1.46	0.93	0.20	0.80	1.10	1.0	0.038	7.03	80.43	0.128	4.92	3.19	2	1.439161	9.8555	0.9436	11.447
18.701	0.89	0.05	0.97	1.0	0.050	37.38	57.57	0.085	1.70	0.93	0.26	0.80	1.10	1.0	0.038	3.49	70.44	0.113	4.27	2.98	2	1.429575	17.38	1.6639	20.185
18.865	0.89	0.05	0.97	1.0	0.050	37.46	57.87	0.086	1.70	0.93	0.26	0.80	1.09	1.0	0.038	3.17	64.62	0.105	3.94	2.82	2	1.420133	17.571	1.6823	20.408
19.029	0.88	0.05	0.96	1.0	0.050	38.53	61.98	0.090	1.79	0.93	0.28	0.80	1.09	1.0	0.038	2.42	56.88	0.097	3.60	2.70	2	1.400632	20.196	1.9335	23.456
19.193	0.88	0.06	0.96	1.0	0.050	39.15	64.37	0.093	1.84	0.93	0.29	0.80	1.09	1.0	0.039	2.17	54.73	0.095	3.49	2.67	2	1.385076	21.717	2.0792	25.223
19.357	0.88	0.06	0.96	1.0	0.050	39.61	66.14	0.095	1.88	0.93	0.30	0.80	1.09	1.0	0.039	2.00	53.20	0.094	3.41	2.65	2	1.371886	22.847	2.1874	26.536
19.521	0.88	0.06	0.96	1.0	0.050	39.56	65.95	0.095	1.88	0.93	0.30	0.80	1.09	1.0	0.039	1.95	51.52	0.093	3.33	2.60	2	1.363988	22.726	2.1758	26.395
19.685	0.88	0.06	0.96	1.0	0.051	39.28	64.87	0.093	1.85	0.93	0.29	0.80	1.08	1.0	0.039	2.20	56.30	0.097	3.44	2.64	2	1.358371	22.037	2.1098	25.594
19.849	0.88	0.05	0.96	1.0	0.051	37.91	59.61	0.087	1.73	0.93	0.27	0.80	1.08	1.0	0.039	3.13	67.89	0.109	3.85	2.79	2	1.363705	18.682	1.7886	21.698
20.013	0.88	0.05	0.97	1.0	0.051	35.52	51.11	0.079	1.54	0.93	0.23	0.80	1.08	1.0	0.039	4.55	71.01	0.113	3.96	2.75	2	1.358687	13.423	1.2851	15.590
20.177	0.87	0.05	0.97	1.0	0.051	34.84	48.47	0.076	1.49	0.92	0.21	0.80	1.08	1.0	0.039	5.13	70.00	0.112	3.88	2.68	2	1.351138	11.741	1.1241	13.636
20.341	0.87	0.05	0.97	1.0	0.051	34.93	48.82	0.076	1.50	0.92	0.22	0.80	1.08	1.0	0.039	5.43	75.40	0.120	4.12	2.81	2	1.343684	11.964	1.1454	13.895
20.505	0.87	0.05	0.97	1.0	0.051	35.10	49.49	0.077	1.51	0.92	0.22	0.80	1.08	1.0	0.039	4.75	68.35	0.110	3.74	2.62	2	1.336323	12.388	1.186	14.387
20.669	0.87	0.05	0.96	1.0	0.051	37.27	57.16	0.085	1.66	0.92	0.26	0.80	1.08	1.0	0.040	2.50	49.68	0.091	3.09	2.37	2	1.328222	17.119	1.639	19.883
20.833	0.87	0.05	0.96	1.0	0.051	37.42	57.71	0.085	1.67	0.92	0.26	0.80	1.07	1.0	0.040	3.02	61.18	0.101	3.39	2.53	2	1.320232	17.469	1.6725	20.289
20.997	0.87	0.05	0.97	1.0	0.051	35.22	49.97	0.077	1.51	0.92	0.22	0.80	1.07	1.0	0.040	4.73	69.77	0.112	3.70	2.61	2	1.31316	12.698	1.2157	14.748
21.161	0.87	0.05	0.97	1.0	0.051	34.90	48.72	0.076	1.49	0.92	0.21	0.80	1.07	1.0	0.040	4.84	66.95	0.108	3.55	2.52	2	1.306174	11.899	1.1392	13.820
21.325	0.87	0.05	0.97	1.0	0.051	34.86	48.57	0.076	1.48	0.91	0.21	0.80	1.07	1.0	0.040	5.08	69.61	0.111	3.64	2.56	2	1.299271	11.803	1.13	13.708
21.489	0.86	0.05	0.97	1.0	0.051	35.58	50.61	0.078	1.52	0.91	0.22	0.80	1.07	1.0	0.040	4.53	68.09	0.109	3.54	2.53	2	1.291671	12.947	1.2395	15.037
21.653	0.86	0.05	0.97	1.0	0.051	36.10	52.64	0.080	1.56	0.91	0.23	0.80	1.07	1.0	0.040	4.02	66.55	0.107	3.45	2.50	2	1.284172	14.239	1.3632	16.538

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W4-C

Data File: 13-52106_SP2W4-C-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

5611.20	Water surface elevation during CPT investigation (ft a
5607.96	Water surface elevation at t_0 (ft amsl)
5593.50	Water surface elevation at t_1 (ft amsl)
5588.50	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earth
7.51	Equiv. Number of Uniform Strain Cycles, N

5616.24	Ground Surface Elevation at time of CPT (ft amsl)
5626.19	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pla
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
1.95	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1104.55	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5588.50	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	5626.19	5625.94	5625.69	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	5625.69	5623.94	5622.19	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	5622.19	5620.19	5618.19	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334
Platform/Random Fill Layer	5618.19	5617.22	5616.24	1.95	0.050	101	0.552	0.503	0.00	0.00	0.552	0.503

2013 CPT Data from ConeTec									CPT Data Interpretations														Conditions at t_1				Liquefaction Triggering Analyses: Idriss & Boulanger (2008)									Youd, et al. (2001)												Idriss & Boulanger (2008)			
Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines...)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of CPT (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F, (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No	r_d	C_σ	K_σ	K_α	Cyclic Stress Ratio: CSR M=7.5, s'v=1atm	Cyclic Resistance Ratio: Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	r_d	D_r	f	K_σ	K_α	Cyclic Stress Ratio: CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No	CN	qc1 TSF	qc1 MPa	qc1N
0.164	5616.08	20.1	0.057	20.0	8.1	3.50	0.28%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0	1.70	34.068	473.55	39.67	2431	0.28%	0.7	51%	0.56	0.00	0.56	0	1.00	0.06	1.03	1.0	0.059	44.24	83.91	0.118	1.99	0.98	0.36	0.80	2.53	1.0	0.017	1.00	39.67	0.083	201.04	101.51	2	1.7	34.154	3.2699	39.667
0.328	5615.91	44.3	0.080	44.3	3.0	1.28	0.18%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	75.242	1045.86	87.43	2679	0.18%	0.5	51%	0.57	0.00	0.57	0	1.00	0.10	1.04	1.0	0.060	61.00	148.43	0.264	4.40	0.98	0.54	0.73	2.91	1.0	0.015	1.00	87.43	0.142	172.13	88.26	2	1.7	75.273	7.2067	87.425
0.492	5615.75	56.7	0.160	56.7	4.6	1.97	0.28%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	96.373	1339.58	111.99	2287	0.28%	0.7	51%	0.58	0.00	0.58	0	1.00	0.12	1.05	1.0	0.061	69.62	181.61	0.563	9.30	0.98	0.61	0.69	2.96	1.0	0.015	1.00	111.99	0.211	170.09	89.70	2	1.7	96.421	9.2314	111.988
0.656	5615.58	59.2	0.227	59.2	1.6	0.69	0.38%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0	1.70	100.708	1399.84	116.99	1792	0.38%	0.8	51%	0.59	0.00	0.59	0	1.00	0.12	1.05	1.0	0.061	71.37	188.36	0.707	11.68	0.98	0.62	0.69	2.77	1.0	0.016	1.00	116.99	0.229	138.70	75.19	2	1.7	100.72	9.6434	116.986
0.820	5615.42	57.7	0.368	57.7	1.8	0.79	0.64%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0	1.70	98.107	1363.69	113.97	1396	0.64%	1.1	51%	0.59	0.00	0.59	0	1.00	0.12	1.04	1.0	0.060	70.32	184.28	0.614	10.17	0.97	0.62	0.69	2.55	1.0	0.017	1.00	113.97	0.218	105.56	57.86	2	1.7	98.126	9.3946	113.968
0.984	5615.26	76.8	0.959	76.8	3.0	1.30	1.25%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0	1.70	130.509	1814.08	151.62	1548	1.25%	1.3	51%	0.60	0.00	0.60	0	1.00	0.16	1.06	1.0	0.061	83.53	235.14	1.000	16.35	0.97	0.71	0.64	2.76	1.0	0.016	1.00	151.62	0.404	163.38	89.86	2	1.7	130.54	12.498	151.615
1.148	5615.09	85.7	0.894	85.6	3.7	1.58	1.04%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0	1.70	145.571	2023.44	169.12	1480	1.04%	1.3	51%	0.61	0.00	0.61	0	1.00	0.19	1.07	1.0	0.062	89.67	258.79	1.000	16.23	0.97	0.75	0.62	2.76	1.0	0.016	1.00	169.12	1.000	346.66	181.45	2	1.7	145.61	13.941	169.117
1.312	5614.93	82.5	0.999	82.4	17.4	7.54	1.21%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	140.046	1946.64	162.87	1247	1.21%	1.4	51%	0.62	0.00	0.62	0	1.00	0.18	1.06	1.0	0.062	87.48	250.35	1.000	16.33	0.97	0.74	0.63	2.57	1.0	0.017	1.00	162.87	1.000	303.45	159.89	2	1.7	140.23	13.426	162.870
1.476	5614.76	93.6	0.450	93.6	0.8	0.34	0.48%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	159.120	2211.77	184.82	1258	0.48%	1.0	51%	0.63	0.00	0.63	0	1.00	0.22	1.07	1.0	0.062	95.18	280.00	1.000	16.16	0.97	0.78	0.61	2.61	1.0	0.016	1.00	184.82	1.000	269.84	143.00	2	1.7	159.13	15.235	184.818
1.640	5614.60	40.2	0.533	40.2	-0.8	-0.35	1.33%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0	1.70	68.306	949.45	79.32	485	1.33%	1.6	51%	0.63	0.00	0.63	0	1.00	0.09	1.03	1.0	0.059	58.16	137.48	0.224	3.78	0.97	0.51	0.74	1.83	1.0	0.023	1.00	79.32	0.126	30.71	17.24	2	1.7	68.297	6.5388	79.323
1.804	5614.44	69.8	0.650	69.8	3.2	1.40	0.93%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0	1.70	118.609	1648.67	137.80	767	0.93%	1.3	51%	0.64	0.00	0.64	0	1.00	0.14	1.04	1.0	0.060	78.68	216.47	1.000	16.60	0.97	0.68	0.66	2.14	1.0	0.020	1.00	137.80	0.323	71.44	44.02	2	1.7	118.64	11.359	137.797
1.968	5614.27	139.8	1.194	139.8	6.7	2.90	0.85%	Interim Cover	0.050	100.7	0.10	0.00	0.10	0	1.70	237.575	3302.29	276.01	1409	0.85%	1.2	51%	0.65	0.00	0.65	0	1.00	0.30	1.08	1.0	0.063	127.18	403.19	1.000	15.98	0.97	0.96	0.60	2.37	1.0	0.018	1.00	276.01	1.000	202.62	109.30	2	1.7	237.65	22.752	276.012
2.133	5614.11	222.3	2.152	222.2	6.7	2.90	0.97%	Interim Cover	0.050	100.7	0.11	0.00	0.11	0	1.70	377.791	5251.29	438.86	2069	0.97%	1.2	51%	0.66	0.00	0.66	0	1.00	0.30	1.08	1.0	0.062	184.33	623.20	1.000	16.05	0.97	1.21	0.60	2.30	1.0	0.019	1.00	438.86	1.000	187.10	101.57	2	1.7	377.86	36.177	438.864
2.297	5613.94	246.8	3.608	246.8	4.8	2.07	1.46%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	419.082	5825.24	486.80	2133	1.46%	1.4	51%	0.67	0.00	0.67	0	1.00	0.30	1.08	1.0	0.062	201.15	687.95	1.000	16.11	0.97	1.27	0.60	2.23	1.0	0.019	1.00	486.80	1.000	173.81	94.96	2	1.69827	419.13	40.128	486.797
2.461	5613.78	219.5	4.267	219.4	6.7	2.90	1.94%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.67	365.913	5086.19	425.07	1770	1.95%	1.5	51%	0.68	0.00	0.68	0	1.00	0.30	1.07	1.0	0.062	179.49	604.56	1.000	16.18	0.97	1.19	0.60	2.17	1.0	0.020	1.00	425.07	1.000	162.28	89.23	2	1.667638	365.98	35.039	425.067
2.625	5613.62	178.9	4.079	179.0	-0.1	-0.03	2.28%	Interim Cover	0.050	100.7	0.13	0.00	0.13	0	1.64	293.386	4078.06	340.75	1353	2.28%	1.6	51%	0.68	0.00	0.68	0	1.00	0.30	1.07	1.0	0.062	149.90	490.65	1.000	16.25	0.97	1.07	0.60	2.12	1.0	0.020	1.00	340.75	1.000	152.20	84.23	2	1.639484	293.39	28.089	340.749
2.789	5613.45	149.3	2.666	149.3	0.3	0.12	1.79%	Interim Cover	0.050	100.7	0.14	0.00	0.14	0	1.61	240.810	3347.26	279.69	1062	1.79%	1.5	51%	0.69	0.00	0.69	0	0.99	0.30	1.07	1.0	0.061	128.47	408.16	1.000	16.32	0.97	0.97	0.60	2.07	1.0	0.021	1.00	279.69	1.000	143.30	79.81	2	1.61347	240.81	23.055	279.690
2.953	5613.29	132.8	2.041	132.8	-0.3	-0.15	1.54%	Interim Cover	0.050	100.7	0.15	0.00	0.15	0	1.61	213.554	2968.40	248.03	892	1.54%	1.5	51%	0.70	0.00	0.70	0	0.99	0.30	1.06	1.0	0.061	117.36	365.39	1.000	16.39	0.97	0.91	0.60	2.02	1.0	0.021	1.00	248.03	1.000	135.40	75.89	2	1.608211	213.55	20.445	248.026
3.117	5613.12	92.1	1.817	92.1	2.6	1.12	1.97%	Interim Cover	0.050	100.7	0.16	0.00	0.16	0	1.70	156.604	2176.80	181.92	586	1.98%	1.7	51%	0.71	0.00	0.71	0	0.99	0.22	1.04	1.0	0.060	94.16	276.08	1.000	16.72	0.97	0.78	0.61	1.94	1.0	0.022	1.00	185.13	1.000	128.32	72.52	2	1.7	156.63	14.996	181.918
3.281	5612.96	80.8	1.379	80.8	2.1	0.89	1.71%	Sand Tailings	0.051	102.8	0.17	0.00	0.17	0	1.70	137.326	1908.83	159.52	487	1.71%	1.7	18%	0.72	0.00	0.72	0	0.99	0.17	1.03	1.0	0.059	62.87	222.39	1.000	16.90	0.97	0.73	0.64	1.82	1.0	0.023	1.02	160.07	1.000	121.83	69.36	2	1.7	137.35	13.15	159.521
3.445	5612.80	68.7	1.150	68.7	0.4	0.18	1.67%	Sand-Slime Tailin	0.047	93.3	0.17	0.00	0.17	0	1.70	116.722	1622.44	135.57	396	1.68%	1.7	47%	0.73	0.00	0.73	0	0.99	0.14	1.02	1.0	0.058	77.85	213.42	1.000	17.04	0.97	0.67	0.66	1.71	1.0	0.025	1.03	139.61	0.333	38.80	27.92	2	1.7	116.73	11.175	135.571
3.609	5612.63	56.4	0.959	56.4	-0.5	-0.20	1.70%	Sand-Slime Tailin	0.047	93.3	0.18	0.00	0.18	0	1.70	95.897	1332.97	111.37	311	1.71%	1.8	47%	0.73	0.00	0.73	0	0.99	0.12	1.02	1.0	0.058	69.36	180.73	0.548	9.39	0.97	0.61	0.70	1.61	1.0	0.027	1.07	119.35	0.238	26.57	17.98	2	1.7	95.892	9.1807	111.373
3.773	5612.47	53.4	0.881	53.4	-0.6	-0.27	1.65%	Sand-Slime Tailin	0.047	93.3	0.19	0.00	0.19	0	1.70	90.797	1262.08	105.45	283	1.66%	1.8	47%	0.74	0.00	0.74	0	0.99	0.11	1.02	1.0	0.058	67.28	172.73	0.437	7.51	0.97	0.59	0.70	1.57	1.0	0.027	1.08	113.95	0.218	23.31	15.41	2	1.7	90.79	8.6923	105.447
3.937	5612.30	48.2	0.768	48.2	-0.6	-0.27	1.59%	Sand-Slime Tailin	0.047	93.3	0.20	0.00	0.20	0	1.70	81.991	1139.67	95.22	245	1.60%	1.8	47%	0.75	0.00	0.75	0	0.99	0.10	1.01	1.0	0.058	63.70	158.92	0.319	5.50	0.97	0.56	0.72	1.52	1.0	0.028	1.10	104.52	0.186	19.17	12.34	2	1.7	81.984	7.8492	95.220
4.101	5612.14	42.9	0.667	42.9	-0.7	-0.29	1.56%	Sand-Slime Tailin	0.047	93.3	0.20	0.00	0.20	0	1.70	72.879	1013.02	84.64	209	1.56%	1.8	47%	0.76	0.00	0.76	0	0.99	0.09	1.01	1.0	0.058	59.98	144.62	0.249	4.31	0.97	0.53	0.73	1.47	1.0	0.029	1.12	95.05	0.160	15.85	10.08	2	1.7	72.872	6.9768	84.636
4.265	5611.97	37.5	0.582	37.5	-0.0	-0.01	1.55%	Sand-Slime Tailin	0.047	93.3	0.21	0.00	0.21	0	1.70	63.767	886.36	74.06	177	1.56%	1.9	47%	0.76	0.00	0.76	0	0.99	0.09	1.01	1.0	0.058	56.28	130.34	0.204	3.54	0.97	0.50	0.75	1.42	1.0	0.030	1.16	85.99	0.139	13.30	8.42	2	1.7	63.767	6.105	74.061
4.429	5611.81	34.9	0.521	35.0	-0.6	-0.25	1.49%	Sand-Slime Tailin	0.047	93.3	0.22	0.00	0.22	0	1.70	59.415	825.87	69.00	159	1.50%	1.9	47%	0.77	0.00	0.77	0	0.99	0.08	1.01	1.0	0.058	54.50	123.50	0.187	3.26	0.97	0.48	0.76	1.39	1.0	0.031	1.18	81.21	0.130	11.98	7.62	2	1.7	59.409	5.6878	69.000
4.593	5611.65	33.0	0.469	33.0	-0.6	-0.26	1.42%	Sand-Slime Tailin	0.047	93.3	0.23	0.00	0.23	0	1.70	56.049	779.08	65.09	144	1.43%	1.9	47%	0.78	0.00	0.78	0	0.98	0.08	1.01	1.0	0.057	53.13	118.22	0.176	3.06	0.97	0.47	0.77	1.36	1.0	0.031	1.19	77.39	0.123	10.98	7.02	2	1.7	56.043	5.3655	65.090
4.757	5611.48	30.9	0.492	30.9	-0.7	-0.32	1.59%	Sand-Slime Tailin	0.047	93.3	0.23	0.00	0.23	0	1.70	52.462	729.22	60.92	131	1.61%	2.0	47%	0.79	0.00	0.79	0	0.98	0.08	1.01	1.0	0.057	51.67	112.59	0.165	2.87	0.97	0.45	0.77	1.34	1.0	0.032	1.26	76.65	0.122	10.52	6.70	2	1.7	52.454	5.022	60.922
4.921	5611.32	29.7	0.432	29.7	-1.3	-0.55	1.45%	Sand-Slime Tailin	0.047	93.3	0.24	0.00	0.24	0	1.70	50.490	701.81	58.63	122	1.47%	2.0	47%	0.79	0.00	0.79	0	0.98	0.08	1.01	1.0	0.057	50.86	109.49	0.159	2.78	0.97	0.44	0.78	1.32	1.0	0.032	1.25	73.30	0.117	9.75	6.27	2	1.7	50.477	4.8326	58.625
5.085	5611.15	26.8	0.410	26.8	-1.5	-0.67	1.53%	Sand-Slime Tailin	0.059	119.0	0.25	0.00	0.25	1	1.70	45.594	633.76	52.94	106	1.54%	2.0	47%	0.80	0.00	0.80	0	0.98	0.07	1.00	1.0	0.057	48.87	101.80	0.146	2.55	0.96	0.42	0.79	1.30	1.0	0.033	1.32	70.05	0.112	9.05	5.80	2	1.7	45.578	4.3636	52.936
5.249	5610.99	24.8	0.386	24.8	-0.4	-0.16	1.56%	Sand-Slime Tailin	0.059	119.0	0.26	0.01	0.25	1	1.70	42.143	585.79	48.94	96	1.57%	2.1	47%	0.81	0.00	0.81	0	0.98	0.07	1.00	1.0	0.057	47.47	96.41	0.137	2.40	0.96	0.40	0.80	1.28	1.0	0.033	1.38	67.39	0.108	8.62	5.51	2	1.7	42.139	4.0344	48.942
5.413	5610.83	26.0	0.371	26.0	-0.4	-0.17	1.43%	Sand-Slime Tailin	0.059	119.0	0.27	0.01	0.26	1	1.70	44.200	614.38	51.33	99	1.44%	2.0	47%	0.82	0.00	0.82	0	0.98	0.07	1.00	1.0	0.057	48.30	99.63	0.142	2.50	0.96	0.41	0.79	1.28	1.0	0.033	1.32	68.00	0.109	8.53	5.51	2	1.7	44.196	4.2313	51.331
5.577	5610.66	24.7	0.321	24.7	-0.3	-0.13	1.30%	Sand-Slime Tailin	0.059	119.0	0.28	0.02	0.26	1	1.70	41.922	582.72	48.69	92	1.32%	2.0	47%	0.83	0.00	0.83	0	0.98	0.07	1.00	1.0	0.057	47.38	96.06	0.136	2.40	0.96	0.40	0.80	1.27	1.0	0.033	1.32	64.25	0.105	8.03	5.21	2	1.7	41.919	4.0133	48.686
5.741	5610.50	27.7	0.310	27.7	-0.3	-0.13	1.12%	Sand-Slime Tailin	0.059	119.0	0.29	0.02	0.27	1	1.70	47.022	653.61	54.61	102	1.13%	1.9	47%	0.84	0.00	0.84	0	0.98	0.07	1.00	1.0	0.057	49.45	104.06	0.149	2.64	0.96	0.43	0.79	1.28	1.0	0.033	1.23	67.08	0.108	8.15	5.39	2	1.7	47.019	4.5016	54.609
5.905	5610.33	28.1	0.321	28.1	-0.4	-0.16	1.14%	Sand-Slime Tailin	0.059	119.0	0.30	0.03	0.27	1	1.70	47.770	664.00	55.48	102	1.15%	1.9	47%	0.85	0.00	0.85	0	0.98	0.07	1.00	1.0	0.057	49.76	105.24	0.151	2.68	0.96	0.43	0.78	1.28	1.0	0.033	1.23	68.51	0.110	8.15	5.41	2	1.7	47.766	4.5732	55.478
6.069	5610.17	23.8	0.368	23.8	-0.4	-0.17	1.54%	Sand-Slime Tailin	0.059	119.0	0.31	0.03	0.28	1	1.70	40.511	563.10	47.05	85	1.56%	2.1	47%	0.86	0.00	0.86	0	0.98	0.07	1.00	1.0	0.056	46.80	93.85	0.133	2.35	0.96	0.40	0.80	1.25	1.0	0.034	1.44	67.86	0.109	7.96	5.15	2	1.7	40.507	3.8781	47.046
6.234	5610.01	18.4	0.319	18.4	-0.5	-0.20	1.73%	Sand-Slime Tailin	0.059	119.0	0.32	0.04	0.28	1	1.70	31.297	435.03	36.34	64	1.76%	2.2	47%	0.87	0.00	0.87	0	0.98	0.06	1.00	1.0	0.056	43.05	79.39	0.112	1.98	0.96	0.35	0.80	1.25	1.0	0.034	1.71	62.22	0.102	7.35	4.67	2	1.7	31.292	2.9959	36.344
6.398	5609.84	20.4	0.332	20.5	-0.3	-0.14	1.62%	Sand-Slime Tailin	0.059	119.0	0.33	0.04	0.29	1	1.70	34.765	483.23	40.37	70	1.65%	2.2	47%	0.88	0.00	0.88	0	0.97	0.07	1.00	1.0	0.056	44.46	84.83	0.119	2.12	0.96	0.37	0.80	1.25	1.0	0.034	1.60	64.41	0.105	7.41	4.77	2	1.7	34.762	3.3281	40.374
6.562	5609.68	17.3	0.407	17.3	-0.4	-0.16	2.35%	Sand-Slime Tailin	0.059	119.0	0.34	0.05	0.29	1	1.70	29.461	409.51	34.21	58	2.40%	2.3	47%	0.89	0.00	0.89	0	0.97	0.06	1.00	1.0	0.056	42.30	76.51	0.108	1.92	0.96	0.34	0.80	1.24	1.0	0.034	2.08	71.05	0.113	7.88	4.90	2	1.7	29.457	2.8202	34.213
6.726	5609.51	11.3	0.330	11.4	-0.5	-0.20	2.91%	Slime Tailings	0.057	113.1	0.35	0.05	0.30	1	1.70	19.295	268.20	22.40	37	3.00%	2.5	71%	0.90	0.00	0.90	0	0.97	0.05	1.00	1.0	0.056	37.89	60.29	0.088	1.57	0.96	0.27	0.80	1.24	1.0	0.034	3.02	67.71	0.109	7.47	4.52	2	1.7	19.29	1.8468	22.404
6.890	5609.35	13.4	0.217	13.4	1.7	0.72	1.62%	Sand-Slime Tailin	0.059	119.0	0.36	0.06	0.30	1	1.70	22.763	316.41	26.46	43	1.66%	2.3	47%	0.91	0.00	0.91	0	0.97	0.06	1.00	1.0	0.056	39.58	66.04	0.095	1.69	0.96	0.30	0.80	1.23	1.0	0.034	2.05	54.36	0.095	6.42	4.05	2	1.7	22.781	2.181	26.458
7.054	5609.19	20.5	0.195	20.5	1.9	0.83	0.95%	Sand-Slime Tailin	0.059	119.0	0.37	0.06	0.31	1	1.70	34.782	483.47	40.42	66	0.97%	2.0	47%	0.92	0.00	0.92	0	0.97	0.07	1.00	1.0	0.056	44.48	84.90	0.119	2.14	0.96	0.37	0.80	1.23	1.0	0.034	1.36	55.14	0.096	6.36	4.25	2	1.7	34.802	3.332	40.421
7.218	5609.02	20.5	0.217	20.5	0.3	0.14	1.06%	Sand-Slime Tailin	0.059	119.0	0.38	0.07	0.31	1	1.70	34.782	483.47	40.40	65	1.08%	2.1	47%	0.93	0.00	0.93	0	0.97	0.07	0.99	1.0	0.056	44.47	84.87	0.119	2.14	0.96	0.37	0.80	1.23	1.0	0.035	1.42	57.29	0.097	6.40	4.27	2	1.7	34.786	3.3304	40.401
7.382	5608.86	18.7	0.284	18.7	-0.3	-0.14	1.52%	Sand-Slime Tailin	0.059	119.0	0.39	0.07	0.31	1	1.70	31.756	441.41	36.88	58	1.55%	2.2	47%	0.94	0.00	0.94	0	0.97	0.06	0.99	1.0	0.056	43.24	80.11	0.113	2.03	0.96	0.35	0.80	1.22	1.0	0.035	1.70	62.74	0.103	6.66	4.34	2	1.7	31.752	3.04	36.879
7.546	5608.69	13.6	0.275	13.6	-0.3	-0.14	2.03%	Sand-Slime Tailin	0.059	119.0	0.40	0.08	0.32	1	1.70	23.086	320.90	26.81	41	2.09%	2.4	47%	0.95	0.00	0.95	0	0.97	0.06	0.99	1.0	0.056	39.70	66.51	0.095	1.72	0.96	0.30	0.80	1.22	1.0	0.035	2.35	63.11	0.103	6.59	4.15	2	1.7	23.082	2.2099	26.809
7.710	5608.53	17.2	0.252	17.2	0.6	0.24	1.46%	Sand-Slime Tailin	0.059	119.0	0.41	0.08	0.32	1	1.70	29.257	406.67	33.99	52	1.50%	2.2	47%	0.96	0.00	0.96	0	0.97	0.06	0.99	1.0	0.055	42.22	76.21	0.108	1.94	0.96	0.34	0.80	1.22	1.0	0.035	1.78	60.41	0.101	6.32	4.13	2	1.7	29.263	2.8016	33.987
7.874	5608.37	19.5	0.259	19.5	0.3	0.14	1.33%	Sand-Slime Tailin	0.059	119.0	0.42	0.09	0.33	1	1.70	33.184	461.26	38.55	58	1.36%	2.2	47%	0.97	0.00	0.97	0	0.96	0.06	0.99	1.0	0.055	43.82	82.37	0.116	2.09	0.96	0.36	0.80	1.21	1.0	0.035	1.61	62.11	0.102	6.34	4.22	2	1.7	33.187	3.1774	38.545
8.038	5608.20	17.5	0.270	17.5	-0.4	-0.19	1.54%	Sand-Slime Tailin	0.059	119.0	0.43	0.09	0.33	1	1.70	29.716	413.05	34.51	51	1.58%	2.3	47%	0.98	0.00	0.98	0	0.96	0.06	0.99	1.0	0.055	42.40	76.91	0.108	1.96	0.96	0.34	0.80	1.21	1.0	0.035	1.83	63.24	0.104	6.33	4.15	2	1.7	29.711	2.8446	34.508
8.202	5608.04	20.8	0.275	20.8	-0.3	-0.15	1.32%	Sand-Slime Tailin	0.059	119.0	0.44	0.10	0.34	1	1.70	35.343	491.27	41.04	60	1.35%	2.2	47%	0.99	0.00	0.99	0	0.96	0.07	0.99	1.0	0.055	44.70	85.74	0.121	2.19	0.96	0.37	0.80	1.21	1.0	0.035	1.58	64.94	0.105	6.36	4.28	2	1.7	35.339	3.3834	41.045
8.366	5607.87	29.7	0.344	29.7	-0.3	-0.13	1.16%	Sand-Slime Tailin	0.059	119.0	0.45	0.10	0.34	1	1.70	50.524	702.28	58.68	85	1.18%	2.0	47%	1.00	0.00	1.00	0	0.96	0.08	0.99	1.0	0.055	50.88	109.56	0.159	2.89	0.96	0.44	0.78	1.23	1.0	0.034	1.31	76.88	0.122	7.28	5.09	2	1.7	50.521	4.8369	58.677
8.530	5607.71	27.7	0.473	27.7	-0.4	-0.17	1.71%	Sand-Slime Tailin	0.059	119.0	0.46	0.11	0.35	1	1.70	47.056	654.08	54.65	78	1.74%	2.1	47%	1.01	0.00	1.01	0	0.96	0.07	0.99	1.0	0.055	49.47	104.12	0.149	2.72	0.96	0.43	0.79	1.21	1.0	0.035	1.55	84.64	0.136	8.02	5.37	2	1.7	47.052	4.5047	54.648
8.694	5607.55	17.5	0.350	17.5	-0.4	-0.18	2.00%	Sand-Slime Tailin	0.059	119.0	0.47	0.11	0.35	1	1.70	29.733	413.29	34.53	48	2.06%	2.4	47%	1.02	0.00	1.02	0	0.96	0.06	0.99	1.0	0.055	42.41	76.94	0.109	1.98	0.96	0.34	0.80	1.20	1.0	0.035	2.13	73.60	0.117	6.79	4.38	2	1.7	29.729	2.8462	34.528
8.858	5607.38	14.1	0.266	14.1	0.3	0.13	1.88%	Sand-Slime Tailin	0.059	119.0	0.48	0.12	0.36	1	1.70	23.987	333.42	27.86	38	1.95%	2.4	47%	1.03	0.00	1.03	0	0.96	0.06	0.99	1.0	0.055	40.07	67.94	0.097	1.77	0.96	0.30	0.80	1.19	1.0	0.035	2.38	66.42	0.107	6.14	3.96	2	1.7	23.99	2.2968	27.863
9.022	5607.22	12.6	0.246	12.4	27.0	11.71	1.96%	Sand-Slime Tailin	0.059	119.0	0.49	0.12	0.36	1	1.70	21.080	293.01	24.82	33	2.04%	2.5	47%	1.04	0.00	1.04	0	0.96	0.06	0.99	1.0	0.055	39.01	63.82	0.092	1.68	0.96	0.29	0.80	1.19	1.0	0.035	2.64	65.56	0.106	6.01	3.85	2	1.7	21.367	2.0457	24.816
9.186	5607.05	14.1	0.209	14.0	21.8	9.43	1.48%	Sand-Slime Tailin	0.059	119.0	0.50	0.13	0.37	1	1.70	23.783	330.58	27.89	37	1.53%	2.4	47%	1.05	0.00	1.05	0	0.96	0.06	0.99	1.0	0.055	40.08	67.97	0.097	1.78	0.96	0.30	0.80	1.19	1.0	0.035	2.17	60.39	0.100	5.62	3.70	2	1.7	24.014	2.2991	27.891
9.350	5606.89	11.2	0.245	11.2	5.5	2.40	2.18%	Slime Tailings	0.057	113.1	0.50	0.13	0.37	1	1.70	19.023	264.42	22.16	29	2.29%	2.6	71%	1.06	0.00	1.06	0	0.96	0.05	0.99	1.0	0.055	37.81	59.97	0.088	1.61	0.95	0.27	0.80	1.18	1.0	0.036	3.06	67.79	0.109	6.02	3.82	2	1.7	19.082	1.8269	22.162
9.514	5606.73	8.4	0.166	8.3	7.5	3.23	1.98%	Slime Tailings	0.057	113.1	0.51	0.14	0.37	1	1.70	14.144	196.60	16.52	21	2.11%	2.6	71%	1.07	0.00	1.07	0	0.95	0.05	0.99	1.0	0.055	35.84	52.36	0.080	1.46	0.95	0.23	0.80	1.18	1.0	0.036	3.62	59.80	0.100	5.46	3.46	2	1.7	14.223	1.3617	16.519
9.678	5606.56	9.2	0.101	9.1	11.5	4.97	1.10%	Sand-Slime Tailin	0.059	119.0	0.52	0.14	0.38	1	1.70	15.470	215.03	18.11	23	1.17%	2.5	47%	1.08	0.00	1.08	0	0.95	0.05	0.99	1.0	0.054	36.65	54.76	0.082	1.51	0.95	0.25	0.80	1.18	1.0	0.036	2.64	47.72	0.090	4.85	3.18	2	1.7	15.592	1.4928	18.109
9.842	5606.40	8.9	0.136	8.8	15.6	6.76	1.53%	Sand-Slime Tailin	0.059	119.0	0.53	0.15	0.38	1	1.70	14.926	207.47	17.53	22	1.63%	2.6	47%	1.09	0.00	1.09	0	0.95	0.05	0.99	1.0	0.054	36.45	53.98	0.081	1.50	0.95	0.24	0.80	1.18	1.0	0.036	3.14	55.03	0.095	5.10	3.30	2	1.7	15.092	1.4449	17.528
10.006	5606.23	7.4	0.138	7.3	21.3	9.25	1.87%	Slime Tailings	0.057	113.1	0.54	0.15	0.39	1	1.70	12.325	171.32	14.58	18	2.02%	2.7	71%	1.09	0.00	1.09	0	0.95	0.05	0.99	1.0	0.054	35.16	49.74	0.077	1.42	0.95	0.22	0.80	1.17	1.0	0.036	3.97	57.82	0.098	5.18	3.30	2	1.7	12.551	1.2017	14.578
10.170	5606.07	10.2	0.164	10.2	-1.3	-0.56	1.60%	Sand-Slime Tailin	0.059	119.0	0.55	0.16	0.39	1	1.70	17.408	241.97	20.20	25	1.69%	2.5	47%	1.10	0.00	1.10	0	0.95	0.05	0.99	1.0	0.054	37.39	57.59	0.085	1.57	0.95	0.26	0.80	1.17	1.0	0.036	2.94	59.41	0.100	5.20	3.39	2	1.7	17.394	1.6653	20.202
10.335	5605.91	11.2	0.177	11.1	9.8	4.26	1.58%	Sand-Slime Tailin	0.059	119.0	0.56	0.17	0.40	1	1.70	18.921	263.00	22.10	27	1.67%	2.5	47%	1.11	0.00	1.11	0	0.95	0.05	0.99	1.0	0.054	38.05	60.15	0.088	1.63	0.95	0.27	0.80	1.17	1.0	0.036	2.77	61.13	0.101	5.23	3.43	2	1.7	19.025	1.8215	22.097
10.499	5605.74	10.6	0.158	10.5	14.1	6.11	1.49%	Sand-Slime Tailin	0.059	119.0	0.57	0.17	0.40	1	1.70	17.833	247.88	20.89	25	1.58%	2.5	47%	1.12	0.00	1.12	0	0.95	0.05	0.99	1.0	0.054	37.63	58.51	0.086	1.60	0.95	0.26	0.80	1.16	1.0	0.036	2.83	59.12	0.099	5.07	3.33	2	1.7	17.983	1.7216	20.886
10.663	5605.58	11.5	0.125	11.4	10.9	4.70	1.09%	Sand-Slime Tailin	0.059	119.0	0.58	0.18	0.41	1	1.70	19.380	269.38	22.64	27	1.15%	2.4	47%	1.13	0.00	1.13	0	0.95	0.05	0.99	1.0	0.054	38.24	60.89	0.089	1.65	0.95	0.27	0.80	1.16	1.0	0.036	2.35	53.28	0.094	4.75	3.20	2	1.7	19.495	1.8665	22.642
10.827	5605.41	11.2	0.137	11.1	7.2	3.12	1.22%	Sand-Slime Tailin	0.059	119.0	0.59	0.18	0.41	1	1.70	18.938	263.24	22.08	26	1.29%	2.5	47%	1.14	0.00	1.14	0	0.95	0.05	0.99	1.0	0.054	38.05	60.13	0.088	1.64	0.95	0.27	0.80	1.16	1.0	0.036	2.54	56.01	0.096	4.81	3.22	2	1.7	19.014	1.8204	22.084
10.991	5605.25	11.3	0.125	11.2	15.6	6.77	1.11%	Sand-Slime Tailin	0.059	119.0	0.60	0.19	0.42	1	1.70	19.057	264.89	22.33	26	1.17%	2.4	47%	1.15	0.00	1.15	0	0.94	0.05	0.98	1.0	0.054	38.13	60.46	0.088	1.64	0.95	0.27	0.80	1.16	1.0	0.036	2.43	54.27	0.095	4.69	3.17	2	1.7	19.223	1.8404	22.326
11.155	5605.09	12.7	0.188	12.6	14.5	6.28	1.48%	Sand-Slime Tailin	0.059	119.0	0.61	0.19	0.42	1	1.70	21.437	297.97	25.08	29	1.56%	2.5	47%	1.16	0.00	1.16	0	0.94	0.06	0.98	1.0	0.054	39.10	64.17	0.093	1.73	0.95	0.29	0.80	1.15	1.0	0.036	2.56	64.20	0.105	5.12	3.42	2	1.7	21.591	2.0671	25.077
11.319	5604.92	10.6	0.193	10.5	12.0	5.18	1.82%	Sand-Slime Tailin	0.059	119.0	0.62	0.20	0.42	1	1.70	17.867	248.35	20.90	23	1.94%	2.6	47%	1.17	0.00	1.17	0	0.94	0.05	0.98	1.0	0.054	37.63	58.53	0.086	1.61	0.95	0.26	0.80	1.15	1.0	0.036	3.23	67.57	0.109	5.26	3.43	2	1.7	17.994	1.7227	20.899
11.483	5604.76	10.1	0.128	10.0	15.4	6.66	1.27%	Sand-Slime Tailin	0.059	119.0	0.63	0.20	0.43	1	1.70	17.000	236.30	19.93	22	1.35%	2.5	47%	1.18	0.00	1.18	0	0.94	0.05	0.98	1.0	0.053	37.29	57.23	0.085	1.59	0.95	0.26	0.80	1.15	1.0	0.036	2.87	57.19	0.097	4.66	3.12	2	1.7	17.163	1.6432	19.934
11.647	5604.59	9.6	0.155	9.5	10.4	4.52	1.62%	Sand-Slime Tailin	0.059	119.0	0.64	0.21	0.43	1	1.70	16.150	224.49	18.89	21	1.74%	2.6	47%	1.19	0.00	1.19	0	0.94	0.05	0.98	1.0	0.053	36.93	55.81	0.083	1.56	0.95	0.25	0.80	1.15	1.0	0.037	3.35	63.33	0.104	4.91	3.24	2	1.7	16.261	1.5568	18.886
11.811	5604.43	7.6	0.132	7.4	26.7	11.58	1.74%	Slime Tailings	0.057	113.1	0.65	0.21	0.44	1	1.70	12.549	174.44	14.90	16	1.91%	2.7	71%	1.20	0.00	1.20	0	0.94	0.05	0.98	1.0	0.053	35.28	50.18	0.078	1.46	0.95	0.22	0.80	1.14	1.0	0.037	4.16	62.05	0.102	4.80	3.13	2	1.695868	12.832	1.2286	14.904
11.975	5604.27	7.8	0.081	7.7	21.2	9.18	1.04%	Sand-Slime Tailin	0.059	119.0	0.66	0.22	0.44	1	1.68	12.884	179.08	15.22	16	1.14%	2.6	47%	1.21	0.00	1.21	0	0.94	0.05	0.98	1.0	0.053	35.64	50.86	0.078	1.47	0.95	0.23	0.80	1.14	1.0	0.037	3.31	50.40	0.092	4.27	2.87	2	1.681958	13.106	1.2548	15.222

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W4-C

Data File: 13-52106_SP2W4-C-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Legend
Tailings Sands
Tailings Sand-Slimes
Tailings Slimes
Interim Cover
Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69

Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Parameter
5611.20	Water surface elevation during CPT investigation (ft a
5607.96	Water surface elevation at t_0 (ft amsl)
5593.50	Water surface elevation at t_1 (ft amsl)
5588.50	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earth
7.51	Equiv. Number of Uniform Strain Cycles, N

Value	Parameter
5616.24	Ground Surface Elevation at time of CPT (ft amsl)
5626.19	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pla
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
1.95	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1104.55	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5588.50	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	5626.19	5625.94	5625.69	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	5625.69	5623.94	5622.19	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	5622.19	5620.19	5618.19	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334
Platform/Random Fill Layer	5618.19	5617.22	5616.24	1.95	0.050	101	0.552	0.503	0.00	0.00	0.552	0.503

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
12.139	5604.10	8.6	0.080	8.5	21.2	9.20	0.93%	Sand-Slime Tailin	0.059	119.0	0.67	0.22	0.45	1	1.67	14.147	196.65	16.69	18	1.01%	2.5	47%	1.22	0.00	1.22	0
12.303	5603.94	7.4	0.144	7.2	28.9	12.53	1.95%	Slime Tailings	0.057	113.1	0.68	0.23	0.45	1	1.66	11.958	166.22	14.24	15	2.14%	2.8	71%	1.23	0.00	1.23	0
12.467	5603.77	6.6	0.098	6.4	31.0	13.42	1.49%	Slime Tailings	0.057	113.1	0.69	0.23	0.46	1	1.64	10.508	146.06	12.57	13	1.66%	2.8	71%	1.24	0.00	1.24	0
12.631	5603.61	10.5	0.114	10.4	20.4	8.82	1.08%	Sand-Slime Tailin	0.059	119.0	0.70	0.24	0.46	1	1.63	16.984	236.07	19.97	21	1.16%	2.5	47%	1.25	0.00	1.25	0
12.795	5603.44	13.7	0.097	13.6	15.2	6.59	0.71%	Sand-Slime Tailin	0.059	119.0	0.71	0.24	0.46	1	1.59	21.666	301.16	25.34	28	0.75%	2.3	47%	1.26	0.00	1.26	0
12.959	5603.28	16.5	0.105	16.4	9.8	4.23	0.64%	Sand-Slime Tailin	0.059	119.0	0.72	0.25	0.47	1	1.55	25.544	355.07	29.78	34	0.67%	2.2	47%	1.27	0.00	1.27	0
13.123	5603.12	21.7	0.122	21.7	9.2	4.00	0.56%	Sand-Slime Tailin	0.059	119.0	0.73	0.25	0.47	1	1.51	32.623	453.45	37.99	44	0.58%	2.1	47%	1.28	0.00	1.28	0
13.287	5602.95	18.8	0.157	18.7	5.8	2.52	0.84%	Sand-Slime Tailin	0.059	119.0	0.74	0.26	0.48	1	1.52	28.407	394.86	33.06	38	0.87%	2.2	47%	1.29	0.00	1.29	0
13.451	5602.79	19.3	0.227	19.2	9.2	4.00	1.18%	Sand-Slime Tailin	0.059	119.0	0.75	0.26	0.48	1	1.50	28.942	402.30	33.72	38	1.22%	2.3	47%	1.30	0.00	1.30	0
13.615	5602.62	15.8	0.262	15.7	7.7	3.33	1.66%	Sand-Slime Tailin	0.059	119.0	0.76	0.27	0.49	1	1.52	23.933	332.67	27.88	31	1.74%	2.5	47%	1.31	0.00	1.31	0
13.779	5602.46	12.7	0.218	12.6	16.1	6.99	1.72%	Sand-Slime Tailin	0.059	119.0	0.77	0.27	0.49	1	1.54	19.381	269.39	22.69	24	1.83%	2.6	47%	1.32	0.00	1.32	0
13.943	5602.30	10.1	0.175	9.9	22.6	9.81	1.74%	Sand-Slime Tailin	0.059	119.0	0.78	0.28	0.50	1	1.54	15.263	212.15	17.98	19	1.88%	2.7	47%	1.33	0.00	1.33	0
14.107	5602.13	9.1	0.134	8.8	44.4	19.24	1.48%	Sand-Slime Tailin	0.059	119.0	0.79	0.28	0.50	1	1.52	13.415	186.46	16.07	17	1.62%	2.7	47%	1.34	0.00	1.34	0
14.271	5601.97	13.3	0.135	13.2	23.4	10.14	1.01%	Sand-Slime Tailin	0.059	119.0	0.79	0.29	0.51	1	1.50	19.817	275.45	23.27	25	1.08%	2.4	47%	1.35	0.00	1.35	0
14.436	5601.80	11.8	0.101	11.7	21.6	9.38	0.86%	Sand-Slime Tailin	0.059	119.0	0.80	0.29	0.51	1	1.50	17.537	243.76	20.60	22	0.92%	2.4	47%	1.36	0.00	1.36	0
14.600	5601.64	11.3	0.117	11.2	20.4	8.83	1.03%	Sand-Slime Tailin	0.059	119.0	0.81	0.30	0.52	1	1.49	16.742	232.71	19.67	20	1.11%	2.5	47%	1.37	0.00	1.37	0
14.764	5601.48	10.3	0.048	10.1	26.4	11.43	0.47%	Sand-Slime Tailin	0.059	119.0	0.82	0.30	0.52	1	1.48	15.025	208.85	17.73	18	0.51%	2.4	47%	1.38	0.00	1.38	0
14.928	5601.31	10.3	0.125	10.2	18.1	7.85	1.21%	Sand-Slime Tailin	0.059	119.0	0.83	0.31	0.53	1	1.47	15.024	208.83	17.64	18	1.32%	2.6	47%	1.39	0.00	1.39	0
15.092	5601.15	9.7	0.124	9.5	36.6	15.86	1.28%	Sand-Slime Tailin	0.059	119.0	0.84	0.31	0.53	1	1.46	13.810	191.97	16.43	17	1.40%	2.6	47%	1.40	0.00	1.40	0
15.256	5600.98	10.1	0.123	10.0	14.9	6.47	1.22%	Sand-Slime Tailin	0.059	119.0	0.85	0.32	0.53	1	1.45	14.471	201.15	16.96	17	1.34%	2.6	47%	1.41	0.00	1.41	0
15.420	5600.82	8.8	0.119	8.6	32.5	14.09	1.36%	Sand-Slime Tailin	0.059	119.0	0.86	0.32	0.54	1	1.44	12.356	171.74	14.69	15	1.50%	2.7	47%	1.42	0.00	1.42	0
15.584	5600.66	9.0	0.124	8.6	54.7	23.71	1.38%	Sand-Slime Tailin	0.059	119.0	0.87	0.33	0.54	1	1.43	12.359	171.79	14.92	15	1.53%	2.7	47%	1.43	0.00	1.43	0
15.748	5600.49	9.1	0.139	8.8	60.7	26.31	1.52%	Sand-Slime Tailin	0.059	119.0	0.88	0.33	0.55	1	1.42	12.476	173.42	15.12	15	1.68%	2.7	47%	1.43	0.00	1.43	0
15.912	5600.33	8.8	0.135	8.4	58.5	25.37	1.54%	Sand-Slime Tailin	0.059	119.0	0.89	0.34	0.55	1	1.41	11.857	164.82	14.37	14	1.72%	2.7	47%	1.44	0.00	1.44	0
16.076	5600.16	8.0	0.083	7.6	54.0	23.40	1.04%	Sand-Slime Tailin	0.059	119.0	0.90	0.34	0.56	1	1.40	10.699	148.72	12.98	13	1.18%	2.7	47%	1.45	0.00	1.45	0
16.240	5600.00	7.9	0.083	7.6	49.3	21.36	1.05%	Sand-Slime Tailin	0.059	119.0	0.91	0.35	0.56	1	1.40	10.560	146.79	12.76	12	1.19%	2.7	47%	1.46	0.00	1.46	0
16.404	5599.84	7.2	0.093	6.8	64.6	27.99	1.29%	Slime Tailings	0.057	113.1	0.92	0.35	0.57	1	1.39	9.446	131.29	11.62	11	1.48%	2.8	71%	1.47	0.00	1.47	0
16.568	5599.67	7.6	0.134	7.3	52.4	22.70	1.75%	Slime Tailings	0.057	113.1	0.93	0.36	0.57	1	1.38	10.095	140.32	12.25	12	2.00%	2.8	71%	1.48	0.00	1.48	0
16.732	5599.51	6.9	0.131	6.6	54.4	23.55	1.89%	Slime Tailings	0.057	113.1	0.94	0.36	0.57	1	1.37	9.064	125.99	11.07	10	2.18%	2.9	71%	1.49	0.00	1.49	0
16.896	5599.34	8.8	0.147	8.5	39.7	17.21	1.67%	Slime Tailings	0.057	113.1	0.95	0.37	0.58	1	1.36	11.645	161.86	13.92	14	1.88%	2.8	71%	1.50	0.00	1.50	0
17.060	5599.18	7.0	0.190	6.8	39.7	17.19	2.72%	Slime Tailings	0.057	113.1	0.96	0.38	0.58	1	1.36	9.153	127.22	11.02	10	3.15%	3.0	71%	1.51	0.00	1.51	0
17.224	5599.02	6.5	0.176	6.2	52.9	22.94	2.70%	Slime Tailings	0.057	113.1	0.97	0.38	0.59	1	1.35	8.333	115.83	10.20	9	3.18%	3.0	71%	1.52	0.00	1.52	0
17.388	5598.85	7.9	0.164	7.7	33.1	14.33	2.07%	Slime Tailings	0.057	113.1	0.98	0.39	0.59	1	1.34	10.339	143.72	12.33	12	2.36%	2.9	71%	1.53	0.00	1.53	0
17.552	5598.69	11.4	0.123	11.3	9.0	3.89	1.08%	Sand-Slime Tailin	0.059	119.0	0.99	0.39	0.60	1	1.33	15.075	209.54	17.60	17	1.19%	2.6	47%	1.54	0.00	1.54	0
17.716	5598.52	11.9	0.100	11.9	9.2	3.97	0.84%	Sand-Slime Tailin	0.059	119.0	1.00	0.40	0.60	1	1.32	15.752	218.95	18.38	18	0.91%	2.5	47%	1.55	0.00	1.55	0
17.880	5598.36	13.3	0.080	13.2	10.8	4.68	0.60%	Sand-Slime Tailin	0.059	119.0	1.01	0.40	0.61	1	1.32	17.409	241.99	20.32	20	0.65%	2.4	47%	1.56	0.00	1.56	0
18.044	5598.20	11.4	0.112	11.3	11.6	5.01	0.98%	Sand-Slime Tailin	0.059	119.0	1.02	0.41	0.61	1	1.31	14.805	205.79	17.31	17	1.08%	2.6	47%	1.57	0.00	1.57	0
18.208	5598.03	9.8	0.153	9.6	32.4	14.04	1.56%	Sand-Slime Tailin	0.059	119.0	1.03	0.41	0.61	1	1.30	12.479	173.46	14.80	14	1.75%	2.7	47%	1.58	0.00	1.58	0
18.372	5597.87	8.7	0.140	8.4	48.2	20.90	1.61%	Slime Tailings	0.057	113.1	1.03	0.42	0.62	1	1.29	10.848	150.78	13.05	12	1.83%	2.8	71%	1.59	0.00	1.59	0
18.537	5597.70	13.2	0.140	13.0	34.0	14.71	1.06%	Sand-Slime Tailin	0.059	119.0	1.04	0.42	0.62	1	1.29	16.691	232.01	19.70	19	1.15%	2.5	47%	1.60	0.00	1.60	0
18.701	5597.54	16.6	0.192	16.5	16.7	7.23	1.15%	Sand-Slime Tailin	0.059	119.0	1.05	0.43	0.63	1	1.27	21.007	292.00	24.55	25	1.23%	2.5	47%	1.61	0.00	1.61	0
18.865	5597.38	18.6	0.304	18.5	20.3	8.79	1.64%	Sand-Slime Tailin	0.059	119.0	1.06	0.43	0.63	1	1.26	23.192	322.37	27.12	28	1.74%	2.5	47%	1.62	0.00	1.62	0
19.029	5597.21	12.1	0.344	12.0	21.5	9.30	2.85%	Slime Tailings	0.057	113.1	1.07	0.44	0.64	1	1.27	15.124	210.23	17.76	17	3.12%	2.8	71%	1.63	0.00	1.63	0
19.193	5597.05	10.5	0.228	10.4	14.6	6.31	2.17%	Slime Tailings	0.057	113.1	1.08	0.44	0.64	1	1.26	13.121	182.38	15.37	15	2.42%	2.8	71%	1.63	0.00	1.63	0
19.357	5596.88	14.9	0.247	14.8	23.9	10.36	1.66%	Sand-Slime Tailin	0.059	119.0	1.09	0.45	0.65	1	1.25	18.446	256.39	21.64	21	1.79%	2.6	47%	1.64	0.00	1.64	0
19.521	5596.72	13.9	0.205	13.8	21.2	9.20	1.47%	Sand-Slime Tailin	0.059	119.0	1.10	0.45	0.65	1	1.25	17.183	238.84	20.15	20	1.60%	2.6	47%	1.65	0.00	1.65	0
19.685	5596.56	13.2	0.218	13.1	22.9	9.93	1.65%	Sand-Slime Tailin	0.059	119.0	1.11	0.46	0.66	1	1.24	16.221	225.47	19.05	19	1.80%	2.7	47%	1.66	0.00	1.66	0
19.849	5596.39	13.5	0.200	13.2	37.2	16.11	1.49%	Sand-Slime Tailin	0.059	119.0	1.12	0.46	0.66	1	1.23	16.280	226.29	19.24	19	1.62%	2.6	47%	1.67	0.00	1.67	0
20.013	5596.23	12.3	0.225	12.1	40.5	17.56	1.82%	Sand-Slime Tailin	0.059	119.0	1.13	0.47	0.66	1	1.22	14.794	205.64	17.54	17	2.01%	2.7	47%	1.68	0.00	1.68	0
20.177	5596.06	11.2	0.272	11.1	13.6	5.88	2.44%	Slime Tailings	0.057	113.1	1.14	0.47	0.67	1	1.22	13.492	187.53	15.79	15	2.72%	2.8	71%	1.69	0.00	1.69	0
20.341	5595.90	8.2	0.252	7.9	49.1	21.27	3.08%	Slime Tailings	0.057	113.1	1.15	0.48	0.67	1	1.21	9.557	132.85	11.53	10	3.58%	3.0	71%	1.70	0.00	1.70	0
20.505	5595.74	9.4	0.193	9.0	75.9	32.90	2.05%	Slime Tailings	0.057	113.1	1.16	0.48	0.68	1	1.21	10.815	150.33	13.23	12	2.33%	2.9	71%	1.71	0.00	1.71	0
20.669	5595.57	9.3	0.202	9.0	52.0	22.51	2.18%	Slime Tailings	0.057	113.1	1.17	0.49	0.68	1	1.20	10.763	149.61	12.95	12	2.49%	2.9	71%	1.72	0.00	1.72	0
20.833	5595.41	8.3	0.219	7.8	73.7	31.95	2.64%	Slime Tailings	0.057	113.1	1.18	0.49	0.69	1	1.20	9.349	129.95	11.50	10	3.08%	3.0	71%	1.73	0.00	1.73	0
20.997	5595.24	12.0	0.180	11.6	62.5	27.06	1.50%	Sand-Slime Tailin	0.059	119.0	1.19	0.50	0.69	1	1.19	13.843	192.42	16.62	16	1.66%	2.7	47%	1.74	0.00	1.74	0
21.161	5595.08	19.0	0.205	19.0	5.5	2.37	1.08%	Sand-Slime Tailin	0.059	119.0	1.20	0.50	0.69	1	1.17	22.300	309.97	25.95	26	1.15%	2.4	47%	1.75	0.00	1.75	0
21.325	5594.91	17.5	0.316	17.4	19.7	8.54	1.80%	Sand-Slime Tailin	0.059	119.0	1.21	0.51	0.70	1	1.17	20.385	283.36	23.84	23	1.94%	2.6	47%	1.76	0.00	1.76	0
21.489	5594.75	17.3	0.420	17.1	33.3	14.41	2.43%	Sand-Slime Tailin	0.059	119.0	1.22	0.51	0.70	1	1.17	19.921	276.90	23.42	23	2.62%	2.7	47%	1.77	0.00	1.77	0
21.653	5594.59	15.7	0.502	15.4	48.2	20.90	3.21%	Slime Tailings	0.057	113.1	1.23	0.52	0.71	1	1.17	17.885	248.60	21.18	20	3.48%	2.8	71%	1.78	0.00	1.78	0
21.817	5594.42	15.8	0.368	15.7	17.6	7.63	2.33%	Sand-Slime Tailin	0.059	119.0	1.24	0.52	0.71	1	1.16	18.175	252.63	21.26	20	2.53%	2.7	47%	1.79	0.00	1.79	0
21.981	5594.26	15.2	0.338	15.1	19.9	8.62	2.23%	Sand-Slime Tailin	0.059	119.0	1.25	0.53	0.72	1	1.15	17.362	241.33	20.33	19	2.43%	2.7	47%	1.80	0.00	1.80	0
22.145	5594.09	12.0	0.255	11.8	32.8	14.22	2.12%	Slime Tailings	0.057	113.1	1.25	0.53	0.72	1	1.15	13.551	188.36	16.01	15	2.37%	2.8	71%	1.81	0.00	1.81	0
22.309	5593.93	8.6	0.140	8.2	71.6	31.03	1.62%	Slime Tailings	0.057	113.1	1.26	0.54	0.73	1	1.14	9.341	129.83	11.44	10	1.90%	2.9	71%	1.82	0.00	1.82	0
22.473	5593.77	9.5	0.099	9.0	82.5	35.75	1.04%	Sand-Slime Tailin	0.059	119.0	1.27	0.54	0.73	1	1.14	10.238	142.31	12.57	11	1.20%	2.7	47%	1.83	0.00	1.83	0
22.638	5593.60	10.4	0.096	9.8	94.2	40.81	0.93%	Sand-Slime Tailin	0.059	119.0	1.28	0.55	0.73	1	1.13	11.059	153.72	13.62	12	1.06%	2.7	47%	1.84	0.00	1.84	0
22.802	5593.44	9.9	0.099	9.3	99.2	43.00	1.00%	Sand-Slime Tailin	0.059	119.0	1.29	0.55	0.74	1	1.13	10.431	144.98	12.92	12	1.15%	2.7	47%	1.85	0.00	1.84	1
22.966	5593.27	10.2	0.107	9.5	106.1	45.99	1.05%	Sand-Slime Tailin	0.059	119.0	1.30	0.56	0.74	1	1.12	10.660	148.17	13.24	12	1.21%	2.7	47%	1.86	0.01	1.85	1
23.130	5593.11	10.7	0.153	10.0	111.1	48.14	1.44%	Sand-Slime Tailin	0.059	119.0	1.31	0.56	0.75	1	1.12	11.110	154.43	13.80	12	1.64%	2.8	47%	1.87	0.01	1.85	1
23.294	5592.95	12.8	0.177	12.1	112.8	48.88	1.39%	Sand-Slime Tailin	0.059	119.0	1.32	0.57	0.75	1	1.11	13.388	186.09	16.46	15	1.55%	2.7	47%	1.88	0.02	1.86	1
23.458	5592.78	14.7	0.172	14.3	63.4	27.46	1.17%	Sand-Slime Tailin	0.059	119.0	1.33	0.57	0.76	1	1.10	15.787	219.45	18.84	18	1.29%	2.6	47%	1.88	0.02	1.86	1
23.622	5592.62	13.1	0.169	12.7	73.0	31.63	1.29%	Sand-Slime Tailin	0.059	119.0	1.34	0.58	0.76	1	1.10	13.909	193.34	16.74	15	1.44%	2.7	47%	1.89	0.03	1.87	1
23.786	5592.45	13.9	0.141	13.4	84.0	36.41	1.02%	Sand-Slime Tailin	0.059	119.0	1.35	0.58	0.77	1	1.09	14.609	203.07	17.63	16	1.13%	2.6	47%	1.90	0.03	1.87	1
23.950	5592.29	12.4	0.180	12.0	69.1	29.93	1.45%	Sand-Slime Tailin	0.059	119.0	1.36	0.59	0.77	1	1.09	13.081	181.83	15.74	14	1.62%	2.7	47%	1.91	0.04	1.88	1

Liquefaction Triggering Analyses

Idriss & Boulanger (2008): Cyclic Stress Ratio (r_d, C_σ, K_σ, K_α, CSR M=7.5, s'v=1atm); Cyclic Resistance Ratio (Δqc_{1n}, qc_{1n-cs}, (CRR) M=7.5, s'v=1atm); FoS. Youd et al. (2001): Cyclic Stress Ratio (r_d, D_r, f, K_σ, K_α, CSR M=7.5, s'v=1atm); Kc, qc_{1n-cs}, (CRR) M=7.5, s'v=1atm; FoS. Last four columns: Idriss & Boulanger (2008).

Depth (ft)	I&B r_d	I&B C_σ	I&B K_σ	I&B K_α	I&B CSR M=7.5, s'v=1atm	Δqc_{1n}	I&B qc_{1n-cs}	I&B (CRR) M=7.5, s'v=1atm	I&B FoS	Youd r_d	D_r	f	Youd K_σ	Youd K_α	Youd CSR M=7.5, s'v=1atm	Kc	Youd qc_{1n-cs}	Youd (CRR) M=7.5, s'v=1atm	Youd FoS	Avg FoS	Liquefiable? 1=Yes 2=No	CN	qc1 TSF	qc1 MPa	qc1N
12.139	0.94	0.05	0.98	1.0	0.053	36.15	52.84	0.080	1.51	0.95	0.24	0.80	1.14	1.0	0.037	2.95	49.28	0.091	4.19	2.85	2	1.668305	14.368	1.3756	16.688
12.303	0.94	0.05	0.98	1.0	0.053	35.05	49.28	0.077	1.45	0.95	0.22	0.80	1.14	1.0	0.037	4.55	64.75	0.105	4.80	3.12	2	1.656275	12.257	1.1735	14.236
12.467	0.93	0.05	0.98	1.0	0.053	34.47	47.04	0.075	1.41	0.95	0.20	0.80	1.14	1.0	0.037	4.48	56.35	0.097	4.37	2.89	2	1.644442	10.826	1.0365	12.574
12.631	0.93	0.05	0.98	1.0	0.053	37.30	57.27	0.085	1.61	0.95	0.26	0.80	1.13	1.0	0.037	2.75	54.84	0.095	4.27	2.94	2	1.631469	17.191	1.6459	19.966
12.795	0.93	0.06	0.98	1.0	0.053	39.19	64.53	0.093	1.76	0.95	0.29	0.80	1.13	1.0	0.037	1.95	49.33	0.091	4.04	2.90	2	1.59077	21.817	2.0888	25.339
12.959	0.93	0.06	0.98	1.0	0.053	40.75	70.52	0.100	1.91	0.95	0.32	0.80	1.13	1.0	0.037	1.68	50.08	0.092	4.03	2.97	2	1.554744	25.639	2.4547	29.778
13.123	0.93	0.06	0.97	1.0	0.052	43.63	81.62	0.115	2.19	0.95	0.36	0.80	1.13	1.0	0.037	1.41	53.48	0.094	4.10	3.15	2	1.506814	32.709	3.1316	37.990
13.287	0.93	0.06	0.98	1.0	0.052	41.90	74.95	0.106	2.02	0.95	0.33	0.80	1.12	1.0	0.037	1.72	56.89	0.097	4.19	3.11	2	1.517492	28.462	2.725	33.057
13.451	0.93	0.06	0.97	1.0	0.052	42.13	75.84	0.107	2.05	0.95	0.34	0.80	1.12	1.0	0.037	1.93	65.17	0.106	4.52	3.28	2	1.504284	29.029	2.7792	33.715
13.615	0.93	0.06	0.98	1.0	0.052	40.08	67.96	0.097	1.86	0.95	0.30	0.80	1.12	1.0	0.037	2.58	72.05	0.115	4.86	3.36	2	1.520523	24.006	2.2983	27.881
13.779	0.92	0.05	0.98	1.0	0.052	38.26	60.95	0.089	1.70	0.94	0.28	0.80	1.12	1.0	0.037	3.08	69.87	0.112	4.69	3.19	2	1.536918	19.535	1.8703	22.689
13.943	0.92	0.05	0.98	1.0	0.052	36.61	54.59	0.082	1.57	0.94	0.24	0.80	1.12	1.0	0.037	3.70	66.52	0.107	4.46	3.02	2	1.5355	15.48	1.482	17.979
14.107	0.92	0.05	0.98	1.0	0.052	35.94	52.01	0.079	1.52	0.94	0.23	0.80	1.11	1.0	0.037	3.76	60.46	0.101	4.14	2.83	2	1.524396	13.837	1.3248	16.071
14.271	0.92	0.05	0.98	1.0	0.052	38.46	61.73	0.090	1.73	0.94	0.28	0.80	1.11	1.0	0.037	2.41	56.17	0.096	3.94	2.84	2	1.501262	20.036	1.9182	23.270
14.436	0.92	0.05	0.98	1.0	0.052	37.53	58.13	0.086	1.65	0.94	0.26	0.80	1.11	1.0	0.037	2.50	51.42	0.093	3.75	2.70	2	1.502727	17.74	1.6984	20.604
14.600	0.92	0.05	0.98	1.0	0.052	37.20	56.86	0.084	1.63	0.94	0.26	0.80	1.11	1.0	0.038	2.79	54.80	0.095	3.83	2.73	2	1.492153	16.932	1.621	19.665
14.764	0.92	0.05	0.98	1.0	0.052	36.52	54.25	0.082	1.58	0.94	0.24	0.80	1.11	1.0	0.038	2.29	40.67	0.084	3.34	2.46	2	1.481748	15.269	1.4618	17.734
14.928	0.92	0.05	0.98	1.0	0.052	36.49	54.13	0.082	1.58	0.94	0.24	0.80	1.10	1.0	0.038	3.25	57.31	0.098	3.85	2.71	2	1.471506	15.19	1.4543	17.643
15.092	0.91	0.05	0.98	1.0	0.052	36.06	52.49	0.080	1.55	0.94	0.23	0.80	1.10	1.0	0.038	3.52	57.87	0.098	3.84	2.69	2	1.461424	14.144	1.3542	16.428
15.256	0.91	0.05	0.98	1.0	0.051	36.25	53.22	0.081	1.57	0.94	0.24	0.80	1.10	1.0	0.038	3.37	57.25	0.097	3.78	2.67	2	1.451498	14.607	1.3984	16.965
15.420	0.91	0.05	0.98	1.0	0.051	35.45	50.14	0.078	1.51	0.94	0.22	0.80	1.10	1.0	0.038	3.95	58.10	0.098	3.78	2.65	2	1.441725	12.648	1.2109	14.690
15.584	0.91	0.05	0.98	1.0	0.051	35.54	50.46	0.078	1.52	0.94	0.22	0.80	1.10	1.0	0.038	3.94	58.84	0.099	3.78	2.65	2	1.4321	12.848	1.2301	14.922
15.748	0.91	0.05	0.97	1.0	0.051	35.60	50.72	0.078	1.53	0.94	0.22	0.80	1.09	1.0	0.038	4.07	61.49	0.102	3.85	2.69	2	1.42262	13.016	1.2461	15.117
15.912	0.91	0.05	0.97	1.0	0.051	35.34	49.71	0.077	1.51	0.94	0.22	0.80	1.09	1.0	0.038	4.27	61.31	0.101	3.81	2.66	2	1.413283	12.374	1.1847	14.372
16.076	0.91	0.05	0.98	1.0	0.051	34.85	47.83	0.075	1.48	0.94	0.21	0.80	1.09	1.0	0.038	3.97	51.55	0.093	3.46	2.47	2	1.404084	11.172	1.0696	12.976
16.240	0.91	0.05	0.97	1.0	0.051	34.78	47.54	0.075	1.47	0.94	0.21	0.80	1.09	1.0	0.038	4.05	51.70	0.093	3.43	2.45	2	1.39502	10.99	1.0521	12.764
16.404	0.90	0.05	0.98	1.0	0.051	34.13	45.75	0.074	1.44	0.94	0.20	0.80	1.09	1.0	0.038	4.74	55.05	0.096	3.51	2.47	2	1.387005	10.005	0.9579	11.620
16.568	0.90	0.05	0.97	1.0	0.051	34.35	46.60	0.074	1.46	0.94	0.20	0.80	1.09	1.0	0.038	5.14	62.91	0.103	3.76	2.61	2	1.379094	10.546	1.0097	12.249
16.732	0.90	0.05	0.97	1.0	0.051	33.94	45.01	0.073	1.43	0.94	0.19	0.80	1.08	1.0	0.038	5.74	63.53	0.104	3.76	2.60	2	1.371285	9.5295	0.9124	11.068
16.896	0.90	0.05	0.97	1.0	0.051	34.93	48.85	0.076	1.51	0.94	0.22	0.80	1.08	1.0	0.038	4.57	63.62	0.104	3.74	2.62	2	1.363577	11.983	1.1472	13.918
17.060	0.90	0.05	0.97	1.0	0.051	33.93	44.95	0.073	1.44	0.94	0.19	0.80	1.08	1.0	0.038	6.70	73.85	0.117	4.20	2.82	2	1.355966	9.4885	0.9084	11.020
17.224	0.90	0.05	0.97	1.0	0.051	33.64	43.83	0.072	1.42	0.94	0.18	0.80	1.08	1.0	0.038	7.10	72.42	0.115	4.09	2.76	2	1.348452	8.779	0.8405	10.196
17.388	0.90	0.05	0.97	1.0	0.050	34.38	46.71	0.074	1.47	0.94	0.20	0.80	1.08	1.0	0.038	5.52	68.04	0.109	3.85	2.66	2	1.341031	10.616	1.0164	12.330
17.552	0.90	0.05	0.97	1.0	0.050	36.47	54.07	0.082	1.62	0.94	0.24	0.80	1.08	1.0	0.038	3.19	56.15	0.096	3.38	2.50	2	1.332865	15.149	1.4504	17.595
17.716	0.89	0.05	0.97	1.0	0.050	36.75	55.13	0.083	1.65	0.94	0.25	0.80	1.07	1.0	0.038	2.79	51.35	0.093	3.22	2.43	2	1.324812	15.828	1.5154	18.383
17.880	0.89	0.05	0.97	1.0	0.050	37.43	57.75	0.085	1.71	0.94	0.26	0.80	1.07	1.0	0.038	2.30	46.76	0.089	3.07	2.39	2	1.316868	17.498	1.6752	20.323
18.044	0.89	0.05	0.97	1.0	0.050	36.37	53.68	0.081	1.62	0.93	0.24	0.80	1.07	1.0	0.038	3.13	54.15	0.095	3.25	2.43	2	1.309032	14.9	1.4265	17.305
18.208	0.89	0.05	0.97	1.0	0.050	35.49	50.29	0.078	1.56	0.93	0.22	0.80	1.07	1.0	0.039	4.29	63.44	0.104	3.53	2.54	2	1.301302	12.743	1.22	14.800
18.372	0.89	0.05	0.97	1.0	0.050	34.63	47.68	0.075	1.51	0.93	0.21	0.80	1.07	1.0	0.039	4.81	62.72	0.103	3.48	2.49	2	1.294458	11.237	1.0759	13.051
18.537	0.89	0.05	0.97	1.0	0.050	37.21	56.91	0.085	1.70	0.93	0.26	0.80	1.07	1.0	0.039	2.92	57.59	0.098	3.28	2.49	2	1.286921	16.964	1.6241	19.703
18.701	0.89	0.06	0.97	1.0	0.049	38.91	63.46	0.092	1.85	0.93	0.29	0.80	1.07	1.0	0.039	2.55	62.56	0.103	3.42	2.64	2	1.270069	21.139	2.0239	24.552
18.865	0.89	0.06	0.96	1.0	0.049	39.81	66.93	0.096	1.94	0.93	0.30	0.80	1.06	1.0	0.039	2.76	74.88	0.119	3.94	2.94	2	1.257014	23.351	2.2356	27.121
19.029	0.88	0.05	0.97	1.0	0.049	36.27	54.04	0.081	1.65	0.93	0.24	0.80	1.06	1.0	0.039	4.91	87.26	0.142	4.66	3.15	2	1.265644	15.294	1.4643	17.763
19.193	0.88	0.05	0.97	1.0	0.049	35.44	50.81	0.078	1.58	0.93	0.23	0.80	1.06	1.0	0.039	4.83	74.31	0.118	3.86	2.72	2	1.259219	13.236	1.2672	15.372
19.357	0.88	0.05	0.97	1.0	0.049	37.89	59.53	0.087	1.78	0.93	0.27	0.80	1.06	1.0	0.039	3.31	71.69	0.114	3.71	2.74	2	1.250547	18.632	1.7838	21.640
19.521	0.88	0.05	0.97	1.0	0.049	37.37	57.52	0.085	1.73	0.93	0.26	0.80	1.06	1.0	0.039	3.32	66.95	0.108	3.48	2.61	2	1.245152	17.348	1.6609	20.149
19.685	0.88	0.05	0.97	1.0	0.049	36.98	56.03	0.084	1.70	0.93	0.25	0.80	1.06	1.0	0.039	3.65	69.51	0.111	3.56	2.63	2	1.238251	16.398	1.57	19.046
19.849	0.88	0.05	0.97	1.0	0.049	37.05	56.29	0.084	1.71	0.93	0.25	0.80	1.05	1.0	0.039	3.47	66.72	0.108	3.42	2.57	2	1.231438	16.565	1.586	19.240
20.013	0.88	0.05	0.97	1.0	0.049	36.45	54.00	0.081	1.66	0.93	0.24	0.80	1.05	1.0	0.039	4.08	71.55	0.114	3.60	2.63	2	1.224709	15.104	1.4461	17.543
20.177	0.87	0.05	0.97	1.0	0.049	35.59	51.38	0.079	1.61	0.93	0.23	0.80	1.05	1.0	0.039	5.03	79.45	0.127	3.98	2.80	2	1.218746	13.595	1.3016	15.789
20.341	0.87	0.05	0.97	1.0	0.049	34.10	45.64	0.073	1.50	0.93	0.20	0.80	1.05	1.0	0.039	7.03	81.06	0.130	4.05	2.78	2	1.212849	9.9289	0.9506	11.532
20.505	0.87	0.05	0.97	1.0	0.049	34.69	47.92	0.076	1.55	0.93	0.21	0.80	1.05	1.0	0.039	5.35	70.73	0.113	3.52	2.53	2	1.207016	11.387	1.0902	13.225
20.669	0.87	0.05	0.97	1.0	0.049	34.60	47.55	0.075	1.54	0.92	0.21	0.80	1.05	1.0	0.039	5.58	72.33	0.115	3.57	2.56	2	1.201248	11.153	1.0678	12.953
20.833	0.87	0.05	0.97	1.0	0.049	34.09	45.59	0.073	1.51	0.92	0.20	0.80	1.05	1.0	0.039	6.64	76.37	0.121	3.75	2.63	2	1.195541	9.8993	0.9478	11.497
20.997	0.87	0.05	0.96	1.0	0.048	36.13	52.75	0.080	1.66	0.92	0.24	0.80	1.05	1.0	0.039	3.93	65.36	0.106	3.25	2.45	2	1.18925	14.307	1.3697	16.616
21.161	0.87	0.06	0.96	1.0	0.048	39.40	65.35	0.094	1.95	0.92	0.29	0.80	1.04	1.0	0.039	2.42	62.89	0.103	3.15	2.55	2	1.174935	22.34	2.1389	25.947
21.325	0.87	0.05	0.96	1.0	0.048	38.66	62.51	0.091	1.89	0.92	0.28	0.80	1.04	1.0	0.039	3.25	77.41	0.123	3.74	2.81	2	1.172249	20.53	1.9655	23.844
21.489	0.86	0.05	0.96	1.0	0.048	38.51	61.93	0.090	1.88	0.92	0.28	0.80	1.04	1.0	0.039	3.80	88.94	0.145	4.40	3.14	2	1.166991	20.163	1.9304	23.418
21.653	0.86	0.05	0.96	1.0	0.048	37.46	58.64	0.086	1.80	0.92	0.27	0.80	1.04	1.0	0.039	4.68	99.17	0.171	5.14	3.47	2	1.16515	18.236	1.7459	21.180
21.817	0.86	0.05	0.96	1.0	0.048	37.76	59.01	0.087	1.81	0.92	0.27	0.80	1.04	1.0	0.039	4.01	85.19	0.137	4.12	2.96	2	1.159106	18.302	1.7523	21.257
21.981	0.86	0.05	0.96	1.0	0.048	37.43	57.76	0.085	1.79	0.91	0.26	0.80	1.04	1.0	0.039	4.06	82.51	0.132	3.94	2.86	2	1.15363	17.505	1.676	20.332
22.145	0.86	0.05	0.96	1.0	0.048	35.66	51.68	0.079	1.65	0.91	0.23	0.80	1.04	1.0	0.039	4.75	76.11	0.121	3.59	2.62	2	1.148424	13.787	1.3199	16.012
22.309	0.86	0.05	0.97	1.0	0.048	34.07	45.51	0.073	1.53	0.91	0.20	0.80	1.03	1.0	0.039	5.55	63.50	0.104	3.07	2.30	2	1.143272	9.8516	0.9432	11.442
22.473	0.86	0.05	0.96	1.0	0.048	34.71	47.28	0.075	1.57	0.91	0.20	0.80	1.03	1.0	0.039	4.33	54.47	0.095	2.79	2.18	2	1.137588	10.824	1.0363	12.572
22.638	0.85	0.05	0.96	1.0	0.048	35.08	48.70	0.076	1.60	0.91	0.21	0.80	1.03	1.0	0.039	3.88	52.88	0.094	2.74	2.17	2	1.131968	11.725	1.1225	13.618
22.802	0.85	0.05	0.96	1.0	0.048	34.83	47.76	0.075	1.58	0.91	0.21	0.80	1.03	1.0	0.039	4.18	54.08	0.095	2.75	2.17	2	1.126411	11.128	1.0654	12.925
22.966	0.85	0.05	0.96	1.0	0.048	34.95	48.19	0.076	1.59	0.91	0.21	0.80	1.03	1.0	0.039	4.18	55.34	0.096	2.76	2.18	2	1.120916	11.403	1.0917	13.243
23.130	0.85	0.05	0.96	1.0	0.048	35.14	48.94	0.076	1.60	0.90	0.21	0.80	1.03	1.0	0.039	4.56	63.00	0.103	2.96	2.28	2	1.115481	11.884	1.1378	13.802
23.294	0.85	0.05	0.96	1.0	0.048	36.07	52.53	0.080	1.68	0.90	0.23	0.80	1.03	1.0	0.039	3.91	64.31	0.105	2.98	2.33	2	1.110106	14.17	1.3566	16.457
23.458	0.85	0.05	0.96	1.0	0.048	36.91	55.75	0.083	1.75	0.90	0.25	0.80	1.03	1.0	0.039	3.27	61.70	0.102	2.87	2.31	2	1.10479	16.225	1.5533	18.844
23.622	0.85	0.05	0.96	1.0	0.048	36.17	52.91	0.080	1.68	0.90	0.24	0.80	1.02	1.0	0.039	3.75	62.77	0.103	2.89	2.28	2	1.099532	14.41	1.3796	16.737
23.786	0.84	0.05	0.96	1.0	0.048	36.49	54.12	0.082	1.71	0.90	0.24	0.80	1.02	1.0	0.039	3.27	57.67	0.098	2.72	2.21	2	1.09433	15.183	1.4537	17.635
23.950	0.84	0.05	0.96	1.0	0.048	35.82	51.56	0.079	1.65	0.90	0.23	0.80	1.02	1.0	0.040	4.14	65.19	0.106	2.92	2.20	2	1.089184	13.551	1.2973	15.738

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W4-C

Data File: 13-52106_SP2W4-C-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Legend:
- Tailings Sands
- Tailings Sand-Slimes
- Tailings Slimes
- Interim Cover
- Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Parameter
5611.20	Water surface elevation during CPT investigation (ft a
5607.96	Water surface elevation at t_0 (ft amsl)
5593.50	Water surface elevation at t_1 (ft amsl)
5588.50	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earth
7.51	Equiv. Number of Uniform Strain Cycles, N

Value	Parameter
5616.24	Ground Surface Elevation at time of CPT (ft amsl)
5626.19	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pla
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
1.95	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1104.55	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5588.50	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	5626.19	5625.94	5625.69	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	5625.69	5623.94	5622.19	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	5622.19	5620.19	5618.19	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334
Platform/Random Fill Layer	5618.19	5617.22	5616.24	1.95	0.050	101	0.552	0.503	0.00	0.00	0.552	0.503

2013 CPT Data from ConeTec / CPT Data Interpretations

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %
24.114	5592.13	12.8	0.188	11.8	149.2	64.65	1.47%	Sand-Slime Tailing	0.059	119.0	1.37	0.60	0.78	1	1.08	12.814	178.11	16.06	15	1.65%	2.7	47%
24.278	5591.96	13.0	0.159	12.1	152.5	66.07	1.22%	Sand-Slime Tailing	0.059	119.0	1.38	0.60	0.78	1	1.08	13.024	181.04	16.32	15	1.37%	2.7	47%
24.442	5591.80	13.9	0.175	13.0	152.5	66.07	1.26%	Sand-Slime Tailing	0.059	119.0	1.39	0.61	0.79	1	1.07	13.931	193.64	17.37	16	1.40%	2.6	47%
24.606	5591.63	14.2	0.192	13.3	152.9	66.26	1.35%	Sand-Slime Tailing	0.059	119.0	1.40	0.61	0.79	1	1.07	14.198	197.35	17.68	16	1.50%	2.7	47%
24.770	5591.47	13.7	0.186	12.8	151.0	65.42	1.36%	Sand-Slime Tailing	0.059	119.0	1.41	0.62	0.80	1	1.06	13.601	189.06	16.96	15	1.51%	2.7	47%
24.934	5591.31	12.8	0.197	12.0	120.3	52.12	1.54%	Sand-Slime Tailing	0.059	119.0	1.42	0.62	0.80	1	1.06	12.734	177.01	15.71	14	1.74%	2.7	47%
25.098	5591.14	11.7	0.209	10.9	127.8	55.38	1.79%	Sand-Slime Tailing	0.059	119.0	1.43	0.63	0.80	1	1.05	11.464	159.35	14.29	13	2.04%	2.8	47%
25.262	5590.98	11.2	0.195	10.6	97.8	42.36	1.74%	Sand-Slime Tailing	0.059	119.0	1.44	0.63	0.81	1	1.05	11.150	154.99	13.69	12	1.99%	2.8	47%
25.426	5590.81	11.4	0.160	10.8	101.4	43.94	1.41%	Sand-Slime Tailing	0.059	119.0	1.45	0.64	0.81	1	1.05	11.236	156.18	13.82	12	1.61%	2.8	47%
25.590	5590.65	11.2	0.149	10.6	105.8	45.83	1.33%	Sand-Slime Tailing	0.059	119.0	1.46	0.64	0.82	1	1.04	10.978	152.60	13.55	12	1.53%	2.8	47%
25.754	5590.49	11.6	0.159	11.1	86.4	37.44	1.37%	Sand-Slime Tailing	0.059	119.0	1.47	0.65	0.82	1	1.04	11.458	159.27	13.96	12	1.57%	2.8	47%
25.918	5590.32	11.7	0.182	11.0	108.2	46.89	1.56%	Sand-Slime Tailing	0.059	119.0	1.48	0.65	0.83	1	1.03	11.356	157.85	14.00	12	1.78%	2.8	47%
26.082	5590.16	11.7	0.204	11.1	102.1	44.24	1.74%	Sand-Slime Tailing	0.059	119.0	1.49	0.66	0.83	1	1.03	11.368	158.02	13.96	12	2.00%	2.8	47%
26.246	5589.99	11.8	0.197	11.1	100.4	43.51	1.67%	Sand-Slime Tailing	0.059	119.0	1.50	0.66	0.84	1	1.02	11.391	158.33	13.97	12	1.92%	2.8	47%
26.410	5589.83	11.4	0.197	10.8	88.6	38.40	1.73%	Sand-Slime Tailing	0.059	119.0	1.51	0.67	0.84	1	1.02	11.016	153.12	13.45	12	2.00%	2.8	47%
26.574	5589.67	10.5	0.197	10.0	88.3	38.26	1.87%	Sand-Slime Tailing	0.059	119.0	1.52	0.67	0.85	1	1.01	10.127	140.77	12.41	11	2.18%	2.9	47%

Conditions at t_1 / Liquefaction Triggering Analyses (Idriss & Boulanger (2008): Cyclic Stress Ratio, Cyclic Resistance Ratio; Youd et al. (2001): Cyclic Stress Ratio; right: Idriss & Boulanger (2008))

Depth at time of CPT (ft)	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No	I&B r_d	I&B C_σ	I&B K_σ	I&B K_a	I&B CSR M=7.5, s'v=1atm	I&B Δqc_{1n}	I&B qc_{1n-cs}	I&B (CRR) M=7.5, s'v=1atm	I&B FoS	Youd r_d	Youd D_r	Youd f	Youd K_σ	Youd K_a	Youd CSR M=7.5, s'v=1atm	Youd Kc	Youd qc_{1n-cs}	Youd (CRR) M=7.5, s'v=1atm	Youd FoS	Avg FoS	Liquefiable? 1=Yes 2=No	CN	qc1 TSF	qc1 MPa	qc1N
24.114	1.92	0.04	1.88	1	0.84	0.05	0.96	1.0	0.048	35.93	51.99	0.079	1.66	0.90	0.23	0.80	1.02	1.0	0.040	4.11	66.05	0.107	2.93	2.29	2	1.084092	13.824	1.3235	16.055
24.278	1.93	0.05	1.89	1	0.84	0.05	0.96	1.0	0.048	36.03	52.34	0.080	1.67	0.90	0.23	0.80	1.02	1.0	0.040	3.76	61.39	0.102	2.76	2.21	2	1.079055	14.051	1.3453	16.320
24.442	1.94	0.05	1.89	1	0.84	0.05	0.96	1.0	0.048	36.39	53.76	0.081	1.69	0.89	0.24	0.80	1.02	1.0	0.040	3.62	62.94	0.103	2.79	2.24	2	1.074071	14.953	1.4316	17.367
24.606	1.95	0.06	1.89	1	0.84	0.05	0.96	1.0	0.048	36.50	54.18	0.082	1.70	0.89	0.24	0.80	1.02	1.0	0.040	3.68	65.11	0.106	2.84	2.27	2	1.069139	15.219	1.457	17.676
24.770	1.96	0.06	1.90	1	0.84	0.05	0.96	1.0	0.048	36.25	53.21	0.081	1.68	0.89	0.24	0.80	1.02	1.0	0.040	3.82	64.78	0.105	2.81	2.24	2	1.064258	14.604	1.3982	16.962
24.934	1.97	0.07	1.90	1	0.84	0.05	0.96	1.0	0.048	35.81	51.53	0.079	1.64	0.89	0.23	0.80	1.01	1.0	0.040	4.29	67.41	0.108	2.87	2.26	2	1.059427	13.53	1.2953	15.714
25.098	1.98	0.07	1.91	1	0.83	0.05	0.96	1.0	0.048	35.31	49.61	0.077	1.60	0.89	0.22	0.80	1.01	1.0	0.040	4.93	70.46	0.113	2.96	2.28	2	1.054647	12.305	1.1781	14.292
25.262	1.99	0.08	1.91	1	0.83	0.05	0.96	1.0	0.048	35.10	48.80	0.076	1.58	0.89	0.21	0.80	1.01	1.0	0.040	5.04	69.04	0.111	2.89	2.24	2	1.049915	11.791	1.1288	13.694
25.426	2.00	0.08	1.92	1	0.83	0.05	0.96	1.0	0.048	35.15	48.97	0.077	1.59	0.89	0.21	0.80	1.01	1.0	0.040	4.60	63.56	0.104	2.70	2.14	2	1.045231	11.898	1.1391	13.819
25.590	2.01	0.09	1.92	1	0.83	0.05	0.96	1.0	0.048	35.05	48.60	0.076	1.58	0.88	0.21	0.80	1.01	1.0	0.040	4.58	62.02	0.102	2.63	2.11	2	1.040595	11.665	1.1168	13.549
25.754	2.02	0.09	1.93	1	0.83	0.05	0.96	1.0	0.048	35.20	49.15	0.077	1.59	0.88	0.22	0.80	1.01	1.0	0.040	4.53	63.18	0.103	2.65	2.12	2	1.036005	12.017	1.1505	13.957
25.918	2.03	0.10	1.93	1	0.83	0.05	0.96	1.0	0.048	35.21	49.21	0.077	1.59	0.88	0.22	0.80	1.01	1.0	0.041	4.76	66.63	0.108	2.74	2.16	2	1.031462	12.053	1.154	13.999
26.082	2.04	0.10	1.94	1	0.83	0.05	0.96	1.0	0.048	35.20	49.16	0.077	1.59	0.88	0.22	0.80	1.01	1.0	0.041	5.00	69.81	0.112	2.82	2.20	2	1.026963	12.023	1.1511	13.964
26.246	2.05	0.11	1.94	1	0.82	0.05	0.96	1.0	0.048	35.20	49.18	0.077	1.58	0.88	0.22	0.80	1.01	1.0	0.041	4.92	68.75	0.110	2.77	2.18	2	1.022509	12.032	1.1519	13.974
26.410	2.06	0.11	1.95	1	0.82	0.05	0.96	1.0	0.048	35.02	48.47	0.076	1.57	0.88	0.21	0.80	1.00	1.0	0.041	5.15	69.27	0.111	2.77	2.17	2	1.018098	11.579	1.1086	13.448
26.574	2.07	0.12	1.95	1	0.82	0.05	0.96	1.0	0.048	34.65	47.07	0.075	1.54	0.88	0.20	0.80	1.00	1.0	0.041	5.67	70.40	0.112	2.79	2.16	2	1.013731	10.686	1.0231	12.411

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W5-C

Data File: 13-52106_SP2W5-C-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Legend:
- Tailings Sands
- Tailings Sand-Slimes
- Tailings Slimes
- Interim Cover
- Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)

Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69

Youd, et al (2001)

Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

5604.20	Water surface elevation during CPT investigation (ft
5604.20	Water surface elevation at t_0 (ft amsl)
5589.01	Water surface elevation at t_1 (ft amsl)
5584.01	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Ear
7.51	Equiv. Number of Uniform Strain Cycles, N

5615.86	Ground Surface Elevation at time of CPT (ft amsl)
5626.28	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pla
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
2.42	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1151.89	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5584.01	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	######	5626.03	5625.78	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	######	5624.03	5622.28	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5620.28	5618.28	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334
Platform/Random Fill Layer	######	5617.07	5615.86	2.42	0.050	101	0.576	0.515	0.00	0.00	0.576	0.515

2013 CPT Data from ConeTec									CPT Data Interpretations														Conditions at t_1			
Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
0.164	5615.70	4.8	0.029	4.8	1.1	0.49	0.60%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0	1.70	8.143	113.19	9.47	580	0.61%	1.2	51%	0.58	0.00	0.58	0
0.328	5615.53	11.7	0.170	11.6	8.2	3.56	1.46%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	19.737	274.34	23.02	705	1.46%	1.5	51%	0.59	0.00	0.59	0
0.492	5615.37	34.1	0.408	34.1	8.9	3.84	1.20%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	57.885	804.60	67.34	1375	1.20%	1.3	51%	0.60	0.00	0.60	0
0.656	5615.20	51.6	0.661	51.6	1.4	0.59	1.28%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0	1.70	87.686	1218.84	101.86	1560	1.28%	1.4	51%	0.61	0.00	0.61	0
0.820	5615.04	73.2	1.112	73.1	6.6	2.84	1.52%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0	1.70	124.304	1727.83	144.45	1770	1.52%	1.4	51%	0.62	0.00	0.62	0
0.984	5614.88	89.2	1.392	89.2	-0.9	-0.37	1.56%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0	1.70	151.606	2107.32	176.07	1798	1.56%	1.4	51%	0.63	0.00	0.63	0
1.148	5614.71	116.0	1.613	115.8	37.9	16.43	1.39%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0	1.70	196.792	2735.41	229.03	2005	1.39%	1.4	51%	0.63	0.00	0.63	0
1.312	5614.55	135.8	1.481	135.7	12.6	5.44	1.09%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	230.724	3207.06	268.13	2054	1.09%	1.3	51%	0.64	0.00	0.64	0
1.476	5614.38	141.1	2.556	141.0	16.3	7.07	1.81%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	239.717	3332.07	278.62	1897	1.81%	1.5	51%	0.65	0.00	0.65	0
1.640	5614.22	158.3	2.323	158.2	7.6	3.31	1.47%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0	1.70	268.974	3738.74	312.49	1915	1.47%	1.4	51%	0.66	0.00	0.66	0
1.804	5614.06	219.1	2.632	219.1	7.2	3.12	1.20%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0	1.70	372.453	5177.10	432.67	2410	1.20%	1.3	51%	0.67	0.00	0.67	0
1.968	5613.89	216.1	2.814	216.0	10.4	4.50	1.30%	Interim Cover	0.050	100.7	0.10	0.00	0.10	0	1.70	367.251	5104.79	426.67	2179	1.30%	1.3	51%	0.68	0.00	0.68	0
2.133	5613.73	184.6	2.875	184.5	8.4	3.65	1.56%	Interim Cover	0.050	100.7	0.11	0.00	0.11	0	1.70	313.718	4360.68	364.47	1718	1.56%	1.4	51%	0.68	0.00	0.68	0
2.297	5613.56	191.7	3.125	191.7	11.1	4.81	1.63%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	325.524	4524.79	378.21	1657	1.63%	1.5	51%	0.69	0.00	0.69	0
2.461	5613.40	166.4	3.732	166.3	8.8	3.82	2.24%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.67	277.345	3855.09	322.23	1342	2.24%	1.6	51%	0.70	0.00	0.70	0
2.625	5613.24	152.8	3.596	152.7	5.5	2.40	2.35%	Interim Cover	0.050	100.7	0.13	0.00	0.13	0	1.64	250.398	3480.54	290.89	1155	2.36%	1.6	51%	0.71	0.00	0.71	0
2.789	5613.07	141.7	3.046	141.7	2.9	1.26	2.15%	Interim Cover	0.050	100.7	0.14	0.00	0.14	0	1.61	228.613	3177.71	265.55	1008	2.15%	1.6	51%	0.72	0.00	0.72	0
2.953	5612.91	135.3	2.327	135.3	3.0	1.28	1.72%	Interim Cover	0.050	100.7	0.15	0.00	0.15	0	1.60	216.180	3004.91	251.11	909	1.72%	1.5	51%	0.72	0.00	0.72	0
3.117	5612.74	130.1	2.548	130.1	2.3	0.98	1.96%	Interim Cover	0.050	100.7	0.16	0.00	0.16	0	1.60	208.503	2898.19	242.19	828	1.96%	1.6	51%	0.73	0.00	0.73	0
3.281	5612.58	111.7	2.753	111.7	2.9	1.27	2.46%	Sand-Slime Tailing	0.047	93.3	0.16	0.00	0.16	0	1.67	186.121	2587.09	216.20	678	2.47%	1.7	47%	0.74	0.00	0.74	0
3.445	5612.42	108.0	2.637	108.0	2.3	1.00	2.44%	Sand-Slime Tailing	0.047	93.3	0.17	0.00	0.17	0	1.67	180.028	2502.39	209.12	626	2.45%	1.7	47%	0.75	0.00	0.75	0
3.609	5612.25	115.0	1.758	115.0	1.5	0.66	1.53%	Sand Tailings	0.051	102.8	0.18	0.00	0.18	0	1.62	186.160	2587.62	216.23	635	1.53%	1.6	18%	0.76	0.00	0.76	0
3.773	5612.09	130.6	2.562	130.6	2.0	0.88	1.96%	Sand Tailings	0.051	102.8	0.19	0.00	0.19	0	1.54	201.640	2802.79	234.22	690	1.96%	1.6	18%	0.77	0.00	0.77	0
3.937	5611.92	134.1	2.416	134.1	2.0	0.88	1.80%	Sand Tailings	0.051	102.8	0.20	0.00	0.20	0	1.52	203.635	2830.52	236.53	678	1.80%	1.6	18%	0.77	0.00	0.77	0
4.101	5611.76	107.5	2.141	107.5	1.8	0.76	1.99%	Sand Tailings	0.051	102.8	0.21	0.00	0.21	0	1.60	172.196	2393.53	200.02	521	2.00%	1.7	18%	0.78	0.00	0.78	0
4.265	5611.59	96.2	1.939	96.1	5.9	2.54	2.02%	Sand-Slime Tailing	0.047	93.3	0.21	0.00	0.21	0	1.64	157.282	2186.22	182.74	449	2.02%	1.7	47%	0.79	0.00	0.79	0
4.429	5611.43	67.8	1.878	67.8	0.9	0.39	2.77%	Sand-Slime Tailing	0.047	93.3	0.22	0.00	0.22	0	1.70	115.175	1600.93	133.78	305	2.78%	1.9	47%	0.80	0.00	0.80	0
4.593	5611.27	82.0	1.346	81.9	5.5	2.36	1.64%	Sand Tailings	0.051	102.8	0.23	0.00	0.23	0	1.67	136.924	1903.24	159.09	356	1.65%	1.7	18%	0.81	0.00	0.81	0
4.757	5611.10	80.0	1.313	80.0	1.7	0.75	1.64%	Sand Tailings	0.051	102.8	0.24	0.00	0.24	0	1.66	133.066	1849.61	154.57	335	1.65%	1.7	18%	0.81	0.00	0.81	0
4.921	5610.94	93.3	1.401	93.3	3.1	1.33	1.50%	Sand Tailings	0.051	102.8	0.25	0.00	0.25	0	1.59	147.935	2056.29	171.85	377	1.51%	1.7	18%	0.82	0.00	0.82	0
5.085	5610.77	97.4	1.343	97.4	3.2	1.40	1.38%	Sand Tailings	0.051	102.8	0.26	0.00	0.26	0	1.56	151.462	2105.33	175.95	381	1.38%	1.6	18%	0.83	0.00	0.83	0
5.249	5610.61	63.5	1.284	63.5	0.9	0.40	2.02%	Sand-Slime Tailing	0.047	93.3	0.26	0.00	0.26	0	1.70	107.951	1500.52	125.39	241	2.03%	1.9	47%	0.84	0.00	0.84	0
5.413	5610.45	54.2	0.816	54.2	-0.6	-0.24	1.51%	Sand-Slime Tailing	0.047	93.3	0.27	0.00	0.27	0	1.70	92.072	1279.80	106.93	199	1.51%	1.8	47%	0.85	0.00	0.85	0
5.577	5610.28	38.7	0.729	38.7	-0.7	-0.30	1.88%	Sand-Slime Tailing	0.047	93.3	0.28	0.00	0.28	0	1.70	65.841	915.19	76.46	138	1.90%	2.0	47%	0.85	0.00	0.85	0
5.741	5610.12	35.6	0.520	35.6	0.1	0.04	1.46%	Sand-Slime Tailing	0.047	93.3	0.29	0.00	0.29	0	1.70	60.520	841.23	70.29	124	1.47%	2.0	47%	0.86	0.00	0.86	0
5.905	5609.95	32.6	0.386	32.6	-0.6	-0.28	1.18%	Sand-Slime Tailing	0.047	93.3	0.29	0.00	0.29	0	1.70	55.420	770.34	64.36	110	1.19%	1.9	47%	0.87	0.00	0.87	0
6.069	5609.79	31.4	0.323	31.4	-0.6	-0.25	1.03%	Sand-Slime Tailing	0.047	93.3	0.30	0.00	0.30	0	1.70	53.346	741.51	61.95	103	1.04%	1.9	47%	0.88	0.00	0.88	0
6.234	5609.63	27.6	0.437	27.6	-0.4	-0.19	1.59%	Sand-Slime Tailing	0.047	93.3	0.31	0.00	0.31	0	1.70	46.852	651.24	54.41	88	1.60%	2.1	47%	0.88	0.00	0.88	0
6.398	5609.46	19.4	0.406	19.4	-0.6	-0.24	2.09%	Sand-Slime Tailing	0.047	93.3	0.32	0.00	0.32	0	1.70	32.963	458.19	38.28	60	2.13%	2.3	47%	0.89	0.00	0.89	0
6.562	5609.30	22.0	0.353	22.0	0.9	0.39	1.60%	Sand-Slime Tailing	0.047	93.3	0.32	0.00	0.32	0	1.70	37.400	519.86	43.45	67	1.63%	2.2	47%	0.90	0.00	0.90	0
6.726	5609.13	32.3	0.314	32.3	1.2	0.51	0.97%	Sand-Slime Tailing	0.047	93.3	0.33	0.00	0.33	0	1.70	54.961	763.96	63.85	97	0.98%	1.9	47%	0.91	0.00	0.91	0
6.890	5608.97	36.5	0.296	36.5	0.3	0.11	0.81%	Sand Tailings	0.051	102.8	0.34	0.00	0.34	0	1.70	61.932	860.85	71.93	106	0.82%	1.8	18%	0.92	0.00	0.92	0
7.054	5608.81	37.5	0.279	37.5	0.2	0.10	0.74%	Sand Tailings	0.051	102.8	0.35	0.00	0.35	0	1.67	62.634	870.61	72.75	107	0.75%	1.8	18%	0.92	0.00	0.92	0
7.218	5608.64	38.6	0.335	38.6	0.2	0.10	0.87%	Sand Tailings	0.051	102.8	0.36	0.00	0.36	0	1.64	63.426	881.62	73.67	107	0.88%	1.9	18%	0.93	0.00	0.93	0
7.382	5608.48	38.6	0.379	38.6	0.0	0.02	0.98%	Sand-Slime Tailing	0.047	93.3	0.36	0.00	0.36	0	1.63	62.785	872.71	72.92	105	0.99%	1.9	47%	0.94	0.00	0.94	0
7.546	5608.31	38.2	0.414	38.2	-0.4	-0.19	1.08%	Sand-Slime Tailing	0.047	93.3	0.37	0.00	0.37	0	1.61	61.540	855.40	71.47	102	1.10%	1.9	47%	0.95	0.00	0.95	0
7.710	5608.15	37.4	0.416	37.4	-0.5	-0.20	1.11%	Sand-Slime Tailing	0.047	93.3	0.38	0.00	0.38	0	1.60	59.889	832.45	69.55	97	1.12%	2.0	47%	0.96	0.00	0.96	0
7.874	5607.99	36.6	0.415	36.6	-0.5	-0.20	1.13%	Sand-Slime Tailing	0.047	93.3	0.39	0.00	0.39	0	1.59	58.233	809.43	67.63	94	1.15%	2.0	47%	0.96	0.00	0.96	0
8.038	5607.82	34.6	0.402	34.6	-0.5	-0.22	1.16%	Sand-Slime Tailing	0.047	93.3	0.40	0.00	0.40	0	1.59	54.871	762.70	63.72	87	1.18%	2.0	47%	0.97	0.00	0.97	0
8.202	5607.66	33.4	0.283	33.5	-0.5	-0.20	0.85%	Sand-Slime Tailing	0.047	93.3	0.40	0.00	0.40	0	1.58	52.769	733.49	61.28	82	0.86%	1.9	47%	0.98	0.00	0.98	0
8.366	5607.49	34.9	0.300	34.9	-0.5	-0.22	0.86%	Sand-Slime Tailing	0.047	93.3	0.41	0.00	0.41	0	1.55	54.238	753.90	62.99	84	0.87%	1.9	47%	0.99	0.00	0.99	0
8.530	5607.33	35.7	0.323	35.7	1.0	0.45	0.91%	Sand-Slime Tailing	0.047	93.3	0.42	0.00	0.42	0	1.53	54.753	761.06	63.60	84	0.92%	1.9	47%	0.99	0.00	0.99	0
8.694	5607.17	37.7	0.356	37.7	0.3	0.14	0.95%	Sand-Slime Tailing	0.047	93.3	0.43	0.00	0.43	0	1.51	56.872	790.53	66.06	87	0.96%	1.9	47%	1.00	0.00	1.00	0
8.858	5607.00	39.5	0.390	39.5	0.3	0.12	0.99%	Sand-Slime Tailing	0.047	93.3	0.43	0.00	0.43	0	1.49	58.703	815.97	68.18	90	1.00%	1.9	47%	1.01	0.00	1.01	0
9.022	5606.84	40.6	0.422	40.6	0.3	0.12	1.04%	Sand-Slime Tailing	0.047	93.3	0.44	0.00	0.44	0	1.47	59.660	829.28	69.29	91	1.05%	2.0	47%	1.02	0.00	1.02	0
9.186	5606.67	38.9	0.458	38.9	0.2	0.10	1.18%	Sand-Slime Tailing	0.047	93.3	0.45	0.00	0.45	0	1.46	57.008	792.41	66.21	86	1.19%	2.0	47%	1.02	0.00	1.02	0
9.350	5606.51	35.6	0.461	35.6	0.2	0.10	1.30%	Sand-Slime Tailing	0.047	93.3	0.46	0.00	0.46	0	1.47	52.127	724.56	60.54	77	1.31%	2.1	47%	1.03	0.00	1.03	0
9.514	5606.35	32.5	0.457	32.5	-0.1	-0.05	1.41%	Sand-Slime Tailing	0.047	93.3	0.46	0.00	0.46	0	1.47	47.683	662.79	55.38	69	1.43%	2.1	47%	1.04	0.00	1.04	0
9.678	5606.18	26.9	0.454	26.9	-0.5	-0.21	1.69%	Sand-Slime Tailing	0.047	93.3	0.47	0.00	0.47	0	1.48	39.847	553.87	46.27	56	1.72%	2.3	47%	1.05	0.00	1.05	0
9.842	5606.02	18.0	0.256	18.0	-0.5	-0.21	1.42%	Sand-Slime Tailing	0.047	93.3	0.48	0.00	0.48	0	1.52	27.373	380.49	31.79	37	1.46%	2.4	47%	1.06	0.00	1.06	0
10.006	5605.85	15.0	0.216	15.1	-0.5	-0.21	1.44%	Sand-Slime Tailing	0.047	93.3	0.49	0.00	0.49	0	1.53	23.015	319.91	26.73	30	1.48%	2.4	47%	1.06	0.00	1.06	0
10.170	5605.69	15.7	0.118	15.7	0.9	0.39	0.75%	Sand-Slime Tailing	0.047	93.3	0.49	0.00	0.49	0	1.51	23.659	328.86	27.49	31	0.78%	2.3	47%	1.07	0.00	1.07	0
10.335	5605.53	12.4	0.142	12.4	0.4	0.18	1.15%	Sand-Slime Tailing	0.047	93.3	0.50	0.00	0.50	0	1.52	18.795	261.25	21.83	24	1.20%	2.5	47%	1.08	0.00	1.08	0
10.499	5605.36	10.8	0.099	10.7	4.9	2.13	0.92%	Sand-Slime Tailing	0.047	93.3	0.51	0.00	0.51	0	1.51	16.147	224.44	18.81	20	0.97%	2.5	47%	1.09	0.00	1.09	0
10.663	5605.20	14.4	0.173	14.4	9.8	4.23	1.20%	Sand-Slime Tailing	0.047	93.3	0.52	0.00	0.52	0	1.47	21.120	293.57	24.63	27	1.24%	2.4	47%	1.09	0.00	1.09	0
10.827	5605.03	12.7	0.151	12.7	5.4	2.33	1.19%	Sand-Slime Tailing	0.047	93.3	0.53	0.00	0.53	0	1.47	18.646	259.18	21.71	23	1.24%	2.5	47%	1.10	0.00	1.10	0
10.991	5604.87	19.4	0.189	19.4	5.3	2.31	0.97%	Sand-Slime Tailing	0.047	93.3	0.53	0.00	0.53	0	1.41	27.383	380.62	31.86	35	1.00%	2.3	47%	1.11	0.00	1.11	0
11.155	5604.71	14.8	0.188	14.8	2.4	1.02	1.27%	Sand-Slime Tailing	0.047	93.3	0.54	0.00	0.54	0	1.42	21.005	291.97	24.42	26	1.32%	2.4	47%	1.12	0.00	1.12	0
11.319	5604.54	12.2	0.105	12.1	2.4	1.02	0.86%	Sand-Slime Tailing	0.047	93.3	0.55	0.00	0.55	0	1.42	17.280	240.19	20.09	21	0.90%	2.4	47%	1.12	0.00	1.12	0
11.483	5604.38	10.1	0.138	10.1	3.1	1.34	1.37%	Sand-Slime Tailing	0.047	93.3	0.56	0.00	0.56	0	1.41	14.151	196.70	16.47	17	1.45%	2.6	47%	1.13	0.00	1.13	0
11.647	5604.21	14.6	0.228	14.6	2.1	0.91	1.56%	Sand-Slime Tailing	0.047	93.3	0.56	0.00	0.56	0	1.38	20.144	280.00	23.42	25	1.63%	2.5	47%	1.14	0.00	1.14	0
11.811	5604.05	12.5	0.140	12.5	3.1	1.35	1.12%	Sand-Slime Tailing	0.059	119.0	0.57	0.00	0.57	1	1.38	17.237	239.60	20.05	21	1.18%	2.5	47%	1.15	0.00	1.15	0
11.975	5603.89	12.6	0.058	12.6	2.8	1.22	0.46%	Sand-Slime Tailing	0.059	119.0	0.58	0.01	0.57	1	1.37	17.307	240.56	20.13	21	0.48%	2.3	47%	1.16	0.00	1.16	0

	Liquefaction Triggering Analyses: Idriss & Boulanger (2008)									Youd et al. (2001)												Idriss & Boulanger (2008)			
	Cyclic Stress Ratio					Cyclic Resistance Ratio				Cyclic Stress Ratio															
Depth (ft)	r_d	C_σ	K_σ	K_α	CSR M=7.5, s'v=1atm	Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	r_d	D_r	f	K_σ	K_α	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No	CN	qc1 TSF	qc1 MPa	qc1N
0.164	1.00	0.04	1.02	1.0	0.059	33.64	43.12	0.071	1.21	0.98	0.18	0.80	2.53	1.0	0.017	1.00	9.47	0.058	4.26	2.74	2	1.7	8.155	0.7808	9.472
0.328	1.00	0.05	1.02	1.0	0.059	38.40	61.43	0.089	1.52	0.97	0.28	0.80	2.20	1.0	0.019	1.00	23.02	0.069	4.34	2.93	2	1.7	19.824	1.898	23.025
0.492	1.00	0.08	1.03	1.0	0.060	53.95	121.29	0.182	3.06	0.97	0.47	0.76	2.32	1.0	0.019	1.00	67.34	0.108	6.40	4.73	2	1.7	57.979	5.5509	67.339
0.656	1.00	0.11	1.04	1.0	0.060	66.07	167.92	0.388	6.46	0.97	0.58	0.71	2.59	1.0	0.017	1.00	101.86	0.178	11.62	9.04	2	1.7	87.7	8.3964	101.859
0.820	1.00	0.15	1.05	1.0	0.061	81.01	225.47	1.000	16.46	0.97	0.69	0.65	2.87	1.0	0.015	1.00	144.45	0.360	23.84	20.15	2	1.7	124.37	11.908	144.452
0.984	1.00	0.20	1.07	1.0	0.062	92.11	268.18	1.000	16.24	0.97	0.77	0.62	2.98	1.0	0.014	1.00	176.07	1.000	62.26	39.25	2	1.7	151.6	14.514	176.071
1.148	1.00	0.30	1.09	1.0	0.063	110.69	339.72	1.000	15.84	0.97	0.87	0.60	2.95	1.0	0.015	1.00	229.03	1.000	54.71	35.28	2	1.7	197.19	18.879	229.029
1.312	1.00	0.30	1.09	1.0	0.063	124.41	392.54	1.000	15.90	0.97	0.95	0.60	2.79	1.0	0.015	1.00	268.13	1.000	65.11	40.50	2	1.7	230.86	22.102	268.127
1.476	1.00	0.30	1.08	1.0	0.063	128.10	406.71	1.000	15.95	0.97	0.96	0.60	2.66	1.0	0.016	1.00	278.62	1.000	62.14	39.05	2	1.7	239.89	22.967	278.618
1.640	1.00	0.30	1.08	1.0	0.062	139.98	452.47	1.000	16.01	0.97	1.02	0.60	2.55	1.0	0.017	1.00	312.49	1.000	243.22	129.62	2	1.7	269.05	25.759	312.491
1.804	1.00	0.30	1.08	1.0	0.062	182.16	614.83	1.000	16.07	0.97	1.20	0.60	2.46	1.0	0.017	1.00	432.67	1.000	221.20	118.63	2	1.7	372.53	35.666	432.671
1.968	1.00	0.30	1.07	1.0	0.062	180.05	606.72	1.000	16.13	0.97	1.19	0.60	2.37	1.0	0.018	1.00	426.67	1.000	202.84	109.49	2	1.7	367.36	35.171	426.668
2.133	1.00	0.30	1.07	1.0	0.062	158.22	522.69	1.000	16.20	0.97	1.10	0.60	2.30	1.0	0.019	1.00	364.47	1.000	187.31	101.76	2	1.7	313.81	30.044	364.468
2.297	1.00	0.30	1.07	1.0	0.061	163.05	541.26	1.000	16.27	0.97	1.12	0.60	2.23	1.0	0.019	1.00	378.21	1.000	174.00	95.14	2	1.69827	325.64	31.177	378.214
2.461	1.00	0.30	1.06	1.0	0.061	143.40	465.63	1.000	16.34	0.97	1.04	0.60	2.17	1.0	0.020	1.00	322.23	1.000	162.47	89.40	2	1.667638	277.44	26.562	322.226
2.625	1.00	0.30	1.06	1.0	0.061	132.40	423.29	1.000	16.41	0.97	0.98	0.60	2.12	1.0	0.020	1.00	290.50	1.000	152.37	84.39	2	1.639484	250.45	23.979	290.888
2.789	0.99	0.30	1.06	1.0	0.061	123.51	389.07	1.000	16.48	0.97	0.94	0.60	2.07	1.0	0.021	1.00	265.55	1.000	143.47	79.97	2	1.61347	228.64	21.89	265.554
2.953	0.99	0.30	1.05	1.0	0.060	118.44	369.56	1.000	16.55	0.97	0.91	0.60	2.02	1.0	0.021	1.00	251.11	1.000	135.55	76.05	2	1.598376	216.21	20.7	251.115
3.117	0.99	0.30	1.05	1.0	0.060	115.31	357.50	1.000	16.62	0.97	0.90	0.60	1.98	1.0	0.022	1.00	242.19	1.000	128.47	72.54	2	1.603006	208.53	19.964	242.190
3.281	0.99	0.30	1.05	1.0	0.060	106.13	322.33	1.000	16.68	0.97	0.85	0.60	1.94	1.0	0.022	1.06	229.38	1.000	122.54	69.61	2	1.666111	186.15	17.822	216.204
3.445	0.99	0.29	1.04	1.0	0.060	103.64	312.76	1.000	16.76	0.97	0.83	0.60	1.90	1.0	0.022	1.07	223.18	1.000	117.15	66.95	2	1.666926	180.05	17.238	209.119
3.609	0.99	0.30	1.04	1.0	0.059	77.37	293.60	1.000	16.81	0.97	0.85	0.60	1.87	1.0	0.023	1.00	216.23	1.000	111.72	64.27	2	1.618783	186.18	17.824	216.231
3.773	0.99	0.30	1.04	1.0	0.059	81.97	316.18	1.000	16.88	0.97	0.88	0.60	1.83	1.0	0.023	1.00	234.22	1.000	106.79	61.83	2	1.54395	201.66	19.307	234.215
3.937	0.99	0.30	1.03	1.0	0.059	82.56	319.09	1.000	16.95	0.97	0.89	0.60	1.80	1.0	0.024	1.00	236.53	1.000	102.27	59.61	2	1.518641	203.65	19.498	236.532
4.101	0.99	0.26	1.03	1.0	0.059	73.22	273.24	1.000	17.08	0.97	0.82	0.60	1.77	1.0	0.024	1.04	207.11	1.000	98.12	57.60	2	1.601976	172.21	16.488	200.016
4.265	0.99	0.22	1.02	1.0	0.058	94.39	277.14	1.000	17.21	0.97	0.78	0.61	1.72	1.0	0.025	1.06	193.46	1.000	94.64	55.92	2	1.636141	157.34	15.064	182.743
4.429	0.99	0.14	1.01	1.0	0.058	77.22	211.00	1.000	17.36	0.97	0.67	0.67	1.57	1.0	0.027	1.22	163.57	1.000	91.41	54.38	2	1.7	115.18	11.028	133.780
4.593	0.98	0.17	1.01	1.0	0.058	62.76	221.86	1.000	17.36	0.96	0.73	0.64	1.62	1.0	0.026	1.04	165.68	1.000	88.09	52.73	2	1.671027	136.98	13.115	159.095
4.757	0.98	0.17	1.01	1.0	0.057	61.60	216.17	1.000	17.42	0.96	0.72	0.64	1.59	1.0	0.027	1.05	162.43	1.000	85.00	51.21	2	1.663111	133.08	12.741	154.568
4.921	0.98	0.20	1.01	1.0	0.057	66.02	237.88	1.000	17.44	0.96	0.76	0.62	1.61	1.0	0.026	1.01	173.52	1.000	82.13	49.78	2	1.58643	147.96	14.166	171.852
5.085	0.98	0.20	1.01	1.0	0.057	67.07	243.02	1.000	17.49	0.96	0.77	0.62	1.59	1.0	0.027	1.00	175.95	1.000	79.44	48.47	2	1.555375	151.49	14.504	175.951
5.249	0.98	0.13	1.00	1.0	0.057	74.28	199.67	1.000	17.57	0.96	0.65	0.68	1.47	1.0	0.029	1.17	146.26	0.371	28.62	23.10	2	1.698942	107.96	10.336	125.390
5.413	0.98	0.11	1.00	1.0	0.057	67.80	174.73	0.460	8.11	0.96	0.60	0.70	1.41	1.0	0.030	1.13	120.33	0.242	18.15	13.13	2	1.7	92.066	8.8144	106.929
5.577	0.98	0.09	1.00	1.0	0.057	57.12	133.58	0.213	3.75	0.96	0.54	0.75	1.33	1.0	0.032	1.30	99.66	0.172	12.55	8.15	2	1.7	65.834	6.3029	76.462
5.741	0.98	0.08	1.00	1.0	0.057	54.95	125.25	0.191	3.38	0.96	0.48	0.76	1.31	1.0	0.032	1.25	87.61	0.143	10.13	6.75	2	1.7	60.521	5.7943	70.292
5.905	0.98	0.08	1.00	1.0	0.056	52.87	117.23	0.174	3.08	0.96	0.46	0.77	1.28	1.0	0.033	1.22	78.38	0.125	8.64	5.86	2	1.7	55.413	5.3053	64.359
6.069	0.98	0.08	1.00	1.0	0.056	52.03	113.98	0.167	2.97	0.96	0.45	0.77	1.27	1.0	0.033	1.20	74.27	0.118	7.97	5.47	2	1.7	53.34	5.1068	61.951
6.234	0.98	0.07	1.00	1.0	0.056	49.38	103.79	0.149	2.65	0.96	0.43	0.79	1.24	1.0	0.034	1.43	77.86	0.124	8.16	5.40	2	1.7	46.847	4.4852	54.410
6.398	0.97	0.06	1.00	1.0	0.056	43.73	82.00	0.115	2.05	0.96	0.36	0.80	1.22	1.0	0.035	1.92	73.58	0.117	7.52	4.79	2	1.7	32.957	3.1553	38.278
6.562	0.97	0.07	1.00	1.0	0.056	45.54	88.99	0.125	2.24	0.96	0.38	0.80	1.22	1.0	0.035	1.62	70.38	0.112	7.06	4.65	2	1.7	37.41	3.5816	43.449
6.726	0.97	0.08	1.00	1.0	0.056	52.69	116.54	0.172	3.08	0.96	0.46	0.77	1.25	1.0	0.034	1.21	76.95	0.122	7.51	5.29	2	1.7	54.974	5.2632	63.848
6.890	0.97	0.09	0.99	1.0	0.056	40.48	112.41	0.164	2.94	0.96	0.49	0.76	1.26	1.0	0.034	1.13	81.47	0.130	7.80	5.37	2	1.69536	61.934	5.9296	71.933
7.054	0.97	0.09	0.99	1.0	0.056	40.69	113.44	0.166	2.98	0.96	0.49	0.75	1.25	1.0	0.034	1.11	81.07	0.130	7.57	5.28	2	1.668458	62.636	5.9968	72.748
7.218	0.97	0.09	0.99	1.0	0.056	40.92	114.59	0.169	3.03	0.96	0.50	0.75	1.24	1.0	0.034	1.15	84.37	0.136	7.75	5.39	2	1.642315	63.428	6.0726	73.668
7.382	0.97	0.09	0.99	1.0	0.056	55.88	128.80	0.200	3.60	0.96	0.49	0.75	1.24	1.0	0.034	1.18	86.12	0.139	7.79	5.70	2	1.625714	62.785	6.0111	72.922
7.546	0.97	0.08	0.99	1.0	0.055	55.37	126.84	0.195	3.52	0.96	0.49	0.76	1.23	1.0	0.034	1.22	87.14	0.142	7.75	5.63	2	1.612257	61.536	5.8914	71.470
7.710	0.97	0.08	0.99	1.0	0.055	54.69	124.25	0.189	3.41	0.96	0.48	0.76	1.22	1.0	0.035	1.24	86.34	0.140	7.51	5.46	2	1.600873	59.884	5.7333	69.552
7.874	0.96	0.08	0.99	1.0	0.055	54.02	121.65	0.183	3.31	0.96	0.47	0.76	1.21	1.0	0.035	1.26	85.43	0.138	7.26	5.29	2	1.58975	58.228	5.5747	67.628
8.038	0.96	0.08	0.99	1.0	0.055	52.65	116.37	0.172	3.12	0.96	0.46	0.77	1.20	1.0	0.035	1.30	83.14	0.133	6.89	5.01	2	1.58632	54.866	5.2528	63.723
8.202	0.96	0.08	0.99	1.0	0.055	51.79	113.08	0.166	3.01	0.96	0.45	0.77	1.19	1.0	0.036	1.23	75.08	0.119	6.05	4.53	2	1.577541	52.764	5.0516	61.282
8.366	0.96	0.08	0.99	1.0	0.055	52.39	115.38	0.170	3.09	0.96	0.46	0.77	1.19	1.0	0.036	1.22	76.88	0.122	6.08	4.59	2	1.553638	54.233	5.1922	62.988
8.530	0.96	0.08	0.99	1.0	0.055	52.61	116.21	0.172	3.13	0.96	0.46	0.77	1.18	1.0	0.036	1.23	78.46	0.125	6.11	4.62	2	1.534547	54.763	5.243	63.603
8.694	0.96	0.08	0.99	1.0	0.055	53.47	119.53	0.179	3.26	0.96	0.47	0.77	1.18	1.0	0.036	1.23	81.42	0.130	6.25	4.75	2	1.510156	56.876	5.4453	66.057
8.858	0.96	0.08	0.99	1.0	0.055	54.21	122.40	0.185	3.38	0.96	0.48	0.76	1.18	1.0	0.036	1.23	84.20	0.136	6.39	4.89	2	1.488026	58.705	5.6204	68.183
9.022	0.96	0.08	0.99	1.0	0.055	54.60	123.90	0.188	3.45	0.95	0.48	0.76	1.17	1.0	0.036	1.25	86.34	0.140	6.49	4.97	2	1.469827	59.663	5.7121	69.295
9.186	0.96	0.08	0.99	1.0	0.055	53.52	119.74	0.179	3.28	0.95	0.47	0.77	1.17	1.0	0.036	1.31	86.94	0.141	6.44	4.86	2	1.464002	57.01	5.4582	66.214
9.350	0.96	0.08	0.99	1.0	0.054	51.54	112.08	0.164	3.01	0.95	0.45	0.78	1.15	1.0	0.036	1.41	85.30	0.138	6.18	4.59	2	1.46588	52.129	4.9908	60.544
9.514	0.95	0.07	0.99	1.0	0.054	49.72	105.10	0.151	2.78	0.95	0.43	0.79	1.14	1.0	0.037	1.52	84.00	0.135	5.96	4.37	2	1.46671	47.682	4.565	55.379
9.678	0.95	0.07	0.99	1.0	0.054	46.53	92.81	0.131	2.41	0.95	0.39	0.80	1.13	1.0	0.037	1.81	83.75	0.135	5.85	4.13	2	1.4813	39.843	3.8145	46.275
9.842	0.95	0.06	0.99	1.0	0.054	41.45	73.24	0.104	1.91	0.95	0.33	0.80	1.12	1.0	0.037	2.15	68.25	0.110	4.69	3.30	2	1.52243	27.369	2.6203	31.787
10.006	0.95	0.06	0.99	1.0	0.054	39.67	66.40	0.095	1.75	0.95	0.30	0.80	1.12	1.0	0.037	2.45	65.38	0.106	4.46	3.11	2	1.52925	23.011	2.203	26.725
10.170	0.95	0.06	0.99	1.0	0.054	39.94	67.43	0.096	1.78	0.95	0.30	0.80	1.12	1.0	0.038	1.86	51.18	0.092	3.84	2.81	2	1.507886	23.667	2.2659	27.488
10.335	0.95	0.05	0.99	1.0	0.054	37.96	59.79	0.088	1.62	0.95	0.27	0.80	1.11	1.0	0.038	2.60	56.78	0.097	3.96	2.79	2	1.519415	18.799	1.7998	21.834
10.499	0.95	0.05	0.99	1.0	0.054	36.90	55.70	0.083	1.54	0.95	0.25	0.80	1.11	1.0	0.038	2.67	50.18	0.092	3.69	2.62	2	1.506223	16.193	1.5503	18.807
10.663	0.95	0.06	0.99	1.0	0.054	38.94	63.57	0.092	1.70	0.95	0.29	0.80	1.11	1.0	0.038	2.43	59.84	0.100	3.97	2.83	2	1.470756	21.21	2.0306	24.634
10.827	0.95	0.05	0.99	1.0	0.054	37.92	59.63	0.087	1.62	0.95	0.27	0.80	1.10	1.0	0.038	2.67	57.90	0.098	3.84	2.73	2	1.468221	18.696	1.7899	21.714
10.991	0.94	0.06	0.98	1.0	0.054	41.47	73.33	0.104	1.93	0.95	0.33	0.80	1.10	1.0	0.038	1.87	59.57	0.100	3.84	2.89	2	1.410766	27.43	2.6261	31.858
11.155	0.94	0.06	0.99	1.0	0.054	38.87	63.29	0.092	1.70	0.95	0.29	0.80	1.10	1.0	0.038	2.53	61.68	0.102	3.87	2.79	2	1.424057	21.026	2.013	24.420
11.319	0.94	0.05	0.99	1.0	0.054	37.35	57.44	0.085	1.58	0.95	0.26	0.80	1.09	1.0	0.038	2.51	50.41	0.092	3.45	2.52	2	1.423399	17.301	1.6564	20.094
11.483	0.94	0.05	0.99	1.0	0.054	36.08	52.54	0.080	1.49	0.95	0.23	0.80	1.09	1.0	0.038	3.51	57.77	0.098	3.63	2.56	2	1.408057	14.178	1.3574	16.467
11.647	0.94	0.05	0.98	1.0	0.053	38.51	61.93	0.090	1.68	0.95	0.28	0.80	1.09	1.0	0.038	2.87	67.29	0.108	3.96	2.82	2	1.383531	20.162	1.9303	23.417
11.811	0.94	0.05	0.98	1.0	0.053	37.33	57.39	0.085	1.59	0.95	0.26	0.80	1.09	1.0	0.038	2.80	56.18	0.096	3.50	2.54	2	1.383402	17.264	1.6529	20.051
11.975	0.94	0.05	0.98	1.0	0.053	37.36	57.49	0.085	1.60	0.95	0.26	0.80	1.08	1.0	0.039	2.05	41.26	0.084	3.03	2.31	2	1.374638	17.331	1.6593	20.129

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W5-C

Data File:	13-52106_SP2W5-C-BSC-CPT
Location:	White Mesa 2013 CPT Investigation
..\..\..\6.2.3 Field Data\2013 Field Investigation\Conetec Da	
Tailings Sands	
Tailings Sand-Slimes	
Tailings Slimes	
Interim Cover	
Cells Requiring User Input/Manipulation	

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

5604.20	Water surface elevation during CPT investigation (ft
5604.20	Water surface elevation at t_0 (ft amsl)
5589.01	Water surface elevation at t_1 (ft amsl)
5584.01	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Ear
7.51	Equiv. Number of Uniform Strain Cycles, N

5615.86	Ground Surface Elevation at time of CPT (ft amsl)
5626.28	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pla
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
2.42	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1151.89	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5584.01	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	######	5626.03	5625.78	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	######	5624.03	5622.28	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5620.28	5618.28	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334
Platform/Random Fill Layer	######	5617.07	5615.86	2.42	0.050	101	0.576	0.515	0.00	0.00	0.576	0.515

2013 CPT Data from ConeTec															CPT Data Interpretations								Conditions at t_1				Liquefaction Triggering Analyses: Idriss & Boulanger (2008) — Cyclic Stress Ratio					Cyclic Resistance Ratio				Youd et al. (2001) — Cyclic Stress Ratio												Idriss & Boulanger (2008)			
Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No	r_d	C_σ	K_σ	K_α	CSR M=7.5, s'v=1atm	Δqc_{1n}	$qc_{1n\text{-}cs}$	(CRR) M=7.5, s'v=1atm	FoS	r_d	D_r	f	K_σ	K_α	CSR M=7.5, s'v=1atm	Kc	$qc_{1n\text{-}cs}$	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No	CN	qc1 TSF	qc1 MPa	qc1N
12.139	5603.72	13.5	0.096	13.4	5.0	2.18	0.71%	Sand-Slime Tailing	0.059	119.0	0.59	0.01	0.58	1	1.36	18.315	254.58	21.32	22	0.75%	2.4	47%	1.17	0.00	1.17	0	0.94	0.05	0.98	1.0	0.053	37.78	59.10	0.087	1.63	0.95	0.27	0.80	1.08	1.0	0.039	2.26	48.23	0.090	3.22	2.42	2	1.364781	18.358	1.7576	21.322
12.303	5603.56	11.6	0.118	11.5	11.0	4.78	1.02%	Sand-Slime Tailing	0.059	119.0	0.60	0.02	0.58	1	1.36	15.638	217.37	18.27	19	1.07%	2.5	47%	1.18	0.00	1.18	0	0.94	0.05	0.98	1.0	0.053	36.71	54.98	0.082	1.55	0.95	0.25	0.80	1.08	1.0	0.039	2.90	53.04	0.094	3.32	2.44	2	1.357485	15.732	1.5061	18.271
12.467	5603.39	11.3	0.166	11.2	12.8	5.56	1.47%	Sand-Slime Tailing	0.059	119.0	0.61	0.03	0.59	1	1.35	15.110	210.03	17.67	18	1.56%	2.6	47%	1.19	0.00	1.19	0	0.93	0.05	0.98	1.0	0.053	36.50	54.18	0.082	1.54	0.95	0.24	0.80	1.08	1.0	0.039	3.47	61.35	0.101	3.57	2.55	2	1.34909	15.218	1.457	17.675
12.631	5603.23	11.0	0.151	10.9	12.5	5.42	1.38%	Sand-Slime Tailing	0.059	119.0	0.62	0.03	0.59	1	1.34	14.588	202.77	17.06	17	1.46%	2.6	47%	1.20	0.00	1.20	0	0.93	0.05	0.98	1.0	0.053	36.29	53.35	0.081	1.52	0.95	0.24	0.80	1.08	1.0	0.039	3.47	59.22	0.099	3.46	2.49	2	1.340812	14.693	1.4067	17.065
12.795	5603.06	18.2	0.083	18.2	2.6	1.13	0.46%	Sand-Slime Tailing	0.059	119.0	0.63	0.04	0.60	1	1.31	23.841	331.39	27.71	29	0.47%	2.2	47%	1.21	0.00	1.21	0	0.93	0.06	0.98	1.0	0.053	40.02	67.74	0.097	1.83	0.95	0.30	0.80	1.08	1.0	0.039	1.65	45.66	0.088	3.05	2.44	2	1.312115	23.862	2.2846	27.715
12.959	5602.90	20.3	0.069	20.3	0.7	0.29	0.34%	Sand-Slime Tailing	0.059	119.0	0.64	0.04	0.60	1	1.30	26.297	365.53	30.55	33	0.35%	2.1	47%	1.22	0.00	1.22	0	0.93	0.06	0.98	1.0	0.053	41.02	71.56	0.102	1.93	0.95	0.32	0.80	1.07	1.0	0.039	1.46	44.47	0.087	2.99	2.46	2	1.297327	26.302	2.5182	30.548
13.123	5602.74	21.3	0.128	21.3	-0.0	-0.01	0.60%	Sand-Slime Tailing	0.059	119.0	0.65	0.05	0.61	1	1.29	27.402	380.89	31.83	34	0.62%	2.2	47%	1.23	0.00	1.23	0	0.93	0.06	0.98	1.0	0.053	41.46	73.29	0.104	1.97	0.95	0.33	0.80	1.07	1.0	0.039	1.63	51.99	0.093	3.18	2.57	2	1.287096	27.402	2.6235	31.826
13.287	5602.57	22.1	0.250	22.1	2.2	0.94	1.13%	Sand-Slime Tailing	0.059	119.0	0.66	0.05	0.61	1	1.28	28.264	392.88	32.85	35	1.16%	2.3	47%	1.24	0.00	1.24	0	0.93	0.06	0.98	1.0	0.052	41.82	74.67	0.106	2.01	0.94	0.33	0.80	1.07	1.0	0.039	1.99	65.50	0.106	3.60	2.80	2	1.277779	28.282	2.7077	32.848
13.451	5602.41	17.9	0.288	17.9	3.9	1.69	1.61%	Sand-Slime Tailing	0.059	119.0	0.67	0.06	0.61	1	1.29	22.955	319.07	26.70	28	1.67%	2.5	47%	1.25	0.00	1.25	0	0.93	0.06	0.98	1.0	0.052	39.66	66.36	0.095	1.81	0.94	0.30	0.80	1.07	1.0	0.039	2.69	71.93	0.115	3.85	2.83	2	1.285254	22.986	2.2007	26.697
13.615	5602.24	16.1	0.193	16.1	8.8	3.83	1.20%	Sand-Slime Tailing	0.059	119.0	0.68	0.06	0.62	1	1.28	20.647	287.00	24.06	25	1.25%	2.5	47%	1.26	0.00	1.26	0	0.93	0.06	0.98	1.0	0.052	38.74	62.80	0.091	1.74	0.94	0.28	0.80	1.07	1.0	0.039	2.56	61.51	0.102	3.39	2.57	2	1.284834	20.718	1.9836	24.063
13.779	5602.08	19.4	0.123	19.3	9.7	4.21	0.63%	Sand-Slime Tailing	0.059	119.0	0.69	0.07	0.62	1	1.27	24.473	340.18	28.51	30	0.66%	2.2	47%	1.27	0.00	1.27	0	0.92	0.06	0.98	1.0	0.052	40.30	68.82	0.098	1.88	0.94	0.31	0.80	1.07	1.0	0.039	1.79	51.10	0.092	3.06	2.47	2	1.266741	24.55	2.3504	28.514
13.943	5601.92	25.1	0.130	25.1	8.8	3.83	0.52%	Sand-Slime Tailing	0.059	119.0	0.70	0.07	0.63	1	1.24	31.169	433.25	36.28	39	0.53%	2.1	47%	1.28	0.00	1.28	0	0.92	0.06	0.98	1.0	0.052	43.03	79.31	0.112	2.15	0.94	0.35	0.80	1.06	1.0	0.039	1.47	53.16	0.094	3.09	2.62	2	1.244282	31.238	2.9907	36.281
14.107	5601.75	25.6	0.219	25.6	8.3	3.58	0.85%	Sand-Slime Tailing	0.059	119.0	0.71	0.08	0.63	1	1.24	31.630	439.66	36.81	39	0.88%	2.2	47%	1.29	0.00	1.29	0	0.92	0.06	0.97	1.0	0.052	43.21	80.02	0.113	2.17	0.94	0.35	0.80	1.06	1.0	0.039	1.68	62.01	0.102	3.34	2.75	2	1.237001	31.694	3.0344	36.811
14.271	5601.59	25.3	0.206	25.3	14.8	6.43	0.81%	Sand-Slime Tailing	0.059	119.0	0.72	0.08	0.64	1	1.23	31.101	432.30	36.25	39	0.84%	2.2	47%	1.30	0.00	1.30	0	0.92	0.06	0.97	1.0	0.052	43.02	79.27	0.112	2.15	0.94	0.35	0.80	1.06	1.0	0.039	1.67	60.69	0.101	3.27	2.71	2	1.231716	31.215	2.9885	36.254
14.436	5601.42	28.0	0.355	27.9	15.7	6.79	1.27%	Sand-Slime Tailing	0.059	119.0	0.73	0.09	0.64	1	1.22	33.991	472.48	39.62	42	1.30%	2.3	47%	1.31	0.00	1.31	0	0.92	0.06	0.97	1.0	0.052	44.20	83.81	0.118	2.28	0.94	0.36	0.80	1.06	1.0	0.039	1.87	74.22	0.118	3.81	3.04	2	1.22008	34.111	3.2658	39.618
14.600	5601.26	21.9	0.337	21.8	19.3	8.38	1.54%	Sand-Slime Tailing	0.059	119.0	0.74	0.09	0.65	1	1.23	26.771	372.11	31.26	33	1.59%	2.4	47%	1.32	0.00	1.32	0	0.92	0.06	0.97	1.0	0.052	41.27	72.53	0.103	1.99	0.94	0.32	0.80	1.06	1.0	0.039	2.38	74.56	0.119	3.80	2.89	2	1.228005	26.919	2.5772	31.265
14.764	5601.10	27.4	0.402	27.2	33.6	14.56	1.47%	Sand-Slime Tailing	0.059	119.0	0.75	0.10	0.65	1	1.21	32.863	456.79	38.46	41	1.51%	2.3	47%	1.32	0.00	1.32	0	0.92	0.06	0.97	1.0	0.052	43.79	82.25	0.116	2.25	0.94	0.36	0.80	1.06	1.0	0.039	2.04	78.35	0.125	3.97	3.11	2	1.20996	33.116	3.1706	38.463
14.928	5600.93	49.6	0.629	49.5	20.9	9.05	1.27%	Sand Tailings	0.062	123.5	0.76	0.10	0.66	1	1.17	57.889	804.66	67.41	74	1.29%	2.1	18%	1.33	0.00	1.33	0	0.92	0.08	0.96	1.0	0.051	39.32	106.73	0.154	3.02	0.94	0.47	0.76	1.07	1.0	0.039	1.42	95.65	0.161	5.10	4.06	2	1.170186	58.042	5.5569	67.412
15.092	5600.77	29.2	0.705	29.1	11.9	5.15	2.41%	Sand-Slime Tailing	0.059	119.0	0.77	0.11	0.66	1	1.19	34.821	484.01	40.55	43	2.48%	2.4	47%	1.34	0.00	1.34	0	0.91	0.07	0.97	1.0	0.051	44.52	85.07	0.120	2.33	0.94	0.37	0.80	1.05	1.0	0.039	2.51	101.61	0.178	5.57	3.95	2	1.194955	34.91	3.3422	40.545
15.256	5600.60	26.1	0.521	26.1	10.3	4.48	1.99%	Sand-Slime Tailing	0.059	119.0	0.78	0.11	0.67	1	1.20	31.170	433.26	36.29	38	2.05%	2.4	47%	1.35	0.00	1.35	0	0.91	0.06	0.97	1.0	0.051	43.03	79.32	0.112	2.18	0.94	0.35	0.80	1.05	1.0	0.039	2.45	88.96	0.145	4.54	3.36	2	1.195155	31.247	2.9916	36.291
15.420	5600.44	21.1	0.398	21.0	25.4	11.00	1.88%	Sand-Slime Tailing	0.059	119.0	0.79	0.12	0.67	1	1.20	25.169	349.85	29.45	30	1.96%	2.5	47%	1.36	0.00	1.36	0	0.91	0.06	0.97	1.0	0.051	40.63	70.08	0.100	1.94	0.94	0.31	0.80	1.05	1.0	0.039	2.75	81.14	0.130	4.02	2.98	2	1.19967	25.359	2.4279	29.453
15.584	5600.28	18.2	0.232	17.9	47.5	20.56	1.28%	Sand-Slime Tailing	0.059	119.0	0.80	0.12	0.68	1	1.20	21.442	298.05	25.32	26	1.34%	2.5	47%	1.37	0.00	1.37	0	0.91	0.06	0.97	1.0	0.051	39.18	64.50	0.093	1.81	0.94	0.29	0.80	1.05	1.0	0.039	2.58	65.28	0.106	3.26	2.54	2	1.200568	21.798	2.0869	25.317
15.748	5600.11	17.7	0.358	17.4	55.7	24.12	2.02%	Sand-Slime Tailing	0.059	119.0	0.81	0.13	0.68	1	1.20	20.745	288.36	24.58	25	2.12%	2.6	47%	1.38	0.00	1.38	0	0.91	0.06	0.97	1.0	0.051	38.92	63.50	0.092	1.79	0.94	0.29	0.80	1.05	1.0	0.039	3.25	79.94	0.128	3.90	2.85	2	1.195675	21.16	2.0259	24.577
15.912	5599.95	15.1	0.207	14.6	74.8	32.40	1.37%	Sand-Slime Tailing	0.059	119.0	0.82	0.13	0.68	1	1.20	17.473	242.88	20.94	21	1.45%	2.6	47%	1.39	0.00	1.39	0	0.91	0.05	0.97	1.0	0.051	37.65	58.59	0.086	1.69	0.94	0.26	0.80	1.05	1.0	0.040	3.07	64.37	0.105	3.18	2.44	2	1.195967	18.031	1.7263	20.942
16.076	5599.78	20.3	0.257	19.8	68.4	29.65	1.27%	Sand-Slime Tailing	0.059	119.0	0.83	0.14	0.69	1	1.18	23.370	324.85	27.73	28	1.32%	2.4	47%	1.40	0.00	1.40	0	0.91	0.06	0.97	1.0	0.051	40.03	67.75	0.097	1.90	0.94	0.30	0.80	1.05	1.0	0.040	2.42	67.01	0.108	3.26	2.58	2	1.178531	23.874	2.2857	27.728
16.240	5599.62	21.4	0.347	21.2	43.6	18.89	1.62%	Sand-Slime Tailing	0.059	119.0	0.84	0.14	0.69	1	1.17	24.772	344.33	29.14	30	1.68%	2.5	47%	1.41	0.00	1.41	0	0.91	0.06	0.97	1.0	0.051	40.52	69.66	0.099	1.95	0.94	0.31	0.80	1.04	1.0	0.040	2.60	75.89	0.121	3.62	2.78	2	1.170704	25.091	2.4022	29.141
16.404	5599.46	16.6	0.322	16.3	49.4	21.39	1.94%	Sand-Slime Tailing	0.059	119.0	0.85	0.15	0.70	1	1.17	19.179	266.59	22.70	23	2.04%	2.6	47%	1.42	0.00	1.42	0	0.90	0.05	0.97	1.0	0.051	38.26	60.96	0.089	1.75	0.94	0.28	0.80	1.04	1.0	0.040	3.39	77.02	0.122	3.65	2.70	2	1.174472	19.541	1.8709	22.696
16.568	5599.29	13.3	0.286	12.8	72.0	31.18	2.16%	Sand-Slime Tailing	0.059	119.0	0.86	0.15	0.70	1	1.17	15.003	208.55	18.04	18	2.31%	2.7	47%	1.43	0.00	1.43	0	0.90	0.05	0.97	1.0	0.051	36.63	54.66	0.082	1.62	0.94	0.25	0.80	1.04	1.0	0.040	4.22	76.04	0.121	3.58	2.60	2	1.171225	15.529	1.4868	18.037
16.732	5599.13	10.2	0.232	9.8	68.1	29.53	2.28%	Slime Tailings	0.057	113.1	0.87	0.16	0.71	1	1.17	11.379	158.16	13.79	13	2.49%	2.9	71%	1.44	0.00	1.44	0	0.90	0.05	0.98	1.0	0.051	34.89	48.68	0.076	1.50	0.94	0.21	0.80	1.04	1.0	0.040	5.25	72.36	0.115	3.40	2.45	2	1.165837	11.874	1.1369	13.792
16.896	5598.96	9.5	0.302	9.0	80.2	34.74	3.18%	Slime Tailings	0.057	113.1	0.88	0.16	0.71	1	1.16	10.433	145.02	12.79	12	3.51%	3.0	71%	1.45	0.00	1.45	0	0.90	0.05	0.98	1.0	0.051	34.54	47.33	0.075	1.48	0.94	0.21	0.80	1.04	1.0	0.040	6.40	81.87	0.131	3.84	2.66	2	1.160506	11.014	1.0545	12.792
17.060	5598.80	16.7	0.143	16.2	83.4	36.16	0.86%	Sand-Slime Tailing	0.059	119.0	0.88	0.17	0.72	1	1.15	18.672	259.55	22.38	22	0.90%	2.4	47%	1.46	0.00	1.46	0	0.90	0.05	0.97	1.0	0.051	38.15	60.54	0.088	1.75	0.94	0.27	0.80	1.04	1.0	0.040	2.43	54.50	0.095	2.77	2.26	2	1.15262	19.273	1.8452	22.384
17.224	5598.64	29.8	0.265	29.6	24.9	10.78	0.89%	Sand-Slime Tailing	0.059	119.0	0.89	0.17	0.72	1	1.13	33.458	465.06	39.06	40	0.92%	2.2	47%	1.47	0.00	1.47	0	0.90	0.06	0.97	1.0	0.050	44.00	83.06	0.117	2.33	0.94	0.36	0.80	1.04	1.0	0.040	1.69	66.07	0.107	3.09	2.71	2	1.1288	33.633	3.22	39.063
17.388	5598.47	19.1	0.394	19.0	18.5	8.03	2.06%	Sand-Slime Tailing	0.059	119.0	0.90	0.18	0.73	1	1.14	21.615	300.45	25.26	25	2.16%	2.6	47%	1.48	0.00	1.48	0	0.90	0.06	0.97	1.0	0.050	39.16	64.42	0.093	1.85	0.94	0.29	0.80	1.03	1.0	0.040	3.26	82.40	0.132	3.80	2.82	2	1.137647	21.747	2.0821	25.258
17.552	5598.31	15.7	0.311	15.6	23.1	10.01	1.98%	Sand-Slime Tailing	0.059	119.0	0.91	0.18	0.73	1	1.14	17.686	245.84	20.73	20	2.10%	2.7	47%	1.49	0.00	1.49	0	0.90	0.05	0.97	1.0	0.050	37.57	58.30	0.086	1.71	0.93	0.26	0.80	1.03	1.0	0.040	3.70	76.68	0.122	3.49	2.60	2	1.137384	17.85	1.709	20.732
17.716	5598.14	13.9	0.260	13.8	26.1	11.33	1.86%	Sand-Slime Tailing	0.059	119.0	0.92	0.19	0.73	1	1.13	15.596	216.78	18.33	18	2.00%	2.7	47%	1.50	0.00	1.50	0	0.89	0.05	0.97	1.0	0.050	36.73	55.06	0.083	1.64	0.93	0.25	0.80	1.03	1.0	0.040	3.94	72.19	0.115	3.27	2.46	2	1.131767	15.78	1.5108	18.328
17.880	5597.98	18.8	0.179	18.5	52.4	22.70	0.95%	Sand-Slime Tailing	0.059	119.0	0.93	0.19	0.74	1	1.12	20.761	288.58	24.54	24	1.00%	2.4	47%	1.51	0.00	1.51	0	0.89	0.06	0.97	1.0	0.050	38.91	63.45	0.092	1.83	0.93	0.29	0.80	1.03	1.0	0.040	2.38	58.47	0.099	2.79	2.31	2	1.122221	21.128	2.0228	24.539
18.044	5597.82	39.1	0.438	39.0	24.3	10.53	1.12%	Sand-Slime Tailing	0.059	119.0	0.94	0.20	0.74	1	1.10	42.754	594.28	49.85	51	1.15%	2.2	47%	1.52	0.00	1.52	0	0.89	0.07	0.96	1.0	0.049	47.78	97.63	0.139	2.80	0.93	0.41	0.80	1.03	1.0	0.040	1.61	80.28	0.128	3.60	3.20	2	1.09766	42.92	4.1092	49.849
18.208	5597.65	18.6	0.428	18.6	11.8	5.10	2.30%	Sand-Slime Tailing	0.059	119.0	0.95	0.20	0.75	1	1.11	20.630	286.76	24.06	24	2.42%	2.6	47%	1.53	0.00	1.53	0	0.89	0.06	0.97	1.0	0.050	38.74	62.79	0.091	1.83	0.93	0.28	0.80	1.03	1.0	0.040	3.58	86.19	0.140	3.90	2.86	2	1.112129	20.712	1.9829	24.055
18.372	5597.49	12.8	0.269	12.7	14.8	6.43	2.10%	Sand-Slime Tailing	0.059	119.0	0.96	0.21	0.75	1	1.11	14.096	195.93	16.49	16	2.27%	2.8	47%	1.54	0.00	1.54	0	0.89	0.05	0.97	1.0	0.050	36.09	52.58	0.080	1.60	0.93	0.23	0.80	1.03	1.0	0.040	4.51	74.42	0.118	3.29	2.45	2	1.109913	14.199	1.3594	16.491
18.537	5597.32	17.7	0.255	17.5	38.1	16.51	1.44%	Sand-Slime Tailing	0.059	119.0	0.97	0.21	0.76	1	1.10	19.280	267.99	22.70	22	1.52%	2.5	47%	1.55	0.00	1.55	0	0.89	0.05	0.97	1.0	0.050	38.26	60.96	0.089	1.79	0.93	0.28	0.80	1.03	1.0	0.040	3.02	68.48	0.110	3.03	2.41	2	1.10298	19.542	1.871	22.697
18.701	5597.16	15.7	0.298	15.5	35.1	15.21	1.90%	Sand-Slime Tailing	0.059	119.0	0.98	0.22	0.76	1	1.10	17.040	236.85	20.07	19	2.02%	2.7	47%	1.56	0.00	1.56	0	0.89	0.05	0.97	1.0	0.050	37.34	57.41	0.085	1.71	0.93	0.26	0.80	1.02	1.0	0.040	3.74	75.13	0.119	3.28	2.50	2	1.099343	17.281	1.6545	20.071
18.865	5597.00	16.1	0.307	15.8	50.1	21.72	1.90%	Sand-Slime Tailing	0.059	119.0	0.99	0.22	0.77	1	1.09	17.309	240.60	20.50	20	2.03%	2.7	47%	1.57	0.00	1.57	0	0.89	0.05	0.97	1.0	0.050	37.49	57.99	0.086	1.73	0.93	0.26	0.80	1.02	1.0	0.040	3.70	75.79	0.120	3.29	2.51	2	1.094143	17.652	1.69	20.501
19.029	5596.83	26.6	0.234	26.5	23.1	10.00	0.88%	Sand-Slime Tailing	0.059	119.0	1.00	0.23	0.77	1	1.08	28.588	397.38	33.38	33	0.91%	2.3	47%	1.58	0.00	1.58	0	0.88	0.06	0.96	1.0	0.049	42.01	75.39	0.106	2.16	0.93	0.33	0.80	1.02	1.0	0.040	1.88	62.88	0.103	2.80	2.48	2	1.080432	28.744	2.7519	33.384
19.193	5596.67	29.7	0.205	29.7	9.5	4.12	0.69%	Sand-Slime Tailing	0.059	119.0	1.01	0.24	0.78	1	1.07	31.852	442.74	37.07	37	0.71%	2.2	47%	1.59	0.00	1.59	0	0.88	0.06	0.96	1.0	0.049	43.30	80.37	0.113	2.31	0.93	0.35	0.80	1.02	1.0	0.040	1.63	60.40	0.100	2.71	2.51	2	1.073899	31.916	3.0556	37.068
19.357	5596.50	31.2	0.166	31.2	6.0	2.60	0.53%	Sand-Slime Tailing	0.059	119.0	1.02	0.24	0.78	1	1.07	33.332	463.32	38.76	39	0.55%	2.1	47%	1.60	0.00	1.60	0	0.88	0.06	0.96	1.0	0.049	43.90	82.66	0.116	2.38	0.93	0.36	0.80	1.02	1.0	0.040	1.48	57.35	0.098	2.62	2.50	2	1.068688	33.372	3.1951	38.760
19.521	5596.34	30.6	0.174	30.6	5.8	2.51	0.57%	Sand-Slime Tailing	0.059	119.0	1.03	0.25	0.79	1	1.06	32.529	452.15	37.83	38	0.59%	2.1	47%	1.61	0.00	1.61	0	0.88	0.06	0.96	1.0	0.049	43.57	81.39	0.115	2.34	0.93	0.36	0.80	1.02	1.0	0.040	1.53	57.77	0.098	2.62	2.48	2	1.064776	32.567	3.118	37.825
19.685	5596.18	30.2	0.251	30.2	5.6	2.43	0.83%	Sand-Slime Tailing	0.059	119.0	1.04	0.25	0.79	1	1.06	32.002	444.83	37.21	37	0.86%	2.2	47%	1.62	0.00	1.62	0	0.88	0.06	0.96	1.0	0.049	43.35	80.56	0.113	2.32	0.93	0.35	0.80	1.02	1.0	0.040	1.73	64.49	0.105	2.79	2.56	2	1.060724	32.039	3.0674	37.212
19.849	5596.01	25.2	0.236	25.2	6.5	2.83	0.93%	Sand-Slime Tailing	0.059	119.0	1.05	0.26	0.80	1	1.06	26.686	370.94	31.04	30	0.98%	2.3	47%	1.63	0.00	1.63	0	0.88	0.06	0.96	1.0	0.049	41.19	72.23	0.102	2.10	0.93	0.32	0.80	1.02	1.0	0.040	2.03	63.17	0.103	2.74	2.42	2	1.058982	26.73	2.5591	31.045
20.013	5595.85	19.0	0.220	19.0	7.3	3.16	1.16%	Sand-Slime Tailing	0.059	119.0	1.06	0.26	0.80	1	1.06	20.060	278.83	23.35	22	1.23%	2.5	47%	1.64	0.00	1.64	0	0.88	0.05	0.96	1.0	0.049	38.49	61.85	0.090	1.84	0.93	0.28	0.80	1.01	1.0	0.040	2.72	63.54	0.104	2.74	2.29	2	1.05802	20.108	1.9252	23.355
20.177	5595.68	29.6	0.210	29.5	8.7	3.79	0.71%	Sand-Slime Tailing	0.059	119.0	1.07	0.27	0.80	1	1.05	30.959	430.33	36.02	35	0.74%	2.2	47%	1.65	0.00	1.65	0	0.87	0.06	0.96	1.0	0.049	42.94	78.96	0.111	2.29	0.93	0.35	0.80	1.01	1.0	0.040	1.68	60.65	0.101	2.64	2.47	2	1.048399	31.016	2.9695	36.024
20.341	5595.52	30.3	0.241	30.2	8.7	3.77	0.80%	Sand-Slime Tailing	0.059	119.0	1.08	0.27	0.81	1	1.04	31.560	438.68	36.72	36	0.83%	2.2	47%	1.66	0.00	1.66	0	0.87	0.06	0.96	1.0	0.048	43.18	79.90	0.112	2.32	0.92	0.35	0.80	1.01	1.0	0.040	1.73	63.52	0.104	2.71	2.52	2	1.043997	31.617	3.027	36.721
20.505	5595.36	30.4	0.302	30.3	9.5	4.11	0.99%	Sand-Slime Tailing	0.059	119.0	1.09	0.28	0.81	1	1.04	31.508	437.97	36.67	36	1.03%	2.3	47%	1.67	0.00	1.67	0	0.87	0.06	0.96	1.0	0.048	43.16	79.83	0.112	2.33	0.92	0.35	0.80	1.01	1.0	0.040	1.88	68.85	0.110	2.87	2.60	2	1.039881	31.57	3.0225	36.667
20.669	5595.19	31.3	0.368	31.3	10.8	4.68	1.17%	Sand-Slime Tailing	0.059	119.0	1.10	0.28	0.82	1	1.04	32.371	449.96	37.68	37	1.22%	2.3	47%	1.68	0.00	1.68	0	0.87	0.06	0.96	1.0	0.048	43.52	81.19	0.114	2.37	0.92	0.35	0.80	1.01	1.0	0.040	1.97	74.32	0.118	3.06	2.72	2	1.035544	32.441	3.1059	37.678
20.833	5595.03	30.5	0.484	30.4	10.9	4.74	1.59%	Sand-Slime Tailing	0.059	119.0	1.11	0.29	0.82	1	1.03	31.396	436.41	36.55	36	1.65%	2.4	47%	1.69	0.00	1.69	0	0.87	0.06	0.96	1.0	0.048	43.12	79.67	0.112	2.33	0.92	0.35	0.80	1.01	1.0	0.040	2.30	83.89	0.135	3.48	2.90	2	1.031761	31.467	3.0126	36.547
20.997	5594.86	26.1	0.582	26.0	10.9	4.74	2.23%	Sand-Slime Tailing	0.059	119.0	1.12	0.29	0.83	1	1.03	26.780	372.24	31.18	30	2.33%	2.5	47%	1.69	0.00	1.69	0	0.87	0.06	0.96	1.0	0.048	41.24	72.42	0.103	2.13	0.92	0.32	0.80	1.01	1.0	0.040	3.01	93.89	0.157	4.03	3.08	2	1.028813	26.85	2.5706	31.185
21.161	5594.70	20.1	0.593	20.1	11.7	5.06	2.95%	Slime Tailings	0.057	113.1	1.13	0.30	0.83	1	1.03	20.583	286.10	23.99	23	3.12%	2.7	71%	1.70	0.00	1.70	0	0.87	0.06	0.96	1.0	0.048	38.44	62.44	0.091	1.88	0.92	0.28	0.80	1.01	1.0	0.040	4.14	99.39	0.171	4.39	3.13	2	1.02656	20.657	1.9777	23.992
21.325	5594.53	18.4	0.531	18.3	20.6	8.93	2.89%	Slime Tailings	0.057	113.1	1.14	0.30	0.84	1	1.02	18.692	259.82	21.86	21	3.08%	2.7	71%	1.71	0.00	1.71	0	0.87	0.05	0.96	1.0	0.048	37.70	59.56	0.087	1.81	0.92	0.27	0.80	1.01	1.0	0.040	4.37	95.63	0.161	4.12	2.96	2	1.023086	18.823	1.8021	21.862
21.489	5594.37	17.0	0.447	16.8	29.0	12.56	2.63%	Slime Tailings	0.057	113.1	1.15	0.31	0.84	1	1.02	17.124	238.03	20.10	19	2.82%	2.8	71%	1.72	0.00	1.72	0	0.86	0.05	0.96	1.0	0.048	37.09	57.19	0.085	1.76	0.91	0.26	0.80	1.00	1.0	0.040	4.44	89.28	0.146	3.72	2.74	2	1.019302	17.309	1.6571	20.103
21.653	5594.21	14.2	0.424	14.0	29.7	12.89	2.99%	Slime Tailings	0.057	113.1	1.16	0.31	0.84	1	1.02	14.215	197.59	16.73	15	3.25%	2.9	71%	1.73	0.00	1.73	0	0.86	0.05	0.96	1.0	0.048	35.91	52.64	0.080	1.66	0.91	0.24	0.80	1.00	1.0	0.040	5.36	89.70	0.147	3.73	2.70	2	1.015373	14.404	1.379	16.729
21.817	5594.04	16.9	0.422	16.5	68.7	29.77	2.50%	Slime Tailings	0.057	113.1	1.17	0.32	0.85	1	1.01	16.669	231.70	19.86	19	2.68%	2.8	71%	1.74	0.00	1.74	0	0.86	0.05	0.96	1.0	0.048	37.01	56.87	0.084	1.76	0.91	0.26	0.80	1.00	1.0	0.040	4.38	86.93	0.141	3.56	2.66	2	1.011479	17.103	1.6374	19.864
21.981	5593.88	21.8	0.335	21.7	23.7	10.26	1.54%	Sand-Slime Tailing	0.059	119.0	1.18	0.32	0.85	1	1.01	21.800	303.01	25.49	24	1.62%	2.5	47%	1.75	0.00	1.75	0	0.86	0.06	0.96	1.0	0.048	39.24	64.73	0.093	1.95	0.91	0.29	0.80	1.00	1.0	0.040	2.93	74.56	0.119	2.98	2.47	2	1.006907	21.948	2.1013	25.492
22.145	5593.71	21.8	0.428	21.7	22.3	9.65	1.96%	Sand-Slime Tailing	0.059	119.0	1.18	0.33	0.86	1	1.00	21.771	302.62	25.45	24	2.07%	2.6	47%	1.76	0.00	1.76	0	0.86	0.06	0.96	1.0	0.048	39.23	64.67	0.093	1.95	0.91	0.29	0.80	1.00	1.0	0.040	3.28	83.48	0.134	3.36	2.66	2	1.002806	21.91	2.0977	25.448
22.309	5593.55	17.7	0.439	17.6	19.7	8.53	2.48%	Sand-Slime Tailing	0.059	119.0	1.19	0.33	0.86	1	1.00	17.547	243.90	20.52	19	2.66%	2.7	47%	1.77	0.00	1.77	0	0.86	0.05	0.96	1.0	0.048	37.50	58.02	0.086	1.80	0.91	0.26	0.80	1.00	1.0	0.040	4.28	87.80	0.143	3.57	2.68	2	0.998694	17.67	1.6917	20.522
22.473	5593.39	16.8	0.471	16.6	34.2	14.81	2.80%	Slime Tailings	0.057	113.1	1.20	0.34	0.87	1	0.99	16.546	229.99	19.46	18	3.01%	2.8	71%	1.78	0.00	1.78	0	0.86	0.05	0.96	1.0	0.048	36.87	56.33	0.084	1.76	0.91	0.25	0.80	1.00	1.0	0.040	4.70	91.53	0.151	3.76	2.76	2	0.994943	16.758	1.6044	19.464
22.638	5593.22	19.3	0.376	19.1	34.2	14.81	1.95%	Sand-Slime Tailing	0.059	119.0	1.21	0.34	0.87	1	0.99	18.876	262.38	22.17	21	2.08%	2.6	47%	1.79	0.00	1.79	0	0.85	0.05	0.96	1.0	0.047	38.08	60.25	0.088	1.86	0.90	0.27	0.80	1.00	1.0	0.040	3.63	80.39	0.128	3.18	2.52	2	0.990892	19.088	1.8275	22.169
22.802	5593.06	15.1	0.327	14.7	65.1	28.22	2.17%	Sand-Slime Tailing	0.059	119.0	1.22	0.35	0.88	1	0.99	14.455	200.93	17.25	16	2.36%	2.8	47%	1.80	0.00	1.80	0	0.85	0.05	0.96	1.0	0.047	36.35	53.61	0.081	1.71	0.90	0.24	0.80	1.00	1.0	0.040	4.57	78.92	0.126	3.10	2.40	2	0.986693	14.856	1.4223	17.255
22.966	5592.89	12.6	0.218	11.9	111.5	48.31	1.73%	Sand-Slime Tailing	0.059	119.0	1.23	0.35	0.88	1	0.98	11.703	162.67	14.39	13	1.92%	2.8	47%	1.81	0.00	1.81	0	0.85	0.05	0.96	1.0	0.047	35.35	49.73	0.077	1.63	0.90	0.22	0.80	1.00	1.0	0.040	4.76	68.44	0.110	2.70	2.16	2	0.982626	12.387	1.1859	14.387
23.130	5592.73	12.0	0.226	11.4	106.7	46.22	1.88%	Sand-Slime Tailing	0.059	119.0	1.24	0.36	0.89	1	0.98	11.107	154.39	13.66	12	2.10%	2.8	47%	1.82	0.00	1.82	0	0.85	0.05	0.96	1.0	0.047	35.09	48.75	0.076	1.61	0.90	0.21	0.80	0.99	1.0	0.040	5.13	70.08	0.112	2.74	2.18	2	0.978597	11.759	1.1258	13.657
23.294	5592.57	14.5	0.334	13.6	154.3	66.85	2.30%	Sand-Slime Tailing	0.059	119.0	1.25	0.36	0.89	1	0.97	13.235	183.97	16.46	15	2.51%	2.8	47%	1.83	0.00	1.83	0	0.85	0.05	0.96	1.0	0.047	36.08	52.54	0.080	1.69	0.90	0.23	0.80	0.99	1.0	0.040	4.87	80.16	0.128	3.12	2.41	2	0.974605	14.174	1.357	16.462
23.458	5592.40	17.3	0.173	16.5	120.2	52.09	1.00%	Sand-Slime Tailing	0.059	119.0	1.26	0.37	0.89	1	0.97	16.025	222.75	19.46	18	1.08%	2.5	47%	1.84	0.00	1.84	0	0.85	0.05	0.96	1.0	0.047	37.13	56.58	0.084	1.79	0.90	0.25	0.80	0.99	1.0	0.040	3.02	58.77	0.099	2.40	2.10	2	0.97065	16.754	1.604	19.459
23.622	5592.24	26.9	0.267	26.6	51.3	22.22	0.99%	Sand-Slime Tailing	0.059	119.0	1.27	0.37	0.90	1	0.97	25.759	358.04	30.28	29	1.04%	2.4	47%	1.85	0.00	1.85	0	0.85	0.06	0.95	1.0	0.047	40.92	71.20	0.101	2.16	0.90	0.32	0.80	0.99	1.0	0.040	2.17	65.84	0.107	2.58	2.37	2	0.969095	26.069	2.4958	30.277
23.786	5592.07	18.3	0.357	17.9	69.4	30.09	1.95%	Sand-Slime Tailing	0.059	119.0	1.28	0.38	0.90	1	0.96	17.187	238.90	20.45	19	2.10%	2.7	47%	1.86	0.00	1.86	0	0.85	0.05	0.96	1.0	0.047	37.47	57.92	0.086	1.83	0.90	0.26	0.80	0.99	1.0	0.040	3.87	79.22	0.126	3.05	2.44	2	0.96285	17.604	1.6854	20.446
23.950	5591.91	13.8	0.283	13.3	90.4	39.18	2.05%	Sand-Slime Tailing	0.059	119.0	1.29	0.38	0.91	1	0.96	12.716	176.76	15.40	14	2.26%	2.8	47%	1.87	0.00	1.87	0	0.84	0.05	0.96	1.0	0.047	35.70	51.10	0.079	1.67	0.89	0.23	0.80	0.99	1.0	0.040	4.89	75.23	0.120	2.88	2.27	2	0.959003	13.258	1.2693	15.398

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W5-C

Data File: 13-52106_SP2W5-C-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Legend
Tailings Sands
Tailings Sand-Slimes
Tailings Slimes
Interim Cover
Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Parameter
5604.20	Water surface elevation during CPT investigation (ft
5604.20	Water surface elevation at t_0 (ft amsl)
5589.01	Water surface elevation at t_1 (ft amsl)
5584.01	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Ear
7.51	Equiv. Number of Uniform Strain Cycles, N

Value	Parameter
5615.86	Ground Surface Elevation at time of CPT (ft amsl)
5626.28	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pla
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
2.42	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1151.89	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5584.01	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	######	5626.03	5625.78	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	######	5624.03	5622.28	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5620.28	5618.28	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334
Platform/Random Fill Layer	######	5617.07	5615.86	2.42	0.050	101	0.576	0.515	0.00	0.00	0.576	0.515

2013 CPT Data from ConeTec / CPT Data Interpretations

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No
24.114	5591.75	10.3	0.189	10.0	60.4	26.18	1.83%	Sand-Slime Tailing	0.059	119.0	1.30	0.39	0.91	1
24.278	5591.58	10.0	0.219	9.3	112.2	48.61	2.19%	Slime Tailings	0.057	113.1	1.31	0.39	0.92	1
24.442	5591.42	14.0	0.326	13.2	122.0	52.86	2.33%	Slime Tailings	0.057	113.1	1.32	0.40	0.92	1
24.606	5591.25	14.1	0.236	13.7	63.7	27.60	1.67%	Sand-Slime Tailing	0.059	119.0	1.33	0.40	0.93	1
24.770	5591.09	23.3	0.448	22.8	72.8	31.55	1.92%	Sand-Slime Tailing	0.059	119.0	1.34	0.41	0.93	1
24.934	5590.93	29.6	0.313	29.2	58.1	25.19	1.06%	Sand-Slime Tailing	0.059	119.0	1.35	0.41	0.94	1
25.098	5590.76	38.5	0.429	38.5	11.6	5.02	1.11%	Sand-Slime Tailing	0.059	119.0	1.36	0.42	0.94	1
25.262	5590.60	30.5	0.493	30.4	9.2	3.99	1.62%	Sand-Slime Tailing	0.059	119.0	1.37	0.42	0.94	1
25.426	5590.43	25.9	0.457	25.8	10.7	4.64	1.77%	Sand-Slime Tailing	0.059	119.0	1.38	0.43	0.95	1
25.590	5590.27	23.2	0.409	23.0	38.5	16.67	1.76%	Sand-Slime Tailing	0.059	119.0	1.39	0.43	0.95	1
25.754	5590.11	23.9	0.457	23.6	50.5	21.90	1.91%	Sand-Slime Tailing	0.059	119.0	1.40	0.44	0.96	1
25.918	5589.94	23.4	0.409	22.9	85.5	37.03	1.75%	Sand-Slime Tailing	0.059	119.0	1.41	0.44	0.96	1
26.082	5589.78	26.8	0.466	26.4	63.1	27.33	1.74%	Sand-Slime Tailing	0.059	119.0	1.42	0.45	0.97	1
26.246	5589.61	24.8	0.467	24.4	58.0	25.13	1.89%	Sand-Slime Tailing	0.059	119.0	1.43	0.46	0.97	1
26.410	5589.45	27.9	0.443	27.7	46.7	20.25	1.59%	Sand-Slime Tailing	0.059	119.0	1.44	0.46	0.98	1
26.574	5589.29	21.4	0.459	21.2	34.8	15.06	2.15%	Sand-Slime Tailing	0.059	119.0	1.45	0.47	0.98	1
26.739	5589.12	22.9	0.449	22.4	91.9	39.81	1.96%	Sand-Slime Tailing	0.059	119.0	1.46	0.47	0.99	1
26.903	5588.96	23.7	0.369	23.3	57.9	25.11	1.56%	Sand-Slime Tailing	0.059	119.0	1.47	0.48	0.99	1
27.067	5588.79	17.9	0.322	17.4	76.8	33.26	1.80%	Sand-Slime Tailing	0.059	119.0	1.48	0.48	1.00	1
27.231	5588.63	17.2	0.221	16.6	101.5	44.00	1.29%	Sand-Slime Tailing	0.059	119.0	1.49	0.49	1.00	1
27.395	5588.47	17.3	0.221	16.7	96.1	41.66	1.28%	Sand-Slime Tailing	0.059	119.0	1.50	0.49	1.00	1
27.559	5588.30	17.1	0.300	16.3	130.8	56.69	1.75%	Sand-Slime Tailing	0.059	119.0	1.51	0.50	1.01	1
27.723	5588.14	24.2	0.427	23.2	165.1	71.55	1.76%	Sand-Slime Tailing	0.059	119.0	1.52	0.50	1.01	1
27.887	5587.97	31.6	0.511	31.4	40.1	17.37	1.62%	Sand-Slime Tailing	0.059	119.0	1.53	0.51	1.02	1
28.051	5587.81	29.9	0.506	29.4	77.3	33.50	1.69%	Sand-Slime Tailing	0.059	119.0	1.53	0.51	1.02	1
28.215	5587.65	34.1	0.485	33.8	56.5	24.47	1.42%	Sand-Slime Tailing	0.059	119.0	1.54	0.52	1.03	1
28.379	5587.48	23.6	0.376	23.3	54.2	23.50	1.59%	Sand-Slime Tailing	0.059	119.0	1.55	0.52	1.03	1
28.543	5587.32	20.0	0.587	19.3	110.3	47.80	2.94%	Slime Tailings	0.057	113.1	1.56	0.53	1.04	1
28.707	5587.15	20.3	0.625	19.3	175.0	75.82	3.07%	Slime Tailings	0.057	113.1	1.57	0.53	1.04	1
28.871	5586.99	70.9	0.744	70.3	91.2	39.52	1.05%	Sand Tailings	0.062	123.5	1.58	0.54	1.05	1
29.035	5586.82	72.6	0.686	72.2	66.2	28.68	0.94%	Sand Tailings	0.062	123.5	1.59	0.54	1.05	1
29.199	5586.66	79.5	1.181	79.4	15.5	6.72	1.49%	Sand Tailings	0.062	123.5	1.60	0.55	1.06	1
29.363	5586.50	113.4	1.549	113.4	8.3	3.58	1.37%	Sand Tailings	0.062	123.5	1.61	0.55	1.06	1
29.527	5586.33	133.5	2.246	133.4	9.1	3.95	1.68%	Sand Tailings	0.062	123.5	1.62	0.56	1.07	1
29.691	5586.17	134.1	3.012	134.1	-0.7	-0.28	2.25%	Sand-Slime Tailing	0.059	119.0	1.63	0.56	1.07	1
29.855	5586.00	114.2	2.896	114.0	26.4	11.45	2.54%	Sand-Slime Tailing	0.059	119.0	1.64	0.57	1.08	1
30.019	5585.84	179.1	2.896	178.1	160.2	69.40	1.62%	Sand Tailings	0.062	123.5	1.65	0.57	1.08	1
30.183	5585.68	217.4	2.896	217.3	26.4	11.43	1.33%	Sand Tailings	0.062	123.5	1.66	0.58	1.09	1

CPT Data Interpretations (cont.) / Conditions at t_1 / Liquefaction Triggering Analyses – Idriss & Boulanger (2008)

Depth (ft)	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No	r_d	C_σ	K_σ	K_α	CSR M=7.5, s'v=1atm	Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS
24.114	0.96	9.514	132.24	11.47	10	2.09%	2.9	47%	1.88	0.00	1.88	0	0.84	0.05	0.96	1.0	0.047	34.32	45.79	0.074	1.57
24.278	0.95	8.871	123.30	11.08	9	2.51%	3.0	71%	1.89	0.00	1.89	0	0.84	0.05	0.96	1.0	0.047	33.95	45.02	0.073	1.55
24.442	0.95	12.529	174.15	15.39	14	2.58%	2.8	71%	1.90	0.00	1.90	0	0.84	0.05	0.96	1.0	0.047	35.45	50.84	0.078	1.68
24.606	0.94	12.962	180.17	15.49	14	1.85%	2.8	47%	1.91	0.00	1.91	0	0.84	0.05	0.96	1.0	0.047	35.73	51.22	0.079	1.69
24.770	0.94	21.533	299.31	25.51	24	2.04%	2.6	47%	1.92	0.00	1.92	0	0.84	0.06	0.96	1.0	0.046	39.25	64.75	0.093	2.02
24.934	0.94	27.544	382.86	32.39	30	1.11%	2.4	47%	1.93	0.00	1.93	0	0.84	0.06	0.95	1.0	0.046	41.66	74.05	0.105	2.28
25.098	0.94	36.269	504.14	42.20	40	1.15%	2.3	47%	1.94	0.00	1.94	0	0.83	0.07	0.95	1.0	0.046	45.10	87.31	0.123	2.69
25.262	0.94	28.493	396.05	33.16	31	1.69%	2.5	47%	1.94	0.00	1.94	0	0.83	0.06	0.95	1.0	0.046	41.93	75.08	0.106	2.32
25.426	0.93	23.999	333.59	27.95	26	1.87%	2.5	47%	1.95	0.00	1.95	0	0.83	0.06	0.95	1.0	0.046	40.10	68.05	0.097	2.12
25.590	0.93	21.279	295.77	24.97	23	1.87%	2.6	47%	1.96	0.00	1.96	0	0.83	0.06	0.95	1.0	0.046	39.06	64.03	0.092	2.02
25.754	0.92	21.735	302.12	25.58	23	2.03%	2.6	47%	1.97	0.00	1.97	0	0.83	0.06	0.95	1.0	0.046	39.27	64.86	0.093	2.04
25.918	0.92	21.004	291.95	24.96	23	1.86%	2.6	47%	1.98	0.00	1.98	0	0.83	0.06	0.95	1.0	0.046	39.06	64.02	0.092	2.03
26.082	0.92	24.200	336.38	28.53	26	1.84%	2.5	47%	1.99	0.00	1.99	0	0.83	0.06	0.95	1.0	0.045	40.31	68.83	0.098	2.16
26.246	0.91	22.278	309.67	26.26	24	2.00%	2.6	47%	2.00	0.00	2.00	0	0.82	0.06	0.95	1.0	0.045	39.51	65.77	0.094	2.08
26.410	0.91	25.216	350.50	29.60	27	1.67%	2.5	47%	2.01	0.00	2.01	0	0.82	0.06	0.95	1.0	0.045	40.68	70.28	0.100	2.21
26.574	0.90	19.114	265.68	22.43	20	2.30%	2.7	47%	2.02	0.00	2.02	0	0.82	0.05	0.95	1.0	0.045	38.17	60.59	0.089	1.95
26.739	0.90	20.162	280.25	24.02	22	2.09%	2.6	47%	2.03	0.00	2.03	0	0.82	0.06	0.95	1.0	0.045	38.72	62.74	0.091	2.01
26.903	0.90	20.966	291.42	24.73	22	1.66%	2.6	47%	2.04	0.00	2.04	1	0.82	0.06	0.95	1.0	0.045	38.97	63.70	0.092	2.04
27.067	0.89	15.524	215.78	18.53	16	1.96%	2.7	47%	2.05	0.01	2.05	1	0.82	0.05	0.96	1.0	0.045	36.80	55.33	0.083	1.83
27.231	0.89	14.729	204.74	17.76	16	1.41%	2.7	47%	2.06	0.01	2.05	1	0.82	0.05	0.96	1.0	0.045	36.53	54.29	0.082	1.80
27.395	0.89	14.791	205.60	17.80	16	1.40%	2.7	47%	2.07	0.02	2.05	1	0.82	0.05	0.96	1.0	0.045	36.54	54.34	0.082	1.80
27.559	0.88	14.394	200.07	17.55	15	1.92%	2.7	47%	2.08	0.02	2.06	1	0.81	0.05	0.96	1.0	0.045	36.46	54.01	0.081	1.79
27.723	0.88	20.498	284.93	24.87	22	1.88%	2.6	47%	2.09	0.03	2.06	1	0.81	0.06	0.95	1.0	0.045	39.02	63.89	0.092	2.04
27.887	0.89	27.813	386.60	32.56	30	1.70%	2.5	47%	2.10	0.03	2.07	1	0.81	0.06	0.95	1.0	0.045	41.72	74.28	0.105	2.33
28.051	0.88	25.927	360.38	30.61	28	1.79%	2.5	47%	2.11	0.04	2.07	1	0.81	0.06	0.95	1.0	0.045	41.04	71.64	0.102	2.25
28.215	0.88	29.829	414.63	35.01	32	1.49%	2.4	47%	2.12	0.04	2.08	1	0.81	0.06	0.95	1.0	0.045	42.58	77.59	0.109	2.43
28.379	0.87	20.248	281.45	23.86	21	1.71%	2.6	47%	2.13	0.05	2.08	1	0.81	0.05	0.95	1.0	0.045	38.67	62.53	0.091	2.00
28.543	0.86	16.699	232.11	20.09	18	3.18%	2.8	71%	2.14	0.05	2.09	1	0.81	0.05	0.95	1.0	0.046	37.08	57.17	0.085	1.86
28.707	0.86	16.595	230.67	20.37	18	3.33%	2.8	71%	2.15	0.06	2.09	1	0.80	0.05	0.95	1.0	0.046	37.18	57.55	0.085	1.87
28.871	0.90	63.004	875.75	73.77	66	1.07%	2.1	18%	2.16	0.06	2.10	1	0.80	0.09	0.92	1.0	0.044	40.95	114.71	0.169	3.83
29.035	0.89	64.601	897.96	75.46	68	0.97%	2.0	18%	2.17	0.07	2.10	1	0.80	0.09	0.92	1.0	0.044	41.38	116.84	0.173	3.92
29.199	0.90	71.104	988.34	82.68	74	1.52%	2.1	18%	2.18	0.07	2.11	1	0.80	0.09	0.92	1.0	0.044	43.23	125.91	0.193	4.40
29.363	0.91	103.022	1432.01	119.71	105	1.39%	2.0	18%	2.19	0.08	2.11	1	0.80	0.12	0.89	1.0	0.043	52.69	172.40	0.433	10.18
29.527	0.91	122.058	1696.61	141.82	124	1.70%	2.0	18%	2.20	0.08	2.12	1	0.80	0.15	0.87	1.0	0.041	58.35	200.17	1.000	24.11
29.691	0.91	122.449	1702.04	142.21	124	2.27%	2.1	47%	2.21	0.09	2.12	1	0.80	0.15	0.87	1.0	0.041	80.18	222.39	1.000	24.12
29.855	0.90	102.984	1431.48	119.78	105	2.57%	2.2	47%	2.22	0.09	2.13	1	0.79	0.12	0.89	1.0	0.043	72.31	192.09	0.813	19.11
30.019	0.93	164.913	2292.29	192.61	164	1.63%	1.9	18%	2.23	0.10	2.13	1	0.79	0.24	0.78	1.0	0.037	71.33	263.94	1.000	26.69
30.183	0.94	203.425	2827.61	236.45	199	1.34%	1.8	18%	2.24	0.10	2.14	1	0.79	0.30	0.73	1.0	0.035	82.54	318.98	1.000	28.64

Liquefaction Triggering Analyses – Youd et al. (2001) / Idriss & Boulanger (2008)

Depth (ft)	r_d	D_r	f	K_σ	K_α	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No	CN	qc1 TSF	qc1 MPa	qc1N
24.114	0.89	0.20	0.80	0.99	1.0	0.040	5.85	67.03	0.108	2.59	2.08	2	0.95519	9.874	0.9453	11.468
24.278	0.89	0.19	0.80	0.99	1.0	0.040	6.45	71.42	0.114	2.72	2.14	2	0.951801	9.5373	0.9131	11.077
24.442	0.89	0.23	0.80	0.99	1.0	0.040	5.19	79.86	0.127	3.03	2.36	2	0.948439	13.251	1.2687	15.390
24.606	0.89	0.23	0.80	0.99	1.0	0.040	4.48	69.42	0.111	2.64	2.16	2	0.944722	13.337	1.2769	15.490
24.770	0.89	0.29	0.80	0.98	1.0	0.040	3.30	84.25	0.136	3.21	2.61	2	0.943183	21.962	2.1026	25.507
24.934	0.89	0.33	0.80	0.98	1.0	0.040	2.15	69.61	0.111	2.62	2.45	2	0.942626	27.886	2.6698	32.388
25.098	0.88	0.38	0.80	0.98	1.0	0.040	1.86	78.30	0.125	2.93	2.81	2	0.943024	36.337	3.4789	42.203
25.262	0.88	0.33	0.80	0.98	1.0	0.040	2.55	84.46	0.136	3.18	2.75	2	0.936336	28.547	2.733	33.155
25.426	0.88	0.31	0.80	0.98	1.0	0.040	2.99	83.54	0.134	3.13	2.63	2	0.930567	24.062	2.3037	27.946
25.590	0.88	0.29	0.80	0.98	1.0	0.040	3.23	80.75	0.129	3.00	2.51	2	0.925559	21.501	2.0585	24.972
25.754	0.88	0.29	0.80	0.98	1.0	0.040	3.31	84.64	0.136	3.16	2.60	2	0.922538	22.026	2.1088	25.582
25.918	0.88	0.29	0.80	0.98	1.0	0.040	3.23	80.65	0.129	2.97	2.50	2	0.918806	21.494	2.0578	24.964
26.082	0.88	0.31	0.80	0.98	1.0	0.040	2.94	83.82	0.135	3.10	2.63	2	0.917709	24.561	2.3515	28.526
26.246	0.88	0.30	0.80	0.98	1.0	0.040	3.24	84.96	0.137	3.14	2.61	2	0.913039	22.609	2.1646	26.259
26.410	0.87	0.31	0.80	0.98	1.0	0.040	2.75	81.34	0.130	2.97	2.59	2	0.911974	25.482	2.4397	29.596
26.574	0.87	0.27	0.80	0.97	1.0	0.040	3.85	86.38	0.140	3.19	2.57	2	0.903719	19.31	1.8487	22.427
26.739	0.87	0.28	0.80	0.97	1.0	0.039	3.52	84.47	0.136	3.09	2.55	2	0.9017	20.679	1.9798	24.018
26.903	0.87	0.29	0.80	0.97	1.0	0.039	3.10	76.78	0.122	2.76	2.40	2	0.899044	21.291	2.0384	24.728
27.067	0.87	0.25	0.80	0.97	1.0	0.040	4.10	75.99	0.121	2.72	2.27	2	0.892685	15.952	1.5272	18.527
27.231	0.87	0.24	0.80	0.97	1.0	0.040	3.67	65.24	0.106	2.37	2.08	2	0.889446	15.293	1.4641	17.762
27.395	0.87	0.24	0.80	0.97	1.0	0.040	3.66	65.18	0.106	2.35	2.08	2	0.886234	15.323	1.467	17.797
27.559	0.86	0.24	0.80	0.97	1.0	0.040	4.23	74.31	0.118	2.61	2.20	2	0.883047	15.115	1.4471	17.555
27.723	0.86	0.29	0.80	0.97	1.0	0.040	3.29	81.72	0.131	2.88	2.46	2	0.883549	21.409	2.0497	24.865
27.887	0.86	0.33	0.80	0.97	1.0	0.040	2.62	85.37	0.138	3.02	2.67	2	0.886883	28.035	2.684	32.561
28.051	0.86	0.32	0.80	0.97	1.0	0.040	2.80	85.63	0.138	3.01	2.63	2	0.882469	26.353	2.523	30.607
28.215	0.86	0.34	0.80	0.97	1.0	0.040	2.36	82.64	0.132	2.87	2.65	2	0.88305	30.141	2.8857	35.007
28.379	0.86	0.28	0.80	0.96	1.0	0.040	3.25	77.44	0.123	2.65	2.33	2	0.870513	20.543	1.9668	23.859
28.543	0.86	0.26	0.80	0.96	1.0	0.040	4.87	97.86	0.167	3.58	2.72	2	0.864778	17.294	1.6558	20.086
28.707	0.86	0.26	0.80	0.96	1.0	0.040	4.93	100.50	0.174	3.72	2.80	2	0.862075	17.537	1.6789	20.368
28.871	0.85	0.50	0.75	0.95	1.0	0.041	1.40	103.45	0.183	3.88	3.85	2	0.896209	63.514	6.0808	73.767
29.035	0.85	0.50	0.75	0.95	1.0	0.041	1.35	101.77	0.178	3.76	3.84	2	0.894632	64.971	6.2203	75.460
29.199	0.85	0.52	0.74	0.95	1.0	0.041	1.51	124.72	0.260	5.46	4.93	2	0.895737	71.19	6.8158	82.683
29.363	0.85	0.63	0.68	0.94	1.0	0.042	1.28	153.66	0.417	8.71	9.44	2	0.908885	103.07	9.8678	119.708
29.527	0.85	0.69	0.66	0.93	1.0	0.042	1.30	184.56	1.000	20.76	22.43	2	0.914773	122.11	11.691	141.824
29.691	0.85	0.69	0.66	0.93	1.0	0.042	1.44	205.32	1.000	20.66	22.39	2	0.91325	122.44	11.723	142.212
29.855	0.85	0.63	0.68	0.93	1.0	0.042	1.62	194.57	1.000	20.55	19.83	2	0.903371	103.13	9.874	119.783
30.019	0.84	0.80	0.60	0.91	1.0	0.043	1.19	229.76	1.000	20.45	23.57	2	0.925852	165.84	15.877	192.611
30.183	0.84	0.89	0.60	0.91	1.0	0.043	1.10	259.26	1.000	20.34	24.49	2	0.936365	203.58	19.491	236.445

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W6-S

Data File: 13-52106_SP2W6-S-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Tailings Sands
Tailings Sand-Slimes
Tailings Slimes
Interim Cover
Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

5604.40	Water surface elevation during CPT investigation (f
5604.40	Water surface elevation at t_0 (ft amsl)
5588.59	Water surface elevation at t_1 (ft amsl)
5583.59	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Ear
7.51	Equiv. Number of Uniform Strain Cycles, N

5615.85	Ground Surface Elevation at time of CPT (ft amsl)
5625.41	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pl
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
1.56	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1065.26	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5583.59	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	######	5625.16	5624.91	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	######	5623.16	5621.41	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5619.41	5617.41	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334
Platform/Random Fill Layer	######	5616.63	5615.85	1.56	0.050	101	0.533	0.493	0.00	0.00	0.533	0.493

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil. Pore Pressure at time of CPT (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F, (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil. Pore Pressure at t_1 (tsf)	Effective Stress t_1 (tsf)	Saturated at t_1 1=Yes 0=No
0.164	5615.69	6.5	0.020	6.5	1.2	0.51	0.31%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0	1.70	11.067	153.83	12.87	788	0.31%	0.9	51%	0.54	0.00	0.54	0
0.328	5615.52	22.2	0.060	22.2	2.8	1.22	0.27%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	37.723	524.35	43.85	1343	0.27%	0.7	51%	0.55	0.00	0.55	0
0.492	5615.36	34.7	0.122	34.7	1.7	0.75	0.35%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	58.973	819.72	68.51	1399	0.35%	0.8	51%	0.56	0.00	0.56	0
0.656	5615.19	54.7	0.219	54.6	1.9	0.81	0.40%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0	1.70	92.888	1291.14	107.91	1653	0.40%	0.9	51%	0.57	0.00	0.57	0
0.820	5615.03	83.1	0.349	83.1	2.0	0.85	0.42%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0	1.70	141.202	1962.71	164.02	2010	0.42%	0.9	51%	0.57	0.00	0.57	0
0.984	5614.87	94.0	0.544	94.0	2.0	0.85	0.58%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0	1.70	159.715	2220.04	185.52	1895	0.58%	1.0	51%	0.58	0.00	0.58	0
1.148	5614.70	94.8	0.470	94.8	2.0	0.87	0.50%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0	1.70	161.126	2239.65	187.16	1638	0.50%	1.0	51%	0.59	0.00	0.59	0
1.312	5614.54	92.2	0.392	92.2	1.8	0.77	0.43%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	156.689	2177.98	182.01	1394	0.43%	0.9	51%	0.60	0.00	0.60	0
1.476	5614.37	90.8	0.315	90.8	0.7	0.29	0.35%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	154.309	2144.90	179.23	1220	0.35%	0.9	51%	0.61	0.00	0.61	0
1.640	5614.21	85.8	0.359	85.8	4.3	1.87	0.42%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0	1.70	145.843	2027.22	169.44	1038	0.42%	1.0	51%	0.62	0.00	0.62	0
1.804	5614.05	83.8	0.375	83.8	2.0	0.86	0.45%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0	1.70	142.375	1979.01	165.38	921	0.45%	1.0	51%	0.62	0.00	0.62	0
1.968	5613.88	76.6	0.445	76.6	1.8	0.79	0.58%	Interim Cover	0.050	100.7	0.10	0.00	0.10	0	1.70	130.135	1808.88	151.17	771	0.58%	1.1	51%	0.63	0.00	0.63	0
2.133	5613.72	61.3	0.546	61.3	1.1	0.47	0.89%	Interim Cover	0.050	100.7	0.11	0.00	0.11	0	1.70	104.159	1447.81	120.99	570	0.89%	1.4	51%	0.64	0.00	0.64	0
2.297	5613.55	64.2	0.470	64.2	1.8	0.79	0.73%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	109.123	1516.81	126.76	554	0.73%	1.3	51%	0.65	0.00	0.65	0
2.461	5613.39	68.7	0.730	68.7	2.8	1.20	1.06%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	116.807	1623.62	135.70	554	1.06%	1.4	51%	0.66	0.00	0.66	0
2.625	5613.23	191.6	1.300	191.6	4.3	1.85	0.68%	Interim Cover	0.050	100.7	0.13	0.00	0.13	0	1.64	314.125	4366.34	364.89	1449	0.68%	1.1	51%	0.66	0.00	0.66	0
2.789	5613.06	241.3	3.362	241.3	3.2	1.37	1.39%	Interim Cover	0.050	100.7	0.14	0.00	0.14	0	1.61	389.250	5410.57	452.13	1717	1.39%	1.4	51%	0.67	0.00	0.67	0
2.953	5612.90	265.3	5.646	265.3	4.3	1.85	2.13%	Interim Cover	0.050	100.7	0.15	0.00	0.15	0	1.59	421.663	5861.12	489.79	1783	2.13%	1.6	51%	0.68	0.00	0.68	0
3.117	5612.73	238.5	7.457	238.5	2.5	1.06	3.13%	Interim Cover	0.050	100.7	0.16	0.00	0.16	0	1.57	373.653	5193.78	434.00	1518	3.13%	1.7	51%	0.69	0.00	0.69	0
3.281	5612.57	217.3	7.057	217.3	1.3	0.58	3.25%	Sand-Slime Tailing	0.047	93.3	0.16	0.00	0.16	0	1.55	336.251	4673.89	390.55	1319	3.25%	1.8	47%	0.70	0.00	0.70	0
3.445	5612.41	217.9	6.621	217.9	0.9	0.38	3.04%	Sand-Slime Tailing	0.047	93.3	0.17	0.00	0.17	0	1.53	333.101	4630.11	386.89	1264	3.04%	1.7	47%	0.70	0.00	0.70	0
3.609	5612.24	256.0	7.793	256.0	1.4	0.59	3.04%	Sand-Slime Tailing	0.047	93.3	0.18	0.00	0.18	0	1.51	386.904	5377.97	449.38	1422	3.05%	1.7	47%	0.71	0.00	0.71	0
3.773	5612.08	314.1	8.489	314.1	6.9	2.98	2.70%	Sand Tailings	0.051	102.8	0.19	0.00	0.19	0	1.49	469.029	6519.50	544.82	1667	2.70%	1.7	18%	0.72	0.00	0.72	0
3.937	5611.91	227.8	8.106	227.7	12.0	5.18	3.56%	Sand-Slime Tailing	0.047	93.3	0.20	0.00	0.20	0	1.48	336.474	4676.99	390.92	1161	3.56%	1.8	47%	0.73	0.00	0.73	0
4.101	5611.75	218.4	6.483	218.4	6.5	2.83	2.97%	Sand-Slime Tailing	0.047	93.3	0.20	0.00	0.20	0	1.46	319.444	4440.28	371.08	1072	2.97%	1.7	47%	0.74	0.00	0.74	0
4.265	5611.58	214.9	5.761	214.9	3.0	1.32	2.68%	Sand-Slime Tailing	0.047	93.3	0.21	0.00	0.21	0	1.45	311.252	4326.41	361.53	1016	2.68%	1.7	47%	0.74	0.00	0.74	0
4.429	5611.42	175.0	4.480	175.0	2.3	0.98	2.56%	Sand-Slime Tailing	0.047	93.3	0.22	0.00	0.22	0	1.44	251.142	3490.88	291.71	798	2.56%	1.7	47%	0.75	0.00	0.75	0
4.593	5611.26	150.8	3.824	150.8	1.6	0.68	2.54%	Sand-Slime Tailing	0.047	93.3	0.23	0.00	0.23	0	1.43	215.630	2997.26	250.46	665	2.54%	1.7	47%	0.76	0.00	0.76	0
4.757	5611.09	121.0	2.453	121.0	1.6	0.71	2.03%	Sand Tailings	0.051	102.8	0.24	0.00	0.24	0	1.50	181.995	2529.74	211.39	514	2.03%	1.7	18%	0.77	0.00	0.77	0
4.921	5610.93	111.4	1.755	111.4	0.9	0.40	1.57%	Sand Tailings	0.051	102.8	0.24	0.00	0.24	0	1.52	169.758	2359.64	197.17	457	1.58%	1.6	18%	0.78	0.00	0.78	0
5.085	5610.76	105.9	2.102	105.9	0.1	0.06	1.99%	Sand Tailings	0.051	102.8	0.25	0.00	0.25	0	1.53	161.916	2250.64	188.06	419	1.99%	1.7	18%	0.78	0.00	0.78	0
5.249	5610.60	102.9	2.378	102.9	-1.0	-0.44	2.31%	Sand-Slime Tailing	0.047	93.3	0.26	0.00	0.26	0	1.53	157.250	2185.78	182.63	396	2.32%	1.8	47%	0.79	0.00	0.79	0
5.413	5610.44	102.4	2.370	102.4	-0.5	-0.23	2.31%	Sand-Slime Tailing	0.047	93.3	0.27	0.00	0.27	0	1.52	155.399	2160.05	180.48	382	2.32%	1.8	47%	0.80	0.00	0.80	0
5.577	5610.27	101.3	2.366	101.3	-0.4	-0.15	2.34%	Sand-Slime Tailing	0.047	93.3	0.27	0.00	0.27	0	1.51	152.916	2125.53	177.60	368	2.34%	1.8	47%	0.81	0.00	0.81	0
5.741	5610.11	96.2	2.597	96.2	-1.0	-0.43	2.70%	Sand-Slime Tailing	0.047	93.3	0.28	0.00	0.28	0	1.52	145.768	2026.18	169.29	339	2.71%	1.9	47%	0.82	0.00	0.82	0
5.905	5609.94	86.9	2.414	86.9	-0.9	-0.40	2.78%	Sand-Slime Tailing	0.047	93.3	0.29	0.00	0.29	0	1.54	133.514	1855.84	155.06	298	2.79%	1.9	47%	0.82	0.00	0.82	0
6.069	5609.78	80.9	2.523	80.9	-1.0	-0.43	3.12%	Sand-Slime Tailing	0.047	93.3	0.30	0.00	0.30	0	1.55	125.130	1739.31	145.32	271	3.13%	2.0	47%	0.83	0.00	0.83	0
6.234	5609.62	79.6	2.316	79.6	-1.1	-0.49	2.91%	Sand-Slime Tailing	0.047	93.3	0.31	0.00	0.31	0	1.54	122.573	1703.76	142.35	260	2.92%	2.0	47%	0.84	0.00	0.84	0
6.398	5609.45	76.6	2.134	76.6	-0.2	-0.10	2.79%	Sand-Slime Tailing	0.047	93.3	0.31	0.00	0.31	0	1.54	117.783	1637.19	136.80	244	2.80%	2.0	47%	0.85	0.00	0.85	0
6.562	5609.29	57.1	1.783	57.1	-0.0	-0.01	3.12%	Sand-Slime Tailing	0.047	93.3	0.32	0.00	0.32	0	1.61	91.966	1278.33	106.81	177	3.14%	2.1	47%	0.85	0.00	0.85	0
6.726	5609.12	51.8	1.588	51.8	-0.1	-0.03	3.07%	Sand-Slime Tailing	0.047	93.3	0.33	0.00	0.33	0	1.62	84.096	1168.93	97.67	157	3.09%	2.1	47%	0.86	0.00	0.86	0
6.890	5608.96	49.7	1.224	49.7	-0.8	-0.33	2.46%	Sand-Slime Tailing	0.047	93.3	0.34	0.00	0.34	0	1.62	80.549	1119.63	93.54	147	2.48%	2.1	47%	0.87	0.00	0.87	0
7.054	5608.80	56.3	1.510	56.4	-0.3	-0.13	2.68%	Sand-Slime Tailing	0.047	93.3	0.34	0.00	0.34	0	1.57	88.530	1230.57	102.82	163	2.70%	2.1	47%	0.88	0.00	0.88	0
7.218	5608.63	68.1	2.477	68.1	7.0	3.01	3.64%	Slime Tailings	0.041	82.7	0.35	0.00	0.35	0	1.51	102.716	1427.76	119.37	193	3.66%	2.1	71%	0.88	0.00	0.88	0
7.382	5608.47	66.2	2.994	66.2	1.5	0.65	4.52%	Slime Tailings	0.041	82.7	0.36	0.00	0.36	0	1.51	99.683	1385.59	115.79	184	4.55%	2.2	71%	0.89	0.00	0.89	0
7.546	5608.30	143.2	1.935	143.2	2.8	1.21	1.35%	Sand Tailings	0.051	102.8	0.37	0.00	0.37	0	1.30	186.431	2591.40	216.56	391	1.35%	1.6	18%	0.90	0.00	0.90	0
7.710	5608.14	161.7	1.640	161.7	-0.1	-0.04	1.01%	Sand Tailings	0.051	102.8	0.37	0.00	0.37	0	1.27	204.599	2843.92	237.63	431	1.02%	1.5	18%	0.91	0.00	0.91	0
7.874	5607.98	86.8	1.774	86.8	4.1	1.79	2.04%	Sand-Slime Tailing	0.047	93.3	0.38	0.00	0.38	0	1.40	121.855	1693.79	141.57	226	2.05%	1.9	47%	0.91	0.00	0.91	0
8.038	5607.81	50.5	1.194	50.5	1.7	0.75	2.36%	Sand-Slime Tailing	0.047	93.3	0.39	0.00	0.39	0	1.52	76.535	1063.84	88.91	129	2.38%	2.1	47%	0.92	0.00	0.92	0
8.202	5607.65	34.7	0.878	34.7	0.9	0.37	2.53%	Sand-Slime Tailing	0.047	93.3	0.40	0.00	0.40	0	1.58	54.878	762.80	63.75	86	2.56%	2.2	47%	0.93	0.00	0.93	0
8.366	5607.48	25.8	0.664	25.8	0.5	0.20	2.58%	Sand-Slime Tailing	0.047	93.3	0.40	0.00	0.40	0	1.63	41.903	582.45	48.67	63	2.62%	2.3	47%	0.94	0.00	0.94	0
8.530	5607.32	31.8	0.573	31.8	2.8	1.21	1.80%	Sand-Slime Tailing	0.047	93.3	0.41	0.00	0.41	0	1.57	49.800	692.22	57.87	76	1.83%	2.2	47%	0.95	0.00	0.95	0
8.694	5607.16	34.8	0.413	34.8	2.3	1.01	1.19%	Sand-Slime Tailing	0.047	93.3	0.42	0.00	0.42	0	1.54	53.460	743.09	62.12	82	1.20%	2.0	47%	0.95	0.00	0.95	0
8.858	5606.99	33.7	0.343	33.7	0.9	0.37	1.02%	Sand-Slime Tailing	0.047	93.3	0.43	0.00	0.43	0	1.53	51.481	715.59	59.80	78	1.03%	2.0	47%	0.96	0.00	0.96	0
9.022	5606.83	29.3	0.358	29.3	0.1	0.05	1.22%	Sand-Slime Tailing	0.047	93.3	0.44	0.00	0.44	0	1.54	44.964	624.99	52.22	66	1.24%	2.1	47%	0.97	0.00	0.97	0
9.186	5606.66	20.9	0.342	20.9	-0.3	-0.13	1.64%	Sand-Slime Tailing	0.047	93.3	0.44	0.00	0.44	0	1.58	32.960	458.14	38.28	46	1.67%	2.3	47%	0.98	0.00	0.98	0
9.350	5606.50	12.6	0.327	12.6	-0.6	-0.25	2.59%	Slime Tailings	0.041	82.7	0.45	0.00	0.45	0	1.64	20.679	287.43	24.01	27	2.69%	2.6	71%	0.98	0.00	0.98	0
9.514	5606.34	12.0	0.251	12.0	-0.7	-0.29	2.10%	Slime Tailings	0.041	82.7	0.46	0.00	0.46	0	1.63	19.500	271.05	22.64	25	2.18%	2.6	71%	0.99	0.00	0.99	0
9.678	5606.17	14.1	0.216	14.1	-0.6	-0.26	1.53%	Sand-Slime Tailing	0.047	93.3	0.46	0.00	0.46	0	1.59	22.445	311.98	26.06	29	1.58%	2.5	47%	1.00	0.00	1.00	0
9.842	5606.01	23.2	0.158	23.2	-0.3	-0.12	0.68%	Sand-Slime Tailing	0.047	93.3	0.47	0.00	0.47	0	1.50	34.822	484.03	40.44	48	0.70%	2.1	47%	1.00	0.00	1.00	0
10.006	5605.84	22.6	0.274	22.6	-0.3	-0.12	1.21%	Sand-Slime Tailing	0.047	93.3	0.48	0.00	0.48	0	1.49	33.696	468.37	39.13	46	1.24%	2.2	47%	1.01	0.00	1.01	0
10.170	5605.68	11.1	0.368	11.1	-0.5	-0.23	3.32%	Slime Tailings	0.041	82.7	0.49	0.00	0.49	0	1.56	17.349	241.15	20.14	22	3.47%	2.8	71%	1.02	0.00	1.02	0
10.335	5605.52	10.3	0.383	10.3	0.3	0.12	3.73%	Slime Tailings	0.041	82.7	0.49	0.00	0.49	0	1.55	15.894	220.93	18.46	20	3.91%	2.8	71%	1.03	0.00	1.03	0
10.499	5605.35	8.6	0.299	8.6	1.8	0.79	3.46%	Slime Tailings	0.041	82.7	0.50	0.00	0.50	0	1.53	13.186	183.29	15.34	16	3.68%	2.9	71%	1.03	0.00	1.03	0
10.663	5605.19	11.2	0.222	11.2	2.1	0.91	1.98%	Slime Tailings	0.041	82.7	0.51	0.00	0.51	0	1.51	16.923	235.23	19.68	21	2.08%	2.6	71%	1.04	0.00	1.04	0
10.827	5605.02	22.3	0.182	22.3	1.3	0.55	0.82%	Sand-Slime Tailing	0.047	93.3	0.51	0.00	0.51	0	1.43	31.828	442.41	36.98	42	0.84%	2.2	47%	1.05	0.00	1.05	0
10.991	5604.86	26.2	0.185	26.2	0.6	0.25	0.71%	Sand-Slime Tailing	0.047	93.3	0.52	0.00	0.52	0	1.40	36.562	508.21	42.47	49	0.72%	2.1	47%	1.05	0.00	1.05	0
11.155	5604.70	24.7	0.273	24.7	0.3	0.14	1.10%	Sand-Slime Tailing	0.047	93.3	0.53	0.00	0.53	0	1.39	34.382	477.91	39.94	46	1.13%	2.2	47%	1.06	0.00	1.06	0
11.319	5604.53	17.5	0.349	17.5	-0.1	-0.05	1.99%	Sand-Slime Tailing	0.047	93.3	0.54	0.00	0.54	0	1.41	24.763	344.20	28.76	32	2.06%	2.5	47%	1.07	0.00	1.07	0
11.483	5604.37	12.5	0.390	12.5	-0.2	-0.07	3.12%	Slime Tailings	0.057	113.1	0.55	0.00	0.55	1	1.43	17.845	248.04	20.72	22	3.27%	2.7	71%	1.08	0.00	1.08	0
11.647	5604.20	12.1	0.339	12.1	2.0	0.88	2.79%	Slime Tailings	0.057	113.1	0.56	0.01	0.55	1	1.42	17.214	239.27	20.01	21	2.93%	2.7	71%	1.09	0.00	1.09	0
11.811	5604.04	10.7	0.328	10.7	10.4	4.49	3.06%	Slime Tailings	0.057	113.1	0.57	0.01	0.55	1	1.41	15.051	209.21	17.59	18	3.23%	2.8	71%	1.10	0.00	1.10	0
11.975	5603.88	17.0	0.353	16.9	18.5	8.03	2.08%	Sand-Slime Tailing	0.059	119.0	0.57	0.02	0.56	1	1.38	23.239	323.02	27.18	29	2.15%	2.5	47%	1.11	0.00	1.11	0

Liquefaction Triggering Analyses

Depth (ft)	I&B (2008) r_d	C_σ	K_σ	K_α	CSR M=7.5, σ'v=1atm	Δq_{c1n}	q_{c1n-cs}	(CRR) M=7.5, σ'v=1atm	FoS	Youd (2001) r_d	D_r	f	K_σ	K_α	CSR M=7.5, σ'v=1atm	Kc	q_{c1n-cs}	(CRR) M=7.5, σ'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No	I&B (2008) CN	qc1 TSF	qc1 MPa	qc1N
0.164	1.00	0.05	1.02	1.0	0.059	34.84	47.70	0.075	1.27	0.98	0.21	0.80	2.53	1.0	0.017	1.00	12.87	0.061	3.63	2.45	2	1.7	11.079	1.0607	12.868
0.328	1.00	0.07	1.03	1.0	0.060	45.71	89.56	0.126	2.12	0.98	0.38	0.80	2.20	1.0	0.020	1.00	43.85	0.087	4.59	3.35	2	1.7	37.753	3.6145	43.848
0.492	1.00	0.08	1.04	1.0	0.060	54.36	122.88	0.186	3.10	0.98	0.48	0.76	2.33	1.0	0.018	1.00	68.51	0.110	5.44	4.27	2	1.7	58.991	5.6478	68.515
0.656	1.00	0.11	1.05	1.0	0.061	68.19	176.10	0.478	7.90	0.98	0.60	0.70	2.66	1.0	0.016	1.00	107.91	0.197	119.17	63.53	2	1.7	92.908	8.895	107.907
0.820	1.00	0.18	1.07	1.0	0.062	87.88	251.90	1.000	16.11	0.98	0.74	0.63	3.07	1.0	0.014	1.00	164.02	1.000	484.49	250.30	2	1.7	141.22	13.521	164.022
0.984	1.00	0.22	1.09	1.0	0.063	95.43	280.95	1.000	15.90	0.98	0.79	0.61	3.07	1.0	0.014	1.00	185.52	1.000	403.90	209.90	2	1.7	159.74	15.293	185.524
1.148	1.00	0.23	1.09	1.0	0.063	96.00	283.16	1.000	15.93	0.98	0.79	0.61	2.91	1.0	0.015	1.00	187.16	1.000	346.34	181.13	2	1.7	161.15	15.428	187.163
1.312	1.00	0.22	1.08	1.0	0.062	94.19	276.20	1.000	16.04	0.97	0.78	0.61	2.72	1.0	0.016	1.00	182.01	1.000	303.16	159.60	2	1.7	156.71	15.003	182.007
1.476	1.00	0.21	1.07	1.0	0.062	93.22	272.45	1.000	16.12	0.97	0.77	0.61	2.58	1.0	0.017	1.00	179.23	1.000	269.58	142.85	2	1.7	154.32	14.774	179.229
1.640	1.00	0.19	1.06	1.0	0.062	89.78	259.22	1.000	16.26	0.97	0.75	0.62	2.41	1.0	0.018	1.00	169.44	1.000	242.72	129.49	2	1.7	145.89	13.967	169.441
1.804	1.00	0.18	1.06	1.0	0.061	88.36	253.74	1.000	16.33	0.97	0.74	0.63	2.30	1.0	0.019	1.00	165.38	1.000	220.74	118.54	2	1.7	142.4	13.633	165.384
1.968	1.00	0.16	1.05	1.0	0.061	83.37	234.54	1.000	16.49	0.97	0.71	0.65	2.15	1.0	0.020	1.00	151.17	0.401	81.22	48.86	2	1.7	130.15	12.461	151.167
2.133	1.00	0.13	1.04	1.0	0.060	72.78	193.77	0.869	14.52	0.97	0.64	0.68	1.94	1.0	0.022	1.00	120.99	0.245	45.74	30.13	2	1.7	104.17	9.9733	120.988
2.297	1.00	0.13	1.04	1.0	0.060	74.81	201.57	1.000	16.72	0.97	0.65	0.67	1.92	1.0	0.022	1.00	126.76	0.269	46.79	31.75	2	1.7	109.14	10.449	126.762
2.461	1.00	0.14	1.04	1.0	0.060	77.94	213.64	1.000	16.72	0.97	0.67	0.66	1.92	1.0	0.022	1.00	135.70	0.312	50.65	33.68	2	1.7	116.84	11.186	135.698
2.625	1.00	0.30	1.08	1.0	0.062	#####	523.26	1.000	16.12	0.97	1.10	0.60	2.12	1.0	0.020	1.00	364.89	1.000	152.06	84.09	2	1.639484	314.17	30.079	364.888
2.789	0.99	0.30	1.07	1.0	0.062	#####	641.11	1.000	16.19	0.97	1.23	0.60	2.07	1.0	0.021	1.00	452.13	1.000	143.17	79.68	2	1.61347	389.28	37.27	452.127
2.953	0.99	0.30	1.07	1.0	0.061	#####	691.99	1.000	16.26	0.97	1.28	0.60	2.02	1.0	0.021	1.00	489.79	1.000	135.27	75.77	2	1.589322	421.71	40.374	489.785
3.117	0.99	0.30	1.07	1.0	0.061	#####	616.63	1.000	16.33	0.97	1.20	0.60	1.98	1.0	0.022	1.06	461.98	1.000	128.20	72.27	2	1.566812	373.68	35.776	434.004
3.281	0.99	0.30	1.06	1.0	0.061	#####	557.82	1.000	16.40	0.97	1.14	0.60	1.94	1.0	0.022	1.08	423.01	1.000	122.29	69.34	2	1.547263	336.26	32.194	390.550
3.445	0.99	0.30	1.06	1.0	0.061	#####	552.87	1.000	16.46	0.97	1.14	0.60	1.90	1.0	0.023	1.07	412.59	1.000	116.91	66.68	2	1.52883	333.11	31.892	386.887
3.609	0.99	0.30	1.06	1.0	0.061	#####	637.29	1.000	16.53	0.97	1.22	0.60	1.87	1.0	0.023	1.06	476.39	1.000	111.98	64.25	2	1.511403	386.92	37.043	449.380
3.773	0.99	0.30	1.05	1.0	0.060	#####	706.20	1.000	16.60	0.97	1.30	0.60	1.84	1.0	0.023	1.02	554.48	1.000	107.01	61.80	2	1.493247	469.09	44.911	544.823
3.937	0.99	0.30	1.05	1.0	0.060	#####	558.33	1.000	16.66	0.97	1.14	0.60	1.81	1.0	0.024	1.12	437.65	1.000	102.87	59.77	2	1.477644	336.58	32.225	390.923
4.101	0.99	0.30	1.05	1.0	0.060	#####	531.53	1.000	16.73	0.97	1.11	0.60	1.78	1.0	0.024	1.07	397.43	1.000	99.05	57.89	2	1.462791	319.5	30.589	371.085
4.265	0.99	0.30	1.04	1.0	0.060	#####	518.63	1.000	16.79	0.97	1.10	0.60	1.75	1.0	0.024	1.05	378.28	1.000	95.50	56.15	2	1.448628	311.28	29.802	361.533
4.429	0.99	0.30	1.04	1.0	0.059	#####	424.32	1.000	16.86	0.97	0.99	0.60	1.73	1.0	0.025	1.05	307.64	1.000	92.20	54.53	2	1.435098	251.16	24.046	291.710
4.593	0.98	0.30	1.04	1.0	0.059	#####	368.60	1.000	16.93	0.97	0.91	0.60	1.71	1.0	0.025	1.07	268.21	1.000	89.12	53.02	2	1.42972	215.64	20.646	250.458
4.757	0.98	0.30	1.03	1.0	0.059	76.13	287.53	1.000	17.00	0.97	0.84	0.60	1.68	1.0	0.025	1.04	220.27	1.000	85.96	51.48	2	1.504592	182.01	17.426	211.395
4.921	0.98	0.25	1.03	1.0	0.058	72.50	269.67	1.000	17.14	0.97	0.81	0.60	1.66	1.0	0.026	1.00	197.17	1.000	83.01	50.08	2	1.523449	169.77	16.253	197.174
5.085	0.98	0.23	1.02	1.0	0.058	70.17	258.22	1.000	17.25	0.97	0.79	0.60	1.63	1.0	0.026	1.06	200.17	1.000	80.26	48.75	2	1.529534	161.92	15.502	188.058
5.249	0.98	0.22	1.02	1.0	0.058	94.35	276.98	1.000	17.32	0.97	0.78	0.61	1.60	1.0	0.027	1.11	203.34	1.000	77.93	47.62	2	1.52774	157.24	15.054	182.626
5.413	0.98	0.21	1.02	1.0	0.058	93.60	274.08	1.000	17.38	0.97	0.78	0.61	1.57	1.0	0.027	1.12	202.03	1.000	75.73	46.55	2	1.517569	155.39	14.877	180.481
5.577	0.98	0.21	1.01	1.0	0.057	92.59	270.19	1.000	17.44	0.96	0.77	0.62	1.55	1.0	0.027	1.13	200.40	1.000	73.65	45.54	2	1.509532	152.91	14.64	177.598
5.741	0.98	0.19	1.01	1.0	0.057	89.67	258.96	1.000	17.50	0.96	0.75	0.62	1.52	1.0	0.028	1.19	201.39	1.000	71.68	44.59	2	1.515261	145.76	13.955	169.290
5.905	0.98	0.17	1.01	1.0	0.057	84.68	239.74	1.000	17.57	0.96	0.72	0.64	1.48	1.0	0.029	1.23	190.57	1.000	69.82	43.69	2	1.53676	133.5	12.782	155.058
6.069	0.98	0.15	1.01	1.0	0.057	81.27	226.59	1.000	17.62	0.96	0.70	0.65	1.45	1.0	0.029	1.31	189.90	1.000	68.05	42.84	2	1.547112	125.12	11.979	145.320
6.234	0.98	0.15	1.00	1.0	0.057	80.23	222.57	1.000	17.67	0.96	0.69	0.66	1.43	1.0	0.030	1.29	182.97	1.000	66.38	42.02	2	1.539087	122.56	11.734	142.348
6.398	0.97	0.14	1.00	1.0	0.056	78.28	215.07	1.000	17.71	0.96	0.68	0.66	1.41	1.0	0.030	1.28	175.75	1.000	64.78	41.25	2	1.538242	117.78	11.276	136.795
6.562	0.97	0.11	1.00	1.0	0.056	67.76	174.57	0.459	8.14	0.96	0.60	0.70	1.34	1.0	0.032	1.47	156.93	0.439	27.80	17.97	2	1.611744	91.966	8.8048	106.813
6.726	0.97	0.10	1.00	1.0	0.056	64.56	162.23	0.341	6.07	0.96	0.57	0.71	1.32	1.0	0.032	1.52	148.18	0.383	23.65	14.86	2	1.624415	84.095	8.0513	97.672
6.890	0.97	0.10	1.00	1.0	0.056	63.11	156.65	0.305	5.45	0.96	0.56	0.72	1.30	1.0	0.033	1.41	131.92	0.294	17.74	11.59	2	1.620049	80.541	7.711	93.544
7.054	0.97	0.11	1.00	1.0	0.056	66.36	169.18	0.399	7.14	0.96	0.59	0.71	1.31	1.0	0.032	1.41	145.18	0.365	21.55	14.34	2	1.571078	88.527	8.4756	102.819
7.218	0.97	0.12	1.00	1.0	0.056	71.66	191.03	0.781	13.98	0.96	0.63	0.68	1.33	1.0	0.032	1.53	182.92	1.000	57.98	35.98	2	1.509204	102.78	9.8403	119.375
7.382	0.97	0.12	1.00	1.0	0.056	70.41	186.20	0.655	11.75	0.96	0.62	0.69	1.31	1.0	0.032	1.75	202.06	1.000	56.91	34.33	2	1.505326	99.697	9.545	115.792
7.546	0.97	0.30	0.99	1.0	0.055	77.45	294.01	1.000	18.12	0.96	0.85	0.60	1.41	1.0	0.030	1.00	216.56	1.000	55.62	36.87	2	1.301895	186.45	17.851	216.555
7.710	0.97	0.30	0.98	1.0	0.055	82.84	320.47	1.000	18.19	0.96	0.89	0.60	1.40	1.0	0.030	1.00	237.63	1.000	54.38	36.29	2	1.265533	204.6	19.588	237.628
7.874	0.96	0.15	0.99	1.0	0.055	79.95	221.52	1.000	18.09	0.96	0.69	0.66	1.32	1.0	0.032	1.18	167.67	1.000	53.32	35.70	2	1.404187	121.89	11.67	141.570
8.038	0.96	0.10	0.99	1.0	0.055	61.48	150.39	0.273	4.93	0.96	0.54	0.73	1.24	1.0	0.034	1.45	128.98	0.280	14.62	9.78	2	1.515245	76.551	7.329	88.910
8.202	0.96	0.08	0.99	1.0	0.055	52.66	116.41	0.172	3.11	0.96	0.46	0.77	1.20	1.0	0.035	1.76	112.27	0.212	10.86	6.98	2	1.581493	54.886	5.2548	63.747
8.366	0.96	0.07	0.99	1.0	0.055	47.37	96.05	0.136	2.46	0.96	0.40	0.80	1.16	1.0	0.036	2.09	101.59	0.178	8.94	5.70	2	1.625416	41.908	4.0123	48.673
8.530	0.96	0.08	0.99	1.0	0.055	50.60	108.47	0.157	2.85	0.96	0.44	0.78	1.18	1.0	0.036	1.60	92.72	0.154	7.62	5.23	2	1.568016	49.827	4.7705	57.872
8.694	0.96	0.08	0.99	1.0	0.055	52.09	114.20	0.168	3.05	0.96	0.46	0.77	1.18	1.0	0.036	1.34	83.09	0.133	6.48	4.76	2	1.535318	53.482	5.1204	62.116
8.858	0.96	0.08	0.99	1.0	0.055	51.27	111.08	0.162	2.95	0.96	0.45	0.78	1.17	1.0	0.036	1.30	77.98	0.124	5.92	4.43	2	1.526724	51.489	4.9296	59.802
9.022	0.96	0.07	0.99	1.0	0.055	48.62	100.84	0.144	2.62	0.96	0.42	0.79	1.15	1.0	0.037	1.47	76.82	0.122	5.73	4.18	2	1.537215	44.965	4.3049	52.224
9.186	0.96	0.06	0.99	1.0	0.055	43.73	82.00	0.115	2.10	0.96	0.36	0.80	1.14	1.0	0.037	1.99	76.07	0.121	5.57	3.84	2	1.577766	32.957	3.1553	38.277
9.350	0.96	0.06	0.99	1.0	0.055	38.45	62.46	0.091	1.65	0.96	0.28	0.80	1.14	1.0	0.037	3.47	83.20	0.134	6.07	3.86	2	1.639861	20.673	1.9792	24.010
9.514	0.95	0.05	0.99	1.0	0.055	37.97	60.61	0.089	1.62	0.96	0.27	0.80	1.14	1.0	0.037	3.27	74.01	0.118	5.27	3.44	2	1.630423	19.493	1.8663	22.640
9.678	0.95	0.06	0.99	1.0	0.055	39.44	65.50	0.094	1.72	0.96	0.29	0.80	1.13	1.0	0.037	2.54	66.27	0.107	4.72	3.22	2	1.588461	22.439	2.1483	26.061
9.842	0.95	0.07	0.99	1.0	0.054	44.48	84.93	0.120	2.19	0.95	0.37	0.80	1.13	1.0	0.037	1.42	57.38	0.098	4.23	3.21	2	1.502248	34.819	3.3336	40.441
10.006	0.95	0.06	0.99	1.0	0.054	44.03	83.16	0.117	2.15	0.95	0.36	0.80	1.12	1.0	0.037	1.75	68.53	0.110	4.69	3.42	2	1.490966	33.693	3.2258	39.133
10.170	0.95	0.05	0.99	1.0	0.054	37.10	57.25	0.085	1.56	0.95	0.26	0.80	1.12	1.0	0.038	4.49	90.38	0.149	6.26	3.91	2	1.562976	17.344	1.6605	20.144
10.335	0.95	0.05	0.99	1.0	0.054	36.52	54.98	0.082	1.52	0.95	0.25	0.80	1.12	1.0	0.038	5.04	92.99	0.155	6.43	3.97	2	1.546147	15.897	1.522	18.464
10.499	0.95	0.05	0.99	1.0	0.054	35.43	50.76	0.078	1.44	0.95	0.23	0.80	1.11	1.0	0.038	5.50	84.30	0.136	5.56	3.50	2	1.529724	13.204	1.2641	15.335
10.663	0.95	0.05	0.99	1.0	0.054	36.94	56.62	0.084	1.55	0.95	0.26	0.80	1.11	1.0	0.038	3.58	70.44	0.113	4.55	3.05	2	1.513694	16.943	1.6221	19.678
10.827	0.95	0.06	0.99	1.0	0.054	43.27	80.25	0.113	2.09	0.95	0.35	0.80	1.11	1.0	0.038	1.59	58.90	0.099	3.95	3.02	2	1.428543	31.839	3.0483	36.979
10.991	0.94	0.07	0.99	1.0	0.054	45.20	87.67	0.123	2.29	0.95	0.38	0.80	1.11	1.0	0.038	1.42	60.27	0.100	3.94	3.12	2	1.397102	36.567	3.5009	42.471
11.155	0.94	0.06	0.99	1.0	0.054	44.31	84.24	0.119	2.20	0.95	0.36	0.80	1.10	1.0	0.038	1.70	67.83	0.109	4.22	3.21	2	1.390862	34.385	3.292	39.936
11.319	0.94	0.06	0.99	1.0	0.054	40.39	69.15	0.099	1.83	0.95	0.31	0.80	1.10	1.0	0.038	2.75	79.07	0.126	4.81	3.32	2	1.413397	24.762	2.3707	28.759
11.483	0.94	0.05	0.99	1.0	0.054	37.30	58.03	0.086	1.59	0.95	0.26	0.80	1.10	1.0	0.038	4.35	90.07	0.148	5.57	3.58	2	1.428725	17.843	1.7083	20.724
11.647	0.94	0.05	0.99	1.0	0.054	37.06	57.07	0.085	1.58	0.95	0.26	0.80	1.09	1.0	0.038	4.22	84.43	0.136	5.08	3.33	2	1.420263	17.231	1.6497	20.013
11.811	0.94	0.05	0.99	1.0	0.054	36.21	53.80	0.081	1.52	0.95	0.24	0.80	1.09	1.0	0.038	4.81	84.62	0.136	5.06	3.29	2	1.411915	15.142	1.4497	17.587
11.975	0.94	0.06	0.99	1.0	0.053	39.83	67.01	0.096	1.80	0.95	0.30	0.80	1.09	1.0	0.038	2.95	80.09	0.128	4.70	3.25	2	1.379148	23.398	2.2401	27.175

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W6-S

Data File: 13-52106_SP2W6-S-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\.\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Parameter
5604.40	Water surface elevation during CPT investigation (f
5604.40	Water surface elevation at t_0 (ft amsl)
5588.59	Water surface elevation at t_1 (ft amsl)
5583.59	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Ear
7.51	Equiv. Number of Uniform Strain Cycles, N
5615.85	Ground Surface Elevation at time of CPT (ft amsl)
5625.41	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pl
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
1.56	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1065.26	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5583.59	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	######	5625.16	5624.91	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	######	5623.16	5621.41	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5619.41	5617.41	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334
Platform/Random Fill Layer	######	5616.63	5615.85	1.56	0.050	101	0.533	0.493	0.00	0.00	0.533	0.493

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1 / Liquefaction Triggering Analyses (Idriss & Boulanger (2008); Youd et al. (2001)) / Idriss & Boulanger (2008)

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil. Pore Pressure at time of CPT (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F, (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil. Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No	I&B r_d	I&B C_σ	I&B K_σ	I&B K_α	I&B CSR M=7.5, σ'v=1atm	I&B Δqc_{1n}	I&B qc_{1n-cs}	I&B (CRR) M=7.5, σ'v=1atm	I&B FoS	Youd r_d	Youd D_r	Youd f	Youd K_σ	Youd K_α	Youd CSR M=7.5, σ'v=1atm	Youd Kc	Youd qc_{1n-cs}	Youd (CRR) M=7.5, σ'v=1atm	Youd FoS	Avg FoS	Liquefiable? 1=Yes 2=No	I&B (2008) CN	I&B (2008) qc1 TSF	I&B (2008) qc1 MPa	I&B (2008) qc1N
12.139	5603.71	12.2	0.338	12.1	8.3	3.58	2.77%	Slime Tailings	0.057	113.1	0.58	0.02	0.56	1	1.39	16.931	235.34	19.75	21	2.91%	2.7	71%	1.12	0.00	1.12	0	0.94	0.05	0.99	1.0	0.053	36.96	56.71	0.084	1.58	0.95	0.26	0.80	1.09	1.0	0.038	4.26	84.15	0.135	4.95	3.26	2	1.39462	17.003	1.6278	19.748
12.303	5603.55	8.8	0.266	8.8	6.5	2.80	3.02%	Slime Tailings	0.057	113.1	0.59	0.03	0.57	1	1.39	12.161	169.03	14.19	14	3.24%	2.9	71%	1.13	0.00	1.13	0	0.94	0.05	0.99	1.0	0.053	35.03	49.22	0.077	1.44	0.95	0.22	0.80	1.09	1.0	0.038	5.55	78.80	0.126	4.56	3.00	2	1.38661	12.217	1.1696	14.189
12.467	5603.38	5.7	0.163	5.7	9.4	4.08	2.86%	Slime Tailings	0.057	113.1	0.60	0.03	0.57	1	1.38	7.790	108.28	9.14	9	3.19%	3.1	71%	1.14	0.00	1.14	0	0.93	0.04	0.99	1.0	0.053	33.27	42.41	0.071	1.32	0.95	0.17	0.80	1.09	1.0	0.039	7.34	67.12	0.108	3.90	2.61	2	1.378705	7.8707	0.7535	9.141
12.631	5603.22	6.7	0.119	6.6	17.7	7.65	1.77%	Slime Tailings	0.057	113.1	0.61	0.04	0.58	1	1.37	9.089	126.34	10.73	11	1.94%	2.9	71%	1.14	0.00	1.14	0	0.93	0.05	0.99	1.0	0.053	33.82	44.56	0.072	1.36	0.95	0.19	0.80	1.08	1.0	0.039	5.42	58.12	0.098	3.52	2.44	2	1.370901	9.2401	0.8846	10.732
12.795	5603.05	9.3	0.181	9.2	25.8	11.18	1.94%	Slime Tailings	0.057	113.1	0.62	0.04	0.58	1	1.36	12.514	173.95	14.79	15	2.08%	2.8	71%	1.15	0.00	1.15	0	0.93	0.05	0.99	1.0	0.053	35.24	50.03	0.078	1.46	0.95	0.22	0.80	1.08	1.0	0.039	4.45	65.88	0.107	3.79	2.63	2	1.363197	12.734	1.2191	14.789
12.959	5602.89	8.3	0.182	8.2	18.0	7.82	2.18%	Slime Tailings	0.057	113.1	0.63	0.05	0.58	1	1.36	11.157	155.08	13.13	13	2.36%	2.8	71%	1.16	0.00	1.16	0	0.93	0.05	0.99	1.0	0.053	34.66	47.80	0.075	1.42	0.95	0.21	0.80	1.08	1.0	0.039	5.12	67.20	0.108	3.82	2.62	2	1.355592	11.309	1.0827	13.135
13.123	5602.73	6.3	0.181	6.2	22.2	9.60	2.85%	Slime Tailings	0.057	113.1	0.64	0.05	0.59	1	1.35	8.372	116.37	9.94	10	3.17%	3.0	71%	1.17	0.00	1.17	0	0.93	0.05	0.99	1.0	0.053	33.55	43.49	0.072	1.35	0.95	0.18	0.80	1.08	1.0	0.039	6.98	69.37	0.111	3.90	2.62	2	1.348082	8.558	0.8193	9.940
13.287	5602.56	5.9	0.160	5.6	56.5	24.47	2.70%	Slime Tailings	0.057	113.1	0.65	0.06	0.59	1	1.34	7.468	103.80	9.22	9	3.03%	3.0	71%	1.18	0.00	1.18	0	0.93	0.04	0.99	1.0	0.053	33.30	42.52	0.071	1.34	0.95	0.18	0.80	1.08	1.0	0.039	7.21	66.51	0.107	3.74	2.54	2	1.340666	7.9402	0.7602	9.222
13.451	5602.40	5.0	0.142	4.6	62.6	27.11	2.87%	Slime Tailings	0.057	113.1	0.66	0.06	0.60	1	1.33	6.080	84.51	7.67	7	3.31%	3.1	71%	1.19	0.00	1.19	0	0.93	0.04	0.99	1.0	0.053	32.76	40.42	0.069	1.31	0.95	0.16	0.80	1.08	1.0	0.039	8.42	64.56	0.105	3.64	2.47	2	1.333343	6.6009	0.632	7.666
13.615	5602.23	4.7	0.156	4.3	65.6	28.41	3.34%	Slime Tailings	0.057	113.1	0.67	0.07	0.60	1	1.33	5.649	78.52	7.19	7	3.90%	3.2	71%	1.20	0.00	1.20	0	0.93	0.04	0.99	1.0	0.053	32.59	39.78	0.068	1.30	0.95	0.15	0.80	1.07	1.0	0.039	9.34	67.15	0.108	3.72	2.51	2	1.32611	6.192	0.5928	7.192
13.779	5602.07	5.0	0.155	4.5	70.8	30.68	3.12%	Slime Tailings	0.057	113.1	0.68	0.07	0.60	1	1.32	5.962	82.87	7.60	7	3.62%	3.2	71%	1.21	0.00	1.21	0	0.92	0.04	0.99	1.0	0.053	32.73	40.34	0.069	1.31	0.95	0.16	0.80	1.07	1.0	0.039	8.78	66.76	0.108	3.68	2.49	2	1.318966	6.5446	0.6266	7.601
13.943	5601.91	5.3	0.171	4.9	65.5	28.40	3.23%	Slime Tailings	0.057	113.1	0.69	0.08	0.61	1	1.31	6.441	89.54	8.10	8	3.69%	3.1	71%	1.22	0.00	1.22	0	0.92	0.04	0.98	1.0	0.053	32.91	41.01	0.069	1.32	0.95	0.16	0.80	1.07	1.0	0.039	8.51	68.96	0.111	3.75	2.54	2	1.31191	6.9782	0.6681	8.105
14.107	5601.74	5.7	0.161	5.3	66.6	28.87	2.81%	Slime Tailings	0.057	113.1	0.70	0.08	0.61	1	1.30	6.929	96.32	8.68	8	3.20%	3.1	71%	1.23	0.00	1.23	0	0.92	0.04	0.98	1.0	0.052	33.11	41.79	0.070	1.34	0.94	0.17	0.80	1.07	1.0	0.039	7.72	67.00	0.108	3.64	2.49	2	1.304938	7.472	0.7154	8.678
14.271	5601.58	6.2	0.224	5.8	64.0	27.75	3.64%	Slime Tailings	0.057	113.1	0.70	0.09	0.62	1	1.30	7.477	103.93	9.29	9	4.11%	3.1	71%	1.24	0.00	1.24	0	0.92	0.04	0.98	1.0	0.052	33.32	42.61	0.071	1.35	0.94	0.18	0.80	1.07	1.0	0.039	8.17	75.85	0.121	4.04	2.70	2	1.298051	7.9957	0.7655	9.287
14.436	5601.41	6.8	0.221	6.7	27.2	11.78	3.24%	Slime Tailings	0.057	113.1	0.71	0.09	0.62	1	1.29	8.600	119.54	10.24	10	3.61%	3.0	71%	1.25	0.00	1.25	0	0.92	0.05	0.98	1.0	0.052	33.65	43.90	0.072	1.38	0.94	0.18	0.80	1.07	1.0	0.039	7.30	74.79	0.119	3.96	2.67	2	1.291246	8.8188	0.8443	10.242
14.600	5601.25	12.2	0.194	12.0	33.9	14.70	1.58%	Sand-Slime Tailing	0.059	119.0	0.72	0.10	0.63	1	1.28	15.444	214.67	18.25	18	1.68%	2.6	47%	1.26	0.00	1.26	0	0.92	0.05	0.98	1.0	0.052	36.70	54.96	0.082	1.58	0.94	0.25	0.80	1.07	1.0	0.039	3.56	64.99	0.106	3.49	2.54	2	1.283752	15.715	1.5046	18.252
14.764	5601.09	17.1	0.255	17.0	12.7	5.52	1.49%	Sand-Slime Tailing	0.059	119.0	0.73	0.10	0.63	1	1.27	21.529	299.25	25.12	26	1.56%	2.5	47%	1.27	0.00	1.27	0	0.92	0.06	0.98	1.0	0.052	39.11	64.23	0.093	1.79	0.94	0.29	0.80	1.06	1.0	0.039	2.74	68.85	0.110	3.63	2.71	2	1.265666	21.63	2.0708	25.121
14.928	5600.92	15.7	0.220	15.7	4.6	1.99	1.40%	Sand-Slime Tailing	0.059	119.0	0.74	0.11	0.63	1	1.26	19.827	275.59	23.07	24	1.47%	2.5	47%	1.28	0.00	1.28	0	0.92	0.05	0.98	1.0	0.052	38.39	61.46	0.089	1.73	0.94	0.28	0.80	1.06	1.0	0.039	2.84	65.58	0.106	3.47	2.60	2	1.263662	19.863	1.9017	23.070
15.092	5600.76	10.8	0.225	10.8	8.1	3.49	2.08%	Slime Tailings	0.057	113.1	0.75	0.11	0.64	1	1.26	13.623	189.36	15.90	16	2.23%	2.8	71%	1.29	0.00	1.29	0	0.91	0.05	0.98	1.0	0.052	35.62	51.52	0.079	1.52	0.94	0.23	0.80	1.06	1.0	0.039	4.46	70.87	0.113	3.67	2.60	2	1.262592	13.687	1.3104	15.896
15.256	5600.59	23.2	0.308	23.2	2.0	0.87	1.33%	Sand-Slime Tailing	0.059	119.0	0.76	0.12	0.64	1	1.23	28.564	397.04	33.19	35	1.37%	2.4	47%	1.29	0.00	1.29	0	0.91	0.06	0.98	1.0	0.051	41.94	75.14	0.106	2.06	0.94	0.33	0.80	1.06	1.0	0.039	2.14	71.16	0.114	3.66	2.86	2	1.229629	28.58	2.7362	33.194
15.420	5600.43	16.2	0.412	16.2	0.7	0.28	2.55%	Slime Tailings	0.057	113.1	0.77	0.12	0.65	1	1.24	20.096	279.34	23.35	24	2.68%	2.7	71%	1.30	0.00	1.30	0	0.91	0.05	0.98	1.0	0.052	38.22	61.56	0.090	1.74	0.94	0.28	0.80	1.06	1.0	0.039	3.75	87.44	0.142	4.55	3.15	2	1.243568	20.101	1.9245	23.346
15.584	5600.27	12.6	0.274	12.6	2.6	1.12	2.17%	Slime Tailings	0.057	113.1	0.78	0.13	0.65	1	1.24	15.661	217.69	18.21	18	2.32%	2.7	71%	1.31	0.00	1.31	0	0.91	0.05	0.98	1.0	0.052	36.43	54.64	0.082	1.59	0.94	0.25	0.80	1.06	1.0	0.039	4.15	75.50	0.120	3.82	2.71	2	1.242925	15.681	1.5013	18.212
15.748	5600.10	10.3	0.241	10.2	8.8	3.82	2.34%	Slime Tailings	0.057	113.1	0.79	0.13	0.66	1	1.24	12.652	175.86	14.77	14	2.54%	2.8	71%	1.32	0.00	1.32	0	0.91	0.05	0.98	1.0	0.051	35.23	50.01	0.077	1.51	0.94	0.22	0.80	1.06	1.0	0.039	4.99	73.70	0.117	3.71	2.61	2	1.236759	12.72	1.2178	14.774
15.912	5599.94	9.3	0.182	8.8	77.2	33.43	1.96%	Slime Tailings	0.057	113.1	0.80	0.14	0.66	1	1.23	10.854	150.88	13.30	13	2.14%	2.8	71%	1.33	0.00	1.33	0	0.91	0.05	0.98	1.0	0.051	34.72	48.01	0.076	1.47	0.94	0.21	0.80	1.05	1.0	0.039	4.99	66.36	0.107	3.37	2.42	2	1.230662	11.447	1.096	13.295
16.076	5599.77	9.1	0.171	8.6	82.6	35.81	1.87%	Slime Tailings	0.057	113.1	0.81	0.14	0.66	1	1.22	10.569	146.90	13.01	13	2.05%	2.8	71%	1.34	0.00	1.34	0	0.91	0.05	0.98	1.0	0.051	34.62	47.63	0.075	1.47	0.94	0.21	0.80	1.05	1.0	0.039	4.99	64.85	0.105	3.29	2.38	2	1.224633	11.2	1.0723	13.009
16.240	5599.61	10.3	0.119	9.8	84.2	36.48	1.15%	Sand-Slime Tailing	0.059	119.0	0.82	0.15	0.67	1	1.22	11.912	165.58	14.58	14	1.25%	2.7	47%	1.35	0.00	1.35	0	0.91	0.05	0.98	1.0	0.051	35.41	49.99	0.077	1.51	0.94	0.22	0.80	1.05	1.0	0.039	3.76	54.85	0.095	2.96	2.24	2	1.217988	12.552	1.2017	14.578
16.404	5599.45	10.7	0.142	10.3	64.6	28.00	1.33%	Sand-Slime Tailing	0.059	119.0	0.83	0.15	0.67	1	1.21	12.466	173.27	15.05	15	1.44%	2.7	47%	1.36	0.00	1.36	0	0.90	0.05	0.98	1.0	0.051	35.58	50.62	0.078	1.53	0.94	0.22	0.80	1.05	1.0	0.039	3.89	58.50	0.099	3.04	2.29	2	1.211425	12.954	1.2402	15.046
16.568	5599.28	9.7	0.148	9.1	90.7	39.29	1.52%	Sand-Slime Tailing	0.059	119.0	0.84	0.16	0.68	1	1.20	11.013	153.08	13.58	13	1.67%	2.8	47%	1.37	0.00	1.37	0	0.90	0.05	0.98	1.0	0.051	35.07	48.65	0.076	1.49	0.94	0.21	0.80	1.05	1.0	0.039	4.46	60.55	0.101	3.09	2.29	2	1.204942	11.695	1.1197	13.583
16.732	5599.12	11.2	0.142	10.7	72.9	31.59	1.27%	Sand-Slime Tailing	0.059	119.0	0.85	0.16	0.68	1	1.20	12.872	178.92	15.58	15	1.37%	2.7	47%	1.38	0.00	1.38	0	0.90	0.05	0.98	1.0	0.051	35.77	51.35	0.079	1.55	0.94	0.23	0.80	1.05	1.0	0.040	3.73	58.07	0.098	2.99	2.27	2	1.198538	13.418	1.2846	15.584
16.896	5598.95	11.8	0.171	11.3	78.1	33.86	1.45%	Sand-Slime Tailing	0.059	119.0	0.86	0.17	0.69	1	1.19	13.484	187.43	16.34	16	1.56%	2.7	47%	1.39	0.00	1.39	0	0.90	0.05	0.98	1.0	0.051	36.03	52.37	0.080	1.57	0.94	0.23	0.80	1.05	1.0	0.040	3.80	62.13	0.102	3.10	2.33	2	1.19221	14.065	1.3466	16.336
17.060	5598.79	12.0	0.161	11.4	83.5	36.17	1.35%	Sand-Slime Tailing	0.059	119.0	0.87	0.18	0.69	1	1.19	13.567	188.59	16.48	16	1.45%	2.7	47%	1.40	0.00	1.40	0	0.90	0.05	0.98	1.0	0.051	36.08	52.56	0.080	1.58	0.94	0.23	0.80	1.04	1.0	0.040	3.67	60.46	0.101	3.02	2.30	2	1.185959	14.185	1.3581	16.476
17.224	5598.63	12.8	0.164	12.3	73.7	31.95	1.28%	Sand-Slime Tailing	0.059	119.0	0.88	0.18	0.70	1	1.18	14.547	202.20	17.53	17	1.38%	2.6	47%	1.41	0.00	1.41	0	0.90	0.05	0.97	1.0	0.051	36.45	53.97	0.081	1.61	0.94	0.24	0.80	1.04	1.0	0.040	3.44	60.21	0.100	3.00	2.30	2	1.179781	15.09	1.4447	17.526
17.388	5598.46	10.4	0.217	9.9	73.6	31.89	2.09%	Slime Tailings	0.057	113.1	0.89	0.19	0.70	1	1.17	11.637	161.76	14.14	14	2.29%	2.8	71%	1.42	0.00	1.42	0	0.90	0.05	0.98	1.0	0.051	35.01	49.16	0.077	1.52	0.94	0.22	0.80	1.04	1.0	0.040	4.98	70.37	0.112	3.34	2.43	2	1.174304	12.177	1.1658	14.143
17.552	5598.30	9.6	0.305	9.0	98.4	42.63	3.19%	Slime Tailings	0.057	113.1	0.90	0.19	0.71	1	1.17	10.462	145.41	12.98	12	3.52%	3.0	71%	1.43	0.00	1.43	0	0.90	0.05	0.98	1.0	0.051	34.61	47.59	0.075	1.49	0.94	0.21	0.80	1.04	1.0	0.040	6.35	82.50	0.132	3.91	2.70	2	1.168884	11.179	1.0703	12.984
17.716	5598.13	12.3	0.378	11.6	110.0	47.65	3.07%	Slime Tailings	0.057	113.1	0.90	0.20	0.71	1	1.16	13.532	188.09	16.64	16	3.31%	2.9	71%	1.44	0.00	1.44	0	0.89	0.05	0.97	1.0	0.050	35.88	52.53	0.080	1.59	0.94	0.24	0.80	1.04	1.0	0.040	5.27	87.75	0.143	4.20	2.89	2	1.163521	14.33	1.372	16.644
17.880	5597.97	15.9	0.393	15.5	61.9	26.81	2.47%	Slime Tailings	0.057	113.1	0.91	0.20	0.71	1	1.16	17.966	249.73	21.39	21	2.62%	2.7	71%	1.45	0.00	1.45	0	0.89	0.05	0.97	1.0	0.050	37.54	58.92	0.087	1.73	0.94	0.27	0.80	1.04	1.0	0.040	4.01	85.65	0.138	4.05	2.89	2	1.15763	18.413	1.7629	21.386
18.044	5597.81	13.0	0.378	12.5	74.4	32.24	2.91%	Slime Tailings	0.057	113.1	0.92	0.21	0.72	1	1.15	14.435	200.65	17.39	17	3.13%	2.8	71%	1.46	0.00	1.46	0	0.89	0.05	0.97	1.0	0.050	36.14	53.53	0.081	1.61	0.94	0.24	0.80	1.04	1.0	0.040	5.00	87.01	0.141	4.11	2.86	2	1.152961	14.971	1.4333	17.387
18.208	5597.64	15.2	0.346	14.8	53.4	23.14	2.28%	Sand-Slime Tailing	0.059	119.0	0.93	0.21	0.72	1	1.15	17.001	236.31	20.19	20	2.43%	2.7	47%	1.47	0.00	1.47	0	0.89	0.05	0.97	1.0	0.050	37.38	57.57	0.085	1.70	0.94	0.26	0.80	1.04	1.0	0.040	4.03	81.33	0.130	3.76	2.73	2	1.147167	17.384	1.6643	20.190
18.372	5597.48	20.1	0.278	20.0	22.1	9.56	1.38%	Sand-Slime Tailing	0.059	119.0	0.94	0.22	0.73	1	1.13	22.670	315.11	26.51	26	1.45%	2.5	47%	1.48	0.00	1.48	0	0.89	0.06	0.97	1.0	0.050	39.60	66.11	0.095	1.90	0.93	0.30	0.80	1.03	1.0	0.040	2.63	69.61	0.111	3.20	2.55	2	1.134641	22.826	2.1854	26.511
18.537	5597.31	25.1	0.274	25.1	0.0	0.00	1.09%	Sand-Slime Tailing	0.059	119.0	0.95	0.22	0.73	1	1.12	28.232	392.43	32.79	33	1.13%	2.3	47%	1.49	0.00	1.49	0	0.89	0.06	0.97	1.0	0.050	41.80	74.59	0.105	2.12	0.93	0.33	0.80	1.03	1.0	0.040	2.05	67.17	0.108	3.09	2.61	2	1.123003	28.232	2.703	32.790
18.701	5597.15	25.6	0.284	25.6	-1.5	-0.63	1.11%	Sand-Slime Tailing	0.059	119.0	0.96	0.23	0.74	1	1.12	28.599	397.53	33.20	33	1.15%	2.3	47%	1.50	0.00	1.50	0	0.89	0.06	0.97	1.0	0.050	41.95	75.15	0.106	2.14	0.93	0.33	0.80	1.03	1.0	0.040	2.05	68.05	0.109	3.10	2.62	2	1.117594	28.589	2.7371	33.205
18.865	5596.99	26.1	0.274	26.0	4.6	1.98	1.05%	Sand-Slime Tailing	0.059	119.0	0.97	0.23	0.74	1	1.11	28.952	402.43	33.66	34	1.09%	2.3	47%	1.50	0.00	1.50	0	0.89	0.06	0.97	1.0	0.049	42.11	75.77	0.107	2.16	0.93	0.33	0.80	1.03	1.0	0.040	1.99	66.98	0.108	3.05	2.61	2	1.112238	28.983	2.7749	33.662
19.029	5596.82	26.3	0.324	26.2	6.9	2.99	1.23%	Sand-Slime Tailing	0.059	119.0	0.98	0.24	0.75	1	1.11	29.032	403.54	33.77	34	1.28%	2.4	47%	1.51	0.00	1.51	0	0.88	0.06	0.97	1.0	0.049	42.15	75.92	0.107	2.17	0.93	0.34	0.80	1.03	1.0	0.040	2.12	71.66	0.114	3.21	2.69	2	1.107245	29.08	2.7841	33.774
19.193	5596.66	19.7	0.359	19.6	11.6	5.03	1.82%	Sand-Slime Tailing	0.059	119.0	0.99	0.24	0.75	1	1.11	21.744	302.25	25.35	25	1.92%	2.6	47%	1.52	0.00	1.52	0	0.88	0.06	0.97	1.0	0.049	39.19	64.54	0.093	1.88	0.93	0.29	0.80	1.03	1.0	0.040	3.10	78.57	0.125	3.49	2.69	2	1.109408	21.825	2.0895	25.348
19.357	5596.49	17.3	0.409	17.2	10.2	4.42	2.36%	Sand-Slime Tailing	0.059	119.0	1.00	0.25	0.75	1	1.11	19.087	265.31	22.25	22	2.51%	2.7	47%	1.53	0.00	1.53	0	0.88	0.05	0.97	1.0	0.049	38.11	60.36	0.088	1.79	0.93	0.27	0.80	1.03	1.0	0.040	3.85	85.76	0.139	3.85	2.82	2	1.107144	19.158	1.8341	22.250
19.521	5596.33	21.7	0.317	21.6	11.8	5.13	1.46%	Sand-Slime Tailing	0.059	119.0	1.01	0.25	0.76	1	1.10	23.745	330.06	27.67	27	1.53%	2.5	47%	1.54	0.00	1.54	0	0.88	0.06	0.97	1.0	0.049	40.01	67.68	0.097	1.97	0.93	0.30	0.80	1.03	1.0	0.040	2.63	72.87	0.116	3.20	2.58	2	1.09729	23.826	2.2811	27.673
19.685	5596.17	22.7	0.488	22.7	9.2	3.99	2.15%	Sand-Slime Tailing	0.059	119.0	1.02	0.26	0.76	1	1.09	24.734	343.80	28.80	28	2.25%	2.6	47%	1.55	0.00	1.55	0	0.88	0.06	0.97	1.0	0.049	40.40	69.20	0.099	2.01	0.93	0.31	0.80	1.02	1.0	0.040	3.07	88.53	0.145	3.96	2.99	2	1.091531	24.797	2.374	28.800
19.849	5596.00	19.2	0.558	19.2	4.8	2.06	2.91%	Slime Tailings	0.057	113.1	1.03	0.26	0.77	1	1.09	20.883	290.27	24.29	24	3.07%	2.7	71%	1.56	0.00	1.56	0	0.88	0.06	0.97	1.0	0.049	38.55	62.84	0.091	1.86	0.93	0.28	0.80	1.02	1.0	0.040	4.03	97.81	0.167	4.56	3.21	2	1.09049	20.915	2.0024	24.292
20.013	5595.84	17.8	0.580	17.8	9.9	4.27	3.26%	Slime Tailings	0.057	113.1	1.04	0.27	0.77	1	1.09	19.301	268.29	22.49	22	3.46%	2.8	71%	1.57	0.00	1.57	0	0.88	0.05	0.97	1.0	0.049	37.92	60.42	0.088	1.80	0.93	0.27	0.80	1.02	1.0	0.040	4.49	101.07	0.176	4.78	3.29	2	1.087393	19.368	1.8543	22.495
20.177	5595.67	16.5	0.428	16.5	3.3	1.42	2.59%	Slime Tailings	0.057	113.1	1.05	0.27	0.78	1	1.08	17.865	248.32	20.77	20	2.77%	2.7	71%	1.58	0.00	1.58	0	0.87	0.05	0.97	1.0	0.049	37.32	58.10	0.086	1.75	0.93	0.26	0.80	1.02	1.0	0.040	4.25	88.39	0.144	3.90	2.82	2	1.084035	17.887	1.7125	20.775
20.341	5595.51	16.1	0.364	15.8	46.6	20.19	2.26%	Sand-Slime Tailing	0.059	119.0	1.06	0.28	0.78	1	1.08	17.027	236.67	20.14	19	2.42%	2.7	47%	1.59	0.00	1.59	0	0.87	0.05	0.97	1.0	0.049	37.36	57.50	0.085	1.74	0.93	0.26	0.80	1.02	1.0	0.040	4.08	82.25	0.132	3.54	2.64	2	1.078998	17.34	1.6602	20.140
20.505	5595.35	17.0	0.387	16.6	69.6	30.17	2.27%	Sand-Slime Tailing	0.059	119.0	1.07	0.28	0.79	1	1.07	17.836	247.93	21.26	20	2.42%	2.7	47%	1.60	0.00	1.60	0	0.87	0.05	0.97	1.0	0.049	37.76	59.02	0.087	1.78	0.93	0.27	0.80	1.02	1.0	0.040	3.94	83.73	0.135	3.60	2.69	2	1.073838	18.303	1.7524	21.258
20.669	5595.18	17.8	0.559	17.1	110.3	47.80	3.15%	Slime Tailings	0.057	113.1	1.08	0.29	0.79	1	1.07	18.247	253.63	22.05	21	3.35%	2.8	71%	1.61	0.00	1.61	0	0.87	0.05	0.97	1.0	0.049	37.77	59.81	0.088	1.80	0.93	0.27	0.80	1.02	1.0	0.040	4.50	99.19	0.171	4.55	3.18	2	1.068928	18.983	1.8174	22.047
20.833	5595.02	20.8	0.452	20.2	105.5	45.73	2.17%	Sand-Slime Tailing	0.059	119.0	1.09	0.29	0.79	1	1.06	21.444	298.07	25.72	25	2.29%	2.6	47%	1.62	0.00	1.62	0	0.87	0.06	0.96	1.0	0.048	39.32	65.04	0.094	1.93	0.93	0.29	0.80	1.02	1.0	0.040	3.37	86.69	0.141	3.73	2.83	2	1.062097	22.143	2.12	25.718
20.997	5594.85	32.5	0.419	32.2	39.9	17.27	1.29%	Sand-Slime Tailing	0.059	119.0	1.10	0.30	0.80	1	1.05	33.912	471.38	39.69	39	1.33%	2.3	47%	1.63	0.00	1.63	0	0.87	0.06	0.96	1.0	0.048	44.22	83.91	0.118	2.45	0.93	0.36	0.80	1.01	1.0	0.040	1.98	78.44	0.125	3.30	2.88	2	1.051875	34.174	3.2718	39.691
21.161	5594.69	30.5	0.438	30.5	-5.4	-2.35	1.44%	Sand-Slime Tailing	0.059	119.0	1.11	0.30	0.80	1	1.05	32.002	444.83	37.13	37	1.49%	2.4	47%	1.64	0.00	1.64	0	0.87	0.06	0.96	1.0	0.048	43.32	80.45	0.113	2.36	0.92	0.35	0.80	1.01	1.0	0.040	2.16	80.34	0.128	3.37	2.86	2	1.048569	31.967	3.0605	37.128
21.325	5594.52	26.6	0.429	26.6	10.9	4.71	1.61%	Sand-Slime Tailing	0.059	119.0	1.12	0.31	0.81	1	1.05	27.780	386.14	32.35	32	1.68%	2.4	47%	1.65	0.00	1.65	0	0.87	0.06	0.96	1.0	0.048	41.65	73.99	0.105	2.18	0.92	0.33	0.80	1.01	1.0	0.040	2.50	80.95	0.129	3.39	2.78	2	1.045923	27.851	2.6664	32.347
21.489	5594.36	31.3	0.445	31.2	10.5	4.56	1.42%	Sand-Slime Tailing	0.059	119.0	1.13	0.31	0.81	1	1.04	32.472	451.36	37.79	37	1.48%	2.4	47%	1.66	0.00	1.66	0	0.86	0.06	0.96	1.0	0.048	43.56	81.35	0.114	2.39	0.92	0.35	0.80	1.01	1.0	0.040	2.13	80.68	0.129	3.36	2.87	2	1.0401	32.54	3.1154	37.794
21.653	5594.20	33.9	0.558	33.9	8.4	3.65	1.64%	Sand-Slime Tailing	0.059	119.0	1.14	0.32	0.82	1	1.04	35.087	487.71	40.81	40	1.70%	2.4	47%	1.67	0.00	1.67	0	0.86	0.07	0.96	1.0	0.048	44.62	85.43	0.120	2.52	0.92	0.37	0.80	1.01	1.0	0.040	2.17	88.64	0.145	3.76	3.14	2	1.035325	35.142	3.3645	40.815
21.817	5594.03	28.7	0.579	28.7	11.6	5.03	2.01%	Sand-Slime Tailing	0.059	119.0	1.15	0.32	0.82	1	1.03	29.609	411.56	34.48	34	2.10%	2.5	47%	1.68	0.00	1.68	0	0.86	0.06	0.96	1.0	0.048	42.39	76.87	0.108	2.27	0.92	0.34	0.80	1.01	1.0	0.040	2.68	92.26	0.153	3.96	3.11	2	1.032743	29.684	2.8419	34.476
21.981	5593.87	32.2	0.577	32.1	12.6	5.46	1.79%	Sand-Slime Tailing	0.059	119.0	1.16	0.33	0.83	1	1.03	33.006	458.78	38.43	38	1.86%	2.4	47%	1.69	0.00	1.69	0	0.86	0.06	0.96	1.0	0.048	43.78	82.21	0.116	2.43	0.92	0.36	0.80	1.01	1.0	0.040	2.36	90.58	0.149	3.84	3.13	2	1.0279	33.087	3.1677	38.428
22.145	5593.70	31.5	0.519	31.4	11.5	4.97	1.65%	Sand-Slime Tailing	0.059	119.0	1.17	0.33	0.83	1	1.02	32.168	447.13	37.45	36	1.71%	2.4	47%	1.70	0.00	1.70	0	0.86	0.06	0.96	1.0	0.048	43.43	80.88	0.114	2.40	0.92	0.35	0.80	1.01	1.0	0.040	2.31	86.41	0.140	3.59	2.99	2	1.024123	32.241	3.0868	37.446
22.309	5593.54	38.3	0.405	38.2	9.8	4.23	1.06%	Sand-Slime Tailing	0.059	119.0	1.18	0.34	0.84	1	1.02	38.964	541.60	45.33	44	1.09%	2.2	47%	1.71	0.00	1.71	0	0.86	0.07	0.95	1.0	0.047	46.20	91.53	0.129	2.73	0.91	0.39	0.80	1.01	1.0	0.040	1.70	77.22	0.123	3.14	2.93	2	1.019209	39.027	3.7364	45.327
22.473	5593.38	36.9	0.465	36.9	8.3	3.58	1.26%	Sand-Slime Tailing	0.059	119.0	1.18	0.34	0.84	1	1.02	37.469	520.81	43.58	43	1.30%	2.3	47%	1.72	0.00	1.72	0	0.86	0.07	0.95	1.0	0.047	45.59	89.16	0.126	2.66	0.91	0.38	0.80	1.00	1.0	0.040	1.87	81.40	0.130	3.31	2.99	2	1.015682	37.521	3.5923	43.578
22.638	5593.21	38.4	0.519	38.4	9.0	3.91	1.35%	Sand-Slime Tailing	0.059	119.0	1.19	0.35	0.85	1	1.01	38.805	539.39	45.14	44	1.39%	2.3	47%	1.73	0.00	1.73	0	0.85	0.07	0.95	1.0	0.047	46.13	91.27	0.129	2.74	0.91	0.39	0.80	1.00	1.0	0.040	1.89	85.12	0.137	3.48	3.11	2	1.011867	38.862	3.7207	45.136
22.802	5593.05	41.4	0.519	41.3	10.3	4.46	1.25%	Sand-Slime Tailing	0.059	119.0	1.20	0.35	0.85	1	1.01	41.633	578.70	48.43	47	1.29%	2.2	47%	1.74	0.00	1.74	0	0.85	0.07	0.95	1.0	0.047	47.29	95.72	0.136	2.89	0.91	0.40	0.80	1.00	1.0	0.040	1.76	85.15	0.137	3.47	3.18	2	1.008074	41.698	3.9922	48.430
22.966	5592.88	42.6	0.493	42.5	9.8	4.23	1.16%	Sand-Slime Tailing	0.059	119.0	1.21	0.36	0.85	1	1.00	42.702	593.55	49.67	48	1.19%	2.2	47%	1.75	0.00	1.75	0	0.85	0.07	0.95	1.0	0.047	47.72	97.39	0.138	2.96	0.91	0.41	0.80	1.00	1.0	0.040	1.68	83.56	0.134	3.37	3.16	2	1.004512	42.763	4.0941	49.667
23.130	5592.72	41.6	0.532	41.6	11.5	4.97	1.28%	Sand-Slime Tailing	0.059	119.0	1.22	0.36	0.86	1	1.00	41.593	578.15	48.39	47	1.32%	2.2	47%	1.76	0.00	1.76	0	0.85	0.07	0.95	1.0	0.047	47.27	95.66	0.136	2.90	0.91	0.40	0.80	1.00	1.0	0.040	1.78	85.96	0.139	3.48	3.19	2	1.001047	41.665	3.989	48.392
23.294	5592.56	42.3	0.534	42.2	13.1	5.66	1.26%	Sand-Slime Tailing	0.059	119.0	1.23	0.37	0.86	1	1.00	42.088	585.03	48.98	47	1.30%	2.2	47%	1.77	0.00	1.77	0	0.85	0.07	0.95	1.0	0.047	47.48	96.46	0.137	2.93	0.91	0.40	0.80	1.00	1.0	0.040	1.76	86.10	0.139	3.47	3.20	2	0.997587	42.169	4.0373	48.977
23.458	5592.39	47.2	0.593	47.2	13.5	5.86	1.26%	Sand-Slime Tailing	0.059	119.0	1.24	0.37	0.87	1	0.99	46.893	651.82	54.56	53	1.29%	2.2	47%	1.78	0.00	1.78	0	0.85	0.07	0.95	1.0	0.046	49.44	104.00	0.149	3.22	0.91	0.43	0.79	1.00	1.0	0.040	1.66	90.30	0.148	3.69	3.45	2	0.994344	46.977	4.4976	54.561
23.622	5592.23	49.1	0.674	49.0	13.7	5.94	1.37%	Sand-Slime Tailing	0.059	119.0	1.25	0.38	0.87	1	0.99	48.576	675.21	56.52	55	1.41%	2.2	47%	1.79	0.00	1.79	0	0.85	0.08	0.95	1.0	0.046	50.12	106.64	0.154	3.32	0.90	0.43	0.78	1.00	1.0	0.040	1.68	95.21	0.160	3.96	3.64	2	0.99115	48.661	4.6588	56.517
23.786	5592.06	47.0	0.774	46.9	14.2	6.14	1.65%	Sand-Slime Tailing	0.059	119.0	1.26	0.38	0.88	1	0.99	46.335	644.06	53.92	52	1.69%	2.3	47%	1.80	0.00	1.80	0	0.85	0.07	0.95	1.0	0.046	49.21	103.13	0.148	3.20	0.90	0.42	0.79	1.00	1.0	0.040	1.87	100.76	0.175	4.31	3.76	2	0.987748	46.423	4.4445	53.917
23.950	5591.90	41.4	0.772	41.4	13.6	5.88	1.86%	Sand-Slime Tailing	0.059	119.0	1.27	0.39	0.88	1	0.98	40.695	565.65	47.36	46	1.92%	2.4	47%	1.81	0.00	1.81	0	0.84	0.07	0.95	1.0	0.046	46.91	94.27	0.133	2.88	0.90	0.40	0.80	1.00	1.0	0.040	2.14	101.19	0.176	4.33	3.61	2	0.983912	40.778	3.9041	47.361

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W6-S

Data File: 13-52106_SP2W6-S-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3 Field Data\2013 Field Investigation\Conetec Da

Legend:
- Tailings Sands
- Tailings Sand-Slimes
- Tailings Slimes
- Interim Cover
- Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69

Youd, et al (2001)		
Max. Horiz. Acceleration, Amax/g:	0.15	
Earthquake Moment Magnitude, M:	5.5	
Magnitude Scaling Factor, MSF:	2.21	2.21

5604.40	Water surface elevation during CPT investigation (f
5604.40	Water surface elevation at t_0 (ft amsl)
5588.59	Water surface elevation at t_1 (ft amsl)
5583.59	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Ear
7.51	Equiv. Number of Uniform Strain Cycles, N

5615.85	Ground Surface Elevation at time of CPT (ft amsl)
5625.41	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pl
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
1.56	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1065.26	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5583.59	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	######	5625.16	5624.91	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	######	5623.16	5621.41	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5619.41	5617.41	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334
Platform/Random Fill Layer	######	5616.63	5615.85	1.56	0.050	101	0.533	0.493	0.00	0.00	0.533	0.493

2013 CPT Data from ConeTec / CPT Data Interpretations

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No
24.114	5591.74	41.1	0.727	41.0	13.4	5.82	1.77%	Sand-Slime Tailing	0.059	119.0	1.28	0.40	0.89	1
24.278	5591.57	37.0	0.661	36.9	13.4	5.82	1.79%	Sand-Slime Tailing	0.059	119.0	1.29	0.40	0.89	1
24.442	5591.41	32.5	0.603	32.4	13.5	5.86	1.85%	Sand-Slime Tailing	0.059	119.0	1.30	0.41	0.90	1
24.606	5591.24	31.6	0.528	31.5	13.5	5.86	1.67%	Sand-Slime Tailing	0.059	119.0	1.31	0.41	0.90	1
24.770	5591.08	31.6	0.507	31.5	15.0	6.51	1.60%	Sand-Slime Tailing	0.059	119.0	1.32	0.42	0.91	1
24.934	5590.92	32.8	0.414	32.7	16.5	7.16	1.26%	Sand-Slime Tailing	0.059	119.0	1.33	0.42	0.91	1
25.098	5590.75	34.3	0.437	34.2	17.3	7.49	1.27%	Sand-Slime Tailing	0.059	119.0	1.34	0.43	0.92	1
25.262	5590.59	36.0	0.512	35.9	14.2	6.17	1.42%	Sand-Slime Tailing	0.059	119.0	1.35	0.43	0.92	1
25.426	5590.42	41.3	0.688	41.2	15.1	6.55	1.67%	Sand-Slime Tailing	0.059	119.0	1.36	0.44	0.92	1
25.590	5590.26	34.2	0.767	34.1	15.3	6.63	2.24%	Sand-Slime Tailing	0.059	119.0	1.37	0.44	0.93	1
25.754	5590.10	26.7	0.796	26.6	16.0	6.92	2.98%	Slime Tailings	0.057	113.1	1.38	0.45	0.93	1
25.918	5589.93	29.3	0.592	29.2	15.0	6.51	2.02%	Sand-Slime Tailing	0.059	119.0	1.39	0.45	0.94	1
26.082	5589.77	35.4	0.454	35.3	14.3	6.19	1.28%	Sand-Slime Tailing	0.059	119.0	1.40	0.46	0.94	1
26.246	5589.60	36.2	0.371	36.2	3.2	1.39	1.02%	Sand-Slime Tailing	0.059	119.0	1.41	0.46	0.95	1
26.410	5589.44	36.1	0.419	36.1	4.6	1.98	1.16%	Sand-Slime Tailing	0.059	119.0	1.42	0.47	0.95	1
26.574	5589.28	33.9	0.531	33.8	12.8	5.56	1.57%	Sand-Slime Tailing	0.059	119.0	1.43	0.47	0.96	1
26.739	5589.11	36.3	0.568	36.2	16.5	7.16	1.57%	Sand-Slime Tailing	0.059	119.0	1.44	0.48	0.96	1
26.903	5588.95	38.8	0.595	38.7	16.5	7.16	1.53%	Sand-Slime Tailing	0.059	119.0	1.45	0.48	0.97	1
27.067	5588.78	39.4	0.647	39.3	18.0	7.81	1.64%	Sand-Slime Tailing	0.059	119.0	1.46	0.49	0.97	1
27.231	5588.62	40.3	0.712	40.2	20.4	8.83	1.77%	Sand-Slime Tailing	0.059	119.0	1.47	0.49	0.98	1
27.395	5588.46	41.4	0.723	41.3	21.0	9.12	1.75%	Sand-Slime Tailing	0.059	119.0	1.48	0.50	0.98	1
27.559	5588.29	42.9	0.670	42.8	19.2	8.30	1.56%	Sand-Slime Tailing	0.059	119.0	1.49	0.50	0.98	1
27.723	5588.13	42.3	0.619	42.2	18.1	7.86	1.46%	Sand-Slime Tailing	0.059	119.0	1.50	0.51	0.99	1
27.887	5587.96	42.4	0.626	42.2	20.2	8.77	1.48%	Sand-Slime Tailing	0.059	119.0	1.51	0.51	0.99	1
28.051	5587.80	39.8	0.634	39.7	20.9	9.07	1.59%	Sand-Slime Tailing	0.059	119.0	1.52	0.52	1.00	1
28.215	5587.64	43.4	0.590	43.3	19.6	8.48	1.36%	Sand-Slime Tailing	0.059	119.0	1.53	0.52	1.00	1
28.379	5587.47	44.3	0.552	44.2	15.3	6.61	1.25%	Sand-Slime Tailing	0.059	119.0	1.54	0.53	1.01	1
28.543	5587.31	44.6	0.539	44.5	16.5	7.16	1.21%	Sand-Slime Tailing	0.059	119.0	1.55	0.53	1.01	1
28.707	5587.14	45.4	0.570	45.2	18.3	7.93	1.26%	Sand-Slime Tailing	0.059	119.0	1.56	0.54	1.02	1
28.871	5586.98	47.7	0.530	47.6	19.4	8.39	1.11%	Sand Tailings	0.062	123.5	1.57	0.54	1.02	1
29.035	5586.81	50.3	0.530	50.2	19.4	8.42	1.05%	Sand Tailings	0.062	123.5	1.58	0.55	1.03	1
29.199	5586.65	52.6	0.530	52.4	18.7	8.10	1.01%	Sand Tailings	0.062	123.5	1.59	0.55	1.03	1

CPT Data Interpretations (continued) / Conditions at t_1

Depth at time of CPT (ft)	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
24.114	0.98	40.240	559.34	46.83	45	1.82%	2.3	47%	1.82	0.00	1.82	0
24.278	0.98	36.033	500.86	41.95	40	1.85%	2.4	47%	1.82	0.00	1.82	0
24.442	0.97	31.538	438.38	36.73	35	1.93%	2.4	47%	1.83	0.00	1.83	0
24.606	0.97	30.546	424.59	35.57	34	1.74%	2.4	47%	1.84	0.00	1.84	0
24.770	0.97	30.436	423.06	35.45	33	1.67%	2.4	47%	1.85	0.00	1.85	0
24.934	0.96	31.433	436.92	36.62	35	1.32%	2.4	47%	1.86	0.00	1.86	0
25.098	0.96	32.804	455.97	38.22	36	1.33%	2.3	47%	1.87	0.00	1.87	0
25.262	0.96	34.352	477.49	40.00	38	1.48%	2.3	47%	1.88	0.00	1.88	0
25.426	0.95	39.342	546.86	45.80	43	1.72%	2.3	47%	1.89	0.00	1.89	0
25.590	0.95	32.336	449.47	37.66	35	2.34%	2.5	47%	1.90	0.00	1.90	0
25.754	0.94	25.105	348.96	29.27	27	3.14%	2.7	71%	1.91	0.00	1.91	0
25.918	0.94	27.443	381.46	31.98	30	2.12%	2.5	47%	1.92	0.00	1.92	0
26.082	0.94	33.177	461.16	38.63	36	1.34%	2.3	47%	1.93	0.00	1.93	0
26.246	0.94	33.911	471.36	39.41	37	1.07%	2.3	47%	1.94	0.00	1.94	0
26.410	0.93	33.729	468.84	39.21	36	1.21%	2.3	47%	1.95	0.00	1.95	0
26.574	0.93	31.447	437.12	36.61	34	1.63%	2.4	47%	1.96	0.00	1.96	0
26.739	0.93	33.570	466.63	39.10	36	1.63%	2.4	47%	1.97	0.00	1.97	0
26.903	0.93	35.865	498.52	41.77	39	1.59%	2.4	47%	1.98	0.00	1.98	0
27.067	0.92	36.285	504.36	42.26	39	1.70%	2.4	47%	1.99	0.00	1.99	0
27.231	0.92	37.005	514.36	43.11	40	1.83%	2.4	47%	2.00	0.00	2.00	0
27.395	0.92	37.919	527.07	44.18	41	1.81%	2.4	47%	2.01	0.00	2.01	1
27.559	0.92	39.157	544.29	45.61	42	1.62%	2.3	47%	2.02	0.01	2.01	1
27.723	0.91	38.500	535.15	44.84	41	1.52%	2.3	47%	2.03	0.01	2.01	1
27.887	0.91	38.435	534.24	44.77	41	1.53%	2.3	47%	2.04	0.02	2.02	1
28.051	0.91	35.941	499.57	41.88	38	1.66%	2.4	47%	2.05	0.02	2.02	1
28.215	0.90	39.142	544.07	45.59	42	1.41%	2.3	47%	2.06	0.03	2.03	1
28.379	0.90	39.911	554.76	46.45	42	1.29%	2.3	47%	2.07	0.03	2.03	1
28.543	0.90	40.085	557.18	46.66	43	1.25%	2.3	47%	2.08	0.04	2.04	1
28.707	0.90	40.610	564.48	47.29	43	1.30%	2.3	47%	2.09	0.05	2.04	1
28.871	0.90	42.658	592.95	49.67	45	1.15%	2.2	18%	2.10	0.05	2.05	1
29.035	0.89	44.933	624.57	52.31	47	1.09%	2.2	18%	2.11	0.06	2.05	1
29.199	0.89	46.851	651.23	54.54	49	1.04%	2.2	18%	2.12	0.06	2.06	1

Liquefaction Triggering Analyses

Depth at time of CPT (ft)	Idriss & Boulanger (2008) Cyclic Stress Ratio r_d	C_σ	K_σ	K_a	CSR M=7.5, s'v=1atm	Cyclic Resistance Ratio Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Youd et al. (2001) Cyclic Stress Ratio r_d	D_r	f	K_σ	K_a	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No
24.114	0.84	0.07	0.95	1.0	0.046	46.73	93.56	0.132	2.86	0.90	0.40	0.80	0.99	1.0	0.040	2.10	98.40	0.169	4.12	3.49	2
24.278	0.84	0.07	0.95	1.0	0.046	45.01	86.96	0.122	2.65	0.90	0.37	0.80	0.99	1.0	0.040	2.26	94.94	0.160	3.89	3.27	2
24.442	0.84	0.06	0.95	1.0	0.046	43.18	79.91	0.113	2.43	0.90	0.35	0.80	0.99	1.0	0.040	2.51	92.27	0.153	3.71	3.07	2
24.606	0.84	0.06	0.95	1.0	0.046	42.78	78.35	0.110	2.39	0.90	0.34	0.80	0.99	1.0	0.040	2.44	86.95	0.141	3.41	2.90	2
24.770	0.84	0.06	0.95	1.0	0.046	42.74	78.19	0.110	2.39	0.89	0.34	0.80	0.99	1.0	0.040	2.41	85.32	0.138	3.32	2.85	2
24.934	0.84	0.06	0.95	1.0	0.046	43.15	79.77	0.112	2.44	0.89	0.35	0.80	0.99	1.0	0.040	2.12	77.71	0.124	2.97	2.71	2
25.098	0.83	0.06	0.95	1.0	0.046	43.71	81.93	0.115	2.51	0.89	0.36	0.80	0.99	1.0	0.040	2.07	79.27	0.126	3.02	2.77	2
25.262	0.83	0.06	0.95	1.0	0.046	44.33	84.32	0.119	2.60	0.89	0.37	0.80	0.99	1.0	0.040	2.12	84.60	0.136	3.25	2.92	2
25.426	0.83	0.07	0.95	1.0	0.045	46.36	92.16	0.130	2.86	0.89	0.39	0.80	0.99	1.0	0.040	2.09	95.76	0.162	3.84	3.35	2
25.590	0.83	0.06	0.95	1.0	0.046	43.51	81.17	0.114	2.51	0.89	0.35	0.80	0.98	1.0	0.040	2.74	103.10	0.182	4.31	3.41	2
25.754	0.83	0.06	0.95	1.0	0.046	40.28	69.55	0.099	2.17	0.89	0.31	0.80	0.98	1.0	0.040	3.74	109.38	0.202	4.76	3.46	2
25.918	0.83	0.06	0.95	1.0	0.046	41.52	73.49	0.104	2.28	0.89	0.33	0.80	0.98	1.0	0.040	2.90	92.83	0.154	3.63	2.96	2
26.082	0.83	0.06	0.95	1.0	0.045	43.85	82.48	0.116	2.56	0.88	0.36	0.80	0.98	1.0	0.040	2.08	80.35	0.128	3.01	2.78	2
26.246	0.82	0.06	0.95	1.0	0.045	44.12	83.53	0.118	2.60	0.88	0.36	0.80	0.98	1.0	0.040	1.88	73.99	0.118	2.75	2.67	2
26.410	0.82	0.06	0.95	1.0	0.045	44.05	83.26	0.117	2.60	0.88	0.36	0.80	0.98	1.0	0.040	1.98	77.62	0.123	2.87	2.74	2
26.574	0.82	0.06	0.95	1.0	0.045	43.14	79.75	0.112	2.49	0.88	0.35	0.80	0.98	1.0	0.040	2.36	86.38	0.140	3.25	2.87	2
26.739	0.82	0.06	0.95	1.0	0.045	44.01	83.12	0.117	2.60	0.88	0.36	0.80	0.98	1.0	0.040	2.26	88.48	0.144	3.34	2.97	2
26.903	0.82	0.07	0.95	1.0	0.045	44.95	86.72	0.122	2.73	0.88	0.37	0.80	0.98	1.0	0.040	2.15	89.86	0.147	3.40	3.06	2
27.067	0.82	0.07	0.94	1.0	0.045	45.12	87.39	0.123	2.76	0.88	0.38	0.80	0.98	1.0	0.040	2.21	93.25	0.155	3.57	3.16	2
27.231	0.82	0.07	0.94	1.0	0.045	45.42	88.54	0.125	2.80	0.87	0.38	0.80	0.98	1.0	0.040	2.26	97.33	0.166	3.80	3.30	2
27.395	0.82	0.07	0.94	1.0	0.045	45.80	89.98	0.127	2.85	0.87	0.38	0.80	0.97	1.0	0.040	2.21	97.80	0.167	3.80	3.33	2
27.559	0.81	0.07	0.94	1.0	0.045	46.30	91.90	0.130	2.91	0.87	0.39	0.80	0.97	1.0	0.040	2.07	94.21	0.158	3.57	3.24	2
27.723	0.81	0.07	0.94	1.0	0.045	46.03	90.86	0.128	2.88	0.87	0.39	0.80	0.97	1.0	0.040	2.03	90.98	0.150	3.38	3.13	2
27.887	0.81	0.07	0.94	1.0	0.045	46.00	90.78	0.128	2.87	0.87	0.39	0.80	0.97	1.0	0.040	2.04	91.41	0.151	3.38	3.13	2
28.051	0.81	0.07	0.94	1.0	0.045	44.99	86.87	0.122	2.74	0.87	0.37	0.80	0.97	1.0	0.040	2.20	92.24	0.153	3.41	3.07	2
28.215	0.81	0.07	0.94	1.0	0.045	46.29	91.88	0.130	2.91	0.87	0.39	0.80	0.97	1.0	0.040	1.95	89.01	0.146	3.22	3.07	2
28.379	0.81	0.07	0.94	1.0	0.045	46.59	93.05	0.132	2.95	0.87	0.39	0.80	0.97	1.0	0.040	1.86	86.56	0.140	3.09	3.02	2
28.543	0.81	0.07	0.94	1.0	0.045	46.67	93.33	0.132	2.95	0.86	0.39	0.80	0.97	1.0	0.040	1.84	85.72	0.139	3.04	3.00	2
28.707	0.80	0.07	0.94	1.0	0.045	46.89	94.17	0.133	2.98	0.86	0.40	0.80	0.97	1.0	0.040	1.85	87.70	0.143	3.11	3.05	2
28.871	0.80	0.07	0.94	1.0	0.045	34.79	84.46	0.119	2.66	0.86	0.41	0.80	0.97	1.0	0.040	1.72	85.44	0.138	2.99	2.83	2
29.035	0.80	0.07	0.94	1.0	0.045	35.46	87.78	0.124	2.77	0.86	0.42	0.79	0.96	1.0	0.040	1.64	85.89	0.139	2.99	2.88	2
29.199	0.80	0.07	0.94	1.0	0.045	36.03	90.57	0.128	2.87	0.86	0.43	0.79	0.96	1.0	0.041	1.58	86.40	0.140	3.00	2.93	2

Idriss & Boulanger (2008)

Depth at time of CPT (ft)	CN	qc1 TSF	qc1 MPa	qc1N
24.114	0.980512	40.322	3.8605	46.832
24.278	0.976508	36.115	3.4576	41.945
24.442	0.972208	31.62	3.0273	36.725
24.606	0.968496	30.628	2.9323	35.573
24.770	0.965	30.527	2.9226	35.455
24.934	0.961855	31.533	3.0189	36.623
25.098	0.958897	32.907	3.1505	38.220
25.262	0.956072	34.437	3.297	39.996
25.426	0.954444	39.432	3.7752	45.798
25.590	0.94883	32.427	3.1045	37.662
25.754	0.942728	25.199	2.4125	29.267
25.918	0.940474	27.531	2.6358	31.976
26.082	0.939859	33.261	3.1844	38.630
26.246	0.937013	33.929	3.2484	39.407
26.410	0.933816	33.756	3.2318	39.206
26.574	0.929574	31.522	3.0179	36.611
26.739	0.92761	33.666	3.2232	39.101
26.903	0.92579	35.961	3.4429	41.766
27.067	0.923048	36.389	3.4839	42.264
27.231	0.920512	37.122	3.554	43.115
27.395	0.918124	38.039	3.6419	44.180
27.559	0.91596	39.267	3.7594	45.606
27.723	0.912754	38.603	3.6959	44.835
27.887	0.909913	38.55	3.6907	44.773
28.051	0.905532	36.059	3.4523	41.880
28.215	0.904807	39.253	3.758	45.589
28.379	0.902555	39.997	3.8293	46.454
28.543	0.899974	40.178	3.8466	46.664
28.707	0.897657	40.713	3.8978	47.285
28.871	0.896182	42.767	4.0945	49.671
29.035	0.894898	45.041	4.3123	52.313
29.199	0.893422	46.955	4.4955	54.536

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W7-C

Data File: 13-52106_SP2W7-C-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Parameter
5613.10	Water surface elevation during CPT investigation (f
5611.32	Water surface elevation at t_0 (ft amsl)
5595.40	Water surface elevation at t_1 (ft amsl)
5590.40	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Ea
7.51	Equiv. Number of Uniform Strain Cycles, N
5619.60	Ground Surface Elevation at time of CPT (ft amsl)
5626.65	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pl
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
-0.95	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
812.44	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5590.40	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	######	5626.4	5626.15	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	######	5624.4	5622.65	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5620.65	5618.65	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334
Platform/Random Fill Layer	######	5619.13	5619.60	-0.95	0.050	101	0.406	0.430	0.00	0.00	0.406	0.430

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
0.164	5619.44	37.3	0.106	37.3	3.0	1.31	0.28%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0	1.70	63.359	880.69	73.63	4513	0.28%	0.7	51%	0.41	0.00	0.41	0
0.328	5619.27	49.3	0.150	49.3	3.1	1.34	0.30%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	83.827	######	97.40	2985	0.30%	0.7	51%	0.42	0.00	0.42	0
0.492	5619.11	59.2	0.224	59.1	4.5	1.95	0.38%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	100.521	######	116.80	2386	0.38%	0.8	51%	0.43	0.00	0.43	0
0.656	5618.94	63.9	0.317	63.8	2.3	0.98	0.50%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0	1.70	108.528	######	126.08	1931	0.50%	0.9	51%	0.44	0.00	0.44	0
0.820	5618.78	65.3	0.442	65.3	2.3	1.01	0.68%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0	1.70	110.925	######	128.86	1579	0.68%	1.1	51%	0.45	0.00	0.45	0
0.984	5618.62	74.0	0.500	74.0	6.1	2.66	0.68%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0	1.70	125.766	######	146.15	1492	0.68%	1.1	51%	0.46	0.00	0.46	0
1.148	5618.45	70.5	0.458	70.5	1.5	0.67	0.65%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0	1.70	119.799	######	139.16	1218	0.65%	1.1	51%	0.46	0.00	0.46	0
1.312	5618.29	76.0	0.403	76.0	0.8	0.34	0.53%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	129.234	######	150.11	1149	0.53%	1.0	51%	0.47	0.00	0.47	0
1.476	5618.12	71.1	0.468	71.1	3.0	1.32	0.66%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	120.887	######	140.44	956	0.66%	1.1	51%	0.48	0.00	0.48	0
1.640	5617.96	69.3	0.535	69.3	1.0	0.42	0.77%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0	1.70	117.742	######	136.76	837	0.77%	1.2	51%	0.49	0.00	0.49	0
1.804	5617.80	67.9	0.630	67.9	1.5	0.63	0.93%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0	1.70	115.362	######	134.00	746	0.93%	1.3	51%	0.50	0.00	0.50	0
1.968	5617.63	62.3	0.676	62.3	2.1	0.91	1.08%	Interim Cover	0.050	100.7	0.10	0.00	0.10	0	1.70	105.927	######	123.05	628	1.09%	1.4	51%	0.51	0.00	0.51	0
2.133	5617.47	58.0	0.590	58.0	0.7	0.30	1.02%	Interim Cover	0.050	100.7	0.11	0.00	0.11	0	1.70	98.566	######	114.49	539	1.02%	1.4	51%	0.51	0.00	0.51	0
2.297	5617.30	56.9	0.428	56.9	1.5	0.65	0.75%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	96.730	######	112.36	491	0.75%	1.3	51%	0.52	0.00	0.52	0
2.461	5617.14	58.9	0.597	58.9	2.3	0.99	1.01%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	100.062	######	116.24	474	1.02%	1.5	51%	0.53	0.00	0.53	0
2.625	5616.98	67.5	0.562	67.5	1.5	0.63	0.83%	Interim Cover	0.050	100.7	0.13	0.00	0.13	0	1.70	114.801	######	133.35	510	0.83%	1.4	51%	0.54	0.00	0.54	0
2.789	5616.81	68.3	0.681	68.3	1.1	0.49	1.00%	Interim Cover	0.050	100.7	0.14	0.00	0.14	0	1.70	116.076	######	134.83	485	1.00%	1.4	51%	0.55	0.00	0.55	0
2.953	5616.65	72.4	0.913	72.4	0.1	0.04	1.26%	Interim Cover	0.050	100.7	0.15	0.00	0.15	0	1.70	123.114	######	142.99	486	1.26%	1.5	51%	0.55	0.00	0.55	0
3.117	5616.48	67.6	0.613	67.6	0.1	0.04	0.91%	Interim Cover	0.050	100.7	0.16	0.00	0.16	0	1.70	114.869	######	133.41	429	0.91%	1.4	51%	0.56	0.00	0.56	0
3.281	5616.32	81.3	2.130	81.3	-0.3	-0.12	2.62%	Sand-Slime Tailin	0.047	93.3	0.16	0.00	0.16	0	1.70	138.261	######	160.58	493	2.62%	1.8	47%	0.57	0.00	0.57	0
3.445	5616.16	80.0	1.732	79.9	8.4	3.65	2.17%	Sand-Slime Tailin	0.047	93.3	0.17	0.00	0.17	0	1.70	135.864	######	157.90	463	2.17%	1.8	47%	0.58	0.00	0.58	0
3.609	5615.99	65.9	1.776	65.8	3.9	1.68	2.70%	Sand-Slime Tailin	0.047	93.3	0.18	0.00	0.18	0	1.70	111.911	######	130.03	365	2.70%	1.9	47%	0.59	0.00	0.59	0
3.773	5615.83	50.8	1.506	50.8	2.8	1.21	2.96%	Sand-Slime Tailin	0.047	93.3	0.19	0.00	0.19	0	1.70	86.343	######	100.32	270	2.98%	2.0	47%	0.59	0.00	0.59	0
3.937	5615.66	56.3	1.282	56.3	3.5	1.52	2.28%	Sand-Slime Tailin	0.047	93.3	0.20	0.00	0.20	0	1.70	95.642	######	111.13	287	2.29%	1.9	47%	0.60	0.00	0.60	0
4.101	5615.50	62.9	1.087	62.9	1.5	0.65	1.73%	Sand-Slime Tailin	0.047	93.3	0.20	0.00	0.20	0	1.70	106.913	######	124.19	309	1.73%	1.8	47%	0.61	0.00	0.61	0
4.265	5615.33	59.1	1.275	59.1	0.2	0.10	2.16%	Sand-Slime Tailin	0.047	93.3	0.21	0.00	0.21	0	1.70	100.402	######	116.61	280	2.17%	1.9	47%	0.62	0.00	0.62	0
4.429	5615.17	53.9	1.413	53.9	6.9	3.00	2.62%	Sand-Slime Tailin	0.047	93.3	0.22	0.00	0.22	0	1.70	91.630	######	106.51	246	2.63%	2.0	47%	0.62	0.00	0.62	0
4.593	5615.01	52.0	1.603	52.0	1.0	0.44	3.08%	Sand-Slime Tailin	0.047	93.3	0.23	0.00	0.23	0	1.70	88.468	######	102.76	229	3.09%	2.0	47%	0.63	0.00	0.63	0
4.757	5614.84	50.3	1.706	50.2	1.6	0.71	3.40%	Sand-Slime Tailin	0.047	93.3	0.23	0.00	0.23	0	1.70	85.408	######	99.22	214	3.41%	2.1	47%	0.64	0.00	0.64	0
4.921	5614.68	56.7	1.658	56.7	1.0	0.41	2.93%	Sand-Slime Tailin	0.047	93.3	0.24	0.00	0.24	0	1.70	96.339	######	111.90	234	2.94%	2.0	47%	0.65	0.00	0.65	0
5.085	5614.51	41.7	0.963	41.7	2.7	1.19	2.31%	Sand-Slime Tailin	0.047	93.3	0.25	0.00	0.25	0	1.70	70.856	984.90	82.33	167	2.32%	2.0	47%	0.65	0.00	0.65	0
5.249	5614.35	52.5	1.083	52.5	3.5	1.53	2.06%	Sand-Slime Tailin	0.047	93.3	0.26	0.00	0.26	0	1.70	89.199	######	103.64	204	2.07%	1.9	47%	0.66	0.00	0.66	0
5.413	5614.19	21.3	0.563	21.3	1.4	0.60	2.64%	Sand-Slime Tailin	0.047	93.3	0.26	0.00	0.26	0	1.70	36.210	503.32	42.07	80	2.68%	2.3	47%	0.67	0.00	0.67	0
5.577	5614.02	22.2	0.545	22.2	0.6	0.28	2.46%	Sand-Slime Tailin	0.047	93.3	0.27	0.00	0.27	0	1.70	37.706	524.11	43.80	81	2.49%	2.2	47%	0.68	0.00	0.68	0
5.741	5613.86	18.0	0.373	18.0	0.3	0.13	2.07%	Sand-Slime Tailin	0.047	93.3	0.28	0.00	0.28	0	1.70	30.668	426.29	35.62	64	2.10%	2.3	47%	0.69	0.00	0.69	0
5.905	5613.69	7.7	0.333	7.7	3.8	1.64	4.34%	Slime Tailings	0.041	82.7	0.29	0.00	0.29	0	1.70	13.005	180.77	15.15	26	4.51%	2.8	71%	0.69	0.00	0.69	0
6.069	5613.53	10.4	0.134	10.3	9.4	4.09	1.29%	Sand-Slime Tailin	0.047	93.3	0.29	0.00	0.29	0	1.70	17.544	243.86	20.49	34	1.33%	2.4	47%	0.70	0.00	0.70	0
6.234	5613.37	11.4	0.206	11.4	8.9	3.87	1.80%	Sand-Slime Tailin	0.047	93.3	0.30	0.00	0.30	0	1.70	19.363	269.15	22.60	37	1.85%	2.4	47%	0.71	0.00	0.71	0
6.398	5613.20	13.7	0.185	13.7	7.0	3.03	1.35%	Sand-Slime Tailin	0.047	93.3	0.31	0.00	0.31	0	1.70	23.239	323.02	27.08	43	1.38%	2.3	47%	0.72	0.00	0.72	0
6.562	5613.04	12.1	0.174	12.0	6.7	2.91	1.44%	Sand-Slime Tailin	0.059	119.0	0.32	0.00	0.32	1	1.70	20.417	283.80	23.80	37	1.48%	2.4	47%	0.73	0.00	0.73	0
6.726	5612.87	13.0	0.171	13.0	6.5	2.83	1.32%	Sand-Slime Tailin	0.059	119.0	0.33	0.01	0.32	1	1.70	22.032	306.24	25.67	39	1.35%	2.3	47%	0.73	0.00	0.73	0
6.890	5612.71	12.7	0.139	12.6	5.2	2.27	1.10%	Sand-Slime Tailin	0.059	119.0	0.34	0.01	0.33	1	1.70	21.488	298.68	25.02	38	1.13%	2.3	47%	0.74	0.00	0.74	0
7.054	5612.55	17.0	0.146	16.9	6.6	2.86	0.86%	Sand-Slime Tailin	0.059	119.0	0.35	0.02	0.33	1	1.70	28.747	399.58	33.47	50	0.88%	2.1	47%	0.75	0.00	0.75	0
7.218	5612.38	20.2	0.150	20.2	3.0	1.29	0.74%	Sand-Slime Tailin	0.059	119.0	0.36	0.02	0.34	1	1.70	34.272	476.38	39.84	59	0.76%	2.0	47%	0.76	0.00	0.76	0
7.382	5612.22	19.8	0.235	19.8	2.2	0.97	1.18%	Sand-Slime Tailin	0.059	119.0	0.37	0.03	0.34	1	1.70	33.711	468.58	39.18	57	1.21%	2.2	47%	0.77	0.00	0.77	0
7.546	5612.05	17.7	0.285	17.7	2.4	1.03	1.61%	Sand-Slime Tailin	0.059	119.0	0.38	0.03	0.34	1	1.70	30.022	417.31	34.90	50	1.65%	2.3	47%	0.78	0.00	0.78	0
7.710	5611.89	13.4	0.165	13.3	4.3	1.85	1.24%	Sand-Slime Tailin	0.059	119.0	0.39	0.04	0.35	1	1.70	22.661	314.99	26.37	37	1.27%	2.3	47%	0.79	0.00	0.79	0
7.874	5611.73	9.6	0.188	9.6	6.8	2.93	1.96%	Slime Tailings	0.057	113.1	0.40	0.04	0.35	1	1.70	16.269	226.14	18.98	26	2.04%	2.6	71%	0.80	0.00	0.80	0
8.038	5611.56	13.1	0.151	13.1	10.1	4.39	1.15%	Sand-Slime Tailin	0.059	119.0	0.41	0.05	0.36	1	1.70	22.219	308.84	25.93	36	1.19%	2.3	47%	0.81	0.00	0.81	0
8.202	5611.40	15.0	0.146	15.0	9.8	4.25	0.97%	Sand-Slime Tailin	0.059	119.0	0.42	0.05	0.36	1	1.70	25.449	353.74	29.68	40	1.00%	2.2	47%	0.82	0.00	0.82	0
8.366	5611.23	23.6	0.220	23.6	9.0	3.91	0.93%	Sand-Slime Tailin	0.059	119.0	0.43	0.06	0.37	1	1.70	40.086	557.20	46.67	63	0.95%	2.1	47%	0.83	0.00	0.83	0
8.530	5611.07	19.7	0.264	19.7	4.3	1.88	1.34%	Sand-Slime Tailin	0.059	119.0	0.44	0.06	0.37	1	1.70	33.473	465.27	38.93	52	1.37%	2.2	47%	0.84	0.00	0.84	0
8.694	5610.91	18.6	0.186	18.5	5.3	2.28	1.00%	Sand-Slime Tailin	0.059	119.0	0.45	0.07	0.38	1	1.70	31.518	438.10	36.67	48	1.03%	2.2	47%	0.85	0.00	0.85	0
8.858	5610.74	20.2	0.179	20.2	4.2	1.83	0.88%	Sand-Slime Tailin	0.059	119.0	0.46	0.07	0.38	1	1.70	34.340	477.33	39.94	52	0.91%	2.1	47%	0.86	0.00	0.86	0
9.022	5610.58	17.5	0.248	17.5	1.3	0.56	1.42%	Sand-Slime Tailin	0.059	119.0	0.46	0.08	0.39	1	1.70	29.750	413.53	34.57	44	1.46%	2.3	47%	0.87	0.00	0.87	0
9.186	5610.41	11.5	0.137	11.5	1.4	0.62	1.19%	Sand-Slime Tailin	0.059	119.0	0.47	0.08	0.39	1	1.70	19.584	272.22	22.76	28	1.24%	2.4	47%	0.88	0.00	0.88	0
9.350	5610.25	8.4	0.124	8.3	6.1	2.63	1.48%	Sand-Slime Tailin	0.059	119.0	0.48	0.09	0.40	1	1.70	14.178	197.07	16.54	20	1.57%	2.6	47%	0.89	0.00	0.89	0
9.514	5610.09	6.6	0.048	6.4	25.6	11.08	0.73%	Slime Tailings	0.057	113.1	0.49	0.09	0.40	1	1.70	10.897	151.47	12.97	15	0.79%	2.5	71%	0.90	0.00	0.90	0
9.678	5609.92	7.3	0.052	7.1	34.6	14.98	0.72%	Sand-Slime Tailin	0.059	119.0	0.50	0.10	0.40	1	1.70	11.985	166.59	14.35	17	0.77%	2.5	47%	0.91	0.00	0.91	0
9.842	5609.76	7.7	0.118	7.4	48.9	21.19	1.54%	Slime Tailings	0.057	113.1	0.51	0.10	0.41	1	1.70	12.529	174.15	15.15	18	1.65%	2.6	71%	0.92	0.00	0.92	0
10.006	5609.59	9.2	0.064	8.8	56.4	24.42	0.70%	Sand-Slime Tailin	0.059	119.0	0.52	0.11	0.41	1	1.70	15.028	208.89	18.15	21	0.74%	2.4	47%	0.93	0.00	0.93	0
10.170	5609.43	12.6	0.064	12.5	12.0	5.22	0.51%	Sand-Slime Tailin	0.059	119.0	0.53	0.11	0.42	1	1.70	21.318	296.32	24.91	29	0.53%	2.2	47%	0.94	0.00	0.94	0
10.335	5609.27	10.7	0.069	10.6	15.8	6.85	0.65%	Sand-Slime Tailin	0.059	119.0	0.54	0.12	0.42	1	1.70	17.969	249.77	21.06	24	0.68%	2.3	47%	0.95	0.00	0.95	0
10.499	5609.10	9.8	0.093	9.6	39.8	17.26	0.95%	Sand-Slime Tailin	0.059	119.0	0.55	0.12	0.43	1	1.70	16.235	225.67	19.35	22	1.01%	2.5	47%	0.96	0.00	0.96	0
10.663	5608.94	10.0	0.042	9.7	47.3	20.49	0.42%	Sand-Slime Tailin	0.059	119.0	0.56	0.13	0.43	1	1.70	16.558	230.16	19.81	22	0.44%	2.3	47%	0.97	0.00	0.97	0
10.827	5608.77	11.7	0.072	11.4	46.6	20.18	0.62%	Sand-Slime Tailin	0.059	119.0	0.57	0.13	0.44	1	1.69	19.231	267.31	22.91	25	0.65%	2.3	47%	0.98	0.00	0.98	0
10.991	5608.61	10.9	0.095	10.4	75.1	32.54	0.87%	Sand-Slime Tailin	0.059	119.0	0.58	0.14	0.44	1	1.69	17.592	244.52	21.35	23	0.92%	2.4	47%	0.99	0.00	0.99	0
11.155	5608.45	12.8	0.156	12.4	77.1	33.42	1.22%	Sand-Slime Tailin	0.059	119.0	0.59	0.15	0.45	1	1.65	20.356	282.95	24.56	27	1.27%	2.4	47%	1.00	0.00	1.00	0
11.319	5608.28	18.2	0.117	17.6	85.5	37.06	0.64%	Sand-Slime Tailin	0.059	119.0	0.60	0.15	0.45	1	1.58	27.942	388.40	33.44	39	0.67%	2.1	47%	1.01	0.00	1.01	0
11.483	5608.12	21.9	0.123	21.8	24.8	10.73	0.56%	Sand-Slime Tailin	0.059	119.0	0.61	0.16	0.45	1	1.55	33.650	467.74	39.36	47	0.58%	2.0	47%	1.02	0.00	1.02	0
11.647	5607.95	18.8	0.102	18.7	18.8	8.14	0.54%	Sand-Slime Tailin	0.059	119.0	0.62	0.16	0.46	1	1.56	29.097	404.45	34.01	40	0.56%	2.1	47%	1.03	0.00	1.03	0
11.811	5607.79	17.1	0.083	17.0	30.1	13.06	0.48%	Sand-Slime Tailin	0.059	119.0	0.63	0.17	0.46	1	1.56	26.471	367.95	31.09	36	0.50%	2.1	47%	1.04	0.00	1.04	0
11.975	5607.63	15.6	0.099	15.4	45.3	19.65	0.63%	Sand-Slime Tailin	0.059	119.0	0.64	0.17	0.47	1	1.56	24.026	333.97	28.42	32	0.66%	2.2	47%	1.05	0.00	1.05	0

Liquefaction Triggering Analyses

Depth (ft)	I&B (2008) CSR: r_d	C_σ	K_σ	K_α	CSR M=7.5, s'v=1atm	I&B CRR: Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Youd et al. (2001) CSR: r_d	D_r	f	K_σ	K_α	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No	Idriss & Boulanger (2008): CN	qc1 TSF	qc1 MPa	qc1N
0.164	1.00	0.09	1.06	1.0	0.061	56.16	129.78	0.202	3.29	0.98	0.50	0.75	3.16	1.0	0.014	1.00	73.63	0.117	281.58	142.44	2	1.7	63.391	6.0691	73.625
0.328	1.00	0.10	1.07	1.0	0.062	64.50	161.90	0.339	5.46	0.98	0.57	0.72	3.08	1.0	0.014	1.00	97.40	0.166	199.54	102.50	2	1.7	83.86	8.0287	97.398
0.492	1.00	0.12	1.08	1.0	0.063	71.31	188.12	0.701	11.18	0.98	0.62	0.69	3.02	1.0	0.014	1.00	116.80	0.228	183.03	97.10	2	1.7	100.57	9.6285	116.805
0.656	1.00	0.13	1.09	1.0	0.063	74.56	200.64	1.000	15.90	0.98	0.65	0.68	2.88	1.0	0.015	1.00	126.08	0.266	160.29	88.10	2	1.7	108.55	10.393	126.076
0.820	1.00	0.13	1.09	1.0	0.063	75.54	204.40	1.000	15.91	0.98	0.66	0.67	2.71	1.0	0.016	1.00	128.86	0.279	134.37	75.14	2	1.7	110.95	10.622	128.862
0.984	1.00	0.15	1.10	1.0	0.063	81.61	227.75	1.000	15.75	0.98	0.70	0.65	2.71	1.0	0.016	1.00	146.15	0.370	148.67	82.21	2	1.7	125.83	12.047	146.145
1.148	1.00	0.15	1.09	1.0	0.063	79.16	218.31	1.000	15.87	0.98	0.68	0.66	2.51	1.0	0.017	1.00	139.16	0.331	113.82	64.85	2	1.7	119.82	11.471	139.158
1.312	1.00	0.16	1.10	1.0	0.063	83.00	233.11	1.000	15.78	0.98	0.71	0.65	2.48	1.0	0.017	1.00	150.11	0.395	118.90	67.34	2	1.7	129.24	12.374	150.107
1.476	1.00	0.15	1.09	1.0	0.063	79.61	220.05	1.000	15.93	0.98	0.68	0.66	2.31	1.0	0.019	1.00	140.44	0.338	90.47	53.20	2	1.7	120.92	11.577	140.440
1.640	1.00	0.14	1.08	1.0	0.062	78.31	215.08	1.000	16.00	0.98	0.68	0.66	2.21	1.0	0.020	1.00	136.76	0.318	76.70	46.35	2	1.7	117.75	11.274	136.762
1.804	1.00	0.14	1.08	1.0	0.062	77.35	211.35	1.000	16.07	0.98	0.67	0.67	2.12	1.0	0.020	1.00	134.00	0.304	66.66	41.36	2	1.7	115.38	11.046	134.004
1.968	1.00	0.13	1.07	1.0	0.062	73.50	196.56	0.977	15.83	0.98	0.64	0.68	2.00	1.0	0.022	1.00	123.05	0.253	50.97	33.40	2	1.7	105.95	10.144	123.054
2.133	1.00	0.12	1.06	1.0	0.061	70.50	184.98	0.628	10.25	0.98	0.62	0.69	1.90	1.0	0.023	1.00	114.49	0.220	40.80	25.53	2	1.7	98.573	9.4374	114.487
2.297	1.00	0.12	1.06	1.0	0.061	69.75	182.12	0.572	9.37	0.98	0.61	0.69	1.85	1.0	0.023	1.00	112.36	0.212	36.58	22.98	2	1.7	96.746	9.2624	112.364
2.461	1.00	0.12	1.06	1.0	0.061	71.11	187.36	0.682	11.18	0.98	0.62	0.69	1.83	1.0	0.024	1.00	116.24	0.226	36.44	23.81	2	1.7	100.09	9.5823	116.244
2.625	1.00	0.14	1.07	1.0	0.061	77.12	210.47	1.000	16.31	0.98	0.67	0.67	1.87	1.0	0.023	1.00	133.35	0.301	45.43	30.87	2	1.7	114.82	10.993	133.352
2.789	0.99	0.14	1.06	1.0	0.061	77.64	212.47	1.000	16.34	0.98	0.67	0.66	1.84	1.0	0.023	1.00	134.83	0.308	43.82	30.08	2	1.7	116.09	11.114	134.829
2.953	0.99	0.15	1.07	1.0	0.061	80.50	223.49	1.000	16.32	0.98	0.69	0.65	1.83	1.0	0.023	1.00	142.99	0.352	47.32	31.82	2	1.7	123.11	11.787	142.991
3.117	0.99	0.14	1.06	1.0	0.061	77.14	210.55	1.000	16.45	0.98	0.67	0.67	1.76	1.0	0.024	1.00	133.41	0.301	38.34	27.39	2	1.7	114.87	10.998	133.415
3.281	0.99	0.18	1.07	1.0	0.062	86.62	247.20	1.000	16.26	0.98	0.73	0.63	1.83	1.0	0.023	1.12	179.35	1.000	121.56	68.91	2	1.7	138.26	13.237	160.578
3.445	0.99	0.17	1.07	1.0	0.061	85.68	243.58	1.000	16.34	0.98	0.73	0.64	1.79	1.0	0.024	1.07	169.42	1.000	116.20	66.27	2	1.7	135.95	13.016	157.902
3.609	0.99	0.14	1.05	1.0	0.060	75.90	205.93	1.000	16.60	0.98	0.66	0.67	1.67	1.0	0.026	1.18	152.78	0.412	45.82	31.21	2	1.7	111.95	10.718	130.026
3.773	0.99	0.11	1.04	1.0	0.059	65.48	165.80	0.369	6.21	0.97	0.58	0.71	1.55	1.0	0.028	1.28	128.71	0.278	29.73	17.97	2	1.7	86.373	8.2693	100.317
3.937	0.99	0.12	1.04	1.0	0.060	69.27	180.40	0.542	9.11	0.97	0.61	0.70	1.57	1.0	0.027	1.17	129.62	0.283	29.01	19.06	2	1.7	95.679	9.1603	111.126
4.101	0.99	0.13	1.04	1.0	0.060	73.86	198.05	1.000	16.77	0.97	0.64	0.68	1.59	1.0	0.027	1.08	133.72	0.302	29.89	23.33	2	1.7	106.93	10.237	124.191
4.265	0.99	0.12	1.04	1.0	0.059	71.20	187.81	0.693	11.68	0.97	0.62	0.69	1.55	1.0	0.028	1.16	134.72	0.307	29.29	20.48	2	1.7	100.4	9.6127	116.614
4.429	0.99	0.11	1.04	1.0	0.059	67.66	174.16	0.453	7.68	0.97	0.60	0.70	1.51	1.0	0.029	1.25	133.61	0.302	27.76	17.72	2	1.7	91.703	8.7797	106.508
4.593	0.98	0.11	1.03	1.0	0.059	66.34	169.10	0.399	6.77	0.97	0.59	0.71	1.48	1.0	0.029	1.35	139.13	0.330	29.37	18.07	2	1.7	88.479	8.471	102.763
4.757	0.98	0.11	1.03	1.0	0.059	65.10	164.31	0.357	6.09	0.97	0.58	0.71	1.46	1.0	0.029	1.44	142.65	0.350	30.10	18.09	2	1.7	85.425	8.1786	99.216
4.921	0.98	0.12	1.03	1.0	0.059	69.55	181.45	0.560	9.54	0.97	0.61	0.69	1.48	1.0	0.029	1.32	147.75	0.380	31.66	20.60	2	1.7	96.349	9.2245	111.904
5.085	0.98	0.09	1.03	1.0	0.058	59.18	141.50	0.238	4.08	0.97	0.52	0.74	1.38	1.0	0.031	1.32	109.07	0.201	16.21	10.15	2	1.7	70.885	6.7865	82.329
5.249	0.98	0.11	1.03	1.0	0.058	66.65	170.29	0.410	7.03	0.97	0.59	0.71	1.43	1.0	0.030	1.21	125.85	0.265	20.81	13.92	2	1.7	89.237	8.5435	103.643
5.413	0.98	0.07	1.02	1.0	0.058	45.06	87.13	0.123	2.13	0.97	0.37	0.80	1.27	1.0	0.034	1.87	78.68	0.125	9.54	5.84	2	1.7	36.225	3.4681	42.073
5.577	0.98	0.07	1.02	1.0	0.058	45.66	89.46	0.126	2.19	0.97	0.38	0.80	1.26	1.0	0.034	1.79	78.56	0.125	9.26	5.73	2	1.7	37.713	3.6106	43.801
5.741	0.98	0.06	1.01	1.0	0.057	42.80	78.42	0.110	1.93	0.97	0.34	0.80	1.25	1.0	0.034	1.86	66.20	0.107	7.71	4.82	2	1.7	30.671	2.9365	35.623
5.905	0.98	0.05	1.01	1.0	0.057	35.36	50.52	0.078	1.37	0.97	0.22	0.80	1.25	1.0	0.034	4.65	70.38	0.112	7.91	4.64	2	1.7	13.045	1.2489	15.151
6.069	0.98	0.05	1.01	1.0	0.057	37.49	57.98	0.086	1.50	0.97	0.26	0.80	1.24	1.0	0.034	2.14	43.82	0.087	5.93	3.72	2	1.7	17.644	1.6893	20.493
6.234	0.98	0.05	1.01	1.0	0.057	38.23	60.83	0.089	1.56	0.97	0.27	0.80	1.23	1.0	0.035	2.37	53.60	0.094	6.31	3.93	2	1.7	19.458	1.8629	22.599
6.398	0.97	0.06	1.01	1.0	0.057	39.80	66.87	0.096	1.68	0.97	0.30	0.80	1.23	1.0	0.035	1.89	51.26	0.093	6.03	3.86	2	1.7	23.313	2.232	27.077
6.562	0.97	0.05	1.01	1.0	0.057	38.65	62.44	0.091	1.60	0.97	0.28	0.80	1.22	1.0	0.035	2.14	50.97	0.092	5.87	3.73	2	1.7	20.488	1.9616	23.796
6.726	0.97	0.06	1.01	1.0	0.057	39.30	64.97	0.094	1.65	0.97	0.29	0.80	1.22	1.0	0.035	1.98	50.86	0.092	5.79	3.72	2	1.7	22.101	2.116	25.669
6.890	0.97	0.06	1.01	1.0	0.057	39.08	64.10	0.093	1.63	0.97	0.29	0.80	1.21	1.0	0.035	1.89	47.20	0.089	5.53	3.58	2	1.7	21.544	2.0626	25.021
7.054	0.97	0.06	1.01	1.0	0.057	42.04	75.51	0.107	1.89	0.97	0.33	0.80	1.21	1.0	0.035	1.49	49.82	0.091	5.58	3.74	2	1.7	28.817	2.7589	33.469
7.218	0.97	0.06	1.01	1.0	0.056	44.27	84.12	0.118	2.10	0.97	0.36	0.80	1.21	1.0	0.035	1.33	53.04	0.094	5.65	3.87	2	1.7	34.304	3.2842	39.842
7.382	0.97	0.06	1.01	1.0	0.056	44.04	83.22	0.117	2.08	0.97	0.36	0.80	1.20	1.0	0.035	1.55	60.90	0.101	6.00	4.04	2	1.7	33.735	3.2298	39.181
7.546	0.97	0.06	1.01	1.0	0.056	42.54	77.44	0.109	1.94	0.97	0.34	0.80	1.20	1.0	0.035	1.88	65.77	0.106	6.24	4.09	2	1.7	30.047	2.8767	34.898
7.710	0.97	0.06	1.00	1.0	0.056	39.55	65.92	0.095	1.69	0.97	0.30	0.80	1.20	1.0	0.036	2.00	52.82	0.094	5.42	3.56	2	1.7	22.706	2.1739	26.372
7.874	0.96	0.05	1.00	1.0	0.056	36.70	55.68	0.083	1.49	0.97	0.25	0.80	1.19	1.0	0.036	3.10	58.76	0.099	5.66	3.57	2	1.7	16.341	1.5645	18.979
8.038	0.96	0.06	1.00	1.0	0.056	39.40	65.33	0.094	1.68	0.96	0.29	0.80	1.19	1.0	0.036	2.00	51.81	0.093	5.25	3.47	2	1.7	22.327	2.1375	25.931
8.202	0.96	0.06	1.00	1.0	0.056	40.71	70.39	0.100	1.79	0.96	0.31	0.80	1.19	1.0	0.036	1.74	51.61	0.093	5.18	3.49	2	1.7	25.553	2.4465	29.678
8.366	0.96	0.07	1.00	1.0	0.056	46.67	93.34	0.132	2.37	0.96	0.39	0.80	1.19	1.0	0.036	1.38	64.29	0.105	5.77	4.07	2	1.7	40.182	3.847	46.669
8.530	0.96	0.06	1.00	1.0	0.056	43.95	82.89	0.117	2.10	0.96	0.36	0.80	1.18	1.0	0.036	1.71	66.71	0.108	5.86	3.98	2	1.7	33.519	3.2091	38.930
8.694	0.96	0.06	1.00	1.0	0.056	43.16	79.83	0.112	2.02	0.96	0.35	0.80	1.18	1.0	0.036	1.60	58.60	0.099	5.31	3.67	2	1.7	31.574	3.0229	36.671
8.858	0.96	0.06	1.00	1.0	0.055	44.31	84.24	0.119	2.14	0.96	0.36	0.80	1.18	1.0	0.036	1.48	59.08	0.099	5.27	3.71	2	1.7	34.385	3.292	39.936
9.022	0.96	0.06	1.00	1.0	0.055	42.43	76.99	0.109	1.96	0.96	0.34	0.80	1.17	1.0	0.036	1.92	66.25	0.107	5.63	3.79	2	1.7	29.764	2.8496	34.569
9.186	0.96	0.05	1.00	1.0	0.055	38.29	61.05	0.089	1.61	0.96	0.28	0.80	1.17	1.0	0.036	2.34	53.38	0.094	4.89	3.25	2	1.7	19.599	1.8764	22.763
9.350	0.96	0.05	1.00	1.0	0.055	36.10	52.64	0.080	1.45	0.96	0.23	0.80	1.17	1.0	0.036	3.27	54.12	0.095	4.87	3.16	2	1.7	14.243	1.3636	16.542
9.514	0.95	0.05	1.00	1.0	0.055	34.60	47.58	0.075	1.37	0.96	0.21	0.80	1.17	1.0	0.036	3.01	39.09	0.083	4.20	2.78	2	1.7	11.168	1.0693	12.971
9.678	0.95	0.05	1.00	1.0	0.055	35.33	49.68	0.077	1.40	0.96	0.22	0.80	1.16	1.0	0.036	2.79	40.00	0.083	4.19	2.80	2	1.7	12.352	1.1826	14.346
9.842	0.95	0.05	1.00	1.0	0.055	35.36	50.52	0.078	1.42	0.96	0.22	0.80	1.16	1.0	0.036	3.64	55.20	0.096	4.76	3.09	2	1.7	13.048	1.2492	15.154
10.006	0.95	0.05	1.00	1.0	0.055	36.67	54.82	0.082	1.50	0.96	0.25	0.80	1.16	1.0	0.037	2.34	42.55	0.085	4.21	2.86	2	1.7	15.626	1.496	18.149
10.170	0.95	0.06	1.00	1.0	0.055	39.04	63.95	0.092	1.69	0.96	0.29	0.80	1.16	1.0	0.037	1.72	42.73	0.086	4.17	2.93	2	1.7	21.446	2.0532	24.908
10.335	0.95	0.05	0.99	1.0	0.055	37.69	58.75	0.086	1.59	0.96	0.26	0.80	1.15	1.0	0.037	2.09	43.93	0.087	4.17	2.88	2	1.7	18.137	1.7364	21.065
10.499	0.95	0.05	0.99	1.0	0.054	37.09	56.43	0.084	1.54	0.96	0.25	0.80	1.15	1.0	0.037	2.57	49.77	0.091	4.36	2.95	2	1.7	16.658	1.5948	19.347
10.663	0.95	0.05	0.99	1.0	0.054	37.25	57.06	0.085	1.56	0.96	0.26	0.80	1.15	1.0	0.037	1.94	38.50	0.082	3.87	2.72	2	1.7	17.06	1.6333	19.814
10.827	0.95	0.05	0.99	1.0	0.054	38.33	61.24	0.089	1.64	0.96	0.28	0.80	1.15	1.0	0.037	1.97	45.15	0.088	4.09	2.87	2	1.686916	19.721	1.8881	22.905
10.991	0.94	0.05	0.99	1.0	0.054	37.79	59.14	0.087	1.60	0.96	0.27	0.80	1.14	1.0	0.037	2.36	50.32	0.092	4.25	2.93	2	1.68502	18.382	1.7599	21.349
11.155	0.94	0.06	0.99	1.0	0.054	38.92	63.48	0.092	1.70	0.96	0.29	0.80	1.14	1.0	0.037	2.42	59.39	0.099	4.55	3.13	2	1.64827	21.15	2.0249	24.564
11.319	0.94	0.06	0.99	1.0	0.054	42.03	75.46	0.107	1.98	0.96	0.33	0.80	1.14	1.0	0.037	1.55	51.83	0.093	4.21	3.09	2	1.584035	28.788	2.7562	33.436
11.483	0.94	0.06	0.99	1.0	0.054	44.11	83.47	0.117	2.18	0.96	0.36	0.80	1.14	1.0	0.037	1.37	53.90	0.095	4.24	3.21	2	1.545013	33.889	3.2445	39.360
11.647	0.94	0.06	0.99	1.0	0.054	42.23	76.24	0.108	2.00	0.96	0.34	0.80	1.13	1.0	0.037	1.47	50.02	0.092	4.07	3.04	2	1.558511	29.28	2.8033	34.007
11.811	0.94	0.06	0.99	1.0	0.054	41.20	72.29	0.102	1.91	0.96	0.32	0.80	1.13	1.0	0.037	1.51	46.90	0.089	3.92	2.92	2	1.561715	26.765	2.5625	31.086
11.975	0.94	0.06	0.99	1.0	0.054	40.27	68.69	0.098	1.83	0.96	0.31	0.80	1.13	1.0	0.037	1.72	49.00	0.091	3.96	2.89	2	1.564224	24.469	2.3427	28.420

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W7-C

Data File: 13-52106_SP2W7-C-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)

Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69

Youd, et al (2001)

Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

5613.10	Water surface elevation during CPT investigation (f
5611.32	Water surface elevation at t_0 (ft amsl)
5595.40	Water surface elevation at t_1 (ft amsl)
5590.40	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Ea
7.51	Equiv. Number of Uniform Strain Cycles, N

5619.60	Ground Surface Elevation at time of CPT (ft amsl)
5626.65	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pl
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
-0.95	Thickness of Random/Platform Fill on top of existing interim cover (ft)
812.44	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5590.40	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight t (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	######	5626.4	5626.15	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	######	5624.4	5622.65	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5620.65	5618.65	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334
Platform/Random Fill Layer	######	5619.13	5619.60	-0.95	0.050	101	0.406	0.430	0.00	0.00	0.406	0.430

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil. Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil. Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
12.139	5607.46	12.7	0.171	12.4	58.5	25.36	1.34%	Sand-Slime Tailing	0.059	119.0	0.65	0.18	0.47	1	1.58	19.546	271.68	23.37	26	1.42%	2.5	47%	1.06	0.00	1.06	0
12.303	5607.30	13.0	0.141	12.6	69.8	30.26	1.09%	Sand-Slime Tailing	0.059	119.0	0.66	0.18	0.48	1	1.57	19.678	273.52	23.65	26	1.14%	2.4	47%	1.07	0.00	1.07	0
12.467	5607.13	17.3	0.074	17.2	11.4	4.93	0.43%	Sand-Slime Tailing	0.059	119.0	0.67	0.19	0.48	1	1.52	26.200	364.19	30.56	34	0.44%	2.1	47%	1.07	0.00	1.07	0
12.631	5606.97	14.6	0.118	14.6	12.4	5.38	0.81%	Sand-Slime Tailing	0.059	119.0	0.68	0.19	0.49	1	1.53	22.293	309.87	26.03	29	0.85%	2.3	47%	1.08	0.00	1.08	0
12.795	5606.80	14.9	0.109	14.7	29.3	12.70	0.73%	Sand-Slime Tailing	0.059	119.0	0.69	0.20	0.49	1	1.52	22.317	310.21	26.24	29	0.77%	2.3	47%	1.09	0.00	1.09	0
12.959	5606.64	17.4	0.213	17.4	6.0	2.59	1.23%	Sand-Slime Tailing	0.059	119.0	0.70	0.20	0.50	1	1.49	25.878	359.71	30.12	34	1.28%	2.4	47%	1.10	0.00	1.10	0
13.123	5606.48	11.4	0.174	11.3	13.4	5.82	1.53%	Sand-Slime Tailing	0.059	119.0	0.71	0.21	0.50	1	1.53	17.252	239.81	20.19	21	1.63%	2.6	47%	1.11	0.00	1.11	0
13.287	5606.31	10.3	0.144	10.2	24.4	10.58	1.40%	Sand-Slime Tailing	0.059	119.0	0.72	0.21	0.51	1	1.52	15.385	213.85	18.14	19	1.50%	2.6	47%	1.12	0.00	1.12	0
13.451	5606.15	8.1	0.085	7.9	29.0	12.57	1.05%	Sand-Slime Tailing	0.059	119.0	0.73	0.22	0.51	1	1.50	11.935	165.89	14.18	14	1.15%	2.6	47%	1.13	0.00	1.13	0
13.615	5605.98	8.1	0.071	7.9	37.9	16.43	0.88%	Sand-Slime Tailing	0.059	119.0	0.74	0.22	0.52	1	1.49	11.761	163.48	14.07	14	0.96%	2.6	47%	1.14	0.00	1.14	0
13.779	5605.82	8.4	0.071	8.2	32.9	14.24	0.85%	Sand-Slime Tailing	0.059	119.0	0.75	0.23	0.52	1	1.48	12.139	168.73	14.45	15	0.93%	2.6	47%	1.15	0.00	1.15	0
13.943	5605.66	8.9	0.054	8.7	37.7	16.35	0.61%	Sand-Slime Tailing	0.059	119.0	0.76	0.23	0.52	1	1.47	12.806	178.01	15.28	16	0.66%	2.5	47%	1.16	0.00	1.16	0
14.107	5605.49	11.6	0.101	11.4	38.4	16.62	0.87%	Sand-Slime Tailing	0.059	119.0	0.77	0.24	0.53	1	1.46	16.641	231.30	19.73	20	0.93%	2.5	47%	1.17	0.00	1.17	0
14.271	5605.33	9.4	0.125	9.3	28.4	12.32	1.32%	Sand-Slime Tailing	0.059	119.0	0.78	0.24	0.53	1	1.45	13.475	187.30	15.95	16	1.44%	2.6	47%	1.18	0.00	1.18	0
14.436	5605.16	8.8	0.126	8.5	40.5	17.53	1.44%	Sand-Slime Tailing	0.059	119.0	0.79	0.25	0.54	1	1.44	12.287	170.78	14.69	15	1.58%	2.7	47%	1.19	0.00	1.19	0
14.600	5605.00	11.2	0.094	11.1	28.5	12.36	0.84%	Sand-Slime Tailing	0.059	119.0	0.80	0.25	0.54	1	1.43	15.862	220.48	18.72	19	0.90%	2.5	47%	1.20	0.00	1.20	0
14.764	5604.84	15.3	0.076	15.3	10.5	4.53	0.50%	Sand-Slime Tailing	0.059	119.0	0.81	0.26	0.55	1	1.41	21.493	298.76	25.07	27	0.52%	2.3	47%	1.21	0.00	1.21	0
14.928	5604.67	15.6	0.127	15.5	13.6	5.87	0.81%	Sand-Slime Tailing	0.059	119.0	0.82	0.26	0.55	1	1.40	21.691	301.51	25.33	27	0.86%	2.3	47%	1.22	0.00	1.22	0
15.092	5604.51	13.7	0.155	13.6	16.5	7.13	1.13%	Sand-Slime Tailing	0.059	119.0	0.82	0.27	0.56	1	1.40	19.062	264.96	22.31	23	1.20%	2.5	47%	1.23	0.00	1.23	0
15.256	5604.34	17.0	0.133	17.0	4.9	2.14	0.78%	Sand-Slime Tailing	0.059	119.0	0.83	0.27	0.56	1	1.37	23.328	324.26	27.14	29	0.82%	2.3	47%	1.24	0.00	1.24	0
15.420	5604.18	13.1	0.107	13.1	3.5	1.53	0.82%	Sand-Slime Tailing	0.059	119.0	0.84	0.28	0.57	1	1.39	18.162	252.45	21.13	22	0.87%	2.4	47%	1.25	0.00	1.25	0
15.584	5604.02	9.6	0.107	9.5	9.3	4.03	1.12%	Sand-Slime Tailing	0.059	119.0	0.85	0.28	0.57	1	1.38	13.129	182.50	15.34	15	1.23%	2.6	47%	1.26	0.00	1.26	0
15.748	5603.85	9.8	0.122	9.7	17.6	7.63	1.24%	Sand-Slime Tailing	0.059	119.0	0.86	0.29	0.58	1	1.37	13.307	184.97	15.63	16	1.36%	2.6	47%	1.27	0.00	1.27	0
15.912	5603.69	7.9	0.102	7.7	32.5	14.09	1.29%	Sand-Slime Tailing	0.059	119.0	0.87	0.29	0.58	1	1.36	10.527	146.33	12.55	12	1.44%	2.8	47%	1.28	0.00	1.28	0
16.076	5603.52	8.2	0.088	7.9	46.7	20.23	1.07%	Sand-Slime Tailing	0.059	119.0	0.88	0.30	0.58	1	1.35	10.719	148.99	12.91	13	1.20%	2.7	47%	1.29	0.00	1.29	0
16.240	5603.36	8.7	0.081	8.3	59.6	25.83	0.93%	Sand-Slime Tailing	0.059	119.0	0.89	0.30	0.59	1	1.35	11.178	155.37	13.56	13	1.04%	2.7	47%	1.30	0.00	1.30	0
16.404	5603.20	8.6	0.104	8.2	71.5	31.00	1.21%	Sand-Slime Tailing	0.059	119.0	0.90	0.31	0.59	1	1.34	10.935	152.00	13.39	13	1.35%	2.7	47%	1.31	0.00	1.31	0
16.568	5603.03	9.3	0.138	8.8	83.6	36.24	1.48%	Sand-Slime Tailing	0.059	119.0	0.91	0.31	0.60	1	1.33	11.719	162.90	14.42	14	1.64%	2.7	47%	1.32	0.00	1.32	0
16.732	5602.87	9.9	0.155	9.3	84.3	36.52	1.57%	Sand-Slime Tailing	0.059	119.0	0.92	0.32	0.60	1	1.32	12.323	171.28	15.12	15	1.74%	2.7	47%	1.33	0.00	1.33	0
16.896	5602.70	26.6	0.355	26.0	83.4	36.16	1.34%	Sand-Slime Tailing	0.059	119.0	0.93	0.32	0.61	1	1.27	33.013	458.88	39.11	42	1.39%	2.3	47%	1.34	0.00	1.34	0
17.060	5602.54	17.7	0.388	17.6	16.1	6.97	2.20%	Sand-Slime Tailing	0.059	119.0	0.94	0.33	0.61	1	1.29	22.634	314.61	26.44	27	2.32%	2.6	47%	1.35	0.00	1.35	0
17.224	5602.38	12.0	0.476	11.8	26.8	11.63	3.97%	Slime Tailings	0.057	113.1	0.95	0.33	0.62	1	1.30	15.332	213.11	18.06	18	4.32%	2.9	71%	1.36	0.00	1.36	0
17.388	5602.21	14.6	0.394	14.5	24.8	10.76	2.69%	Slime Tailings	0.057	113.1	0.96	0.34	0.62	1	1.29	18.673	259.56	21.92	22	2.88%	2.7	71%	1.37	0.00	1.37	0
17.552	5602.05	10.6	0.341	10.5	16.3	7.05	3.20%	Slime Tailings	0.057	113.1	0.97	0.34	0.62	1	1.28	13.540	188.21	15.88	15	3.53%	2.9	71%	1.38	0.00	1.38	0
17.716	5601.88	11.2	0.288	10.8	64.1	27.78	2.57%	Slime Tailings	0.057	113.1	0.98	0.35	0.63	1	1.28	13.790	191.68	16.61	16	2.82%	2.8	71%	1.39	0.00	1.39	0
17.880	5601.72	12.9	0.210	12.7	33.7	14.62	1.63%	Sand-Slime Tailing	0.059	119.0	0.99	0.36	0.63	1	1.27	16.138	224.31	19.05	19	1.76%	2.6	47%	1.40	0.00	1.40	0
18.044	5601.56	10.5	0.231	10.2	41.6	18.04	2.20%	Slime Tailings	0.057	113.1	1.00	0.36	0.64	1	1.26	12.920	179.59	15.39	15	2.44%	2.8	71%	1.40	0.00	1.40	0
18.208	5601.39	9.1	0.184	8.6	70.9	30.71	2.03%	Slime Tailings	0.057	113.1	1.01	0.37	0.64	1	1.26	10.855	150.88	13.25	13	2.28%	2.8	71%	1.41	0.00	1.41	0
18.372	5601.23	10.2	0.118	9.8	69.3	30.03	1.16%	Sand-Slime Tailing	0.059	119.0	1.02	0.37	0.65	1	1.25	12.220	169.85	14.82	14	1.28%	2.7	47%	1.42	0.00	1.42	0
18.537	5601.06	10.3	0.159	9.8	81.3	35.24	1.55%	Sand-Slime Tailing	0.059	119.0	1.03	0.38	0.65	1	1.24	12.152	168.91	14.85	14	1.72%	2.7	47%	1.43	0.00	1.43	0
18.701	5600.90	12.1	0.167	11.4	113.1	49.03	1.38%	Sand-Slime Tailing	0.059	119.0	1.04	0.38	0.66	1	1.24	14.138	196.51	17.43	17	1.50%	2.6	47%	1.44	0.00	1.44	0
18.865	5600.74	14.0	0.166	13.5	77.6	33.64	1.19%	Sand-Slime Tailing	0.059	119.0	1.05	0.39	0.66	1	1.23	16.569	230.31	19.94	20	1.29%	2.6	47%	1.45	0.00	1.45	0
19.029	5600.57	13.9	0.222	13.5	75.7	32.80	1.59%	Sand-Slime Tailing	0.059	119.0	1.06	0.39	0.67	1	1.22	16.479	229.06	19.81	19	1.72%	2.6	47%	1.46	0.00	1.46	0
19.193	5600.41	14.2	0.182	13.9	41.6	18.02	1.28%	Sand-Slime Tailing	0.059	119.0	1.07	0.40	0.67	1	1.22	16.937	235.42	20.04	20	1.39%	2.6	47%	1.47	0.00	1.47	0
19.357	5600.24	12.2	0.148	11.8	73.0	31.64	1.21%	Sand-Slime Tailing	0.059	119.0	1.08	0.40	0.67	1	1.21	14.220	197.65	17.16	16	1.33%	2.6	47%	1.48	0.00	1.48	0
19.521	5600.08	10.5	0.113	9.8	106.9	46.30	1.08%	Sand-Slime Tailing	0.059	119.0	1.09	0.41	0.68	1	1.20	11.845	164.64	14.69	14	1.20%	2.7	47%	1.49	0.00	1.49	0
19.685	5599.92	10.6	0.200	9.8	131.7	57.08	1.89%	Slime Tailings	0.057	113.1	1.09	0.41	0.68	1	1.20	11.716	162.86	14.75	14	2.10%	2.8	71%	1.50	0.00	1.50	0
19.849	5599.75	36.3	0.300	35.3	156.8	67.96	0.83%	Sand Tailings	0.062	123.5	1.10	0.42	0.69	1	1.15	40.813	567.29	48.71	51	0.85%	2.1	18%	1.51	0.00	1.51	0
20.013	5599.59	33.0	0.456	32.9	14.8	6.43	1.38%	Sand-Slime Tailing	0.059	119.0	1.11	0.42	0.69	1	1.15	37.997	528.16	44.26	46	1.43%	2.3	47%	1.52	0.00	1.52	0
20.177	5599.42	18.7	0.520	18.6	13.8	5.96	2.78%	Slime Tailings	0.057	113.1	1.12	0.43	0.70	1	1.17	21.803	303.07	25.44	25	2.96%	2.7	71%	1.53	0.00	1.53	0
20.341	5599.26	13.7	0.464	13.5	40.0	17.35	3.39%	Slime Tailings	0.057	113.1	1.13	0.43	0.70	1	1.17	15.789	219.47	18.68	18	3.69%	2.8	71%	1.54	0.00	1.54	0
20.505	5599.10	11.5	0.373	11.1	62.3	27.01	3.25%	Slime Tailings	0.057	113.1	1.14	0.44	0.71	1	1.17	12.959	180.13	15.58	15	3.61%	2.9	71%	1.55	0.00	1.55	0
20.669	5598.93	12.4	0.338	11.7	107.6	46.62	2.73%	Slime Tailings	0.057	113.1	1.15	0.44	0.71	1	1.16	13.644	189.65	16.75	16	3.00%	2.8	71%	1.56	0.00	1.56	0
20.833	5598.77	13.3	0.244	12.9	67.9	29.44	1.84%	Sand-Slime Tailing	0.059	119.0	1.16	0.45	0.71	1	1.16	14.894	207.02	17.87	17	2.01%	2.7	47%	1.57	0.00	1.57	0
20.997	5598.60	15.3	0.235	15.0	45.2	19.60	1.54%	Sand-Slime Tailing	0.059	119.0	1.17	0.45	0.72	1	1.15	17.248	239.75	20.41	20	1.67%	2.6	47%	1.58	0.00	1.58	0
21.161	5598.44	18.4	0.276	18.0	52.8	22.87	1.50%	Sand-Slime Tailing	0.059	119.0	1.18	0.46	0.72	1	1.14	20.588	286.17	24.35	24	1.61%	2.5	47%	1.59	0.00	1.59	0
21.325	5598.27	17.9	0.231	17.7	21.2	9.20	1.29%	Sand-Slime Tailing	0.059	119.0	1.19	0.46	0.73	1	1.14	20.141	279.96	23.57	23	1.39%	2.5	47%	1.60	0.00	1.60	0
21.489	5598.11	12.3	0.171	12.1	31.8	13.76	1.39%	Sand-Slime Tailing	0.059	119.0	1.20	0.47	0.73	1	1.13	13.736	190.93	16.21	15	1.54%	2.7	47%	1.61	0.00	1.61	0
21.653	5597.95	9.4	0.173	9.0	70.1	30.36	1.84%	Slime Tailings	0.057	113.1	1.21	0.47	0.74	1	1.13	10.141	140.96	12.35	11	2.11%	2.9	71%	1.62	0.00	1.62	0
21.817	5597.78	10.2	0.308	9.6	109.8	47.60	3.01%	Slime Tailings	0.057	113.1	1.22	0.48	0.74	1	1.12	10.748	149.40	13.38	12	3.41%	3.0	71%	1.63	0.00	1.63	0
21.981	5597.62	16.3	0.494	15.9	55.4	24.01	3.04%	Slime Tailings	0.057	113.1	1.23	0.48	0.75	1	1.12	17.829	247.82	21.16	20	3.28%	2.8	71%	1.63	0.00	1.63	0
22.145	5597.45	14.7	0.580	14.5	37.9	16.40	3.94%	Slime Tailings	0.057	113.1	1.24	0.49	0.75	1	1.11	16.127	224.17	19.04	18	4.31%	2.9	71%	1.64	0.00	1.64	0
22.309	5597.29	15.8	0.533	15.5	43.5	18.86	3.38%	Slime Tailings	0.057	113.1	1.25	0.49	0.75	1	1.11	17.189	238.93	20.31	19	3.67%	2.8	71%	1.65	0.00	1.65	0
22.473	5597.13	14.0	0.457	13.9	15.6	6.74	3.26%	Slime Tailings	0.057	113.1	1.26	0.50	0.76	1	1.10	15.381	213.79	17.99	17	3.58%	2.9	71%	1.66	0.00	1.66	0
22.638	5596.96	22.3	0.455	22.1	22.5	9.75	2.04%	Sand-Slime Tailing	0.059	119.0	1.27	0.50	0.76	1	1.09	24.213	336.55	28.30	28	2.17%	2.6	47%	1.67	0.00	1.67	0
22.802	5596.80	17.6	0.383	17.4	21.7	9.38	2.18%	Sand-Slime Tailing	0.059	119.0	1.28	0.51	0.77	1	1.09	19.057	264.90	22.31	21	2.35%	2.7	47%	1.68	0.00	1.68	0
22.966	5596.63	11.2	0.327	10.7	70.0	30.33	2.93%	Slime Tailings	0.057	113.1	1.28	0.51	0.77	1	1.09	11.705	162.70	14.15	13	3.31%	2.9	71%	1.69	0.00	1.69	0
23.130	5596.47	11.9	0.236	11.3	90.3	39.11	1.99%	Sand-Slime Tailing	0.059	119.0	1.29	0.52	0.78	1	1.08	12.269	170.54	14.96	14	2.23%	2.8	47%	1.70	0.00	1.70	0
23.294	5596.31	13.5	0.214	12.9	103.9	45.01	1.59%	Sand-Slime Tailing	0.059	119.0	1.30	0.52	0.78	1	1.08	13.874	192.85	16.93	16	1.75%	2.7	47%	1.71	0.00	1.71	0
23.458	5596.14	12.3	0.222	11.8	82.8	35.86	1.80%	Sand-Slime Tailing	0.059	119.0	1.31	0.53	0.79	1	1.07	12.714	176.73	15.41	14	2.01%	2.8	47%	1.72	0.00	1.72	0
23.622	5595.98	10.7	0.234	10.1	92.5	40.09	2.19%	Slime Tailings	0.057	113.1	1.32	0.53	0.79	1	1.07	10.821	150.41	13.29	12	2.50%	2.9	71%	1.73	0.00	1.73	0
23.786	5595.81	17.2	0.313	16.6	101.1	43.81	1.82%	Sand-Slime Tailing	0.059	119.0	1.33	0.54	0.79	1	1.07	17.630	245.06	21.26	20	1.98%	2.6	47%	1.74	0.00	1.74	0
23.950	5595.65	18.0	0.305	17.9	11.3	4.88	1.70%	Sand-Slime Tailing	0.059	119.0	1.34	0.54	0.80	1	1.06	18.952	263.44	22.10	21	1.84%	2.6	47%	1.75	0.00	1.75	0

Liquefaction Triggering Analyses

Depth at time of CPT (ft)	Idriss & Boulanger (2008) Cyclic Stress Ratio r_d	C_σ	K_σ	K_α	CSR M=7.5, s'v=1atm	Cyclic Resistance Ratio Δqc_{1n}	$qc_{1n\text{-}cs}$	(CRR) M=7.5, s'v=1atm	FoS	Youd et al. (2001) Cyclic Stress Ratio r_d	D_r	f	K_σ	K_α	CSR M=7.5, s'v=1atm	Kc	$qc_{1n\text{-}cs}$	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No	Idriss & Boulanger (2008) CN	qc1 TSF	qc1 MPa	qc1N
12.139	0.94	0.05	0.99	1.0	0.054	38.50	61.87	0.090	1.68	0.96	0.28	0.80	1.13	1.0	0.037	2.66	62.07	0.102	4.42	3.05	2	1.581356	20.123	1.9266	23.372
12.303	0.94	0.05	0.99	1.0	0.053	38.60	62.24	0.090	1.69	0.95	0.28	0.80	1.12	1.0	0.037	2.41	56.98	0.097	4.16	2.93	2	1.567943	20.361	1.9494	23.648
12.467	0.93	0.06	0.99	1.0	0.053	41.02	71.57	0.102	1.91	0.95	0.32	0.80	1.12	1.0	0.037	1.49	45.52	0.088	3.73	2.82	2	1.520626	26.308	2.5188	30.556
12.631	0.93	0.06	0.99	1.0	0.053	39.43	65.46	0.094	1.77	0.95	0.29	0.80	1.12	1.0	0.038	2.00	52.19	0.093	3.92	2.84	2	1.532171	22.412	2.1457	26.030
12.795	0.93	0.06	0.99	1.0	0.053	39.51	65.75	0.094	1.78	0.95	0.30	0.80	1.12	1.0	0.038	1.93	50.67	0.092	3.83	2.81	2	1.520247	22.595	2.1633	26.243
12.959	0.93	0.06	0.99	1.0	0.053	40.87	70.99	0.101	1.90	0.95	0.32	0.80	1.12	1.0	0.038	2.13	64.14	0.105	4.31	3.11	2	1.491547	25.934	2.4829	30.121
13.123	0.93	0.05	0.99	1.0	0.053	37.38	57.57	0.085	1.61	0.95	0.26	0.80	1.11	1.0	0.038	3.18	64.28	0.105	4.28	2.94	2	1.526744	17.38	1.664	20.186
13.287	0.93	0.05	0.99	1.0	0.053	36.66	54.80	0.082	1.56	0.95	0.25	0.80	1.11	1.0	0.038	3.32	60.28	0.100	4.07	2.81	2	1.515783	15.616	1.4951	18.137
13.451	0.93	0.05	0.99	1.0	0.053	35.27	49.45	0.077	1.46	0.95	0.22	0.80	1.11	1.0	0.038	3.59	50.87	0.092	3.71	2.58	2	1.504999	12.207	1.1687	14.178
13.615	0.93	0.05	0.99	1.0	0.053	35.24	49.31	0.077	1.46	0.95	0.22	0.80	1.11	1.0	0.038	3.38	47.57	0.090	3.57	2.51	2	1.494389	12.115	1.1599	14.070
13.779	0.92	0.05	0.99	1.0	0.053	35.37	49.82	0.077	1.47	0.95	0.22	0.80	1.11	1.0	0.038	3.27	47.31	0.089	3.53	2.50	2	1.483948	12.443	1.1913	14.452
13.943	0.92	0.05	0.99	1.0	0.053	35.66	50.94	0.078	1.49	0.95	0.23	0.80	1.10	1.0	0.038	2.79	42.58	0.085	3.35	2.42	2	1.473672	13.153	1.2593	15.277
14.107	0.92	0.05	0.98	1.0	0.052	37.22	56.96	0.085	1.61	0.95	0.26	0.80	1.10	1.0	0.038	2.59	51.19	0.092	3.59	2.60	2	1.463556	16.991	1.6267	19.734
14.271	0.92	0.05	0.98	1.0	0.052	35.90	51.85	0.079	1.51	0.95	0.23	0.80	1.10	1.0	0.038	3.62	57.81	0.098	3.77	2.64	2	1.453597	13.733	1.3148	15.950
14.436	0.92	0.05	0.98	1.0	0.052	35.45	50.15	0.078	1.48	0.95	0.22	0.80	1.10	1.0	0.038	4.01	58.88	0.099	3.78	2.63	2	1.443792	12.651	1.2112	14.694
14.600	0.92	0.05	0.98	1.0	0.052	36.87	55.59	0.083	1.59	0.95	0.25	0.80	1.10	1.0	0.038	2.68	50.09	0.092	3.47	2.53	2	1.434136	16.117	1.543	18.719
14.764	0.92	0.06	0.98	1.0	0.052	39.09	64.16	0.093	1.78	0.95	0.29	0.80	1.09	1.0	0.038	1.80	45.16	0.088	3.29	2.54	2	1.407553	21.585	2.0666	25.070
14.928	0.92	0.06	0.98	1.0	0.052	39.19	64.52	0.093	1.79	0.95	0.29	0.80	1.09	1.0	0.038	2.10	53.28	0.094	3.51	2.65	2	1.397623	21.809	2.088	25.330
15.092	0.91	0.05	0.98	1.0	0.052	38.12	60.43	0.088	1.70	0.95	0.27	0.80	1.09	1.0	0.038	2.64	58.96	0.099	3.66	2.68	2	1.400566	19.206	1.8387	22.306
15.256	0.91	0.06	0.98	1.0	0.052	39.82	66.96	0.096	1.85	0.95	0.30	0.80	1.09	1.0	0.038	1.98	53.66	0.094	3.46	2.66	2	1.373842	23.37	2.2375	27.143
15.420	0.91	0.05	0.98	1.0	0.052	37.71	58.84	0.087	1.68	0.95	0.27	0.80	1.09	1.0	0.038	2.44	51.47	0.093	3.37	2.52	2	1.387453	18.192	1.7417	21.129
15.584	0.91	0.05	0.98	1.0	0.052	35.68	51.02	0.078	1.52	0.95	0.23	0.80	1.09	1.0	0.038	3.54	54.32	0.095	3.43	2.47	2	1.379148	13.209	1.2647	15.342
15.748	0.91	0.05	0.98	1.0	0.052	35.78	51.41	0.079	1.53	0.95	0.23	0.80	1.08	1.0	0.039	3.65	57.00	0.097	3.49	2.51	2	1.370446	13.458	1.2884	15.630
15.912	0.91	0.05	0.98	1.0	0.052	34.70	47.25	0.075	1.45	0.95	0.20	0.80	1.08	1.0	0.039	4.42	55.40	0.096	3.41	2.43	2	1.361867	10.804	1.0343	12.548
16.076	0.91	0.05	0.98	1.0	0.051	34.83	47.74	0.075	1.46	0.95	0.21	0.80	1.08	1.0	0.039	4.03	52.01	0.093	3.29	2.38	2	1.35341	11.113	1.064	12.908
16.240	0.91	0.05	0.98	1.0	0.051	35.06	48.62	0.076	1.48	0.95	0.21	0.80	1.08	1.0	0.039	3.68	49.89	0.092	3.21	2.35	2	1.345072	11.678	1.1181	13.563
16.404	0.90	0.05	0.98	1.0	0.051	35.00	48.39	0.076	1.48	0.95	0.21	0.80	1.08	1.0	0.039	4.11	54.99	0.095	3.32	2.40	2	1.33685	11.532	1.1041	13.394
16.568	0.90	0.05	0.98	1.0	0.051	35.36	49.78	0.077	1.51	0.94	0.22	0.80	1.08	1.0	0.039	4.21	60.68	0.101	3.48	2.50	2	1.328741	12.413	1.1884	14.417
16.732	0.90	0.05	0.98	1.0	0.051	35.60	50.72	0.078	1.53	0.94	0.22	0.80	1.07	1.0	0.039	4.17	63.04	0.103	3.54	2.54	2	1.320744	13.017	1.2463	15.119
16.896	0.90	0.06	0.97	1.0	0.051	44.02	83.13	0.117	2.31	0.94	0.36	0.80	1.07	1.0	0.039	1.93	75.38	0.120	4.08	3.19	2	1.268264	33.674	3.2239	39.110
17.060	0.90	0.06	0.97	1.0	0.051	39.57	66.01	0.095	1.87	0.94	0.30	0.80	1.07	1.0	0.039	3.20	84.66	0.136	4.61	3.24	2	1.289668	22.763	2.1793	26.438
17.224	0.90	0.05	0.98	1.0	0.051	36.38	54.44	0.082	1.62	0.94	0.25	0.80	1.07	1.0	0.039	5.61	101.37	0.177	5.94	3.78	2	1.298185	15.549	1.4887	18.059
17.388	0.90	0.05	0.98	1.0	0.051	37.72	59.64	0.087	1.73	0.94	0.27	0.80	1.07	1.0	0.039	4.07	89.16	0.146	4.87	3.30	2	1.288706	18.873	1.8069	21.920
17.552	0.90	0.05	0.98	1.0	0.051	35.62	51.49	0.079	1.56	0.94	0.23	0.80	1.07	1.0	0.039	5.55	88.16	0.144	4.76	3.16	2	1.284652	13.671	1.3088	15.878
17.716	0.89	0.05	0.98	1.0	0.050	35.87	52.48	0.080	1.58	0.94	0.24	0.80	1.06	1.0	0.039	4.87	80.89	0.129	4.26	2.92	2	1.278005	14.301	1.3692	16.610
17.880	0.89	0.05	0.97	1.0	0.050	36.98	56.04	0.084	1.66	0.94	0.25	0.80	1.06	1.0	0.039	3.58	68.22	0.110	3.58	2.62	2	1.270685	16.405	1.5706	19.054
18.044	0.89	0.05	0.98	1.0	0.050	35.45	50.83	0.078	1.56	0.94	0.23	0.80	1.06	1.0	0.039	4.82	74.13	0.118	3.83	2.69	2	1.264201	13.249	1.2684	15.387
18.208	0.89	0.05	0.98	1.0	0.050	34.70	47.96	0.076	1.50	0.94	0.21	0.80	1.06	1.0	0.039	5.21	69.03	0.111	3.57	2.54	2	1.257793	11.411	1.0925	13.253
18.372	0.89	0.05	0.98	1.0	0.050	35.50	50.32	0.078	1.55	0.94	0.22	0.80	1.06	1.0	0.039	3.79	56.22	0.097	3.10	2.32	2	1.250732	12.761	1.2217	14.821
18.537	0.89	0.05	0.98	1.0	0.050	35.51	50.36	0.078	1.55	0.94	0.22	0.80	1.06	1.0	0.039	4.27	63.40	0.104	3.31	2.43	2	1.243762	12.783	1.2238	14.847
18.701	0.89	0.05	0.97	1.0	0.050	36.42	53.85	0.081	1.63	0.94	0.24	0.80	1.06	1.0	0.039	3.59	62.60	0.103	3.26	2.44	2	1.236879	15.011	1.4372	17.435
18.865	0.89	0.05	0.97	1.0	0.050	37.29	57.23	0.085	1.70	0.94	0.26	0.80	1.05	1.0	0.039	3.05	60.77	0.101	3.17	2.44	2	1.230082	17.165	1.6434	19.936
19.029	0.88	0.05	0.97	1.0	0.050	37.25	57.06	0.085	1.70	0.94	0.26	0.80	1.05	1.0	0.039	3.48	68.88	0.110	3.45	2.58	2	1.22337	17.057	1.633	19.811
19.193	0.88	0.05	0.97	1.0	0.050	37.33	57.37	0.085	1.71	0.94	0.26	0.80	1.05	1.0	0.039	3.14	62.99	0.103	3.21	2.46	2	1.216741	17.253	1.6518	20.038
19.357	0.88	0.05	0.97	1.0	0.050	36.32	53.47	0.081	1.63	0.94	0.24	0.80	1.05	1.0	0.039	3.47	59.53	0.100	3.07	2.35	2	1.210193	14.771	1.4142	17.156
19.521	0.88	0.05	0.97	1.0	0.050	35.45	50.14	0.078	1.57	0.94	0.22	0.80	1.05	1.0	0.039	3.75	55.14	0.096	2.93	2.25	2	1.203725	12.648	1.2109	14.689
19.685	0.88	0.05	0.97	1.0	0.049	35.22	49.98	0.077	1.57	0.94	0.22	0.80	1.05	1.0	0.039	4.71	69.55	0.111	3.39	2.48	2	1.197992	12.702	1.216	14.752
19.849	0.88	0.07	0.96	1.0	0.049	34.54	83.26	0.117	2.40	0.94	0.40	0.80	1.05	1.0	0.040	1.46	71.18	0.114	3.44	2.92	2	1.154854	41.943	4.0156	48.715
20.013	0.88	0.07	0.96	1.0	0.049	45.82	90.08	0.127	2.61	0.94	0.38	0.80	1.04	1.0	0.040	1.86	82.24	0.132	3.96	3.29	2	1.154221	38.104	3.6481	44.255
20.177	0.87	0.06	0.97	1.0	0.049	38.95	64.39	0.093	1.90	0.94	0.29	0.80	1.04	1.0	0.040	3.80	96.63	0.164	4.90	3.40	2	1.17223	21.904	2.0971	25.440
20.341	0.87	0.05	0.97	1.0	0.049	36.59	55.27	0.083	1.69	0.94	0.25	0.80	1.04	1.0	0.040	5.20	97.17	0.165	4.92	3.30	2	1.173927	16.083	1.5398	18.679
20.505	0.87	0.05	0.97	1.0	0.049	35.51	51.09	0.079	1.60	0.94	0.23	0.80	1.04	1.0	0.040	5.80	90.30	0.148	4.39	3.00	2	1.168511	13.413	1.2842	15.579
20.669	0.87	0.05	0.97	1.0	0.049	35.92	52.68	0.080	1.64	0.94	0.24	0.80	1.04	1.0	0.040	5.09	85.21	0.138	4.05	2.84	2	1.163152	14.425	1.3811	16.754
20.833	0.87	0.05	0.97	1.0	0.049	36.57	54.44	0.082	1.68	0.93	0.24	0.80	1.04	1.0	0.040	4.06	72.57	0.116	3.38	2.53	2	1.157241	15.385	1.4729	17.868
20.997	0.87	0.05	0.97	1.0	0.049	37.46	57.87	0.086	1.76	0.93	0.26	0.80	1.04	1.0	0.040	3.40	69.41	0.111	3.23	2.49	2	1.151398	17.573	1.6824	20.410
21.161	0.87	0.06	0.97	1.0	0.048	38.84	63.19	0.091	1.89	0.93	0.28	0.80	1.04	1.0	0.040	2.94	71.66	0.114	3.30	2.59	2	1.141217	20.964	2.0071	24.348
21.325	0.87	0.05	0.97	1.0	0.048	38.57	62.13	0.090	1.87	0.93	0.28	0.80	1.03	1.0	0.040	2.83	66.67	0.108	3.09	2.48	2	1.136632	20.292	1.9427	23.568
21.489	0.86	0.05	0.97	1.0	0.048	35.99	52.20	0.080	1.65	0.93	0.23	0.80	1.03	1.0	0.040	3.91	63.32	0.104	2.96	2.30	2	1.134265	13.961	1.3366	16.215
21.653	0.86	0.05	0.97	1.0	0.048	34.39	46.74	0.074	1.54	0.93	0.20	0.80	1.03	1.0	0.040	5.44	67.21	0.108	3.07	2.31	2	1.129256	10.635	1.0182	12.351
21.817	0.86	0.05	0.97	1.0	0.048	34.75	48.13	0.076	1.57	0.93	0.21	0.80	1.03	1.0	0.040	6.30	84.34	0.136	3.84	2.70	2	1.124297	11.519	1.1028	13.379
21.981	0.86	0.05	0.97	1.0	0.048	37.46	58.61	0.086	1.80	0.93	0.27	0.80	1.03	1.0	0.040	4.58	96.83	0.164	4.62	3.21	2	1.119211	18.216	1.744	21.157
22.145	0.86	0.05	0.97	1.0	0.048	36.72	55.75	0.083	1.74	0.93	0.25	0.80	1.03	1.0	0.040	5.59	106.43	0.192	5.37	3.55	2	1.114527	16.391	1.5692	19.037
22.309	0.86	0.05	0.97	1.0	0.048	37.16	57.48	0.085	1.78	0.93	0.26	0.80	1.03	1.0	0.040	4.97	100.99	0.176	4.89	3.33	2	1.109714	17.491	1.6746	20.315
22.473	0.86	0.05	0.97	1.0	0.048	36.35	54.34	0.082	1.71	0.93	0.24	0.80	1.03	1.0	0.040	5.32	95.70	0.162	4.47	3.09	2	1.104948	15.488	1.4828	17.989
22.638	0.85	0.06	0.96	1.0	0.048	40.23	68.53	0.098	2.06	0.93	0.31	0.80	1.02	1.0	0.040	3.07	87.01	0.141	3.89	2.97	2	1.093612	24.366	2.3328	28.300
22.802	0.85	0.05	0.96	1.0	0.048	38.12	60.43	0.088	1.86	0.93	0.27	0.80	1.02	1.0	0.040	3.78	84.25	0.136	3.71	2.78	2	1.093357	19.205	1.8387	22.305
22.966	0.85	0.05	0.97	1.0	0.048	35.01	49.16	0.077	1.61	0.93	0.22	0.80	1.02	1.0	0.040	6.03	85.32	0.138	3.75	2.68	2	1.089866	12.181	1.1662	14.148
23.130	0.85	0.05	0.97	1.0	0.048	35.55	50.51	0.078	1.64	0.93	0.22	0.80	1.02	1.0	0.040	4.90	73.26	0.117	3.16	2.40	2	1.084767	12.88	1.2331	14.959
23.294	0.85	0.05	0.97	1.0	0.047	36.24	53.17	0.081	1.70	0.93	0.24	0.80	1.02	1.0	0.040	4.04	68.45	0.110	2.96	2.33	2	1.079723	14.575	1.3954	16.927
23.458	0.85	0.05	0.97	1.0	0.047	35.71	51.12	0.079	1.66	0.93	0.23	0.80	1.02	1.0	0.040	4.60	70.84	0.113	3.04	2.35	2	1.074732	13.269	1.2704	15.411
23.622	0.85	0.05	0.97	1.0	0.047	34.71	48.00	0.076	1.60	0.92	0.21	0.80	1.02	1.0	0.040	5.61	74.52	0.118	3.17	2.38	2	1.0703	11.439	1.0952	13.286
23.786	0.85	0.05	0.96	1.0	0.047	37.76	59.01	0.087	1.84	0.92	0.27	0.80	1.02	1.0	0.040	3.63	77.06	0.123	3.27	2.56	2	1.065253	18.302	1.7523	21.257
23.950	0.84	0.05	0.96	1.0	0.047	38.05	60.15	0.088	1.88	0.92	0.27	0.80	1.02	1.0	0.040	3.41	75.45	0.120	3.18	2.53	2	1.059964	19.027	1.8216	22.098

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2W7-C

Data File:	13-52106_SP2W7-C-BSC-CPT
Location:	White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Da	
(legend)	Tailings Sands
(legend)	Tailings Sand-Slimes
(legend)	Tailings Slimes
(legend)	Interim Cover
(legend)	Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

5613.10	Water surface elevation during CPT investigation (f
5611.32	Water surface elevation at t_0 (ft amsl)
5595.40	Water surface elevation at t_1 (ft amsl)
5590.40	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Ea
7.51	Equiv. Number of Uniform Strain Cycles, N

5619.60	Ground Surface Elevation at time of CPT (ft amsl)
5626.65	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pl
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
-0.95	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
812.44	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5590.40	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	######	5626.4	5626.15	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	######	5624.4	5622.65	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5620.65	5618.65	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334
Platform/Random Fill Layer	######	5619.13	5619.60	-0.95	0.050	101	0.406	0.430	0.00	0.00	0.406	0.430

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
24.114	5595.49	13.6	0.288	13.4	40.7	17.64	2.12%	Sand-Slime Tailing	0.059	119.0	1.35	0.55	0.80	1	1.06	14.105	196.06	16.69	15	2.35%	2.8	47%	1.76	0.00	1.76	0
24.278	5595.32	19.1	0.356	18.5	95.5	41.38	1.87%	Sand-Slime Tailing	0.059	119.0	1.36	0.55	0.81	1	1.05	19.383	269.43	23.24	22	2.01%	2.6	47%	1.77	0.00	1.77	1
24.442	5595.16	19.8	0.406	19.6	24.9	10.80	2.05%	Sand-Slime Tailing	0.059	119.0	1.37	0.56	0.81	1	1.05	20.495	284.88	23.99	23	2.21%	2.6	47%	1.78	0.01	1.77	1
24.606	5594.99	17.4	0.456	17.3	12.2	5.27	2.62%	Slime Tailings	0.057	113.1	1.38	0.56	0.82	1	1.04	18.050	250.89	21.06	20	2.85%	2.7	71%	1.79	0.01	1.78	1
24.770	5594.83	12.0	0.315	11.9	21.2	9.17	2.62%	Slime Tailings	0.057	113.1	1.39	0.57	0.82	1	1.04	12.353	171.70	14.51	13	2.96%	2.9	71%	1.80	0.02	1.78	1
24.934	5594.67	10.2	0.249	9.9	49.0	21.21	2.45%	Slime Tailings	0.057	113.1	1.40	0.58	0.83	1	1.03	10.195	141.71	12.21	11	2.84%	3.0	71%	1.81	0.02	1.78	1
25.098	5594.50	10.1	0.244	9.6	79.6	34.51	2.41%	Slime Tailings	0.057	113.1	1.41	0.58	0.83	1	1.03	9.897	137.57	12.09	10	2.81%	3.0	71%	1.82	0.03	1.79	1
25.262	5594.34	14.2	0.261	14.1	10.4	4.50	1.84%	Sand-Slime Tailing	0.059	119.0	1.42	0.59	0.83	1	1.03	14.489	201.40	16.91	15	2.04%	2.7	47%	1.83	0.03	1.79	1
25.426	5594.17	14.1	0.415	13.8	52.2	22.60	2.93%	Slime Tailings	0.057	113.1	1.43	0.59	0.84	1	1.02	14.116	196.21	16.78	15	3.26%	2.9	71%	1.83	0.04	1.80	1
25.590	5594.01	15.1	0.371	15.0	20.2	8.75	2.46%	Slime Tailings	0.057	113.1	1.44	0.60	0.84	1	1.02	15.231	211.72	17.84	16	2.72%	2.8	71%	1.84	0.04	1.80	1
25.754	5593.85	12.5	0.387	12.0	70.3	30.45	3.10%	Slime Tailings	0.057	113.1	1.45	0.60	0.85	1	1.01	12.203	169.62	14.69	13	3.51%	2.9	71%	1.85	0.05	1.80	1
25.918	5593.68	15.4	0.224	15.0	51.8	22.46	1.46%	Sand-Slime Tailing	0.059	119.0	1.46	0.61	0.85	1	1.01	15.169	210.85	18.00	16	1.61%	2.7	47%	1.86	0.05	1.81	1
26.082	5593.52	20.6	0.226	20.5	15.0	6.51	1.10%	Sand-Slime Tailing	0.059	119.0	1.47	0.61	0.86	1	1.00	20.609	286.46	24.05	22	1.18%	2.5	47%	1.87	0.06	1.81	1
26.246	5593.35	17.9	0.228	17.7	30.6	13.24	1.27%	Sand-Slime Tailing	0.059	119.0	1.48	0.62	0.86	1	1.00	17.733	246.48	20.82	19	1.39%	2.6	47%	1.88	0.06	1.82	1
26.410	5593.19	13.3	0.303	13.1	41.9	18.16	2.27%	Slime Tailings	0.057	113.1	1.49	0.62	0.86	1	1.00	13.030	181.12	15.44	14	2.56%	2.8	71%	1.89	0.07	1.82	1
26.574	5593.03	12.3	0.204	11.9	75.2	32.58	1.65%	Sand-Slime Tailing	0.059	119.0	1.50	0.63	0.87	1	0.99	11.774	163.66	14.22	12	1.88%	2.8	47%	1.90	0.07	1.83	1
26.739	5592.86	21.0	0.154	20.8	25.1	10.86	0.73%	Sand-Slime Tailing	0.059	119.0	1.51	0.63	0.87	1	0.99	20.610	286.48	24.12	22	0.79%	2.4	47%	1.91	0.08	1.83	1
26.903	5592.70	21.7	0.157	21.6	16.6	7.20	0.72%	Sand-Slime Tailing	0.059	119.0	1.51	0.64	0.88	1	0.99	21.287	295.89	24.84	23	0.78%	2.4	47%	1.92	0.08	1.84	1
27.067	5592.53	21.5	0.222	21.4	21.0	9.11	1.03%	Sand-Slime Tailing	0.059	119.0	1.52	0.64	0.88	1	0.98	20.946	291.15	24.48	23	1.11%	2.5	47%	1.93	0.09	1.84	1
27.231	5592.37	20.3	0.256	20.2	23.1	10.02	1.26%	Sand-Slime Tailing	0.059	119.0	1.53	0.65	0.89	1	0.98	19.734	274.30	23.08	21	1.36%	2.5	47%	1.94	0.09	1.85	1
27.395	5592.21	26.5	0.406	26.3	23.6	10.23	1.53%	Sand-Slime Tailing	0.059	119.0	1.54	0.65	0.89	1	0.97	25.657	356.63	29.97	28	1.63%	2.5	47%	1.95	0.10	1.85	1
27.559	5592.04	19.7	0.516	19.6	24.8	10.73	2.61%	Sand-Slime Tailing	0.059	119.0	1.55	0.66	0.90	1	0.97	18.972	263.71	22.21	20	2.84%	2.7	47%	1.96	0.10	1.86	1
27.723	5591.88	15.4	0.486	15.2	25.6	11.08	3.16%	Slime Tailings	0.057	113.1	1.56	0.66	0.90	1	0.97	14.708	204.44	17.26	15	3.51%	2.9	71%	1.97	0.11	1.86	1
27.887	5591.71	13.0	0.486	12.8	45.1	19.56	3.73%	Slime Tailings	0.057	113.1	1.57	0.67	0.91	1	0.96	12.270	170.56	14.57	13	4.24%	3.0	71%	1.98	0.12	1.86	1
28.051	5591.55	11.8	0.486	11.3	75.6	32.75	4.13%	Slime Tailings	0.057	113.1	1.58	0.67	0.91	1	0.96	10.818	150.37	13.09	11	4.77%	3.1	71%	1.99	0.12	1.87	1

Liquefaction Triggering Analyses

Depth at time of CPT (ft)	Idriss & Boulanger (2008) Cyclic Stress Ratio r_d	C_σ	K_σ	K_a	CSR M=7.5, s'v=1atm	Cyclic Resistance Ratio Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Youd et al. (2001) Cyclic Stress Ratio r_d	D_r	f	K_σ	K_a	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No
24.114	0.84	0.05	0.96	1.0	0.047	36.16	52.85	0.080	1.71	0.92	0.24	0.80	1.01	1.0	0.040	4.66	77.81	0.124	3.27	2.49	2
24.278	0.84	0.05	0.96	1.0	0.047	38.45	61.69	0.090	1.92	0.92	0.28	0.80	1.01	1.0	0.040	3.44	79.99	0.128	3.35	2.63	2
24.442	0.84	0.06	0.96	1.0	0.047	38.72	62.71	0.091	1.94	0.92	0.28	0.80	1.01	1.0	0.040	3.52	84.43	0.136	3.55	2.74	2
24.606	0.84	0.05	0.96	1.0	0.047	37.42	58.48	0.086	1.84	0.92	0.26	0.80	1.01	1.0	0.040	4.35	91.61	0.151	3.92	2.88	2
24.770	0.84	0.05	0.96	1.0	0.047	35.14	49.65	0.077	1.64	0.92	0.22	0.80	1.01	1.0	0.040	5.71	82.84	0.133	3.42	2.53	2
24.934	0.84	0.05	0.97	1.0	0.047	34.34	46.55	0.074	1.57	0.91	0.20	0.80	1.01	1.0	0.040	6.33	77.25	0.123	3.14	2.36	2
25.098	0.83	0.05	0.97	1.0	0.047	34.30	46.39	0.074	1.57	0.91	0.20	0.80	1.01	1.0	0.041	6.34	76.70	0.122	3.10	2.33	2
25.262	0.83	0.05	0.96	1.0	0.047	36.23	53.14	0.081	1.71	0.91	0.24	0.80	1.01	1.0	0.041	4.37	73.93	0.118	2.97	2.34	2
25.426	0.83	0.05	0.96	1.0	0.047	35.93	52.71	0.080	1.70	0.91	0.24	0.80	1.01	1.0	0.041	5.42	91.00	0.150	3.76	2.73	2
25.590	0.83	0.05	0.96	1.0	0.047	36.30	54.14	0.082	1.73	0.91	0.24	0.80	1.00	1.0	0.041	4.79	85.43	0.138	3.44	2.58	2
25.754	0.83	0.05	0.96	1.0	0.047	35.20	49.89	0.077	1.63	0.91	0.22	0.80	1.00	1.0	0.041	6.13	90.06	0.148	3.67	2.65	2
25.918	0.83	0.05	0.96	1.0	0.047	36.61	54.61	0.082	1.73	0.91	0.24	0.80	1.00	1.0	0.041	3.79	68.14	0.109	2.69	2.21	2
26.082	0.83	0.06	0.96	1.0	0.047	38.73	62.78	0.091	1.92	0.90	0.28	0.80	1.00	1.0	0.041	2.68	64.55	0.105	2.57	2.25	2
26.246	0.82	0.05	0.96	1.0	0.047	37.60	58.42	0.086	1.82	0.90	0.26	0.80	1.00	1.0	0.041	3.20	66.52	0.107	2.61	2.21	2
26.410	0.82	0.05	0.96	1.0	0.048	35.46	50.90	0.078	1.65	0.90	0.23	0.80	1.00	1.0	0.041	5.18	79.94	0.128	3.08	2.36	2
26.574	0.82	0.05	0.96	1.0	0.048	35.29	49.50	0.077	1.62	0.90	0.22	0.80	1.00	1.0	0.041	4.83	68.70	0.110	2.64	2.13	2
26.739	0.82	0.06	0.96	1.0	0.047	38.76	62.88	0.091	1.92	0.90	0.28	0.80	1.00	1.0	0.041	2.30	55.56	0.096	2.29	2.10	2
26.903	0.82	0.06	0.96	1.0	0.047	39.01	63.86	0.092	1.94	0.90	0.29	0.80	1.00	1.0	0.042	2.24	55.75	0.096	2.28	2.11	2
27.067	0.82	0.06	0.96	1.0	0.047	38.89	63.36	0.092	1.93	0.90	0.29	0.80	0.99	1.0	0.042	2.60	63.68	0.104	2.45	2.19	2
27.231	0.82	0.05	0.96	1.0	0.048	38.40	61.48	0.090	1.88	0.90	0.28	0.80	0.99	1.0	0.042	2.95	68.20	0.110	2.56	2.22	2
27.395	0.82	0.06	0.96	1.0	0.047	40.81	70.78	0.101	2.12	0.89	0.32	0.80	0.99	1.0	0.042	2.66	79.84	0.127	2.96	2.54	2
27.559	0.81	0.05	0.96	1.0	0.048	38.09	60.30	0.088	1.85	0.89	0.27	0.80	0.99	1.0	0.042	4.26	94.50	0.158	3.66	2.76	2
27.723	0.81	0.05	0.96	1.0	0.048	36.10	53.36	0.081	1.69	0.89	0.24	0.80	0.99	1.0	0.042	5.57	96.13	0.163	3.73	2.71	2
27.887	0.81	0.05	0.96	1.0	0.048	35.16	49.73	0.077	1.61	0.89	0.22	0.80	0.99	1.0	0.042	6.77	98.65	0.169	3.87	2.74	2
28.051	0.81	0.05	0.96	1.0	0.048	34.65	47.74	0.075	1.57	0.89	0.21	0.80	0.99	1.0	0.042	7.64	100.00	0.173	3.93	2.75	2

Idriss & Boulanger (2008)

Depth at time of CPT (ft)	CN	qc1 TSF	qc1 MPa	qc1N
24.114	1.055773	14.373	1.3761	16.694
24.278	1.050021	20.009	1.9157	23.240
24.442	1.045128	20.658	1.9778	23.993
24.606	1.042144	18.129	1.7357	21.056
24.770	1.038033	12.49	1.1958	14.506
24.934	1.033939	10.511	1.0063	12.207
25.098	1.029881	10.409	0.9966	12.090
25.262	1.025398	14.555	1.3935	16.905
25.426	1.021415	14.449	1.3833	16.781
25.590	1.017468	15.36	1.4705	17.839
25.754	1.013556	12.648	1.2109	14.690
25.918	1.009233	15.495	1.4835	17.997
26.082	1.004823	20.703	1.9821	24.046
26.246	1.000711	17.924	1.716	20.817
26.410	0.996943	13.291	1.2725	15.437
26.574	0.99278	12.24	1.1719	14.216
26.739	0.988954	20.765	1.988	24.117
26.903	0.985064	21.389	2.0478	24.842
27.067	0.981089	21.075	2.0177	24.477
27.231	0.976931	19.875	1.9028	23.084
27.395	0.974439	25.801	2.4701	29.966
27.559	0.968933	19.122	1.8307	22.208
27.723	0.965107	14.862	1.4229	17.262
27.887	0.961637	12.541	1.2007	14.566
28.051	0.958196	11.27	1.079	13.090

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2E1

Data File: 13-52106_SP2E1-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69

Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

5613.10	Water surface elevation during CPT investigation (ft amsl)
5611.67	Water surface elevation at t_0 (ft amsl)
5595.46	Water surface elevation at t_1 (ft amsl)
5590.46	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earth
7.51	Equiv. Number of Uniform Strain Cycles, N

5619.95	Ground Surface Elevation at time of CPT (ft amsl)
5630.46	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after plac
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
2.51	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1160.95	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5590.46	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	######	5630.21	5629.96	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	######	5628.21	5626.46	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5624.46	5622.46	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334
Platform/Random Fill Layer	######	5621.21	5619.95	2.51	0.050	101	0.580	0.517	0.00	0.00	0.580	0.517

Column groups: 2013 CPT Data from ConeTec (Depth … fs/qt); CPT Data Interpretations (Material Type … FC); Conditions at t_1 (Total Stress … Saturated); Liquefaction Triggering Analyses — Idriss & Boulanger (2008) (Cyclic Stress Ratio; Cyclic Resistance Ratio; FoS) and Youd et al. (2001) (Cyclic Stress Ratio; CRR; FoS); Avg FoS; Liquefiable?; Idriss & Boulanger (2008) (CN, qc1, qc1, qc1N).

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of CPT (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F, (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No	r_d	C_σ	K_σ	K_α	CSR M=7.5, s'v=1atm	Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	r_d	D_r	f	K_σ	K_α	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No	CN	qc1 TSF	qc1 MPa	qc1N
0.164	5619.79	13.5	0.057	13.5	-0.0	-0.01	0.42%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0	1.70	22.933	318.77	26.63	1632	0.42%	0.9	51%	0.59	0.00	0.59	0	1.00	0.06	1.02	1.0	0.059	39.67	66.30	0.095	1.61	0.98	0.30	0.80	2.53	1.0	0.017	1.00	26.63	0.072	174.99	88.30	2	1.7	22.933	2.1956	26.635
0.328	5619.62	36.9	0.160	36.9	0.1	0.05	0.43%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	62.713	871.71	72.84	2232	0.43%	0.9	51%	0.60	0.00	0.60	0	1.00	0.09	1.03	1.0	0.060	55.88	128.72	0.200	3.35	0.97	0.49	0.75	2.65	1.0	0.016	1.00	72.84	0.116	140.58	71.97	2	1.7	62.714	6.0043	72.839
0.492	5619.46	45.5	0.725	45.5	0.2	0.09	1.59%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	77.333	1074.93	89.82	1834	1.59%	1.4	51%	0.61	0.00	0.61	0	1.00	0.10	1.03	1.0	0.060	61.84	151.66	0.279	4.67	0.97	0.55	0.73	2.64	1.0	0.016	1.00	89.82	0.147	119.19	61.93	2	1.7	77.335	7.4041	89.820
0.656	5619.29	78.6	0.721	78.6	0.4	0.19	0.92%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0	1.70	133.671	1858.03	155.26	2379	0.92%	1.2	51%	0.61	0.00	0.61	0	1.00	0.17	1.06	1.0	0.061	84.80	240.06	1.000	16.37	0.97	0.72	0.64	3.23	1.0	0.013	1.00	155.26	0.428	259.71	138.04	2	1.7	133.68	12.798	155.256
0.820	5619.13	133.5	1.017	133.5	1.1	0.48	0.76%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0	1.70	226.865	3153.42	263.50	3230	0.76%	1.1	51%	0.62	0.00	0.62	0	1.00	0.30	1.10	1.0	0.063	122.79	386.30	1.000	15.76	0.97	0.94	0.60	3.37	1.0	0.013	1.00	263.50	1.000	485.59	250.68	2	1.7	226.88	21.721	263.504
0.984	5618.97	159.6	1.857	159.6	1.1	0.48	1.16%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0	1.70	271.388	3772.29	315.21	3220	1.16%	1.3	51%	0.63	0.00	0.63	0	1.00	0.30	1.09	1.0	0.063	140.94	456.15	1.000	15.82	0.97	1.03	0.60	3.13	1.0	0.014	1.00	315.21	1.000	404.82	210.32	2	1.7	271.4	25.984	315.214
1.148	5618.80	202.0	1.570	202.0	1.5	0.66	0.78%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0	1.70	343.332	4772.31	398.78	3491	0.78%	1.1	51%	0.64	0.00	0.64	0	1.00	0.30	1.09	1.0	0.063	170.26	569.04	1.000	15.87	0.97	1.15	0.60	2.95	1.0	0.015	1.00	398.78	1.000	347.12	181.50	2	1.7	343.35	32.872	398.778
1.312	5618.64	282.1	2.962	282.1	2.0	0.85	1.05%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	479.536	6665.55	556.98	4267	1.05%	1.3	51%	0.65	0.00	0.65	0	1.00	0.30	1.09	1.0	0.063	225.78	782.76	1.000	15.93	0.97	1.36	0.60	2.79	1.0	0.015	1.00	556.98	1.000	303.85	159.89	2	1.7	479.56	45.913	556.976
1.476	5618.47	258.6	3.915	258.6	2.8	1.19	1.51%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	439.552	6109.77	510.55	3477	1.51%	1.4	51%	0.65	0.00	0.65	0	1.00	0.30	1.08	1.0	0.063	209.49	720.03	1.000	15.99	0.97	1.30	0.60	2.66	1.0	0.016	1.00	510.55	1.000	270.20	143.09	2	1.7	439.58	42.086	510.547
1.640	5618.31	203.5	4.263	203.5	3.0	1.31	2.09%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0	1.70	345.933	4808.47	401.82	2462	2.10%	1.5	51%	0.66	0.00	0.66	0	1.00	0.30	1.08	1.0	0.063	171.33	573.15	1.000	16.04	0.97	1.16	0.60	2.55	1.0	0.017	1.00	401.82	1.000	243.27	129.66	2	1.7	345.97	33.123	401.818
1.804	5618.15	196.8	3.157	196.7	3.4	1.46	1.60%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0	1.70	334.441	4648.73	388.47	2164	1.61%	1.4	51%	0.67	0.00	0.67	0	1.00	0.30	1.07	1.0	0.062	166.65	555.12	1.000	16.10	0.97	1.14	0.60	2.46	1.0	0.017	1.00	388.47	1.000	221.25	118.67	2	1.7	334.48	32.023	388.475
1.968	5617.98	198.9	2.435	198.9	3.1	1.34	1.22%	Interim Cover	0.050	100.7	0.10	0.00	0.10	0	1.70	338.113	4699.77	392.74	2005	1.22%	1.3	51%	0.68	0.00	0.68	0	1.00	0.30	1.07	1.0	0.062	168.14	560.88	1.000	16.17	0.97	1.14	0.60	2.37	1.0	0.018	1.00	392.74	1.000	202.89	109.53	2	1.7	338.15	32.374	392.736
2.133	5617.82	169.5	1.671	169.5	3.4	1.46	0.99%	Interim Cover	0.050	100.7	0.11	0.00	0.11	0	1.70	288.167	4005.52	334.73	1578	0.99%	1.2	51%	0.69	0.00	0.69	0	1.00	0.30	1.07	1.0	0.062	147.79	482.52	1.000	16.23	0.97	1.06	0.60	2.30	1.0	0.019	1.00	334.73	1.000	187.35	101.79	2	1.7	288.2	27.593	334.730
2.297	5617.65	152.5	1.369	152.5	3.4	1.45	0.90%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	258.952	3599.44	300.80	1318	0.90%	1.2	51%	0.70	0.00	0.70	0	1.00	0.30	1.06	1.0	0.061	135.88	436.68	1.000	16.30	0.97	1.00	0.60	2.23	1.0	0.019	1.00	300.80	1.000	174.04	95.17	2	1.69827	258.99	24.795	300.799
2.461	5617.49	96.6	1.501	96.6	1.4	0.60	1.55%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	164.203	2282.42	190.73	779	1.56%	1.5	51%	0.70	0.00	0.70	0	1.00	0.24	1.05	1.0	0.060	97.25	287.98	1.000	16.57	0.97	0.80	0.60	2.17	1.0	0.020	1.00	190.73	1.000	162.50	89.54	2	1.7	164.22	15.722	190.729
2.625	5617.33	111.8	1.580	111.8	1.3	0.55	1.41%	Interim Cover	0.050	100.7	0.13	0.00	0.13	0	1.70	190.060	2641.83	220.76	845	1.41%	1.5	51%	0.71	0.00	0.71	0	1.00	0.30	1.06	1.0	0.061	107.79	328.55	1.000	16.44	0.97	0.86	0.60	2.12	1.0	0.020	1.00	220.76	1.000	152.41	84.42	2	1.7	190.07	18.198	220.759
2.789	5617.16	136.8	1.973	136.8	1.2	0.50	1.44%	Interim Cover	0.050	100.7	0.14	0.00	0.14	0	1.61	220.642	3066.92	256.28	973	1.44%	1.5	51%	0.72	0.00	0.72	0	0.99	0.30	1.05	1.0	0.061	120.26	376.53	1.000	16.51	0.97	0.92	0.60	2.07	1.0	0.021	1.00	256.28	1.000	143.50	80.00	2	1.61347	220.65	21.125	256.276
2.953	5617.00	124.7	1.720	124.7	1.6	0.69	1.38%	Interim Cover	0.050	100.7	0.15	0.00	0.15	0	1.64	204.705	2845.41	237.77	837	1.38%	1.5	51%	0.73	0.00	0.73	0	0.99	0.30	1.05	1.0	0.060	113.76	351.53	1.000	16.58	0.97	0.89	0.60	2.02	1.0	0.021	1.00	237.77	1.000	135.58	76.08	2	1.641978	204.72	19.6	237.772
3.117	5616.83	124.7	1.712	124.7	1.4	0.61	1.37%	Interim Cover	0.050	100.7	0.16	0.00	0.16	0	1.63	202.585	2815.93	235.31	793	1.37%	1.5	51%	0.74	0.00	0.74	0	0.99	0.30	1.05	1.0	0.060	112.90	348.20	1.000	16.64	0.97	0.89	0.60	1.98	1.0	0.022	1.00	235.31	1.000	128.49	72.57	2	1.625102	202.6	19.397	235.307
3.281	5616.67	121.9	1.635	121.9	1.2	0.52	1.34%	Sand Tailings	0.051	102.8	0.17	0.00	0.17	0	1.62	197.463	2744.73	229.35	736	1.34%	1.5	18%	0.75	0.00	0.75	0	0.99	0.30	1.04	1.0	0.060	80.72	310.08	1.000	16.71	0.97	0.87	0.60	1.93	1.0	0.022	1.00	229.35	1.000	121.99	69.35	2	1.619873	197.47	18.906	229.355
3.445	5616.51	125.5	1.702	125.5	0.9	0.41	1.36%	Sand Tailings	0.051	102.8	0.17	0.00	0.17	0	1.59	199.479	2772.75	231.69	721	1.36%	1.5	18%	0.75	0.00	0.75	0	0.99	0.30	1.04	1.0	0.060	81.32	313.02	1.000	16.78	0.97	0.88	0.60	1.90	1.0	0.022	1.00	231.69	1.000	116.12	66.45	2	1.589344	199.49	19.099	231.693
3.609	5616.34	150.5	1.842	150.5	1.6	0.68	1.22%	Sand Tailings	0.051	102.8	0.18	0.00	0.18	0	1.51	226.750	3151.82	263.37	825	1.22%	1.4	18%	0.76	0.00	0.76	0	0.99	0.30	1.04	1.0	0.059	89.42	352.79	1.000	16.85	0.97	0.94	0.60	1.86	1.0	0.023	1.00	263.37	1.000	110.79	63.82	2	1.506243	226.76	21.71	263.373
3.773	5616.18	107.6	1.906	107.6	1.3	0.56	1.77%	Sand Tailings	0.051	102.8	0.19	0.00	0.19	0	1.63	175.430	2438.48	203.77	563	1.78%	1.6	18%	0.77	0.00	0.77	0	0.99	0.27	1.03	1.0	0.059	74.18	277.95	1.000	16.97	0.97	0.82	0.60	1.83	1.0	0.023	1.00	203.77	1.000	105.93	61.45	2	1.631001	175.44	16.797	203.767
3.937	5616.01	87.2	1.794	87.2	1.1	0.46	2.06%	Sand-Slime Tailings	0.047	93.3	0.20	0.00	0.20	0	1.70	148.257	2060.77	172.20	439	2.06%	1.7	47%	0.78	0.00	0.78	0	0.99	0.20	1.02	1.0	0.058	90.70	262.90	1.000	17.16	0.97	0.76	0.62	1.74	1.0	0.024	1.07	183.75	1.000	101.89	59.52	2	1.7	148.27	14.195	172.204
4.101	5615.85	65.2	1.491	65.2	1.0	0.41	2.29%	Sand-Slime Tailings	0.047	93.3	0.21	0.00	0.21	0	1.70	110.823	1540.44	128.73	315	2.29%	1.9	47%	0.79	0.00	0.79	0	0.99	0.13	1.01	1.0	0.058	75.45	204.17	1.000	17.30	0.97	0.66	0.67	1.60	1.0	0.027	1.15	147.94	0.381	37.40	27.35	2	1.7	110.83	10.611	128.726
4.265	5615.68	46.2	1.366	46.2	0.5	0.23	2.96%	Sand-Slime Tailings	0.047	93.3	0.21	0.00	0.21	0	1.70	78.506	1091.23	91.19	215	2.97%	2.0	47%	0.79	0.00	0.79	0	0.99	0.10	1.01	1.0	0.058	62.28	153.47	0.288	5.01	0.97	0.55	0.72	1.47	1.0	0.029	1.36	123.57	0.255	24.18	14.60	2	1.7	78.512	7.5167	91.186
4.429	5615.52	32.1	1.104	32.1	0.4	0.18	3.44%	Slime Tailings	0.041	82.7	0.22	0.00	0.22	0	1.70	54.519	757.81	63.33	144	3.47%	2.2	71%	0.80	0.00	0.80	0	0.99	0.08	1.01	1.0	0.057	52.14	115.47	0.170	2.97	0.97	0.46	0.77	1.37	1.0	0.031	1.65	104.62	0.186	17.12	10.04	2	1.7	54.523	5.2201	63.326
4.593	5615.36	21.5	0.652	21.5	-0.3	-0.13	3.03%	Slime Tailings	0.041	82.7	0.23	0.00	0.23	0	1.70	36.601	508.75	42.51	94	3.06%	2.3	71%	0.81	0.00	0.81	0	0.98	0.07	1.00	1.0	0.057	44.89	87.40	0.123	2.15	0.96	0.38	0.80	1.31	1.0	0.033	1.86	78.93	0.126	11.20	6.68	2	1.7	36.598	3.5039	42.506
4.757	5615.19	14.9	0.336	15.0	-0.3	-0.11	2.25%	Sand-Slime Tailings	0.047	93.3	0.23	0.00	0.23	0	1.70	25.415	353.27	29.51	63	2.28%	2.3	47%	0.82	0.00	0.82	0	0.98	0.06	1.00	1.0	0.057	40.65	70.17	0.100	1.75	0.96	0.31	0.80	1.30	1.0	0.033	1.95	57.54	0.098	8.43	5.09	2	1.7	25.412	2.433	29.515
4.921	5615.03	12.8	0.162	12.8	2.1	0.92	1.27%	Sand-Slime Tailings	0.047	93.3	0.24	0.00	0.24	0	1.70	21.675	301.28	25.20	52	1.29%	2.2	47%	0.82	0.00	0.82	0	0.98	0.06	1.00	1.0	0.057	39.14	64.34	0.093	1.63	0.96	0.29	0.80	1.29	1.0	0.033	1.68	42.30	0.085	7.12	4.37	2	1.7	21.697	2.0773	25.200
5.085	5614.86	42.1	0.172	42.1	8.1	3.53	0.41%	Sand Tailings	0.051	102.8	0.25	0.00	0.25	0	1.70	71.536	994.35	83.19	167	0.41%	1.5	18%	0.83	0.00	0.83	0	0.98	0.09	1.00	1.0	0.057	43.36	126.54	0.194	3.41	0.96	0.53	0.74	1.38	1.0	0.031	1.00	83.19	0.134	10.78	7.10	2	1.7	71.622	6.8571	83.185
5.249	5614.70	49.6	0.237	49.6	-0.1	-0.03	0.48%	Sand Tailings	0.051	102.8	0.26	0.00	0.26	0	1.70	84.371	1172.76	97.99	190	0.48%	1.5	18%	0.84	0.00	0.84	0	0.98	0.10	1.00	1.0	0.057	47.14	145.13	0.251	4.41	0.96	0.57	0.71	1.41	1.0	0.030	1.00	97.99	0.168	13.09	8.75	2	1.7	84.37	8.0776	97.991
5.413	5614.54	53.8	0.297	53.8	0.1	0.06	0.55%	Sand Tailings	0.051	102.8	0.27	0.00	0.27	0	1.70	91.511	1272.00	106.29	200	0.55%	1.5	18%	0.85	0.00	0.85	0	0.98	0.11	1.00	1.0	0.057	49.26	155.55	0.299	5.27	0.96	0.60	0.70	1.42	1.0	0.030	1.00	106.29	0.192	14.51	9.89	2	1.7	91.512	8.7614	106.286
5.577	5614.37	52.6	0.352	52.6	-0.1	-0.03	0.67%	Sand Tailings	0.051	102.8	0.28	0.00	0.28	0	1.70	89.454	1243.41	103.89	189	0.67%	1.6	18%	0.86	0.00	0.86	0	0.98	0.11	1.00	1.0	0.057	48.65	152.54	0.283	5.00	0.96	0.59	0.71	1.40	1.0	0.030	1.00	103.89	0.184	13.54	9.27	2	1.7	89.453	8.5643	103.895
5.741	5614.21	48.6	0.424	48.6	-0.1	-0.03	0.87%	Sand Tailings	0.051	102.8	0.28	0.00	0.28	0	1.70	82.637	1148.65	95.98	170	0.88%	1.7	18%	0.87	0.00	0.87	0	0.98	0.10	1.00	1.0	0.057	46.63	142.60	0.241	4.27	0.96	0.57	0.72	1.37	1.0	0.031	1.04	99.63	0.172	12.26	8.27	2	1.7	82.636	7.9116	95.977
5.905	5614.04	40.4	0.469	40.4	-0.1	-0.02	1.16%	Sand-Slime Tailings	0.047	93.3	0.29	0.00	0.29	0	1.70	68.646	954.18	79.73	137	1.17%	1.9	47%	0.87	0.00	0.87	0	0.98	0.09	1.00	1.0	0.056	58.26	137.99	0.226	4.00	0.96	0.52	0.74	1.32	1.0	0.032	1.15	91.53	0.151	10.51	7.26	2	1.7	68.645	6.5721	79.728
6.069	5613.88	31.5	0.463	31.5	-0.1	-0.02	1.47%	Sand-Slime Tailings	0.047	93.3	0.30	0.00	0.30	0	1.70	53.584	744.82	62.23	104	1.48%	2.0	47%	0.88	0.00	0.88	0	0.98	0.08	1.00	1.0	0.056	52.13	114.36	0.168	2.98	0.96	0.46	0.77	1.27	1.0	0.033	1.32	81.85	0.131	8.87	5.93	2	1.7	53.583	5.1301	62.234
6.234	5613.72	26.6	0.418	26.6	-0.2	-0.07	1.57%	Sand-Slime Tailings	0.047	93.3	0.31	0.00	0.31	0	1.70	45.254	629.03	52.56	86	1.59%	2.1	47%	0.89	0.00	0.89	0	0.98	0.07	1.00	1.0	0.056	48.73	101.29	0.145	2.57	0.96	0.42	0.79	1.24	1.0	0.034	1.44	75.88	0.121	7.97	5.27	2	1.7	45.252	4.3325	52.558
6.398	5613.55	29.2	0.352	29.2	-0.1	-0.04	1.20%	Sand-Slime Tailings	0.047	93.3	0.32	0.00	0.32	0	1.70	49.674	690.47	57.69	92	1.22%	2.0	47%	0.90	0.00	0.90	0	0.97	0.08	1.00	1.0	0.056	50.54	108.23	0.157	2.79	0.96	0.44	0.78	1.25	1.0	0.034	1.29	74.59	0.119	7.65	5.22	2	1.7	49.673	4.7557	57.692
6.562	5613.39	31.3	0.327	31.3	-0.1	-0.04	1.04%	Sand-Slime Tailings	0.047	93.3	0.32	0.00	0.32	0	1.70	53.244	740.09	61.84	96	1.05%	1.9	47%	0.90	0.00	0.90	0	0.97	0.08	1.00	1.0	0.056	51.99	113.83	0.167	2.98	0.96	0.45	0.77	1.25	1.0	0.034	1.23	75.92	0.121	7.60	5.29	2	1.7	53.243	5.0975	61.839
6.726	5613.22	39.3	0.336	39.4	-0.1	-0.06	0.85%	Sand Tailings	0.051	102.8	0.33	0.00	0.33	0	1.70	66.713	927.31	77.48	118	0.86%	1.8	18%	0.91	0.00	0.91	0	0.97	0.09	0.99	1.0	0.056	41.90	119.38	0.178	3.19	0.96	0.51	0.75	1.27	1.0	0.033	1.12	86.56	0.140	8.62	5.90	2	1.69537	66.711	6.3869	77.481
6.890	5613.06	39.3	0.331	39.4	-0.2	-0.10	0.84%	Sand Tailings	0.062	123.5	0.34	0.00	0.34	1	1.67	65.899	915.99	76.53	115	0.85%	1.8	18%	0.92	0.00	0.92	0	0.97	0.09	0.99	1.0	0.056	41.66	118.19	0.176	3.15	0.96	0.51	0.75	1.26	1.0	0.033	1.12	85.79	0.139	8.30	5.72	2	1.674687	65.897	6.3089	76.535
7.054	5612.90	38.3	0.410	38.3	-0.2	-0.07	1.07%	Sand-Slime Tailings	0.059	119.0	0.35	0.01	0.34	1	1.67	63.953	888.95	74.28	110	1.08%	1.9	47%	0.93	0.00	0.93	0	0.97	0.09	0.99	1.0	0.056	56.35	130.63	0.205	3.67	0.96	0.50	0.75	1.26	1.0	0.034	1.19	88.39	0.144	8.51	6.09	2	1.671539	63.951	6.1227	74.276
7.218	5612.73	36.3	0.454	36.4	-0.2	-0.09	1.25%	Sand-Slime Tailings	0.059	119.0	0.36	0.01	0.35	1	1.67	60.858	845.93	70.68	103	1.26%	2.0	47%	0.94	0.00	0.94	0	0.97	0.08	0.99	1.0	0.056	55.09	125.77	0.193	3.46	0.96	0.49	0.76	1.24	1.0	0.034	1.26	88.99	0.146	8.48	5.97	2	1.674222	60.856	5.8263	70.680
7.382	5612.57	32.3	0.463	32.3	-0.5	-0.21	1.43%	Sand-Slime Tailings	0.059	119.0	0.37	0.02	0.35	1	1.69	54.740	760.88	63.57	90	1.45%	2.0	47%	0.95	0.00	0.95	0	0.97	0.08	0.99	1.0	0.056	52.60	116.17	0.172	3.09	0.96	0.46	0.77	1.23	1.0	0.034	1.37	87.13	0.142	8.14	5.62	2	1.69316	54.735	5.2403	63.571
7.546	5612.40	29.1	0.420	29.1	-0.5	-0.23	1.44%	Sand-Slime Tailings	0.059	119.0	0.38	0.02	0.36	1	1.70	49.419	686.92	57.39	80	1.46%	2.1	47%	0.96	0.00	0.96	0	0.97	0.08	0.99	1.0	0.055	50.43	107.82	0.156	2.81	0.96	0.44	0.78	1.21	1.0	0.035	1.44	82.66	0.133	7.53	5.17	2	1.7	49.413	4.7308	57.391
7.710	5612.24	35.5	0.360	35.5	-0.4	-0.19	1.01%	Sand-Slime Tailings	0.059	119.0	0.39	0.03	0.36	1	1.65	58.534	813.62	67.98	97	1.03%	1.9	47%	0.97	0.00	0.97	0	0.97	0.08	0.99	1.0	0.055	54.14	122.12	0.184	3.33	0.96	0.48	0.76	1.23	1.0	0.034	1.22	82.74	0.133	7.44	5.39	2	1.648375	58.529	5.6036	67.978
7.874	5612.08	29.1	0.340	29.1	-0.8	-0.33	1.17%	Sand-Slime Tailings	0.059	119.0	0.40	0.03	0.37	1	1.69	48.995	681.04	56.90	78	1.19%	2.0	47%	0.98	0.00	0.98	0	0.96	0.08	0.99	1.0	0.055	50.26	107.15	0.155	2.80	0.96	0.44	0.78	1.20	1.0	0.035	1.36	77.25	0.123	6.81	4.81	2	1.685427	48.987	4.6901	56.896
8.038	5611.91	19.8	0.302	19.8	-0.8	-0.33	1.53%	Sand-Slime Tailings	0.059	119.0	0.41	0.04	0.37	1	1.70	33.592	466.93	39.01	52	1.56%	2.3	47%	0.99	0.00	0.99	0	0.96	0.06	0.99	1.0	0.055	43.98	82.99	0.117	2.11	0.96	0.36	0.80	1.18	1.0	0.036	1.81	70.50	0.113	6.17	4.14	2	1.7	33.584	3.2153	39.006
8.202	5611.75	15.7	0.241	15.7	-0.7	-0.32	1.53%	Sand-Slime Tailings	0.059	119.0	0.42	0.04	0.38	1	1.70	26.758	371.94	31.07	41	1.57%	2.3	47%	1.00	0.00	1.00	0	0.96	0.06	0.99	1.0	0.055	41.20	72.27	0.102	1.86	0.96	0.32	0.80	1.18	1.0	0.036	2.08	64.68	0.105	5.69	3.77	2	1.7	26.75	2.5611	31.069
8.366	5611.58	12.1	0.199	12.1	0.0	0.00	1.64%	Sand-Slime Tailings	0.059	119.0	0.43	0.05	0.38	1	1.70	20.587	286.16	23.91	31	1.70%	2.5	47%	1.01	0.00	1.01	0	0.96	0.06	0.99	1.0	0.055	38.69	62.60	0.091	1.65	0.96	0.28	0.80	1.18	1.0	0.036	2.57	61.41	0.102	5.43	3.54	2	1.7	20.587	1.971	23.911
8.530	5611.42	12.2	0.172	12.2	1.6	0.68	1.41%	Sand-Slime Tailings	0.059	119.0	0.44	0.05	0.39	1	1.70	20.672	287.34	24.03	30	1.47%	2.4	47%	1.02	0.00	1.02	0	0.96	0.06	0.99	1.0	0.055	38.73	62.76	0.091	1.65	0.96	0.28	0.80	1.17	1.0	0.036	2.41	57.94	0.098	5.18	3.42	2	1.7	20.689	1.9807	24.029
8.694	5611.26	15.4	0.055	15.4	3.8	1.64	0.36%	Sand-Slime Tailings	0.059	119.0	0.45	0.06	0.39	1	1.70	26.197	364.14	30.47	38	0.37%	2.0	47%	1.03	0.00	1.03	0	0.96	0.06	0.99	1.0	0.055	40.99	71.46	0.101	1.85	0.96	0.32	0.80	1.17	1.0	0.036	1.36	41.48	0.085	4.42	3.13	2	1.7	26.237	2.5119	30.473
8.858	5611.09	18.3	0.062	18.3	2.3	0.99	0.34%	Sand-Slime Tailings	0.059	119.0	0.46	0.06	0.40	1	1.70	31.076	431.96	36.12	45	0.35%	2.0	47%	1.04	0.00	1.04	0	0.96	0.06	0.99	1.0	0.055	42.97	79.09	0.111	2.03	0.95	0.35	0.80	1.17	1.0	0.036	1.26	45.58	0.088	4.54	3.29	2	1.7	31.1	2.9775	36.121
9.022	5610.93	16.7	0.107	16.7	1.6	0.68	0.64%	Sand-Slime Tailings	0.059	119.0	0.47	0.07	0.40	1	1.70	28.441	395.33	33.05	41	0.66%	2.1	47%	1.05	0.00	1.05	0	0.96	0.06	0.99	1.0	0.055	41.89	74.95	0.106	1.94	0.95	0.33	0.80	1.17	1.0	0.036	1.51	50.04	0.092	4.68	3.31	2	1.7	28.458	2.7245	33.052
9.186	5610.76	20.6	0.079	20.6	2.3	1.01	0.38%	Sand-Slime Tailings	0.059	119.0	0.48	0.07	0.41	1	1.67	34.288	476.60	39.85	50	0.39%	2.0	47%	1.06	0.00	1.06	0	0.96	0.06	0.99	1.0	0.055	44.28	84.13	0.118	2.17	0.95	0.36	0.80	1.16	1.0	0.036	1.24	49.54	0.091	4.61	3.39	2	1.668509	34.312	3.285	39.851
9.350	5610.60	19.5	0.075	19.5	1.6	0.68	0.38%	Sand-Slime Tailings	0.059	119.0	0.49	0.08	0.41	1	1.67	32.552	452.47	37.83	46	0.39%	2.0	47%	1.07	0.00	1.07	0	0.96	0.06	0.99	1.0	0.054	43.57	81.39	0.115	2.10	0.95	0.36	0.80	1.16	1.0	0.036	1.27	48.15	0.090	4.50	3.30	2	1.666763	32.568	3.1181	37.826
9.514	5610.44	17.8	0.086	17.8	1.5	0.66	0.48%	Sand-Slime Tailings	0.059	119.0	0.50	0.08	0.41	1	1.67	29.767	413.77	34.59	42	0.50%	2.1	47%	1.08	0.00	1.08	0	0.95	0.06	0.99	1.0	0.054	42.43	77.02	0.109	2.00	0.95	0.34	0.80	1.16	1.0	0.036	1.39	48.17	0.090	4.45	3.23	2	1.672322	29.783	2.8515	34.592
9.678	5610.27	15.7	0.078	15.6	1.8	0.77	0.50%	Sand-Slime Tailings	0.059	119.0	0.51	0.09	0.42	1	1.68	26.331	366.00	30.60	36	0.52%	2.1	47%	1.09	0.00	1.09	0	0.95	0.06	0.99	1.0	0.054	41.03	71.64	0.102	1.87	0.95	0.32	0.80	1.15	1.0	0.036	1.51	46.09	0.088	4.32	3.10	2	1.683575	26.35	2.5227	30.604
9.842	5610.11	16.0	0.072	16.0	2.3	1.01	0.45%	Sand-Slime Tailings	0.059	119.0	0.52	0.09	0.42	1	1.67	26.712	371.30	31.05	37	0.46%	2.1	47%	1.10	0.00	1.10	0	0.95	0.06	0.99	1.0	0.054	41.19	72.24	0.102	1.89	0.95	0.32	0.80	1.15	1.0	0.036	1.46	45.31	0.088	4.24	3.07	2	1.667416	26.736	2.5597	31.053
10.006	5609.94	15.8	0.137	15.8	2.7	1.18	0.87%	Sand-Slime Tailings	0.059	119.0	0.53	0.10	0.43	1	1.66	26.226	364.54	30.49	36	0.89%	2.2	47%	1.11	0.00	1.11	0	0.95	0.06	0.99	1.0	0.054	41.00	71.49	0.101	1.87	0.95	0.32	0.80	1.15	1.0	0.037	1.79	54.55	0.095	4.55	3.21	2	1.657787	26.254	2.5136	30.493
10.170	5609.78	17.6	0.093	17.6	0.8	0.35	0.53%	Sand-Slime Tailings	0.059	119.0	0.54	0.10	0.43	1	1.63	28.606	397.62	33.23	39	0.55%	2.1	47%	1.12	0.00	1.12	0	0.95	0.06	0.98	1.0	0.054	41.96	75.19	0.106	1.97	0.95	0.33	0.80	1.15	1.0	0.037	1.46	48.69	0.091	4.29	3.13	2	1.629036	28.614	2.7395	33.233
10.335	5609.62	16.3	0.209	16.3	0.9	0.39	1.28%	Sand-Slime Tailings	0.059	119.0	0.55	0.11	0.44	1	1.63	26.555	369.12	30.85	36	1.33%	2.3	47%	1.13	0.00	1.13	0	0.95	0.06	0.98	1.0	0.054	41.12	71.97	0.102	1.89	0.95	0.32	0.80	1.14	1.0	0.037	2.08	64.08	0.104	4.90	3.40	2	1.630155	26.564	2.5433	30.853
10.499	5609.45	17.8	0.152	17.8	2.3	1.00	0.85%	Sand-Slime Tailings	0.059	119.0	0.56	0.11	0.44	1	1.60	28.581	397.27	33.22	39	0.88%	2.2	47%	1.14	0.00	1.14	0	0.95	0.06	0.98	1.0	0.054	41.95	75.17	0.106	1.97	0.95	0.33	0.80	1.14	1.0	0.037	1.69	56.22	0.097	4.48	3.23	2	1.604757	28.604	2.7385	33.222
10.663	5609.29	19.9	0.083	19.9	0.8	0.33	0.42%	Sand-Slime Tailings	0.059	119.0	0.57	0.12	0.45	1	1.58	31.420	436.73	36.50	43	0.43%	2.0	47%	1.15	0.00	1.15	0	0.95	0.06	0.98	1.0	0.054	43.10	79.60	0.112	2.09	0.95	0.35	0.80	1.14	1.0	0.037	1.33	48.51	0.090	4.16	3.12	2	1.576497	31.427	3.0088	36.501
10.827	5609.12	16.0	0.095	16.0	-0.5	-0.20	0.59%	Sand-Slime Tailings	0.059	119.0	0.58	0.12	0.45	1	1.60	25.570	355.42	29.69	34	0.62%	2.2	47%	1.16	0.00	1.16	0	0.95	0.06	0.98	1.0	0.054	40.72	70.41	0.100	1.86	0.95	0.31	0.80	1.14	1.0	0.037	1.63	48.41	0.090	4.11	2.99	2	1.600097	25.585	2.4476	29.692
10.991	5608.96	13.0	0.120	13.0	0.1	0.02	0.92%	Sand-Slime Tailings	0.059	119.0	0.59	0.13	0.46	1	1.62	21.109	293.42	24.52	27	0.96%	2.4	47%	1.17	0.00	1.17	0	0.94	0.06	0.98	1.0	0.054	38.90	63.42	0.092	1.71	0.95	0.29	0.80	1.14	1.0	0.037	2.17	53.19	0.094	4.24	2.97	2	1.618819	21.11	2.0211	24.518
11.155	5608.80	10.5	0.104	10.5	0.8	0.35	0.99%	Sand-Slime Tailings	0.059	119.0	0.60	0.13	0.46	1	1.63	17.098	237.66	19.87	21	1.05%	2.5	47%	1.18	0.00	1.18	0	0.94	0.05	0.98	1.0	0.054	37.27	57.14	0.085	1.58	0.95	0.26	0.80	1.13	1.0	0.037	2.63	52.29	0.093	4.16	2.87	2	1.629917	17.106	1.6377	19.868
11.319	5608.63	9.8	0.058	9.8	2.8	1.20	0.59%	Sand-Slime Tailings	0.059	119.0	0.60	0.14	0.47	1	1.62	15.832	220.07	18.42	20	0.63%	2.4	47%	1.19	0.00	1.19	0	0.94	0.05	0.98	1.0	0.054	36.76	55.18	0.083	1.54	0.95	0.25	0.80	1.13	1.0	0.037	2.32	42.69	0.086	3.78	2.66	2	1.617204	15.86	1.5185	18.421
11.483	5608.47	10.7	0.143	10.7	4.7	2.02	1.33%	Sand-Slime Tailings	0.059	119.0	0.61	0.14	0.47	1	1.60	17.154	238.45	19.98	21	1.42%	2.5	47%	1.20	0.00	1.20	0	0.94	0.05	0.98	1.0	0.053	37.31	57.29	0.085	1.59	0.95	0.26	0.80	1.13	1.0	0.037	2.98	59.46	0.100	4.36	2.97	2	1.604714	17.201	1.6468	19.978
11.647	5608.30	9.4	0.085	9.4	6.2	2.70	0.91%	Sand-Slime Tailings	0.059	119.0	0.62	0.15	0.47	1	1.59	14.889	206.96	17.37	18	0.97%	2.5	47%	1.20	0.00	1.20	0	0.94	0.05	0.98	1.0	0.053	36.39	53.76	0.081	1.52	0.95	0.24	0.80	1.13	1.0	0.037	2.83	49.19	0.091	3.95	2.73	2	1.592442	14.951	1.4314	17.365
11.811	5608.14	9.7	0.067	9.6	8.3	3.60	0.69%	Sand-Slime Tailings	0.059	119.0	0.63	0.15	0.48	1	1.58	15.172	210.89	17.72	19	0.74%	2.5	47%	1.21	0.00	1.21	0	0.94	0.05	0.98	1.0	0.053	36.51	54.23	0.082	1.53	0.95	0.24	0.80	1.12	1.0	0.037	2.54	44.93	0.087	3.76	2.64	2	1.580381	15.254	1.4604	17.716
11.975	5607.98	9.5	0.042	9.4	9.2	3.97	0.44%	Sand-Slime Tailings	0.059	119.0	0.64	0.16	0.48	1	1.57	14.744	204.94	17.23	18	0.48%	2.4	47%	1.22	0.00	1.22	0	0.94	0.05	0.98	1.0	0.053	36.34	53.57	0.081	1.52	0.95	0.24	0.80	1.12	1.0	0.037	2.25	38.83	0.082	3.51	2.51	2	1.568527	14.834	1.4202	17.229

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2E1

Data File: 13-52106_SP2E1-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

5613.10	Water surface elevation during CPT investigation (ft a
5611.67	Water surface elevation at t_0 (ft amsl)
5595.46	Water surface elevation at t_1 (ft amsl)
5590.46	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earth
7.51	Equiv. Number of Uniform Strain Cycles, N

5619.95	Ground Surface Elevation at time of CPT (ft amsl)
5630.46	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after plac
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
2.51	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1160.95	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5590.46	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	######	5630.21	5629.96	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	######	5628.21	5626.46	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5624.46	5622.46	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334
Platform/Random Fill Layer	######	5621.21	5619.95	2.51	0.050	101	0.580	0.517	0.00	0.00	0.580	0.517

2013 CPT Data from ConeTec

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines
12.139	5607.81	8.5	0.033	8.5	11.3	4.90	0.39%	Sand-Slime Tailing
12.303	5607.65	7.5	0.137	7.4	15.9	6.87	1.83%	Slime Tailings
12.467	5607.48	9.8	0.166	9.7	9.9	4.27	1.70%	Sand-Slime Tailing
12.631	5607.32	8.6	0.151	8.5	17.3	7.50	1.76%	Slime Tailings
12.795	5607.15	13.0	0.092	12.9	18.8	8.15	0.71%	Sand-Slime Tailing
12.959	5606.99	16.0	0.166	15.9	19.0	8.23	1.04%	Sand-Slime Tailing
13.123	5606.83	14.4	0.162	14.3	15.8	6.85	1.13%	Sand-Slime Tailing
13.287	5606.66	17.3	0.194	17.2	19.5	8.43	1.12%	Sand-Slime Tailing
13.451	5606.50	19.4	0.173	19.3	8.1	3.49	0.89%	Sand-Slime Tailing
13.615	5606.33	16.0	0.144	15.9	7.5	3.27	0.90%	Sand-Slime Tailing
13.779	5606.17	12.6	0.124	12.5	6.8	2.94	0.99%	Sand-Slime Tailing
13.943	5606.01	11.2	0.094	11.1	15.0	6.52	0.84%	Sand-Slime Tailing
14.107	5605.84	10.0	0.113	9.9	19.5	8.43	1.13%	Sand-Slime Tailing
14.271	5605.68	9.1	0.159	8.8	48.1	20.86	1.75%	Slime Tailings
14.436	5605.51	14.3	0.207	13.9	61.3	26.57	1.45%	Sand-Slime Tailing
14.600	5605.35	20.5	0.331	20.4	11.3	4.89	1.62%	Sand-Slime Tailing
14.764	5605.19	14.9	0.361	14.8	6.9	3.00	2.43%	Slime Tailings
14.928	5605.02	12.9	0.158	12.8	9.8	4.24	1.23%	Sand-Slime Tailing
15.092	5604.86	13.3	0.157	13.3	13.5	5.85	1.18%	Sand-Slime Tailing
15.256	5604.69	16.0	0.117	16.0	9.0	3.88	0.73%	Sand-Slime Tailing
15.420	5604.53	20.1	0.148	20.0	8.1	3.53	0.74%	Sand-Slime Tailing
15.584	5604.37	17.1	0.147	17.1	5.0	2.18	0.86%	Sand-Slime Tailing
15.748	5604.20	24.6	0.148	24.6	5.9	2.55	0.60%	Sand-Slime Tailing
15.912	5604.04	28.1	0.259	28.1	1.3	0.58	0.92%	Sand-Slime Tailing
16.076	5603.87	18.4	0.329	18.4	2.2	0.96	1.79%	Sand-Slime Tailing
16.240	5603.71	15.8	0.279	15.8	3.6	1.57	1.76%	Sand-Slime Tailing
16.404	5603.55	16.9	0.229	16.8	5.1	2.20	1.36%	Sand-Slime Tailing
16.568	5603.38	15.2	0.239	15.2	7.9	3.42	1.57%	Sand-Slime Tailing
16.732	5603.22	13.1	0.158	13.0	11.1	4.82	1.21%	Sand-Slime Tailing
16.896	5603.05	15.1	0.126	15.0	13.3	5.78	0.84%	Sand-Slime Tailing
17.060	5602.89	12.8	0.181	12.7	13.0	5.63	1.41%	Sand-Slime Tailing
17.224	5602.73	12.9	0.200	12.8	18.8	8.16	1.55%	Sand-Slime Tailing
17.388	5602.56	12.5	0.226	12.4	18.9	8.17	1.81%	Sand-Slime Tailing
17.552	5602.40	10.1	0.119	9.9	19.4	8.42	1.18%	Sand-Slime Tailing
17.716	5602.23	11.0	0.133	10.8	23.1	10.02	1.21%	Sand-Slime Tailing
17.880	5602.07	10.6	0.104	10.5	25.6	11.08	0.98%	Sand-Slime Tailing
18.044	5601.91	15.6	0.215	15.4	27.3	11.85	1.38%	Sand-Slime Tailing
18.208	5601.74	11.4	0.182	11.3	22.1	9.59	1.59%	Sand-Slime Tailing
18.372	5601.58	9.5	0.143	9.3	33.5	14.51	1.50%	Sand-Slime Tailing
18.537	5601.41	16.2	0.140	15.9	56.4	24.43	0.86%	Sand-Slime Tailing
18.701	5601.25	17.9	0.177	17.7	23.0	9.97	0.99%	Sand-Slime Tailing
18.865	5601.09	14.9	0.143	14.7	24.5	10.62	0.96%	Sand-Slime Tailing
19.029	5600.92	18.2	0.189	18.2	13.4	5.82	1.04%	Sand-Slime Tailing
19.193	5600.76	15.7	0.226	15.6	17.1	7.41	1.44%	Sand-Slime Tailing
19.357	5600.59	12.4	0.221	12.1	42.6	18.48	1.79%	Sand-Slime Tailing
19.521	5600.43	15.2	0.223	14.8	64.4	27.89	1.47%	Sand-Slime Tailing
19.685	5600.27	12.3	0.248	12.1	35.7	15.47	2.01%	Sand-Slime Tailing
19.849	5600.10	12.3	0.010	12.0	55.6	24.11	0.08%	Sand-Slime Tailing
20.013	5599.94	16.7	0.105	16.5	32.1	13.89	0.63%	Sand-Slime Tailing
20.177	5599.77	11.0	0.151	11.0	8.6	3.72	1.37%	Sand-Slime Tailing
20.341	5599.61	16.5	0.104	16.4	12.3	5.34	0.63%	Sand-Slime Tailing
20.505	5599.45	26.3	0.244	26.2	16.8	7.29	0.93%	Sand-Slime Tailing
20.669	5599.28	18.0	0.319	18.0	11.3	4.89	1.77%	Sand-Slime Tailing
20.833	5599.12	15.8	0.362	15.7	15.0	6.52	2.29%	Sand-Slime Tailing
20.997	5598.95	13.5	0.268	13.3	25.6	11.09	1.99%	Sand-Slime Tailing
21.161	5598.79	13.5	0.247	13.3	33.1	14.34	1.83%	Sand-Slime Tailing
21.325	5598.62	14.2	0.171	14.0	32.9	14.27	1.20%	Sand-Slime Tailing
21.489	5598.46	21.5	0.169	21.3	27.8	12.05	0.79%	Sand-Slime Tailing
21.653	5598.30	19.5	0.201	19.4	19.6	8.49	1.03%	Sand-Slime Tailing
21.817	5598.13	15.2	0.196	15.1	19.5	8.45	1.29%	Sand-Slime Tailing
21.981	5597.97	13.5	0.188	13.3	22.6	9.79	1.40%	Sand-Slime Tailing
22.145	5597.80	12.1	0.166	12.0	27.8	12.05	1.37%	Sand-Slime Tailing
22.309	5597.64	9.5	0.208	9.3	33.0	14.31	2.19%	Slime Tailings
22.473	5597.48	10.2	0.214	9.9	57.5	24.93	2.09%	Slime Tailings
22.638	5597.31	12.2	0.168	12.0	43.6	18.90	1.37%	Sand-Slime Tailing
22.802	5597.15	15.7	0.124	15.5	28.3	12.28	0.79%	Sand-Slime Tailing
22.966	5596.98	18.3	0.115	18.2	21.4	9.29	0.63%	Sand-Slime Tailing
23.130	5596.82	17.6	0.122	17.5	22.6	9.77	0.69%	Sand-Slime Tailing
23.294	5596.66	16.7	0.117	16.6	23.3	10.10	0.70%	Sand-Slime Tailing
23.458	5596.49	18.6	0.112	18.5	23.3	10.10	0.60%	Sand-Slime Tailing
23.622	5596.33	24.6	0.061	24.5	18.8	8.15	0.25%	Sand-Slime Tailing
23.786	5596.17	27.8	0.103	27.7	11.3	4.89	0.37%	Sand-Slime Tailing
23.950	5596.00	23.4	0.209	23.4	12.0	5.20	0.89%	Sand-Slime Tailing

CPT Data Interpretations

Depth (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil. Pore Pressure at time of CPT (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %
12.139	0.059	119.0	0.65	0.17	0.49	1	1.56	13.171	183.08	15.43	16	0.42%	2.4	47%
12.303	0.057	113.1	0.66	0.17	0.49	1	1.55	11.398	158.44	13.42	14	2.01%	2.8	71%
12.467	0.059	119.0	0.67	0.18	0.50	1	1.54	14.939	207.65	17.46	18	1.82%	2.7	47%
12.631	0.057	113.1	0.68	0.18	0.50	1	1.53	12.904	179.37	15.18	16	1.91%	2.7	71%
12.795	0.059	119.0	0.69	0.19	0.51	1	1.51	19.343	268.87	22.67	24	0.75%	2.4	47%
12.959	0.059	119.0	0.70	0.19	0.51	1	1.47	23.423	325.57	27.41	30	1.08%	2.4	47%
13.123	0.059	119.0	0.71	0.20	0.52	1	1.48	21.034	292.37	24.60	26	1.19%	2.4	47%
13.287	0.059	119.0	0.72	0.20	0.52	1	1.45	24.868	345.66	29.09	32	1.17%	2.4	47%
13.451	0.059	119.0	0.73	0.21	0.52	1	1.43	27.509	382.38	32.03	35	0.93%	2.3	47%
13.615	0.059	119.0	0.74	0.21	0.53	1	1.44	22.875	317.96	26.65	29	0.95%	2.3	47%
13.779	0.059	119.0	0.75	0.22	0.53	1	1.45	18.200	252.98	21.21	22	1.05%	2.5	47%
13.943	0.059	119.0	0.76	0.22	0.54	1	1.44	16.070	223.37	18.82	19	0.90%	2.5	47%
14.107	0.059	119.0	0.77	0.23	0.54	1	1.43	14.143	196.59	16.63	17	1.23%	2.6	47%
14.271	0.057	113.1	0.78	0.23	0.55	1	1.42	12.506	173.84	15.02	15	1.92%	2.7	71%
14.436	0.059	119.0	0.79	0.24	0.55	1	1.41	19.507	271.15	23.28	24	1.54%	2.5	47%
14.600	0.059	119.0	0.80	0.24	0.56	1	1.37	27.819	386.69	32.42	35	1.68%	2.4	47%
14.764	0.057	113.1	0.81	0.25	0.56	1	1.39	20.567	285.88	23.96	25	2.56%	2.6	71%
14.928	0.059	119.0	0.82	0.25	0.57	1	1.39	17.775	247.07	20.74	21	1.31%	2.5	47%
15.092	0.059	119.0	0.83	0.26	0.57	1	1.38	18.278	254.06	21.36	22	1.25%	2.5	47%
15.256	0.059	119.0	0.84	0.26	0.57	1	1.36	21.654	300.99	25.24	26	0.77%	2.3	47%
15.420	0.059	119.0	0.85	0.27	0.58	1	1.33	26.610	369.88	30.98	33	0.77%	2.2	47%
15.584	0.059	119.0	0.86	0.27	0.58	1	1.34	22.799	316.91	26.53	28	0.90%	2.3	47%
15.748	0.059	119.0	0.87	0.28	0.59	1	1.30	31.972	444.41	37.19	40	0.62%	2.1	47%
15.912	0.059	119.0	0.88	0.28	0.59	1	1.28	36.048	501.07	41.88	46	0.95%	2.2	47%
16.076	0.059	119.0	0.89	0.29	0.60	1	1.31	24.074	334.62	27.98	29	1.88%	2.5	47%
16.240	0.059	119.0	0.90	0.29	0.60	1	1.31	20.712	287.90	24.09	25	1.87%	2.6	47%
16.404	0.059	119.0	0.91	0.30	0.61	1	1.30	21.871	304.00	25.45	26	1.44%	2.5	47%
16.568	0.059	119.0	0.92	0.30	0.61	1	1.30	19.693	273.73	22.95	23	1.67%	2.5	47%
16.732	0.059	119.0	0.93	0.31	0.62	1	1.30	16.874	234.55	19.70	20	1.30%	2.6	47%
16.896	0.059	119.0	0.93	0.31	0.62	1	1.29	19.254	267.63	22.49	23	0.89%	2.4	47%
17.060	0.059	119.0	0.94	0.32	0.63	1	1.28	16.345	227.19	19.10	19	1.52%	2.6	47%
17.224	0.059	119.0	0.95	0.32	0.63	1	1.28	16.340	227.12	19.15	19	1.67%	2.6	47%
17.388	0.059	119.0	0.96	0.33	0.64	1	1.27	15.676	217.89	18.38	18	1.96%	2.7	47%
17.552	0.059	119.0	0.97	0.33	0.64	1	1.26	12.525	174.24	14.74	14	1.31%	2.7	47%
17.716	0.059	119.0	0.98	0.34	0.64	1	1.25	13.593	188.94	16.00	16	1.33%	2.6	47%
17.880	0.059	119.0	0.99	0.34	0.65	1	1.25	13.043	181.30	15.38	15	1.08%	2.6	47%
18.044	0.059	119.0	1.00	0.35	0.65	1	1.24	19.083	265.26	22.41	22	1.47%	2.5	47%
18.208	0.059	119.0	1.01	0.35	0.66	1	1.23	13.923	193.53	16.37	16	1.75%	2.7	47%
18.372	0.059	119.0	1.02	0.36	0.66	1	1.23	11.418	158.71	13.56	13	1.68%	2.8	47%
18.537	0.059	119.0	1.03	0.36	0.67	1	1.22	19.318	268.52	22.93	23	0.92%	2.4	47%
18.701	0.059	119.0	1.04	0.37	0.67	1	1.21	21.370	297.05	25.02	25	1.05%	2.4	47%
18.865	0.059	119.0	1.05	0.37	0.68	1	1.21	17.787	247.23	20.87	20	1.03%	2.5	47%
19.029	0.059	119.0	1.06	0.38	0.68	1	1.19	21.656	301.01	25.27	25	1.10%	2.4	47%
19.193	0.059	119.0	1.07	0.38	0.69	1	1.19	18.615	258.74	21.77	21	1.54%	2.6	47%
19.357	0.059	119.0	1.08	0.39	0.69	1	1.19	14.370	199.75	17.06	16	1.96%	2.7	47%
19.521	0.059	119.0	1.09	0.39	0.70	1	1.18	17.474	242.88	20.85	20	1.58%	2.6	47%
19.685	0.059	119.0	1.10	0.40	0.70	1	1.18	14.233	197.84	16.84	16	2.21%	2.8	47%
19.849	0.059	119.0	1.11	0.40	0.70	1	1.17	14.008	194.71	16.74	16	0.09%	2.3	47%
20.013	0.059	119.0	1.12	0.41	0.71	1	1.16	19.178	266.58	22.54	22	0.67%	2.4	47%
20.177	0.059	119.0	1.13	0.41	0.71	1	1.16	12.696	176.48	14.82	14	1.53%	2.7	47%
20.341	0.059	119.0	1.14	0.42	0.72	1	1.15	18.850	262.02	22.00	21	0.68%	2.4	47%
20.505	0.059	119.0	1.15	0.42	0.72	1	1.13	29.559	410.87	34.47	35	0.97%	2.3	47%
20.669	0.059	119.0	1.16	0.43	0.73	1	1.14	20.422	283.87	23.81	23	1.89%	2.6	47%
20.833	0.059	119.0	1.17	0.43	0.73	1	1.13	17.855	248.19	20.86	20	2.47%	2.7	47%
20.997	0.059	119.0	1.18	0.44	0.74	1	1.13	15.024	208.84	17.66	17	2.18%	2.7	47%
21.161	0.059	119.0	1.19	0.44	0.74	1	1.12	14.951	207.82	17.63	17	2.00%	2.7	47%
21.325	0.059	119.0	1.20	0.45	0.75	1	1.12	15.661	217.68	18.46	17	1.31%	2.6	47%
21.489	0.059	119.0	1.21	0.45	0.75	1	1.11	23.539	327.20	27.56	27	0.83%	2.3	47%
21.653	0.059	119.0	1.22	0.46	0.76	1	1.10	21.372	297.07	24.98	24	1.10%	2.4	47%
21.817	0.059	119.0	1.23	0.46	0.76	1	1.10	16.637	231.26	19.48	18	1.40%	2.6	47%
21.981	0.059	119.0	1.24	0.47	0.77	1	1.10	14.595	202.88	17.13	16	1.54%	2.7	47%
22.145	0.059	119.0	1.25	0.47	0.77	1	1.09	13.053	181.44	15.38	14	1.52%	2.7	47%
22.309	0.057	113.1	1.26	0.48	0.77	1	1.09	10.097	140.34	11.99	11	2.52%	2.9	71%
22.473	0.057	113.1	1.27	0.48	0.78	1	1.08	10.671	148.33	12.85	12	2.39%	2.9	71%
22.638	0.059	119.0	1.28	0.49	0.78	1	1.08	12.884	179.09	15.30	14	1.53%	2.7	47%
22.802	0.059	119.0	1.29	0.49	0.79	1	1.07	16.653	231.47	19.56	18	0.86%	2.5	47%
22.966	0.059	119.0	1.29	0.50	0.79	1	1.07	19.355	269.03	22.65	21	0.68%	2.4	47%
23.130	0.059	119.0	1.30	0.50	0.80	1	1.06	18.534	257.62	21.70	20	0.75%	2.4	47%
23.294	0.059	119.0	1.31	0.51	0.80	1	1.06	17.505	243.32	20.51	19	0.76%	2.4	47%
23.458	0.059	119.0	1.32	0.51	0.81	1	1.05	19.432	270.11	22.75	21	0.65%	2.4	47%
23.622	0.059	119.0	1.33	0.52	0.81	1	1.04	25.556	355.23	29.82	29	0.26%	2.1	47%
23.786	0.059	119.0	1.34	0.52	0.82	1	1.04	28.804	400.34	33.54	32	0.39%	2.1	47%
23.950	0.059	119.0	1.35	0.53	0.82	1	1.04	24.226	336.75	28.23	27	0.95%	2.4	47%

Conditions at t_1 / Liquefaction Triggering Analyses – Idriss & Boulanger (2008)

Depth (ft)	Total Stress at t_1 (tsf)	Equil. Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No	r_d	C_σ	K_σ	K_α	CSR $_{M=7.5, \sigma'v=1atm}$	Δq_{c1n}	$q_{c1n\text{-}cs}$	(CRR) $_{M=7.5, \sigma'v=1atm}$	FoS
12.139	1.23	0.00	1.23	0	0.94	0.05	0.98	1.0	0.053	35.71	51.14	0.079	1.48
12.303	1.24	0.00	1.24	0	0.94	0.05	0.98	1.0	0.053	34.76	48.18	0.076	1.43
12.467	1.25	0.00	1.25	0	0.93	0.05	0.98	1.0	0.053	36.43	53.88	0.081	1.54
12.631	1.26	0.00	1.26	0	0.93	0.05	0.98	1.0	0.053	35.37	50.55	0.078	1.47
12.795	1.27	0.00	1.27	0	0.93	0.05	0.98	1.0	0.053	38.25	60.92	0.089	1.69
12.959	1.28	0.00	1.28	0	0.93	0.06	0.98	1.0	0.053	39.91	67.32	0.096	1.83
13.123	1.29	0.00	1.29	0	0.93	0.06	0.98	1.0	0.053	38.93	63.53	0.092	1.75
13.287	1.30	0.00	1.30	0	0.93	0.06	0.98	1.0	0.053	40.50	69.59	0.099	1.89
13.451	1.31	0.00	1.31	0	0.93	0.06	0.97	1.0	0.052	41.54	73.57	0.104	1.99
13.615	1.32	0.00	1.32	0	0.93	0.06	0.98	1.0	0.052	39.65	66.29	0.095	1.82
13.779	1.33	0.00	1.33	0	0.92	0.05	0.98	1.0	0.052	37.74	58.95	0.087	1.66
13.943	1.34	0.00	1.34	0	0.92	0.05	0.98	1.0	0.052	36.90	55.72	0.083	1.60
14.107	1.35	0.00	1.35	0	0.92	0.05	0.98	1.0	0.052	36.13	52.76	0.080	1.54
14.271	1.36	0.00	1.36	0	0.92	0.05	0.98	1.0	0.052	35.32	50.34	0.078	1.50
14.436	1.37	0.00	1.37	0	0.92	0.05	0.97	1.0	0.052	38.47	61.75	0.090	1.73
14.600	1.38	0.00	1.38	0	0.92	0.06	0.97	1.0	0.052	41.67	74.09	0.105	2.03
14.764	1.39	0.00	1.39	0	0.92	0.06	0.97	1.0	0.052	38.43	62.39	0.091	1.75
14.928	1.40	0.00	1.40	0	0.92	0.05	0.97	1.0	0.052	37.58	58.32	0.086	1.67
15.092	1.41	0.00	1.41	0	0.91	0.05	0.97	1.0	0.051	37.79	59.16	0.087	1.69
15.256	1.42	0.00	1.42	0	0.91	0.06	0.97	1.0	0.051	39.15	64.39	0.093	1.81
15.420	1.43	0.00	1.43	0	0.91	0.06	0.97	1.0	0.051	41.17	72.15	0.102	2.00
15.584	1.44	0.00	1.44	0	0.91	0.06	0.97	1.0	0.051	39.61	66.13	0.095	1.86
15.748	1.45	0.00	1.45	0	0.91	0.06	0.97	1.0	0.051	43.34	80.53	0.113	2.23
15.912	1.46	0.00	1.46	0	0.91	0.07	0.97	1.0	0.051	44.99	86.87	0.122	2.41
16.076	1.47	0.00	1.47	0	0.91	0.06	0.97	1.0	0.051	40.11	68.10	0.097	1.91
16.240	1.48	0.00	1.48	0	0.91	0.06	0.97	1.0	0.051	38.75	62.84	0.091	1.79
16.404	1.49	0.00	1.49	0	0.90	0.06	0.97	1.0	0.051	39.23	64.68	0.093	1.84
16.568	1.50	0.00	1.50	0	0.90	0.05	0.97	1.0	0.051	38.35	61.30	0.089	1.76
16.732	1.51	0.00	1.51	0	0.90	0.05	0.97	1.0	0.051	37.21	56.91	0.085	1.67
16.896	1.52	0.00	1.52	0	0.90	0.05	0.97	1.0	0.050	38.19	60.67	0.089	1.76
17.060	1.53	0.00	1.53	0	0.90	0.05	0.97	1.0	0.050	37.00	56.11	0.084	1.66
17.224	1.53	0.00	1.53	0	0.90	0.05	0.97	1.0	0.050	37.02	56.17	0.084	1.66
17.388	1.54	0.00	1.54	0	0.90	0.05	0.97	1.0	0.050	36.75	55.13	0.083	1.64
17.552	1.55	0.00	1.55	0	0.90	0.05	0.97	1.0	0.050	35.47	50.21	0.078	1.54
17.716	1.56	0.00	1.56	0	0.89	0.05	0.97	1.0	0.050	35.91	51.91	0.079	1.58
17.880	1.57	0.00	1.57	0	0.89	0.05	0.97	1.0	0.050	35.70	51.08	0.079	1.57
18.044	1.58	0.00	1.58	0	0.89	0.05	0.97	1.0	0.050	38.16	60.57	0.088	1.77
18.208	1.59	0.00	1.59	0	0.89	0.05	0.97	1.0	0.050	36.04	52.41	0.080	1.60
18.372	1.60	0.00	1.60	0	0.89	0.05	0.97	1.0	0.050	35.06	48.62	0.076	1.53
18.537	1.61	0.00	1.61	0	0.89	0.05	0.97	1.0	0.049	38.34	61.28	0.089	1.80
18.701	1.62	0.00	1.62	0	0.89	0.06	0.96	1.0	0.049	39.08	64.10	0.093	1.87
18.865	1.63	0.00	1.63	0	0.89	0.05	0.97	1.0	0.049	37.62	58.49	0.086	1.74
19.029	1.64	0.00	1.64	0	0.88	0.06	0.96	1.0	0.049	39.16	64.43	0.093	1.89
19.193	1.65	0.00	1.65	0	0.88	0.05	0.97	1.0	0.049	37.94	59.70	0.088	1.78
19.357	1.66	0.00	1.66	0	0.88	0.05	0.97	1.0	0.049	36.28	53.34	0.081	1.64
19.521	1.67	0.00	1.67	0	0.88	0.05	0.96	1.0	0.049	37.61	58.46	0.086	1.76
19.685	1.68	0.00	1.68	0	0.88	0.05	0.97	1.0	0.049	36.21	53.04	0.080	1.64
19.849	1.69	0.00	1.69	0	0.88	0.05	0.97	1.0	0.049	36.17	52.91	0.080	1.64
20.013	1.70	0.00	1.70	0	0.88	0.05	0.96	1.0	0.049	38.21	60.75	0.089	1.82
20.177	1.71	0.00	1.71	0	0.87	0.05	0.97	1.0	0.049	35.50	50.32	0.078	1.59
20.341	1.72	0.00	1.72	0	0.87	0.05	0.96	1.0	0.048	38.02	60.01	0.088	1.81
20.505	1.73	0.00	1.73	0	0.87	0.06	0.96	1.0	0.048	42.39	76.86	0.108	2.25
20.669	1.74	0.00	1.74	0	0.87	0.05	0.96	1.0	0.048	38.65	62.46	0.091	1.87
20.833	1.75	0.00	1.75	0	0.87	0.05	0.96	1.0	0.048	37.62	58.48	0.086	1.78
20.997	1.76	0.00	1.76	0	0.87	0.05	0.96	1.0	0.048	36.50	54.15	0.082	1.69
21.161	1.77	0.00	1.77	0	0.87	0.05	0.96	1.0	0.048	36.49	54.12	0.082	1.69
21.325	1.78	0.00	1.78	0	0.87	0.05	0.96	1.0	0.048	36.77	55.23	0.083	1.72
21.489	1.79	0.00	1.79	0	0.86	0.06	0.96	1.0	0.048	39.97	67.53	0.097	2.02
21.653	1.80	0.00	1.80	0	0.86	0.06	0.96	1.0	0.048	39.06	64.04	0.092	1.93
21.817	1.81	0.00	1.81	0	0.86	0.05	0.96	1.0	0.048	37.13	56.61	0.084	1.76
21.981	1.82	0.00	1.82	0	0.86	0.05	0.96	1.0	0.048	36.31	53.44	0.081	1.69
22.145	1.83	0.00	1.83	0	0.86	0.05	0.96	1.0	0.048	35.70	51.08	0.079	1.64
22.309	1.84	0.00	1.84	0	0.86	0.05	0.96	1.0	0.048	34.26	46.25	0.074	1.55
22.473	1.85	0.00	1.85	0	0.86	0.05	0.96	1.0	0.048	34.56	47.41	0.075	1.57
22.638	1.86	0.00	1.86	0	0.85	0.05	0.96	1.0	0.048	35.67	50.97	0.078	1.65
22.802	1.87	0.00	1.87	0	0.85	0.05	0.96	1.0	0.047	37.16	56.72	0.084	1.78
22.966	1.88	0.00	1.88	0	0.85	0.06	0.96	1.0	0.047	38.24	60.89	0.089	1.88
23.130	1.89	0.00	1.89	0	0.85	0.05	0.96	1.0	0.047	37.91	59.61	0.087	1.86
23.294	1.89	0.00	1.89	0	0.85	0.05	0.96	1.0	0.047	37.49	58.00	0.086	1.82
23.458	1.90	0.00	1.90	0	0.85	0.06	0.96	1.0	0.047	38.28	61.03	0.089	1.90
23.622	1.91	0.00	1.91	0	0.85	0.06	0.95	1.0	0.047	40.76	70.59	0.100	2.15
23.786	1.92	0.00	1.92	0	0.85	0.06	0.95	1.0	0.046	42.06	75.60	0.107	2.30
23.950	1.93	0.00	1.93	0	0.84	0.06	0.95	1.0	0.047	40.20	68.43	0.098	2.10

Liquefaction Triggering Analyses – Youd et al. (2001)

Depth (ft)	r_d	D_r	f	K_σ	K_α	CSR $_{M=7.5, \sigma'v=1atm}$	Kc	$q_{c1n\text{-}cs}$	(CRR) $_{M=7.5, \sigma'v=1atm}$	FoS	Avg FoS	Liquefiable? 1=Yes 2=No
12.139	0.95	0.23	0.80	1.12	1.0	0.037	2.37	36.59	0.080	3.39	2.44	2
12.303	0.95	0.21	0.80	1.12	1.0	0.037	4.65	62.38	0.103	4.29	2.86	2
12.467	0.95	0.24	0.80	1.12	1.0	0.037	3.70	64.54	0.105	4.35	2.95	2
12.631	0.95	0.22	0.80	1.11	1.0	0.037	4.18	63.47	0.104	4.27	2.87	2
12.795	0.95	0.27	0.80	1.11	1.0	0.037	2.14	48.49	0.090	3.69	2.69	2
12.959	0.95	0.30	0.80	1.11	1.0	0.038	2.14	58.59	0.099	3.99	2.91	2
13.123	0.94	0.29	0.80	1.11	1.0	0.038	2.41	59.16	0.099	3.98	2.86	2
13.287	0.94	0.31	0.80	1.11	1.0	0.038	2.12	61.68	0.102	4.05	2.97	2
13.451	0.94	0.33	0.80	1.10	1.0	0.038	1.82	58.33	0.098	3.88	2.94	2
13.615	0.94	0.30	0.80	1.10	1.0	0.038	2.08	55.52	0.096	3.75	2.78	2
13.779	0.94	0.27	0.80	1.10	1.0	0.038	2.58	54.62	0.095	3.69	2.67	2
13.943	0.94	0.25	0.80	1.10	1.0	0.038	2.65	49.94	0.092	3.52	2.56	2
14.107	0.94	0.24	0.80	1.10	1.0	0.038	3.29	54.75	0.095	3.63	2.59	2
14.271	0.94	0.22	0.80	1.09	1.0	0.038	4.28	64.34	0.105	3.97	2.73	2
14.436	0.94	0.28	0.80	1.09	1.0	0.038	2.84	66.01	0.107	4.01	2.87	2
14.600	0.94	0.33	0.80	1.09	1.0	0.038	2.34	75.74	0.120	4.48	3.26	2
14.764	0.94	0.28	0.80	1.09	1.0	0.038	3.55	84.93	0.137	5.07	3.41	2
14.928	0.94	0.26	0.80	1.09	1.0	0.038	2.90	60.16	0.100	3.68	2.67	2
15.092	0.94	0.27	0.80	1.09	1.0	0.038	2.79	59.56	0.100	3.63	2.66	2
15.256	0.94	0.29	0.80	1.08	1.0	0.038	2.04	51.53	0.093	3.35	2.58	2
15.420	0.94	0.32	0.80	1.08	1.0	0.038	1.78	55.03	0.095	3.42	2.71	2
15.584	0.94	0.30	0.80	1.08	1.0	0.038	2.09	55.54	0.096	3.41	2.64	2
15.748	0.94	0.35	0.80	1.08	1.0	0.038	1.50	55.66	0.096	3.39	2.81	2
15.912	0.94	0.37	0.80	1.08	1.0	0.038	1.60	66.81	0.108	3.78	3.10	2
16.076	0.94	0.31	0.80	1.08	1.0	0.038	2.76	77.26	0.123	4.28	3.10	2
16.240	0.94	0.28	0.80	1.07	1.0	0.038	3.07	74.03	0.118	4.07	2.93	2
16.404	0.94	0.29	0.80	1.07	1.0	0.039	2.62	66.75	0.108	3.69	2.77	2
16.568	0.94	0.28	0.80	1.07	1.0	0.039	3.03	69.61	0.111	3.79	2.78	2
16.732	0.94	0.26	0.80	1.07	1.0	0.039	3.05	60.03	0.100	3.39	2.53	2
16.896	0.94	0.27	0.80	1.07	1.0	0.039	2.38	53.50	0.094	3.16	2.46	2
17.060	0.94	0.25	0.80	1.07	1.0	0.039	3.34	63.84	0.104	3.47	2.57	2
17.224	0.94	0.25	0.80	1.06	1.0	0.039	3.48	66.58	0.107	3.56	2.61	2
17.388	0.93	0.25	0.80	1.06	1.0	0.039	3.85	70.78	0.113	3.71	2.68	2
17.552	0.93	0.22	0.80	1.06	1.0	0.039	3.82	56.34	0.097	3.16	2.35	2
17.716	0.93	0.23	0.80	1.06	1.0	0.039	3.62	57.91	0.098	3.18	2.38	2
17.880	0.93	0.23	0.80	1.06	1.0	0.039	3.44	52.94	0.094	3.02	2.29	2
18.044	0.93	0.27	0.80	1.06	1.0	0.039	2.95	66.15	0.107	3.42	2.60	2
18.208	0.93	0.23	0.80	1.06	1.0	0.039	4.00	65.53	0.106	3.37	2.49	2
18.372	0.93	0.21	0.80	1.05	1.0	0.039	4.53	61.47	0.102	3.21	2.37	2
18.537	0.93	0.28	0.80	1.05	1.0	0.039	2.40	55.11	0.096	3.00	2.40	2
18.701	0.93	0.29	0.80	1.05	1.0	0.039	2.38	59.44	0.100	3.10	2.49	2
18.865	0.93	0.26	0.80	1.05	1.0	0.039	2.70	56.46	0.097	3.00	2.37	2
19.029	0.93	0.29	0.80	1.05	1.0	0.039	2.41	60.84	0.101	3.11	2.50	2
19.193	0.93	0.27	0.80	1.05	1.0	0.039	3.11	67.59	0.109	3.32	2.55	2
19.357	0.93	0.24	0.80	1.04	1.0	0.039	4.12	70.25	0.112	3.41	2.52	2
19.521	0.93	0.26	0.80	1.04	1.0	0.039	3.25	67.72	0.109	3.29	2.52	2
19.685	0.93	0.24	0.80	1.04	1.0	0.039	4.39	73.96	0.118	3.53	2.59	2
19.849	0.93	0.24	0.80	1.04	1.0	0.039	1.87	31.30	0.076	2.27	1.96	2
20.013	0.93	0.27	0.80	1.04	1.0	0.039	2.20	49.63	0.091	2.72	2.27	2
20.177	0.92	0.22	0.80	1.04	1.0	0.039	4.13	61.27	0.101	3.00	2.30	2
20.341	0.92	0.27	0.80	1.04	1.0	0.039	2.25	49.58	0.091	2.69	2.25	2
20.505	0.92	0.34	0.80	1.04	1.0	0.039	1.88	64.63	0.105	3.08	2.66	2
20.669	0.92	0.28	0.80	1.03	1.0	0.039	3.22	76.70	0.122	3.55	2.71	2
20.833	0.92	0.26	0.80	1.03	1.0	0.039	4.01	83.73	0.135	3.90	2.84	2
20.997	0.92	0.24	0.80	1.03	1.0	0.039	4.26	75.26	0.120	3.45	2.57	2
21.161	0.92	0.24	0.80	1.03	1.0	0.039	4.11	72.54	0.115	3.32	2.50	2
21.325	0.91	0.25	0.80	1.03	1.0	0.039	3.32	61.36	0.101	2.90	2.31	2
21.489	0.91	0.30	0.80	1.03	1.0	0.039	2.07	57.16	0.097	2.77	2.39	2
21.653	0.91	0.29	0.80	1.03	1.0	0.039	2.48	61.83	0.102	2.89	2.41	2
21.817	0.91	0.25	0.80	1.03	1.0	0.039	3.29	64.11	0.105	2.95	2.35	2
21.981	0.91	0.24	0.80	1.02	1.0	0.039	3.77	64.60	0.105	2.95	2.32	2
22.145	0.91	0.23	0.80	1.02	1.0	0.039	4.08	62.70	0.103	2.87	2.26	2
22.309	0.91	0.20	0.80	1.02	1.0	0.039	6.02	72.19	0.115	3.20	2.37	2
22.473	0.91	0.21	0.80	1.02	1.0	0.039	5.61	72.09	0.115	3.18	2.38	2
22.638	0.90	0.23	0.80	1.02	1.0	0.039	4.11	62.96	0.103	2.85	2.25	2
22.802	0.90	0.26	0.80	1.02	1.0	0.039	2.72	53.26	0.094	2.58	2.18	2
22.966	0.90	0.27	0.80	1.02	1.0	0.039	2.24	50.80	0.092	2.52	2.20	2
23.130	0.90	0.27	0.80	1.02	1.0	0.039	2.40	52.09	0.093	2.54	2.20	2
23.294	0.90	0.26	0.80	1.01	1.0	0.039	2.52	51.71	0.093	2.52	2.17	2
23.458	0.90	0.28	0.80	1.01	1.0	0.039	2.21	50.28	0.092	2.48	2.19	2
23.622	0.90	0.32	0.80	1.01	1.0	0.039	1.48	44.02	0.087	2.33	2.24	2
23.786	0.89	0.33	0.80	1.01	1.0	0.039	1.49	50.05	0.092	2.45	2.38	2
23.950	0.89	0.31	0.80	1.01	1.0	0.039	2.17	61.33	0.101	2.70	2.40	2

Idriss & Boulanger (2008)

Depth (ft)	CN	qc1 TSF	qc1 MPa	qc1N
12.139	1.556874	13.281	1.2715	15.425
12.303	1.546591	11.551	1.1059	13.416
12.467	1.535304	15.033	1.4393	17.460
12.631	1.525341	13.069	1.2512	15.179
12.795	1.505298	19.52	1.8688	22.671
12.959	1.472195	23.597	2.2592	27.407
13.123	1.475007	21.179	2.0277	24.598
13.287	1.44579	25.043	2.3977	29.086
13.451	1.425348	27.581	2.6406	32.033
13.615	1.436853	22.942	2.1965	26.646
13.779	1.451332	18.261	1.7483	21.209
13.943	1.442557	16.206	1.5515	18.822
14.107	1.432919	14.317	1.3707	16.628
14.271	1.424401	12.934	1.2383	15.022
14.436	1.405423	20.045	1.9191	23.281
14.600	1.365022	27.915	2.6726	32.422
14.764	1.385922	20.627	1.9748	23.957
14.928	1.388686	17.86	1.7099	20.743
15.092	1.378412	18.394	1.761	21.363
15.256	1.355907	21.73	2.0804	25.238
15.420	1.330494	26.677	2.5541	30.984
15.584	1.33562	22.841	2.1868	26.529
15.748	1.300215	32.02	3.0656	37.189
15.912	1.283307	36.059	3.4523	41.880
16.076	1.308352	24.092	2.3065	27.981
16.240	1.31174	20.742	1.9858	24.091
16.404	1.300283	21.912	2.0979	25.449
16.568	1.299836	19.757	1.8915	22.946
16.732	1.298003	16.964	1.6241	19.703
16.896	1.286162	19.361	1.8536	22.486
17.060	1.282937	16.449	1.5748	19.104
17.224	1.275552	16.49	1.5787	19.152
17.388	1.268263	15.825	1.5151	18.380
17.552	1.261069	12.688	1.2147	14.736
17.716	1.253967	13.774	1.3187	15.998
17.880	1.246955	13.242	1.2678	15.380
18.044	1.236754	19.294	1.8472	22.409
18.208	1.233196	14.093	1.3493	16.368
18.372	1.226446	11.675	1.1177	13.559
18.537	1.215729	19.746	1.8905	22.934
18.701	1.205321	21.543	2.0626	25.021
18.865	1.206689	17.971	1.7206	20.872
19.029	1.192486	21.755	2.0829	25.268
19.193	1.192482	18.742	1.7944	21.768
19.357	1.187643	14.687	1.4061	17.058
19.521	1.181446	17.948	1.7184	20.846
19.685	1.175321	14.495	1.3878	16.835
19.849	1.169269	14.414	1.38	16.741
20.013	1.160922	19.411	1.8584	22.544
20.177	1.157375	12.758	1.2215	14.818
20.341	1.150108	18.939	1.8132	21.996
20.505	1.130354	29.678	2.8413	34.469
20.669	1.13646	20.502	1.9629	23.812
20.833	1.134393	17.962	1.7197	20.862
20.997	1.128809	15.205	1.4557	17.659
21.161	1.123287	15.183	1.4536	17.634
21.325	1.117826	15.89	1.5214	18.456
21.489	1.106167	23.731	2.272	27.562
21.653	1.103335	21.507	2.059	24.979
21.817	1.101801	16.771	1.6057	19.479
21.981	1.096574	14.75	1.4122	17.131
22.145	1.091404	13.243	1.2679	15.381
22.309	1.086815	10.321	0.9881	11.987
22.473	1.08227	11.06	1.0589	12.845
22.638	1.077252	13.177	1.2616	15.305
22.802	1.072287	16.842	1.6125	19.561
22.966	1.066378	19.497	1.8667	22.645
23.130	1.062112	18.683	1.7887	21.700
23.294	1.057698	17.659	1.6906	20.510
23.458	1.052111	19.586	1.8751	22.747
23.622	1.044818	25.679	2.4585	29.824
23.786	1.039399	28.875	2.7645	33.537
23.950	1.036644	24.304	2.3269	28.228

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 2E1

Data File: 13-52106_SP2E1-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Legend:
- Tailings Sands
- Tailings Sand-Slimes
- Tailings Slimes
- Interim Cover
- Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69

Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Parameter
5613.10	Water surface elevation during CPT investigation (ft a
5611.67	Water surface elevation at t_0 (ft amsl)
5595.46	Water surface elevation at t_1 (ft amsl)
5590.46	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earth
7.51	Equiv. Number of Uniform Strain Cycles, N

Value	Parameter
5619.95	Ground Surface Elevation at time of CPT (ft amsl)
5630.46	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after plac
3.50	Thickness of Water Storage/Rooting Zone (ft)
4.00	Thickness of High Compaction Layer (ft)
2.51	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1160.95	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5590.46	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	######	5630.21	5629.96	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	######	5628.21	5626.46	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5624.46	5622.46	4.00	0.060	120	0.454	0.334	0.00	0.00	0.454	0.334
Platform/Random Fill Layer	######	5621.21	5619.95	2.51	0.050	101	0.580	0.517	0.00	0.00	0.580	0.517

2013 CPT Data from ConeTec / CPT Data Interpretations

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No
24.114	5595.84	18.1	0.289	18.0	13.9	6.03	1.60%	Sand-Slime Tailing	0.059	119.0	1.36	0.54	0.82	1
24.278	5595.67	18.2	0.238	18.1	15.7	6.80	1.31%	Sand-Slime Tailing	0.059	119.0	1.37	0.54	0.83	1
24.442	5595.51	24.4	0.195	24.3	16.8	7.27	0.80%	Sand-Slime Tailing	0.059	119.0	1.38	0.55	0.83	1
24.606	5595.34	34.4	0.343	34.3	15.2	6.60	1.00%	Sand-Slime Tailing	0.059	119.0	1.39	0.55	0.84	1
24.770	5595.18	20.5	0.393	20.4	14.3	6.19	1.91%	Sand-Slime Tailing	0.059	119.0	1.40	0.56	0.84	1
24.934	5595.02	16.7	0.314	16.6	16.6	7.19	1.89%	Sand-Slime Tailing	0.059	119.0	1.41	0.56	0.85	1
25.098	5594.85	14.6	0.266	14.4	26.3	11.40	1.83%	Sand-Slime Tailing	0.059	119.0	1.42	0.57	0.85	1
25.262	5594.69	24.0	0.214	23.8	30.2	13.07	0.89%	Sand-Slime Tailing	0.059	119.0	1.43	0.57	0.86	1
25.426	5594.52	24.6	0.322	24.5	24.1	10.42	1.31%	Sand-Slime Tailing	0.059	119.0	1.44	0.58	0.86	1
25.590	5594.36	18.9	0.380	18.7	25.6	11.07	2.01%	Sand-Slime Tailing	0.059	119.0	1.45	0.58	0.87	1
25.754	5594.20	17.6	0.410	17.4	32.3	14.00	2.33%	Sand-Slime Tailing	0.059	119.0	1.46	0.59	0.87	1
25.918	5594.03	15.1	0.388	14.8	47.4	20.55	2.56%	Slime Tailings	0.057	113.1	1.47	0.59	0.88	1
26.082	5593.87	12.7	0.338	12.4	51.7	22.40	2.65%	Slime Tailings	0.057	113.1	1.48	0.60	0.88	1
26.246	5593.70	17.4	0.296	17.0	74.4	32.24	1.70%	Sand-Slime Tailing	0.059	119.0	1.49	0.61	0.88	1
26.410	5593.54	15.8	0.331	15.5	39.8	17.23	2.10%	Sand-Slime Tailing	0.059	119.0	1.50	0.61	0.89	1
26.574	5593.38	15.8	0.404	15.3	86.3	37.40	2.55%	Slime Tailings	0.057	113.1	1.51	0.62	0.89	1
26.739	5593.21	16.2	0.416	16.0	39.0	16.89	2.56%	Slime Tailings	0.057	113.1	1.52	0.62	0.90	1
26.903	5593.05	19.8	0.353	19.4	59.3	25.69	1.78%	Sand-Slime Tailing	0.059	119.0	1.53	0.63	0.90	1
27.067	5592.88	25.7	0.481	25.6	31.0	13.43	1.87%	Sand-Slime Tailing	0.059	119.0	1.54	0.63	0.91	1
27.231	5592.72	23.6	0.456	23.3	42.6	18.45	1.93%	Sand-Slime Tailing	0.059	119.0	1.55	0.64	0.91	1
27.395	5592.56	22.8	0.504	22.4	57.1	24.73	2.21%	Sand-Slime Tailing	0.059	119.0	1.56	0.64	0.92	1
27.559	5592.39	17.8	0.379	17.4	71.1	30.80	2.13%	Sand-Slime Tailing	0.059	119.0	1.57	0.65	0.92	1
27.723	5592.23	23.3	0.387	22.9	65.4	28.36	1.66%	Sand-Slime Tailing	0.059	119.0	1.58	0.65	0.92	1
27.887	5592.06	19.0	0.387	18.8	36.8	15.95	2.03%	Sand-Slime Tailing	0.059	119.0	1.59	0.66	0.93	1
28.051	5591.90	23.9	0.387	23.5	75.0	32.50	1.62%	Sand-Slime Tailing	0.059	119.0	1.60	0.66	0.93	1

CPT Data Interpretations (cont.) / Conditions at t_1

Depth at time of CPT (ft)	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
24.114	1.03	18.635	259.03	21.75	20	1.73%	2.6	47%	1.94	0.00	1.94	0
24.278	1.03	18.616	258.76	21.74	20	1.42%	2.6	47%	1.95	0.00	1.95	0
24.442	1.02	24.907	346.21	29.05	28	0.85%	2.3	47%	1.96	0.00	1.96	0
24.606	1.02	34.889	484.95	40.63	39	1.04%	2.2	47%	1.97	0.00	1.97	1
24.770	1.02	20.768	288.68	24.23	23	2.05%	2.6	47%	1.98	0.01	1.97	1
24.934	1.01	16.751	232.84	19.58	18	2.06%	2.7	47%	1.99	0.01	1.98	1
25.098	1.01	14.503	201.59	17.04	15	2.03%	2.7	47%	2.00	0.02	1.98	1
25.262	1.00	23.851	331.52	27.92	26	0.95%	2.4	47%	2.01	0.02	1.99	1
25.426	1.00	24.455	339.93	28.58	27	1.39%	2.5	47%	2.02	0.03	1.99	1
25.590	1.00	18.640	259.10	21.83	20	2.18%	2.7	47%	2.03	0.03	2.00	1
25.754	0.99	17.234	239.55	20.25	19	2.54%	2.7	47%	2.04	0.04	2.00	1
25.918	0.99	14.652	203.67	17.36	16	2.84%	2.8	71%	2.05	0.04	2.01	1
26.082	0.98	12.217	169.82	14.56	13	3.00%	2.9	71%	2.06	0.05	2.01	1
26.246	0.98	16.605	230.81	19.81	18	1.86%	2.7	47%	2.07	0.05	2.01	1
26.410	0.98	15.162	210.75	17.89	16	2.32%	2.8	47%	2.08	0.06	2.02	1
26.574	0.97	14.863	206.60	17.87	16	2.82%	2.8	71%	2.09	0.07	2.02	1
26.739	0.97	15.487	215.27	18.26	16	2.83%	2.8	71%	2.10	0.07	2.03	1
26.903	0.97	18.751	260.63	22.19	20	1.93%	2.6	47%	2.11	0.08	2.03	1
27.067	0.96	24.609	342.07	28.80	27	1.99%	2.5	47%	2.12	0.08	2.04	1
27.231	0.96	22.359	310.79	26.26	24	2.07%	2.6	47%	2.13	0.09	2.04	1
27.395	0.95	21.416	297.69	25.27	23	2.37%	2.6	47%	2.14	0.09	2.05	1
27.559	0.95	16.510	229.49	19.67	18	2.33%	2.7	47%	2.15	0.10	2.05	1
27.723	0.95	21.674	301.27	25.62	23	1.78%	2.6	47%	2.16	0.10	2.06	1
27.887	0.94	17.700	246.03	20.81	19	2.22%	2.7	47%	2.17	0.11	2.06	1
28.051	0.94	22.063	306.68	26.14	24	1.73%	2.6	47%	2.18	0.11	2.06	1

Liquefaction Triggering Analyses — Idriss & Boulanger (2008)

Depth at time of CPT (ft)	Cyclic Stress Ratio: r_d	C_σ	K_σ	K_a	CSR M=7.5, s'v=1atm	Cyclic Resistance Ratio: Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS
24.114	0.84	0.05	0.96	1.0	0.047	37.93	59.68	0.087	1.88
24.278	0.84	0.05	0.96	1.0	0.046	37.93	59.66	0.087	1.88
24.442	0.84	0.06	0.95	1.0	0.046	40.49	69.54	0.099	2.14
24.606	0.84	0.07	0.95	1.0	0.046	44.55	85.19	0.120	2.61
24.770	0.84	0.06	0.95	1.0	0.046	38.80	63.02	0.091	1.97
24.934	0.84	0.05	0.96	1.0	0.047	37.17	56.75	0.084	1.81
25.098	0.83	0.05	0.96	1.0	0.047	36.28	53.31	0.081	1.73
25.262	0.83	0.06	0.95	1.0	0.046	40.09	68.01	0.097	2.09
25.426	0.83	0.06	0.95	1.0	0.046	40.32	68.90	0.098	2.12
25.590	0.83	0.05	0.95	1.0	0.047	37.96	59.79	0.088	1.88
25.754	0.83	0.05	0.96	1.0	0.047	37.40	57.65	0.085	1.83
25.918	0.83	0.05	0.96	1.0	0.047	36.13	53.49	0.081	1.73
26.082	0.83	0.05	0.96	1.0	0.047	35.16	49.72	0.077	1.65
26.246	0.82	0.05	0.96	1.0	0.047	37.25	57.06	0.085	1.81
26.410	0.82	0.05	0.96	1.0	0.047	36.58	54.47	0.082	1.75
26.574	0.82	0.05	0.96	1.0	0.047	36.31	54.18	0.082	1.74
26.739	0.82	0.05	0.96	1.0	0.047	36.45	54.71	0.082	1.75
26.903	0.82	0.05	0.95	1.0	0.047	38.08	60.28	0.088	1.88
27.067	0.82	0.06	0.95	1.0	0.047	40.40	69.20	0.099	2.11
27.231	0.82	0.06	0.95	1.0	0.047	39.51	65.78	0.094	2.02
27.395	0.82	0.06	0.95	1.0	0.047	39.16	64.43	0.093	1.98
27.559	0.81	0.05	0.95	1.0	0.047	37.20	56.86	0.084	1.80
27.723	0.81	0.06	0.95	1.0	0.047	39.29	64.91	0.093	1.99
27.887	0.81	0.05	0.95	1.0	0.047	37.60	58.41	0.086	1.83
28.051	0.81	0.06	0.95	1.0	0.047	39.47	65.61	0.094	2.01

Liquefaction Triggering Analyses — Youd et al. (2001)

Depth at time of CPT (ft)	Cyclic Stress Ratio: r_d	D_r	f	K_σ	K_a	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No
24.114	0.89	0.27	0.80	1.01	1.0	0.039	3.37	73.35	0.117	3.10	2.49	2
24.278	0.89	0.27	0.80	1.01	1.0	0.039	3.10	67.33	0.108	2.87	2.37	2
24.442	0.89	0.31	0.80	1.01	1.0	0.039	2.05	59.56	0.100	2.62	2.38	2
24.606	0.89	0.37	0.80	1.01	1.0	0.039	1.79	72.69	0.116	3.03	2.82	2
24.770	0.89	0.28	0.80	1.00	1.0	0.039	3.40	82.30	0.132	3.43	2.70	2
24.934	0.89	0.26	0.80	1.00	1.0	0.039	3.96	77.45	0.123	3.18	2.50	2
25.098	0.88	0.24	0.80	1.00	1.0	0.039	4.34	73.97	0.118	3.02	2.38	2
25.262	0.88	0.31	0.80	1.00	1.0	0.039	2.21	61.74	0.102	2.60	2.35	2
25.426	0.88	0.31	0.80	1.00	1.0	0.039	2.54	72.71	0.116	2.93	2.52	2
25.590	0.88	0.27	0.80	1.00	1.0	0.040	3.77	82.36	0.132	3.32	2.60	2
25.754	0.88	0.26	0.80	1.00	1.0	0.040	4.27	86.54	0.140	3.51	2.67	2
25.918	0.88	0.24	0.80	1.00	1.0	0.040	5.00	86.83	0.141	3.50	2.62	2
26.082	0.88	0.22	0.80	1.00	1.0	0.040	5.79	84.24	0.136	3.35	2.50	2
26.246	0.87	0.26	0.80	0.99	1.0	0.040	3.77	74.76	0.119	2.92	2.37	2
26.410	0.87	0.24	0.80	0.99	1.0	0.040	4.48	80.16	0.128	3.13	2.44	2
26.574	0.87	0.24	0.80	0.99	1.0	0.040	4.91	87.67	0.143	3.47	2.60	2
26.739	0.87	0.25	0.80	0.99	1.0	0.040	4.84	88.43	0.144	3.49	2.62	2
26.903	0.87	0.27	0.80	0.99	1.0	0.040	3.55	78.85	0.126	3.02	2.45	2
27.067	0.87	0.31	0.80	0.99	1.0	0.040	3.01	86.67	0.141	3.36	2.73	2
27.231	0.87	0.30	0.80	0.99	1.0	0.040	3.27	85.87	0.139	3.30	2.66	2
27.395	0.87	0.29	0.80	0.99	1.0	0.040	3.59	90.66	0.149	3.52	2.75	2
27.559	0.86	0.26	0.80	0.99	1.0	0.040	4.23	83.15	0.133	3.13	2.46	2
27.723	0.86	0.29	0.80	0.99	1.0	0.040	3.11	79.73	0.127	2.97	2.48	2
27.887	0.86	0.26	0.80	0.98	1.0	0.041	3.98	82.85	0.133	3.08	2.46	2
28.051	0.86	0.30	0.80	0.98	1.0	0.041	3.04	79.33	0.126	2.92	2.46	2

Idriss & Boulanger (2008)

Depth at time of CPT (ft)	CN	qc1 TSF	qc1 MPa	qc1N
24.114	1.034131	18.725	1.7927	21.748
24.278	1.029637	18.717	1.7919	21.738
24.442	1.023719	25.014	2.3949	29.053
24.606	1.018055	34.986	3.3495	40.634
24.770	1.016063	20.859	1.997	24.226
24.934	1.012167	16.856	1.6138	19.577
25.098	1.007857	14.669	1.4044	17.037
25.262	1.003389	24.039	2.3015	27.920
25.426	0.9994	24.605	2.3557	28.578
25.590	0.995211	18.799	1.7998	21.834
25.754	0.991028	17.434	1.6691	20.248
25.918	0.987343	14.944	1.4308	17.357
26.082	0.983689	12.535	1.2001	14.558
26.246	0.97965	17.06	1.6333	19.814
26.410	0.975649	15.404	1.4748	17.891
26.574	0.972092	15.387	1.4732	17.871
26.739	0.968565	15.723	1.5053	18.261
26.903	0.965029	19.108	1.8294	22.192
27.067	0.963182	24.796	2.3739	28.799
27.231	0.958797	22.614	2.1651	26.265
27.395	0.95481	21.757	2.083	25.269
27.559	0.94942	16.932	1.621	19.665
27.723	0.947722	22.062	2.1122	25.623
27.887	0.942001	17.917	1.7153	20.809
28.051	0.940871	22.504	2.1545	26.137

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-1S

Data File: 13-52106_SP3-1S-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3 Field Data\2013 Field Investigation\Conetec Da

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69

Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

5608.00	Water surface elevation during CPT investigation (ft
5604.28	Water surface elevation at t_0 (ft amsl)
5595.59	Water surface elevation at t_1 (ft amsl)
5590.59	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Ear
7.51	Equiv. Number of Uniform Strain Cycles, N

5612.56	Ground Surface Elevation at time of CPT (ft amsl)
5620.47	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pl
3.50	Thickness of Water Storage/Rooting Zone (ft)
3.50	Thickness of High Compaction Layer (ft)
0.41	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
887.10	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5590.59	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	######	5620.22	5619.97	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	######	5618.22	5616.47	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5614.72	5612.97	3.50	0.060	120	0.424	0.320	0.00	0.00	0.424	0.320
Platform/Random Fill Layer	######	5612.77	5612.56	0.41	0.050	101	0.445	0.434	0.00	0.00	0.445	0.434

2013 CPT Data from ConeTec															CPT Data Interpretations								Conditions at t_1				Liquefaction Triggering Analyses: Idriss & Boulanger (2008)									Youd et al. (2001)												Idriss & Boulanger (2008)			
Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of CPT (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F, (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No	r_d	C_σ	K_σ	K_α	CSR M=7.5, σ'v=1atm	Δq_{c1n}	q_{c1n-cs}	(CRR) M=7.5, σ'v=1atm	FoS	r_d	D_r	f	K_σ	K_α	CSR M=7.5, σ'v=1atm	Kc	q_{c1n-cs}	(CRR) M=7.5, σ'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No	CN	qc1 TSF	qc1 MPa	qc1N
0.164	5612.40	1.0	0.010	1.0	-0.2	-0.10	1.00%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0	1.70	1.700	23.63	1.97	120	1.01%	1.9	51%	0.45	0.00	0.45	0	1.00	0.04	1.02	1.0	0.059	31.01	32.98	0.063	1.07	0.98	0.08	0.80	2.53	1.0	0.017	1.15	2.26	0.052	125.00	63.03	2	1.7	1.6975	0.1625	1.971
0.328	5612.23	1.0	0.010	1.0	0.4	0.19	1.00%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	1.700	23.63	1.98	60	1.01%	2.1	51%	0.46	0.00	0.46	0	1.00	0.04	1.02	1.0	0.059	31.02	32.99	0.063	1.07	0.98	0.08	0.80	2.20	1.0	0.020	1.44	2.85	0.052	63.11	32.09	2	1.7	1.7046	0.1632	1.980
0.492	5612.07	1.0	0.010	1.0	-0.1	-0.04	1.00%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	1.700	23.63	1.97	39	1.03%	2.2	51%	0.47	0.00	0.47	0	1.00	0.04	1.02	1.0	0.059	31.01	32.99	0.063	1.07	0.98	0.08	0.80	2.03	1.0	0.021	1.78	3.51	0.053	42.54	21.80	2	1.7	1.6989	0.1627	1.973
0.656	5611.90	1.0	0.010	1.0	-0.2	-0.08	1.00%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0	1.70	1.700	23.63	1.97	29	1.04%	2.4	51%	0.48	0.00	0.48	0	1.00	0.04	1.02	1.0	0.059	31.01	32.98	0.063	1.07	0.98	0.08	0.80	1.92	1.0	0.023	2.14	4.21	0.054	32.26	16.67	2	1.7	1.6981	0.1626	1.972
0.820	5611.74	5.6	0.026	5.6	14.4	6.23	0.46%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0	1.70	9.435	131.15	11.14	136	0.46%	1.6	51%	0.48	0.00	0.48	0	1.00	0.05	1.03	1.0	0.059	34.23	45.36	0.073	1.23	0.98	0.19	0.80	1.84	1.0	0.024	1.00	11.14	0.059	28.61	14.92	2	1.7	9.5875	0.9179	11.135
0.984	5611.58	9.5	0.093	9.4	16.6	7.20	0.98%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0	1.70	15.929	221.41	18.71	190	0.99%	1.7	51%	0.49	0.00	0.49	0	1.00	0.05	1.03	1.0	0.059	36.88	55.59	0.083	1.40	0.98	0.25	0.80	1.77	1.0	0.024	1.04	19.42	0.066	26.63	14.01	2	1.7	16.105	1.5419	18.705
1.148	5611.41	19.7	0.245	19.6	13.4	5.80	1.24%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0	1.70	33.371	463.86	38.92	340	1.25%	1.6	51%	0.50	0.00	0.50	0	1.00	0.06	1.03	1.0	0.060	43.98	82.90	0.117	1.95	0.98	0.36	0.80	1.72	1.0	0.025	1.00	38.92	0.082	28.43	15.19	2	1.7	33.513	3.2085	38.923
1.312	5611.25	35.4	0.510	35.4	11.0	4.76	1.44%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	60.146	836.03	69.99	535	1.44%	1.6	51%	0.51	0.00	0.51	0	1.00	0.08	1.04	1.0	0.060	54.88	124.87	0.190	3.16	0.98	0.48	0.76	1.86	1.0	0.023	1.00	69.99	0.112	33.79	18.47	2	1.7	60.263	5.7695	69.991
1.476	5611.08	80.0	0.912	79.9	17.9	7.76	1.14%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	135.830	1888.04	157.98	1075	1.14%	1.4	51%	0.52	0.00	0.52	0	1.00	0.17	1.09	1.0	0.063	85.76	243.74	1.000	15.91	0.98	0.73	0.64	2.43	1.0	0.018	1.00	157.98	0.447	119.94	67.93	2	1.7	136.02	13.023	157.979
1.640	5610.92	89.0	1.063	88.9	17.5	7.59	1.19%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0	1.70	151.130	2100.71	175.74	1076	1.20%	1.4	51%	0.53	0.00	0.53	0	1.00	0.20	1.10	1.0	0.064	91.99	267.74	1.000	15.73	0.98	0.77	0.62	2.45	1.0	0.018	1.00	175.74	1.000	241.77	128.75	2	1.7	151.32	14.487	175.744
1.804	5610.76	96.1	1.232	96.1	7.4	3.19	1.28%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0	1.70	163.370	2270.84	189.84	1057	1.28%	1.4	51%	0.53	0.00	0.53	0	1.00	0.23	1.10	1.0	0.064	96.94	286.77	1.000	15.73	0.98	0.80	0.60	2.45	1.0	0.018	1.00	189.84	1.000	219.87	117.80	2	1.7	163.45	15.649	189.835
1.968	5610.59	77.7	1.349	77.7	5.5	2.40	1.74%	Interim Cover	0.050	100.7	0.10	0.00	0.10	0	1.70	132.073	1835.81	153.46	783	1.74%	1.5	51%	0.54	0.00	0.54	0	1.00	0.16	1.08	1.0	0.062	84.18	237.64	1.000	16.09	0.98	0.72	0.64	2.17	1.0	0.020	1.00	153.46	0.416	83.90	50.00	2	1.7	132.13	12.65	153.463
2.133	5610.43	53.3	1.640	53.3	9.6	4.14	3.07%	Interim Cover	0.050	100.7	0.11	0.00	0.11	0	1.70	90.576	1259.01	105.32	496	3.08%	1.9	51%	0.55	0.00	0.55	0	1.00	0.11	1.05	1.0	0.061	67.28	172.60	0.435	7.18	0.98	0.59	0.70	1.85	1.0	0.023	1.17	122.92	0.253	47.06	27.12	2	1.7	90.677	8.6815	105.316
2.297	5610.26	46.3	1.974	46.2	9.6	4.14	4.27%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	78.557	1091.94	91.36	399	4.28%	2.0	51%	0.56	0.00	0.56	0	1.00	0.10	1.04	1.0	0.060	62.38	153.74	0.290	4.81	0.98	0.55	0.72	1.74	1.0	0.025	1.36	124.55	0.260	44.92	24.86	2	1.7	78.658	7.5308	91.357
2.461	5610.10	39.8	1.642	39.7	8.0	3.48	4.13%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	67.507	938.35	78.50	320	4.14%	2.1	51%	0.57	0.00	0.57	0	1.00	0.09	1.04	1.0	0.060	57.87	136.37	0.221	3.70	0.98	0.51	0.74	1.64	1.0	0.026	1.41	110.83	0.207	33.36	18.53	2	1.7	67.592	6.4713	78.504
2.625	5609.94	45.3	1.613	45.3	4.3	1.87	3.56%	Interim Cover	0.050	100.7	0.13	0.00	0.13	0	1.70	76.959	1069.73	89.44	342	3.57%	2.0	51%	0.58	0.00	0.58	0	1.00	0.10	1.04	1.0	0.060	61.71	151.14	0.277	4.62	0.98	0.55	0.73	1.67	1.0	0.026	1.31	116.85	0.228	34.59	19.61	2	1.7	77.005	7.3724	89.436
2.789	5609.77	38.8	1.441	38.8	0.7	0.30	3.72%	Interim Cover	0.050	100.7	0.14	0.00	0.14	0	1.70	65.892	915.90	76.54	275	3.73%	2.1	51%	0.58	0.00	0.58	0	0.99	0.09	1.03	1.0	0.059	57.18	133.72	0.213	3.58	0.98	0.51	0.75	1.58	1.0	0.027	1.40	107.01	0.194	27.66	15.62	2	1.7	65.899	6.3092	76.538
2.953	5609.61	36.0	1.125	36.0	0.5	0.22	3.13%	Interim Cover	0.050	100.7	0.15	0.00	0.15	0	1.70	61.149	849.97	71.03	241	3.14%	2.0	51%	0.59	0.00	0.59	0	0.99	0.08	1.03	1.0	0.059	55.25	126.27	0.194	3.27	0.97	0.49	0.76	1.53	1.0	0.028	1.35	95.55	0.161	21.71	12.49	2	1.7	61.154	5.8549	71.027
3.117	5609.44	31.9	1.113	31.9	-1.8	-0.76	3.49%	Interim Cover	0.050	100.7	0.16	0.00	0.16	0	1.70	54.213	753.56	62.94	202	3.51%	2.1	51%	0.60	0.00	0.60	0	0.99	0.08	1.03	1.0	0.059	52.41	115.35	0.170	2.88	0.97	0.46	0.77	1.48	1.0	0.029	1.48	93.27	0.155	19.85	11.37	2	1.7	54.194	5.1886	62.944
3.281	5609.28	30.2	1.010	30.2	-1.8	-0.77	3.35%	Slime Tailings	0.041	82.7	0.16	0.00	0.16	0	1.70	51.306	713.15	59.57	183	3.37%	2.1	71%	0.61	0.00	0.61	0	0.99	0.08	1.03	1.0	0.059	50.83	110.40	0.161	2.73	0.97	0.45	0.78	1.45	1.0	0.030	1.50	89.29	0.146	17.90	10.31	2	1.7	51.287	4.9102	59.567
3.445	5609.12	27.8	0.976	27.8	-1.7	-0.73	3.52%	Slime Tailings	0.041	82.7	0.17	0.00	0.17	0	1.70	47.209	656.21	54.81	162	3.54%	2.2	71%	0.61	0.00	0.61	0	0.99	0.07	1.03	1.0	0.059	49.17	103.98	0.149	2.54	0.97	0.43	0.79	1.41	1.0	0.030	1.60	87.77	0.143	16.81	9.67	2	1.7	47.191	4.5181	54.810
3.609	5608.95	23.2	0.881	23.2	-1.0	-0.45	3.80%	Slime Tailings	0.041	82.7	0.18	0.00	0.18	0	1.70	39.406	547.74	45.75	130	3.83%	2.3	71%	0.62	0.00	0.62	0	0.99	0.07	1.02	1.0	0.059	46.02	91.78	0.130	2.21	0.97	0.39	0.80	1.37	1.0	0.031	1.82	83.18	0.134	15.11	8.66	2	1.7	39.395	3.7717	45.755
3.773	5608.79	18.8	1.037	18.8	-0.3	-0.12	5.50%	Slime Tailings	0.041	82.7	0.18	0.00	0.18	0	1.70	32.028	445.19	37.20	101	5.56%	2.5	71%	0.63	0.00	0.63	0	0.99	0.06	1.02	1.0	0.058	43.04	80.24	0.113	1.94	0.97	0.35	0.80	1.36	1.0	0.032	2.53	94.13	0.158	17.18	9.56	2	1.7	32.025	3.0661	37.195
3.937	5608.62	11.7	1.018	11.7	-0.3	-0.13	8.69%	Slime Tailings	0.041	82.7	0.19	0.00	0.19	0	1.70	19.907	276.71	23.12	60	8.84%	2.7	71%	0.63	0.00	0.63	0	0.99	0.05	1.02	1.0	0.058	38.14	61.26	0.089	1.54	0.97	0.28	0.80	1.35	1.0	0.032	4.35	100.63	0.175	18.39	9.96	2	1.7	19.904	1.9056	23.117
4.101	5608.46	25.7	1.084	25.7	0.5	0.20	4.22%	Slime Tailings	0.041	82.7	0.20	0.00	0.20	0	1.70	43.622	606.35	50.67	129	4.26%	2.3	71%	0.64	0.00	0.64	0	0.99	0.07	1.02	1.0	0.058	47.73	98.40	0.140	2.40	0.97	0.41	0.79	1.35	1.0	0.032	1.93	97.99	0.168	17.03	9.71	2	1.7	43.627	4.1768	50.670
4.265	5608.29	24.3	1.143	24.3	0.5	0.20	4.70%	Slime Tailings	0.041	82.7	0.20	0.00	0.20	0	1.70	41.361	574.92	48.04	118	4.74%	2.4	71%	0.65	0.00	0.65	0	0.99	0.07	1.02	1.0	0.058	46.82	94.86	0.134	2.31	0.97	0.40	0.80	1.33	1.0	0.032	2.14	102.77	0.181	17.79	10.05	2	1.7	41.366	3.9604	48.044
4.429	5608.13	21.7	1.211	21.7	-1.0	-0.45	5.58%	Slime Tailings	0.041	82.7	0.21	0.00	0.21	0	1.70	36.907	513.01	42.85	102	5.63%	2.5	71%	0.65	0.00	0.65	0	0.99	0.07	1.02	1.0	0.058	45.01	87.86	0.124	2.13	0.97	0.38	0.80	1.32	1.0	0.032	2.55	109.16	0.201	19.13	10.63	2	1.7	36.896	3.5324	42.852
4.593	5607.97	36.9	1.373	36.9	-0.2	-0.10	3.72%	Slime Tailings	0.057	113.1	0.22	0.00	0.22	1	1.70	62.696	871.47	72.81	167	3.75%	2.2	71%	0.66	0.00	0.66	0	0.98	0.09	1.02	1.0	0.058	55.44	128.26	0.199	3.41	0.97	0.49	0.75	1.40	1.0	0.031	1.63	118.67	0.235	21.58	12.49	2	1.7	62.693	6.0023	72.815
4.757	5607.80	75.7	1.484	75.7	0.5	0.20	1.96%	Sand-Slime Tailing	0.059	119.0	0.23	0.01	0.22	1	1.70	128.690	1788.79	149.47	337	1.97%	1.8	47%	0.67	0.00	0.67	0	0.98	0.16	1.04	1.0	0.059	82.72	232.19	1.000	16.92	0.97	0.71	0.65	1.61	1.0	0.027	1.09	163.61	1.000	89.79	53.36	2	1.7	128.69	12.321	149.471
4.921	5607.64	90.7	1.093	90.7	1.8	0.79	1.21%	Sand Tailings	0.062	123.5	0.24	0.01	0.23	1	1.63	147.850	2055.11	171.74	395	1.21%	1.6	18%	0.68	0.00	0.68	0	0.98	0.20	1.04	1.0	0.059	65.99	237.73	1.000	16.84	0.97	0.76	0.62	1.65	1.0	0.026	1.00	171.74	1.000	87.86	52.35	2	1.630457	147.87	14.157	171.740
5.085	5607.47	113.7	1.047	113.6	8.3	3.60	0.92%	Sand Tailings	0.062	123.5	0.25	0.02	0.23	1	1.53	173.889	2417.06	202.05	484	0.92%	1.4	18%	0.69	0.00	0.69	0	0.98	0.27	1.06	1.0	0.060	73.74	275.80	1.000	16.65	0.97	0.82	0.60	1.68	1.0	0.025	1.00	202.05	1.000	86.02	51.33	2	1.530444	173.97	16.656	202.054
5.249	5607.31	123.4	0.699	123.3	4.9	2.11	0.57%	Sand Tailings	0.062	123.5	0.26	0.02	0.24	1	1.49	183.875	2555.86	213.61	515	0.57%	1.2	18%	0.70	0.00	0.70	0	0.98	0.30	1.06	1.0	0.060	76.70	290.31	1.000	16.63	0.97	0.84	0.60	1.67	1.0	0.026	1.00	213.61	1.000	84.25	50.44	2	1.491041	183.92	17.609	213.613
5.413	5607.15	101.2	0.707	101.2	3.6	1.54	0.70%	Sand Tailings	0.062	123.5	0.27	0.03	0.24	1	1.56	157.808	2193.53	183.32	414	0.70%	1.4	18%	0.71	0.00	0.71	0	0.98	0.22	1.04	1.0	0.059	68.96	252.28	1.000	16.96	0.97	0.78	0.61	1.64	1.0	0.026	1.00	183.32	1.000	82.55	49.75	2	1.55921	157.84	15.112	183.324
5.577	5606.98	80.8	0.675	80.8	2.2	0.94	0.84%	Sand Tailings	0.062	123.5	0.28	0.03	0.25	1	1.64	132.252	1838.30	153.63	323	0.84%	1.5	18%	0.72	0.00	0.72	0	0.98	0.17	1.03	1.0	0.058	61.36	214.99	1.000	17.18	0.97	0.72	0.64	1.56	1.0	0.027	1.00	153.63	0.417	33.76	25.47	2	1.636779	132.27	12.664	153.628
5.741	5606.82	76.8	0.595	76.8	2.1	0.89	0.77%	Sand Tailings	0.062	123.5	0.29	0.04	0.25	1	1.65	126.407	1757.06	146.84	301	0.78%	1.5	18%	0.73	0.00	0.73	0	0.98	0.16	1.02	1.0	0.058	59.63	206.47	1.000	17.26	0.97	0.70	0.65	1.53	1.0	0.028	1.00	146.84	0.374	29.72	23.49	2	1.646141	126.43	12.104	146.839
5.905	5606.65	74.6	0.547	74.6	2.0	0.86	0.73%	Sand Tailings	0.062	123.5	0.30	0.04	0.26	1	1.65	122.801	1706.93	142.65	287	0.74%	1.5	18%	0.74	0.00	0.74	0	0.98	0.15	1.02	1.0	0.058	58.56	201.21	1.000	17.32	0.97	0.69	0.66	1.51	1.0	0.028	1.00	142.65	0.350	27.25	22.29	2	1.647003	122.82	11.759	142.649
6.069	5606.49	70.2	0.520	70.2	1.3	0.57	0.74%	Sand Tailings	0.062	123.5	0.31	0.05	0.26	1	1.66	116.482	1619.10	135.30	265	0.74%	1.5	18%	0.75	0.00	0.75	0	0.98	0.14	1.02	1.0	0.057	56.68	191.98	0.810	14.09	0.97	0.67	0.66	1.49	1.0	0.029	1.00	135.30	0.310	23.72	18.90	2	1.65882	116.5	11.153	135.303
6.234	5606.33	60.0	0.488	60.0	1.2	0.52	0.81%	Sand Tailings	0.062	123.5	0.32	0.05	0.27	1	1.70	101.915	1416.62	118.38	222	0.82%	1.6	18%	0.76	0.00	0.76	0	0.98	0.12	1.01	1.0	0.057	52.35	170.74	0.415	7.26	0.97	0.63	0.69	1.44	1.0	0.030	1.00	118.38	0.234	17.58	12.42	2	1.7	101.93	9.7586	118.383
6.398	5606.16	59.3	0.442	59.3	0.8	0.36	0.75%	Sand Tailings	0.062	123.5	0.33	0.06	0.27	1	1.70	100.623	1398.66	116.88	215	0.75%	1.6	18%	0.78	0.00	0.78	0	0.97	0.12	1.01	1.0	0.057	51.97	168.85	0.396	6.95	0.97	0.62	0.69	1.43	1.0	0.030	1.00	116.88	0.228	16.83	11.89	2	1.698285	100.63	9.6345	116.878
6.562	5606.00	58.2	0.392	58.2	1.2	0.52	0.67%	Sand Tailings	0.062	123.5	0.34	0.06	0.28	1	1.69	98.587	1370.35	114.52	207	0.68%	1.6	18%	0.79	0.00	0.79	0	0.97	0.12	1.01	1.0	0.057	51.37	165.88	0.370	6.50	0.97	0.62	0.69	1.42	1.0	0.030	1.00	114.52	0.220	15.90	11.20	2	1.693055	98.599	9.4399	114.517
6.726	5605.83	53.1	0.371	53.1	1.1	0.46	0.70%	Sand Tailings	0.062	123.5	0.35	0.07	0.28	1	1.70	90.304	1255.23	104.90	186	0.70%	1.6	18%	0.80	0.00	0.80	0	0.97	0.11	1.01	1.0	0.057	48.91	153.80	0.290	5.11	0.97	0.59	0.70	1.39	1.0	0.031	1.00	104.90	0.187	13.33	9.22	2	1.7	90.315	8.6468	104.896
6.890	5605.67	49.1	0.311	49.1	0.6	0.26	0.63%	Sand Tailings	0.062	123.5	0.36	0.07	0.29	1	1.70	83.470	1160.23	96.95	169	0.64%	1.6	18%	0.81	0.00	0.81	0	0.97	0.10	1.01	1.0	0.057	46.88	143.83	0.246	4.35	0.97	0.57	0.72	1.36	1.0	0.031	1.00	96.95	0.165	11.52	7.94	2	1.7	83.476	7.992	96.953
7.054	5605.51	56.4	0.288	56.4	1.2	0.51	0.51%	Sand Tailings	0.062	123.5	0.37	0.08	0.29	1	1.67	94.245	1310.00	109.47	191	0.51%	1.5	18%	0.82	0.00	0.82	0	0.97	0.11	1.01	1.0	0.056	50.08	159.55	0.323	5.73	0.97	0.60	0.70	1.38	1.0	0.031	1.00	109.47	0.202	13.89	9.81	2	1.670412	94.257	9.0242	109.474
7.218	5605.34	56.4	0.275	56.4	1.4	0.59	0.49%	Sand Tailings	0.062	123.5	0.38	0.08	0.30	1	1.66	93.553	1300.38	108.67	187	0.49%	1.5	18%	0.83	0.00	0.83	0	0.97	0.11	1.00	1.0	0.056	49.87	158.54	0.317	5.63	0.96	0.60	0.70	1.37	1.0	0.031	1.00	108.67	0.199	13.49	9.56	2	1.659913	93.567	8.9581	108.672
7.382	5605.18	44.0	0.351	44.0	0.2	0.09	0.80%	Sand Tailings	0.062	123.5	0.39	0.09	0.30	1	1.70	74.766	1039.25	86.84	143	0.81%	1.7	18%	0.84	0.00	0.84	0	0.97	0.10	1.00	1.0	0.056	44.29	131.13	0.206	3.67	0.96	0.54	0.73	1.32	1.0	0.032	1.06	91.90	0.152	10.13	6.90	2	1.7	74.768	7.1583	86.839
7.546	5605.01	36.9	0.372	36.9	-0.1	-0.05	1.01%	Sand-Slime Tailing	0.059	119.0	0.40	0.09	0.31	1	1.70	62.747	872.18	72.88	118	1.02%	1.9	47%	0.85	0.00	0.85	0	0.97	0.09	1.00	1.0	0.056	55.86	128.74	0.200	3.57	0.96	0.49	0.75	1.29	1.0	0.033	1.15	84.08	0.135	8.87	6.22	2	1.7	62.746	6.0073	72.875
7.710	5604.85	30.0	0.299	30.0	0.2	0.08	1.00%	Sand-Slime Tailing	0.059	119.0	0.41	0.10	0.31	1	1.70	51.034	709.37	59.28	94	1.01%	1.9	47%	0.86	0.00	0.86	0	0.97	0.08	1.00	1.0	0.056	51.09	110.37	0.161	2.87	0.96	0.44	0.78	1.25	1.0	0.034	1.22	72.36	0.115	7.45	5.16	2	1.7	51.036	4.8862	59.275
7.874	5604.69	32.9	0.212	32.9	1.1	0.46	0.64%	Sand-Slime Tailing	0.059	119.0	0.42	0.10	0.32	1	1.70	55.896	776.95	64.93	102	0.65%	1.8	47%	0.87	0.00	0.87	0	0.96	0.08	1.00	1.0	0.056	53.07	118.01	0.175	3.15	0.96	0.47	0.77	1.26	1.0	0.034	1.10	71.42	0.114	7.26	5.20	2	1.7	55.907	5.3526	64.933
8.038	5604.52	38.9	0.166	38.9	2.2	0.94	0.43%	Sand Tailings	0.062	123.5	0.43	0.11	0.32	1	1.70	66.079	918.50	76.77	119	0.43%	1.6	18%	0.88	0.00	0.88	0	0.96	0.09	1.00	1.0	0.056	41.72	118.49	0.176	3.17	0.96	0.51	0.75	1.28	1.0	0.033	1.00	76.77	0.122	7.66	5.42	2	1.7	66.102	6.3286	76.773
8.202	5604.36	38.5	0.158	38.5	1.2	0.52	0.41%	Sand Tailings	0.062	123.5	0.44	0.11	0.33	1	1.70	65.399	909.05	75.97	116	0.42%	1.6	18%	0.89	0.00	0.89	0	0.96	0.09	1.00	1.0	0.056	41.51	117.48	0.174	3.14	0.96	0.50	0.75	1.27	1.0	0.033	1.00	75.97	0.121	7.47	5.30	2	1.7	65.412	6.2625	75.972
8.366	5604.19	36.9	0.159	36.9	0.5	0.22	0.43%	Sand Tailings	0.062	123.5	0.45	0.12	0.33	1	1.70	62.798	872.89	72.94	110	0.44%	1.7	18%	0.90	0.00	0.90	0	0.96	0.09	1.00	1.0	0.055	40.74	113.68	0.167	3.01	0.96	0.49	0.75	1.26	1.0	0.034	1.02	74.14	0.118	7.18	5.10	2	1.7	62.803	6.0128	72.942
8.530	5604.03	31.2	0.156	31.2	-0.5	-0.20	0.50%	Sand-Slime Tailing	0.059	119.0	0.46	0.12	0.34	1	1.70	53.040	737.26	61.60	91	0.51%	1.8	47%	0.91	0.00	0.91	0	0.96	0.08	1.00	1.0	0.055	51.90	113.50	0.166	3.01	0.96	0.45	0.77	1.24	1.0	0.034	1.09	66.94	0.108	6.49	4.75	2	1.7	53.035	5.0776	61.597
8.694	5603.87	24.0	0.142	24.0	-0.0	-0.02	0.59%	Sand-Slime Tailing	0.059	119.0	0.47	0.13	0.34	1	1.70	40.800	567.12	47.39	69	0.60%	1.9	47%	0.92	0.00	0.92	0	0.96	0.07	1.00	1.0	0.055	46.92	94.31	0.133	2.42	0.96	0.40	0.80	1.20	1.0	0.035	1.20	57.03	0.097	5.77	4.09	2	1.7	40.8	3.9062	47.386
8.858	5603.70	20.0	0.119	20.0	3.7	1.59	0.60%	Sand-Slime Tailing	0.059	119.0	0.48	0.13	0.35	1	1.70	33.949	471.89	39.48	56	0.61%	2.0	47%	0.92	0.00	0.92	0	0.96	0.06	1.00	1.0	0.055	44.15	83.62	0.118	2.13	0.96	0.36	0.80	1.20	1.0	0.035	1.29	50.93	0.092	5.40	3.77	2	1.7	33.988	3.254	39.475
9.022	5603.54	23.7	0.086	23.7	6.8	2.94	0.36%	Sand-Slime Tailing	0.059	119.0	0.49	0.14	0.35	1	1.70	40.273	559.79	46.86	66	0.37%	1.8	47%	0.93	0.00	0.93	0	0.96	0.07	0.99	1.0	0.055	46.74	93.59	0.132	2.40	0.96	0.40	0.80	1.20	1.0	0.035	1.13	52.86	0.094	5.42	3.91	2	1.7	40.345	3.8626	46.858
9.186	5603.37	27.5	0.145	27.5	5.4	2.34	0.53%	Sand-Slime Tailing	0.059	119.0	0.50	0.14	0.36	1	1.70	46.665	648.64	54.27	76	0.54%	1.9	47%	0.94	0.00	0.94	0	0.96	0.07	0.99	1.0	0.055	49.33	103.60	0.149	2.70	0.96	0.43	0.79	1.21	1.0	0.035	1.15	62.27	0.102	5.85	4.28	2	1.7	46.722	4.4732	54.265
9.350	5603.21	37.0	0.177	37.0	6.8	2.95	0.48%	Sand Tailings	0.062	123.5	0.51	0.15	0.36	1	1.64	60.777	844.79	70.67	101	0.48%	1.7	18%	0.95	0.00	0.95	0	0.96	0.08	0.99	1.0	0.055	40.16	110.82	0.161	2.95	0.96	0.49	0.76	1.23	1.0	0.034	1.05	74.41	0.118	6.66	4.80	2	1.642609	60.846	5.8254	70.669
9.514	5603.05	43.3	0.205	43.3	8.3	3.61	0.47%	Sand Tailings	0.062	123.5	0.52	0.15	0.37	1	1.59	68.941	958.28	80.17	117	0.48%	1.7	18%	0.96	0.00	0.96	0	0.95	0.09	0.99	1.0	0.055	42.58	122.75	0.186	3.40	0.96	0.52	0.74	1.25	1.0	0.034	1.02	81.39	0.130	7.23	5.31	2	1.594014	69.024	6.6083	80.167
9.678	5602.88	41.4	0.300	41.3	6.0	2.61	0.73%	Sand Tailings	0.062	123.5	0.53	0.16	0.37	1	1.59	65.913	916.19	76.62	110	0.73%	1.8	18%	0.97	0.00	0.97	0	0.95	0.09	0.99	1.0	0.054	41.68	118.30	0.176	3.23	0.96	0.51	0.75	1.24	1.0	0.034	1.10	84.50	0.136	7.46	5.35	2	1.594798	65.973	6.3163	76.624
9.842	5602.72	27.8	0.053	27.7	6.0	2.62	0.19%	Sand-Slime Tailing	0.059	119.0	0.54	0.16	0.38	1	1.68	46.511	646.50	54.09	72	0.19%	1.7	47%	0.98	0.00	0.98	0	0.95	0.07	0.99	1.0	0.054	49.27	103.37	0.148	2.72	0.96	0.42	0.79	1.19	1.0	0.035	1.03	55.73	0.096	5.21	3.96	2	1.676664	46.574	4.459	54.093
10.006	5602.55	18.0	0.353	17.9	7.9	3.43	1.96%	Sand-Slime Tailing	0.059	119.0	0.55	0.17	0.38	1	1.70	30.464	423.45	35.48	46	2.03%	2.4	47%	0.99	0.00	0.99	0	0.95	0.06	0.99	1.0	0.054	42.74	78.22	0.110	2.02	0.96	0.34	0.80	1.18	1.0	0.036	2.18	77.52	0.123	6.60	4.31	2	1.7	30.548	2.9247	35.480
10.170	5602.39	8.2	0.125	8.2	7.0	3.02	1.52%	Slime Tailings	0.057	113.1	0.56	0.18	0.38	1	1.70	13.889	193.06	16.22	20	1.63%	2.6	71%	1.00	0.00	1.00	0	0.95	0.05	0.99	1.0	0.054	35.74	51.95	0.079	1.46	0.96	0.23	0.80	1.17	1.0	0.036	3.34	54.12	0.095	5.02	3.24	2	1.7	13.963	1.3368	16.217
10.335	5602.23	13.5	0.090	13.4	11.9	5.17	0.67%	Sand-Slime Tailing	0.059	119.0	0.57	0.18	0.39	1	1.70	22.763	316.41	26.58	33	0.70%	2.2	47%	1.01	0.00	1.01	0	0.95	0.06	0.99	1.0	0.054	39.63	66.21	0.095	1.75	0.96	0.30	0.80	1.17	1.0	0.036	1.72	45.75	0.088	4.61	3.18	2	1.7	22.89	2.1915	26.585
10.499	5602.06	10.5	0.118	10.3	21.6	9.36	1.13%	Sand-Slime Tailing	0.059	119.0	0.58	0.19	0.39	1	1.70	17.561	244.10	20.66	25	1.19%	2.4	47%	1.02	0.00	1.02	0	0.95	0.05	0.99	1.0	0.054	37.55	58.21	0.086	1.58	0.96	0.26	0.80	1.17	1.0	0.036	2.50	51.61	0.093	4.80	3.19	2	1.7	17.79	1.7032	20.662
10.663	5601.90	9.7	0.087	9.5	38.5	16.68	0.89%	Sand-Slime Tailing	0.059	119.0	0.59	0.19	0.40	1	1.70	16.150	224.49	19.23	23	0.95%	2.4	47%	1.03	0.00	1.03	0	0.95	0.05	0.99	1.0	0.054	37.05	56.28	0.084	1.55	0.96	0.25	0.80	1.17	1.0	0.036	2.42	46.55	0.089	4.54	3.05	2	1.7	16.559	1.5853	19.232
10.827	5601.73	10.0	0.117	9.7	46.7	20.25	1.17%	Sand-Slime Tailing	0.059	119.0	0.60	0.20	0.40	1	1.70	16.490	229.21	19.73	23	1.25%	2.5	47%	1.04	0.00	1.04	0	0.95	0.05	0.99	1.0	0.054	37.22	56.95	0.085	1.56	0.96	0.26	0.80	1.16	1.0	0.036	2.67	52.71	0.094	4.74	3.15	2	1.7	16.986	1.6262	19.728
10.991	5601.57	10.2	0.059	9.9	46.8	20.28	0.58%	Sand-Slime Tailing	0.059	119.0	0.61	0.20	0.41	1	1.70	16.898	234.88	20.20	24	0.61%	2.3	47%	1.05	0.00	1.05	0	0.94	0.05	0.99	1.0	0.054	37.39	57.59	0.085	1.58	0.96	0.26	0.80	1.16	1.0	0.036	2.04	41.17	0.084	4.22	2.90	2	1.7	17.395	1.6654	20.203
11.155	5601.41	16.6	0.090	16.3	43.7	18.93	0.54%	Sand-Slime Tailing	0.059	119.0	0.62	0.21	0.41	1	1.69	27.563	383.13	32.55	39	0.56%	2.1	47%	1.06	0.00	1.06	0	0.94	0.06	0.99	1.0	0.054	41.72	74.26	0.105	1.95	0.96	0.33	0.80	1.16	1.0	0.036	1.49	48.45	0.090	4.47	3.21	2	1.689954	28.024	2.683	32.548
11.319	5601.24	15.8	0.118	15.7	25.2	10.92	0.75%	Sand-Slime Tailing	0.059	119.0	0.63	0.21	0.42	1	1.69	26.439	367.50	31.02	36	0.78%	2.2	47%	1.07	0.00	1.07	0	0.94	0.06	0.99	1.0	0.054	41.18	72.19	0.102	1.90	0.96	0.32	0.80	1.16	1.0	0.036	1.69	52.28	0.093	4.57	3.24	2	1.686149	26.704	2.5566	31.015
11.483	5601.08	12.9	0.083	12.7	24.3	10.51	0.64%	Sand-Slime Tailing	0.059	119.0	0.64	0.22	0.42	1	1.70	21.658	301.05	25.45	29	0.68%	2.3	47%	1.08	0.00	1.08	0	0.94	0.06	0.99	1.0	0.054	39.23	64.68	0.093	1.74	0.95	0.29	0.80	1.15	1.0	0.037	1.84	46.90	0.089	4.32	3.03	2	1.7	21.915	2.0982	25.453
11.647	5600.91	11.0	0.114	10.8	43.0	18.65	1.03%	Sand-Slime Tailing	0.059	119.0	0.65	0.22	0.43	1	1.70	18.309	254.50	21.80	24	1.10%	2.4	47%	1.09	0.00	1.09	0	0.94	0.05	0.99	1.0	0.054	37.95	59.74	0.088	1.63	0.95	0.27	0.80	1.15	1.0	0.037	2.46	53.63	0.094	4.52	3.08	2	1.7	18.766	1.7966	21.795
11.811	5600.75	9.6	0.088	9.2	64.1	27.78	0.91%	Sand-Slime Tailing	0.059	119.0	0.66	0.23	0.43	1	1.70	15.691	218.10	19.01	21	0.98%	2.5	47%	1.10	0.00	1.10	0	0.94	0.05	0.99	1.0	0.054	36.97	55.98	0.084	1.56	0.95	0.25	0.80	1.15	1.0	0.037	2.62	49.79	0.091	4.34	2.95	2	1.7	16.371	1.5674	19.014
11.975	5600.59	9.8	0.035	9.4	61.1	26.46	0.36%	Sand-Slime Tailing	0.059	119.0	0.67	0.23	0.44	1	1.70	16.014	222.59	19.35	21	0.38%	2.3	47%	1.11	0.00	1.11	0	0.94	0.05	0.99	1.0	0.053	37.09	56.44	0.084	1.57	0.95	0.25	0.80	1.15	1.0	0.037	1.93	37.34	0.081	3.81	2.69	2	1.7	16.662	1.5952	19.352

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-1S

Data File: 13-52106_SP3-1S-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3 Field Data\2013 Field Investigation\Conetec Da

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69

Youd, et al (2001)		
Max. Horiz. Acceleration, Amax/g:	0.15	
Earthquake Moment Magnitude, M:	5.5	
Magnitude Scaling Factor, MSF:	2.21	2.21

5608.00	Water surface elevation during CPT investigation (ft
5604.28	Water surface elevation at t_0 (ft amsl)
5595.59	Water surface elevation at t_1 (ft amsl)
5590.59	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Eart
7.51	Equiv. Number of Uniform Strain Cycles, N

5612.56	Ground Surface Elevation at time of CPT (ft amsl)
5620.47	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pl
3.50	Thickness of Water Storage/Rooting Zone (ft)
3.50	Thickness of High Compaction Layer (ft)
0.41	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
887.10	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5590.59	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	######	5620.22	5619.97	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	######	5618.22	5616.47	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5614.72	5612.97	3.50	0.060	120	0.424	0.320	0.00	0.00	0.424	0.320
Platform/Random Fill Layer	######	5612.77	5612.56	0.41	0.050	101	0.445	0.434	0.00	0.00	0.445	0.434

2013 CPT Data from ConeTec / CPT Data Interpretations

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No
12.139	5600.42	9.7	0.064	9.4	51.9	22.49	0.66%	Sand-Slime Tailing	0.059	119.0	0.68	0.24	0.44	1
12.303	5600.26	11.1	0.121	10.7	65.5	28.37	1.09%	Sand-Slime Tailing	0.059	119.0	0.69	0.24	0.45	1
12.467	5600.09	16.8	0.110	16.4	67.8	29.38	0.66%	Sand-Slime Tailing	0.059	119.0	0.70	0.25	0.45	1
12.631	5599.93	30.9	0.086	30.8	23.6	10.23	0.28%	Sand Tailings	0.062	123.5	0.71	0.25	0.45	1
12.795	5599.76	30.6	0.167	30.5	23.2	10.07	0.55%	Sand-Slime Tailing	0.059	119.0	0.72	0.26	0.46	1
12.959	5599.60	24.9	0.293	24.8	9.7	4.19	1.18%	Sand-Slime Tailing	0.059	119.0	0.73	0.26	0.46	1
13.123	5599.44	22.1	0.250	22.0	13.6	5.90	1.13%	Sand-Slime Tailing	0.059	119.0	0.74	0.27	0.47	1
13.287	5599.27	17.9	0.174	17.8	18.4	7.98	0.97%	Sand-Slime Tailing	0.059	119.0	0.75	0.27	0.47	1
13.451	5599.11	18.6	0.120	18.3	33.7	14.61	0.65%	Sand-Slime Tailing	0.059	119.0	0.76	0.28	0.48	1
13.615	5598.94	19.0	0.093	18.8	27.6	11.94	0.49%	Sand-Slime Tailing	0.059	119.0	0.77	0.28	0.48	1
13.779	5598.78	18.8	0.035	18.6	24.7	10.70	0.19%	Sand-Slime Tailing	0.059	119.0	0.77	0.29	0.49	1
13.943	5598.62	17.5	0.045	17.4	14.9	6.47	0.26%	Sand-Slime Tailing	0.059	119.0	0.78	0.29	0.49	1
14.107	5598.45	15.4	0.100	15.2	27.0	11.68	0.65%	Sand-Slime Tailing	0.059	119.0	0.79	0.30	0.50	1
14.271	5598.29	16.8	0.261	16.6	35.9	15.54	1.55%	Sand-Slime Tailing	0.059	119.0	0.80	0.30	0.50	1
14.436	5598.12	15.9	0.208	15.7	41.2	17.86	1.31%	Sand-Slime Tailing	0.059	119.0	0.81	0.31	0.51	1
14.600	5597.96	17.8	0.165	17.6	26.3	11.41	0.93%	Sand-Slime Tailing	0.059	119.0	0.82	0.31	0.51	1
14.764	5597.80	15.1	0.105	15.0	29.7	12.88	0.69%	Sand-Slime Tailing	0.059	119.0	0.83	0.32	0.52	1
14.928	5597.63	16.4	0.396	16.2	36.8	15.96	2.41%	Sand-Slime Tailing	0.059	119.0	0.84	0.32	0.52	1
15.092	5597.47	15.6	0.201	15.3	59.5	25.80	1.29%	Sand-Slime Tailing	0.059	119.0	0.85	0.33	0.52	1
15.256	5597.30	25.6	0.270	25.4	23.7	10.26	1.06%	Sand-Slime Tailing	0.059	119.0	0.86	0.33	0.53	1
15.420	5597.14	21.4	0.308	21.3	15.0	6.48	1.44%	Sand-Slime Tailing	0.059	119.0	0.87	0.34	0.53	1
15.584	5596.98	18.8	0.188	18.7	18.8	8.16	1.00%	Sand-Slime Tailing	0.059	119.0	0.88	0.34	0.54	1
15.748	5596.81	20.6	0.295	20.4	18.0	7.78	1.44%	Sand-Slime Tailing	0.059	119.0	0.89	0.35	0.54	1
15.912	5596.65	16.7	0.170	16.4	37.1	16.09	1.02%	Sand-Slime Tailing	0.059	119.0	0.90	0.35	0.55	1
16.076	5596.48	19.8	0.165	19.5	48.9	21.20	0.83%	Sand-Slime Tailing	0.059	119.0	0.91	0.36	0.55	1
16.240	5596.32	21.9	0.284	21.7	42.0	18.19	1.30%	Sand-Slime Tailing	0.059	119.0	0.92	0.36	0.56	1
16.404	5596.16	21.9	0.319	21.5	65.3	28.28	1.46%	Sand-Slime Tailing	0.059	119.0	0.93	0.37	0.56	1
16.568	5595.99	28.0	0.500	27.9	24.0	10.38	1.78%	Sand-Slime Tailing	0.059	119.0	0.94	0.37	0.57	1
16.732	5595.83	19.0	0.522	18.7	40.7	17.62	2.75%	Slime Tailings	0.057	113.1	0.95	0.38	0.57	1
16.896	5595.66	22.1	0.393	21.4	112.6	48.78	1.78%	Sand-Slime Tailing	0.059	119.0	0.96	0.38	0.57	1
17.060	5595.50	22.9	0.460	22.6	47.8	20.69	2.01%	Sand-Slime Tailing	0.059	119.0	0.97	0.39	0.58	1
17.224	5595.34	19.0	0.308	18.5	76.9	33.34	1.62%	Sand-Slime Tailing	0.059	119.0	0.98	0.40	0.58	1
17.388	5595.17	26.8	0.182	26.7	20.4	8.84	0.68%	Sand-Slime Tailing	0.059	119.0	0.99	0.40	0.59	1
17.552	5595.01	24.3	0.073	24.2	8.2	3.55	0.30%	Sand-Slime Tailing	0.059	119.0	1.00	0.41	0.59	1
17.716	5594.84	21.7	0.073	21.6	11.9	5.16	0.34%	Sand-Slime Tailing	0.059	119.0	1.01	0.41	0.60	1
17.880	5594.68	17.6	0.073	17.5	13.5	5.83	0.42%	Sand-Slime Tailing	0.059	119.0	1.02	0.42	0.60	1

CPT Data Interpretations (cont.) / Conditions at t_1

Depth at time of CPT (ft)	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
12.139	1.69	15.804	219.68	18.99	20	0.71%	2.4	47%	1.12	0.00	1.12	0
12.303	1.67	17.874	248.45	21.55	23	1.16%	2.5	47%	1.13	0.00	1.13	0
12.467	1.60	26.138	363.32	31.14	36	0.68%	2.2	47%	1.14	0.00	1.14	0
12.631	1.49	45.876	637.67	53.54	66	0.28%	1.8	18%	1.15	0.00	1.15	0
12.795	1.48	45.191	628.16	52.74	65	0.56%	1.9	47%	1.16	0.00	1.16	0
12.959	1.51	37.430	520.28	43.58	52	1.21%	2.2	47%	1.17	0.00	1.17	0
13.123	1.52	33.392	464.15	38.93	46	1.17%	2.2	47%	1.18	0.00	1.18	0
13.287	1.54	27.284	379.25	31.89	36	1.02%	2.3	47%	1.19	0.00	1.19	0
13.451	1.52	27.891	387.68	32.76	37	0.67%	2.2	47%	1.20	0.00	1.20	0
13.615	1.51	28.342	393.95	33.22	38	0.51%	2.1	47%	1.21	0.00	1.21	0
13.779	1.50	27.908	387.92	32.68	37	0.19%	2.0	47%	1.22	0.00	1.22	0
13.943	1.50	26.084	362.57	30.46	34	0.27%	2.0	47%	1.23	0.00	1.23	0
14.107	1.51	22.922	318.61	26.92	29	0.69%	2.3	47%	1.24	0.00	1.24	0
14.271	1.49	24.694	343.25	29.07	32	1.63%	2.4	47%	1.25	0.00	1.25	0
14.436	1.48	23.240	323.03	27.43	30	1.38%	2.4	47%	1.26	0.00	1.26	0
14.600	1.46	25.776	358.29	30.22	33	0.97%	2.3	47%	1.27	0.00	1.27	0
14.764	1.47	21.980	305.52	25.85	28	0.73%	2.3	47%	1.28	0.00	1.28	0
14.928	1.45	23.488	326.48	27.67	30	2.55%	2.6	47%	1.29	0.00	1.29	0
15.092	1.45	22.121	307.48	26.32	28	1.36%	2.4	47%	1.30	0.00	1.30	0
15.256	1.39	35.271	490.27	41.20	47	1.09%	2.2	47%	1.31	0.00	1.31	0
15.420	1.40	29.754	413.58	34.71	38	1.50%	2.3	47%	1.32	0.00	1.32	0
15.584	1.40	26.274	365.21	30.71	33	1.05%	2.3	47%	1.33	0.00	1.33	0
15.748	1.39	28.363	394.25	33.12	36	1.50%	2.4	47%	1.34	0.00	1.34	0
15.912	1.40	22.984	319.47	27.07	29	1.08%	2.4	47%	1.35	0.00	1.35	0
16.076	1.38	26.799	372.50	31.61	34	0.87%	2.3	47%	1.36	0.00	1.36	0
16.240	1.36	29.415	408.87	34.58	38	1.35%	2.3	47%	1.36	0.00	1.36	0
16.404	1.35	29.002	403.13	34.32	37	1.52%	2.4	47%	1.37	0.00	1.37	0
16.568	1.32	36.866	512.44	43.05	48	1.85%	2.3	47%	1.38	0.00	1.38	0
16.732	1.35	25.254	351.03	29.73	32	2.90%	2.6	71%	1.39	0.00	1.39	0
16.896	1.33	28.441	395.33	34.12	37	1.86%	2.4	47%	1.40	0.00	1.40	0
17.060	1.32	29.824	414.56	35.10	38	2.10%	2.4	47%	1.41	0.00	1.41	1
17.224	1.33	24.585	341.73	29.29	31	1.71%	2.5	47%	1.42	0.01	1.42	1
17.388	1.29	34.509	479.67	40.27	44	0.70%	2.1	47%	1.43	0.01	1.42	1
17.552	1.29	31.333	435.53	36.47	39	0.31%	2.0	47%	1.44	0.02	1.42	1
17.716	1.30	27.980	388.93	32.61	35	0.35%	2.1	47%	1.45	0.02	1.43	1
17.880	1.30	22.828	317.31	26.64	27	0.44%	2.2	47%	1.46	0.03	1.43	1

Liquefaction Triggering Analyses

Depth at time of CPT (ft)	Idriss & Boulanger (2008) Cyclic Stress Ratio r_d	C_σ	K_σ	K_a	CSR M=7.5, s'v=1atm	Cyclic Resistance Ratio Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Youd et al. (2001) Cyclic Stress Ratio r_d	D_r	f	K_σ	K_a	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No	Idriss & Boulanger (2008) CN	qc1 TSF	qc1 MPa	qc1N
12.139	0.94	0.05	0.99	1.0	0.053	36.96	55.95	0.083	1.56	0.95	0.25	0.80	1.14	1.0	0.037	2.36	44.75	0.087	4.06	2.81	2	1.688489	16.351	1.5655	18.991
12.303	0.94	0.05	0.99	1.0	0.053	37.86	59.41	0.087	1.64	0.95	0.27	0.80	1.14	1.0	0.037	2.59	55.72	0.096	4.42	3.03	2	1.670492	18.557	1.7766	21.553
12.467	0.93	0.06	0.98	1.0	0.053	41.22	72.37	0.103	1.93	0.95	0.32	0.80	1.14	1.0	0.037	1.64	50.96	0.092	4.21	3.07	2	1.596709	26.814	2.5672	31.143
12.631	0.93	0.07	0.98	1.0	0.053	35.78	89.31	0.126	2.39	0.95	0.42	0.79	1.14	1.0	0.037	1.09	58.49	0.099	4.45	3.42	2	1.490923	46.095	4.4132	53.537
12.795	0.93	0.07	0.98	1.0	0.053	48.80	101.53	0.145	2.75	0.95	0.42	0.79	1.14	1.0	0.037	1.21	63.65	0.104	4.64	3.70	2	1.484114	45.406	4.3472	52.737
12.959	0.93	0.07	0.98	1.0	0.053	45.59	89.16	0.126	2.39	0.95	0.38	0.80	1.13	1.0	0.037	1.63	71.04	0.113	5.01	3.70	2	1.506858	37.521	3.5923	43.579
13.123	0.93	0.06	0.98	1.0	0.053	43.96	82.89	0.117	2.22	0.95	0.36	0.80	1.13	1.0	0.037	1.72	67.05	0.108	4.73	3.47	2	1.515057	33.521	3.2093	38.932
13.287	0.93	0.06	0.98	1.0	0.053	41.49	73.38	0.104	1.97	0.95	0.33	0.80	1.13	1.0	0.037	1.86	59.29	0.099	4.31	3.14	2	1.535421	27.461	2.6291	31.894
13.451	0.93	0.06	0.98	1.0	0.052	41.79	74.56	0.105	2.01	0.95	0.33	0.80	1.12	1.0	0.037	1.60	52.27	0.093	4.01	3.01	2	1.520751	28.211	2.7009	32.765
13.615	0.93	0.06	0.98	1.0	0.052	41.95	75.17	0.106	2.03	0.95	0.33	0.80	1.12	1.0	0.037	1.47	48.88	0.091	3.86	2.95	2	1.508334	28.601	2.7383	33.218
13.779	0.92	0.06	0.98	1.0	0.052	41.76	74.45	0.105	2.01	0.95	0.33	0.80	1.12	1.0	0.037	1.26	41.27	0.084	3.56	2.79	2	1.500419	28.139	2.694	32.682
13.943	0.92	0.06	0.98	1.0	0.052	40.98	71.44	0.101	1.94	0.95	0.32	0.80	1.12	1.0	0.037	1.36	41.55	0.085	3.54	2.74	2	1.499961	26.224	2.5107	30.458
14.107	0.92	0.06	0.98	1.0	0.052	39.74	66.66	0.096	1.83	0.95	0.30	0.80	1.12	1.0	0.037	1.84	49.42	0.091	3.78	2.80	2	1.506034	23.175	2.2188	26.917
14.271	0.92	0.06	0.98	1.0	0.052	40.50	69.56	0.099	1.90	0.95	0.31	0.80	1.11	1.0	0.038	2.44	71.02	0.113	4.66	3.28	2	1.485827	25.027	2.3961	29.068
14.436	0.92	0.06	0.98	1.0	0.052	39.92	67.36	0.096	1.85	0.95	0.30	0.80	1.11	1.0	0.038	2.37	64.97	0.106	4.30	3.07	2	1.483063	23.621	2.2615	27.435
14.600	0.92	0.06	0.98	1.0	0.052	40.90	71.12	0.101	1.95	0.95	0.32	0.80	1.11	1.0	0.038	1.92	58.11	0.098	3.97	2.96	2	1.461241	26.017	2.4908	30.217
14.764	0.92	0.06	0.98	1.0	0.052	39.37	65.21	0.094	1.81	0.95	0.29	0.80	1.11	1.0	0.038	1.95	50.29	0.092	3.68	2.74	2	1.470246	22.253	2.1305	25.846
14.928	0.92	0.06	0.98	1.0	0.052	40.00	67.67	0.097	1.87	0.95	0.30	0.80	1.11	1.0	0.038	3.16	87.53	0.142	5.65	3.76	2	1.45255	23.822	2.2807	27.667
15.092	0.91	0.06	0.98	1.0	0.052	39.53	65.85	0.095	1.83	0.95	0.30	0.80	1.10	1.0	0.038	2.44	64.33	0.105	4.12	2.98	2	1.448658	22.659	2.1694	26.317
15.256	0.91	0.07	0.97	1.0	0.051	44.75	85.96	0.121	2.36	0.95	0.37	0.80	1.10	1.0	0.038	1.66	68.40	0.110	4.28	3.32	2	1.388093	35.477	3.3965	41.204
15.420	0.91	0.06	0.97	1.0	0.051	42.47	77.18	0.109	2.12	0.95	0.34	0.80	1.10	1.0	0.038	2.11	73.21	0.116	4.51	3.31	2	1.399511	29.884	2.8611	34.709
15.584	0.91	0.06	0.97	1.0	0.051	41.07	71.78	0.102	1.98	0.95	0.32	0.80	1.10	1.0	0.038	1.98	60.69	0.101	3.87	2.93	2	1.404285	26.439	2.5313	30.708
15.748	0.91	0.06	0.97	1.0	0.051	41.92	75.04	0.106	2.07	0.94	0.33	0.80	1.10	1.0	0.038	2.18	72.28	0.115	4.38	3.23	2	1.387634	28.519	2.7304	33.123
15.912	0.91	0.06	0.97	1.0	0.051	39.80	66.87	0.096	1.87	0.94	0.30	0.80	1.09	1.0	0.038	2.19	59.36	0.099	3.76	2.81	2	1.399728	23.308	2.2315	27.071
16.076	0.91	0.06	0.97	1.0	0.051	41.39	73.00	0.103	2.03	0.94	0.32	0.80	1.09	1.0	0.038	1.82	57.57	0.098	3.66	2.84	2	1.375706	27.219	2.6059	31.613
16.240	0.91	0.06	0.97	1.0	0.051	42.43	77.01	0.109	2.13	0.94	0.34	0.80	1.09	1.0	0.038	2.04	70.42	0.112	4.18	3.16	2	1.358653	29.771	2.8503	34.577
16.404	0.90	0.06	0.97	1.0	0.051	42.34	76.66	0.108	2.13	0.94	0.34	0.80	1.09	1.0	0.038	2.16	74.09	0.118	4.34	3.24	2	1.351456	29.553	2.8294	34.324
16.568	0.90	0.07	0.97	1.0	0.051	45.40	88.45	0.125	2.46	0.94	0.38	0.80	1.09	1.0	0.038	2.04	87.67	0.143	5.22	3.84	2	1.321846	37.064	3.5485	43.048
16.732	0.90	0.06	0.97	1.0	0.051	40.44	70.17	0.100	1.97	0.94	0.31	0.80	1.09	1.0	0.038	3.27	97.24	0.166	6.01	3.99	2	1.349769	25.597	2.4506	29.729
16.896	0.90	0.06	0.97	1.0	0.051	42.27	76.39	0.108	2.13	0.94	0.34	0.80	1.08	1.0	0.038	2.39	81.44	0.130	4.69	3.41	2	1.329655	29.376	2.8124	34.118
17.060	0.90	0.06	0.97	1.0	0.051	42.61	77.71	0.110	2.17	0.94	0.34	0.80	1.08	1.0	0.038	2.49	87.26	0.142	5.06	3.62	2	1.31966	30.218	2.893	35.096
17.224	0.90	0.06	0.97	1.0	0.051	40.58	69.87	0.099	1.96	0.94	0.31	0.80	1.08	1.0	0.039	2.56	74.93	0.119	4.21	3.08	2	1.327489	25.223	2.4148	29.295
17.388	0.90	0.07	0.97	1.0	0.051	44.43	84.70	0.119	2.35	0.94	0.37	0.80	1.08	1.0	0.039	1.49	59.88	0.100	3.49	2.92	2	1.293425	34.673	3.3196	40.271
17.552	0.90	0.06	0.97	1.0	0.051	43.09	79.56	0.112	2.21	0.94	0.35	0.80	1.08	1.0	0.039	1.31	47.86	0.090	3.10	2.65	2	1.294762	31.399	3.0062	36.469
17.716	0.89	0.06	0.97	1.0	0.051	41.74	74.35	0.105	2.06	0.94	0.33	0.80	1.08	1.0	0.039	1.42	46.25	0.089	3.02	2.54	2	1.29659	28.077	2.6881	32.609
17.880	0.89	0.06	0.97	1.0	0.051	39.64	66.29	0.095	1.86	0.94	0.30	0.80	1.07	1.0	0.039	1.68	44.88	0.087	2.95	2.41	2	1.304474	22.938	2.1961	26.641

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-2C

Data File: 13-52106_SP3-2C-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Data

- Tailings Sands
- Tailings Sand-Slimes
- Tailings Slimes
- Interim Cover
- Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69

Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

5605.30	Water surface elevation during CPT investigation (ft amsl)
5602.54	Water surface elevation at t_0 (ft amsl)
5591.64	Water surface elevation at t_1 (ft amsl)
5586.64	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earthquake
7.51	Equiv. Number of Uniform Strain Cycles, N

5610.82	Ground Surface Elevation at time of CPT (ft amsl)
5621.51	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement
3.50	Thickness of Water Storage/Rooting Zone (ft)
3.50	Thickness of High Compaction Layer (ft)
3.19	Thickness of Random/Platform Fill Layer on top of existing interim cover (ft)
1167.12	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5586.64	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	5621.51	5621.26	5621.01	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
Water Storage/Rooting Zone Layer	5621.01	5619.26	5617.51	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	5617.51	5615.76	5614.01	3.50	0.060	120	0.424	0.320	0.00	0.00	0.424	0.320
Platform/Random Fill Layer	5614.01	5612.415	5610.82	3.19	0.050	101	0.585	0.504	0.00	0.00	0.585	0.504

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
0.164	5610.66	9.5	0.818	9.5	10.4	4.49	8.58%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0	1.70	16.099	223.78	18.83	1153	8.59%	2.2	51%	0.59	0.00	0.59	0
0.328	5610.49	67.8	0.428	67.8	8.7	3.76	0.63%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	115.243	1601.88	133.95	4105	0.63%	1.0	51%	0.60	0.00	0.60	0
0.492	5610.33	104.7	0.603	104.6	7.9	3.44	0.58%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	177.871	2472.41	206.68	4223	0.58%	1.0	51%	0.61	0.00	0.61	0
0.656	5610.16	73.4	0.695	73.3	5.6	2.42	0.95%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0	1.70	124.661	1732.79	144.86	2219	0.95%	1.2	51%	0.62	0.00	0.62	0
0.820	5610.00	90.8	1.617	90.7	4.4	1.90	1.78%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0	1.70	154.241	2143.95	179.20	2196	1.78%	1.5	51%	0.62	0.00	0.62	0
0.984	5609.84	98.7	0.951	98.7	4.8	2.06	0.96%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0	1.70	167.790	2332.28	194.94	1991	0.96%	1.2	51%	0.63	0.00	0.63	0
1.148	5609.67	142.9	1.153	142.9	5.8	2.53	0.81%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0	1.70	242.879	3376.02	282.16	2470	0.81%	1.1	51%	0.64	0.00	0.64	0
1.312	5609.51	142.3	0.768	142.3	5.6	2.43	0.54%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	241.910	3362.55	281.03	2153	0.54%	1.0	51%	0.65	0.00	0.65	0
1.476	5609.34	150.3	0.964	150.3	3.4	1.49	0.64%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	255.544	3552.06	296.84	2021	0.64%	1.0	51%	0.66	0.00	0.66	0
1.640	5609.18	142.9	0.948	142.9	4.8	2.08	0.66%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0	1.70	242.862	3375.78	282.13	1729	0.66%	1.1	51%	0.67	0.00	0.67	0
1.804	5609.02	129.8	0.906	129.8	4.9	2.12	0.70%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0	1.70	220.643	3066.94	256.32	1428	0.70%	1.1	51%	0.67	0.00	0.67	0
1.968	5608.85	134.9	1.437	134.9	3.7	1.61	1.07%	Interim Cover	0.050	100.7	0.10	0.00	0.10	0	1.70	229.313	3187.45	266.38	1360	1.07%	1.3	51%	0.68	0.00	0.68	0
2.133	5608.69	130.9	0.753	130.9	2.7	1.15	0.58%	Interim Cover	0.050	100.7	0.11	0.00	0.11	0	1.70	222.496	3092.69	258.45	1218	0.58%	1.1	51%	0.69	0.00	0.69	0
2.297	5608.52	120.4	0.968	120.4	3.4	1.47	0.80%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	204.714	2845.52	237.80	1040	0.80%	1.2	51%	0.70	0.00	0.70	0
2.461	5608.36	98.7	1.136	98.7	3.8	1.64	1.15%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	167.773	2332.04	194.90	796	1.15%	1.4	51%	0.71	0.00	0.71	0
2.625	5608.20	75.5	1.164	75.5	3.5	1.50	1.54%	Interim Cover	0.050	100.7	0.13	0.00	0.13	0	1.70	128.367	1784.30	149.13	570	1.54%	1.6	51%	0.72	0.00	0.72	0
2.789	5608.03	54.0	0.768	54.0	2.0	0.85	1.42%	Interim Cover	0.050	100.7	0.14	0.00	0.14	0	1.70	91.749	1275.31	106.59	383	1.43%	1.6	51%	0.72	0.00	0.72	0
2.953	5607.87	50.1	0.997	50.1	1.2	0.53	1.99%	Interim Cover	0.050	100.7	0.15	0.00	0.15	0	1.70	85.136	1183.39	98.90	336	2.00%	1.8	51%	0.73	0.00	0.73	0
3.117	5607.70	56.9	1.094	56.9	2.7	1.18	1.92%	Interim Cover	0.050	100.7	0.16	0.00	0.16	0	1.70	96.713	1344.31	112.36	362	1.93%	1.8	51%	0.74	0.00	0.74	0
3.281	5607.54	64.2	0.738	64.2	2.1	0.92	1.15%	Sand Tailings	0.051	102.8	0.17	0.00	0.17	0	1.70	109.174	1517.52	126.83	387	1.15%	1.6	18%	0.75	0.00	0.75	0
3.445	5607.38	52.1	0.886	52.1	2.0	0.87	1.70%	Sand-Slime Tailin	0.047	93.3	0.17	0.00	0.17	0	1.70	88.570	1231.12	102.89	300	1.71%	1.8	47%	0.76	0.00	0.76	0
3.609	5607.21	29.1	1.041	29.1	0.7	0.30	3.58%	Slime Tailings	0.041	82.7	0.18	0.00	0.18	0	1.70	49.436	687.16	57.43	161	3.60%	2.2	71%	0.76	0.00	0.76	0
3.773	5607.05	21.5	1.042	21.5	1.5	0.65	4.84%	Slime Tailings	0.041	82.7	0.19	0.00	0.19	0	1.70	36.550	508.05	42.47	114	4.89%	2.4	71%	0.77	0.00	0.77	0
3.937	5606.88	16.3	0.676	16.3	3.3	1.44	4.14%	Slime Tailings	0.041	82.7	0.19	0.00	0.19	0	1.70	27.744	385.64	32.26	83	4.19%	2.4	71%	0.78	0.00	0.78	0
4.101	5606.72	18.3	0.612	18.2	5.0	2.18	3.35%	Slime Tailings	0.041	82.7	0.20	0.00	0.20	0	1.70	31.008	431.01	36.08	90	3.39%	2.3	71%	0.78	0.00	0.78	0
4.265	5606.55	15.1	0.610	15.0	4.1	1.76	4.05%	Slime Tailings	0.041	82.7	0.21	0.00	0.21	0	1.70	25.568	355.40	29.75	72	4.11%	2.4	71%	0.79	0.00	0.79	0
4.429	5606.39	19.3	0.601	19.3	4.8	2.09	3.11%	Slime Tailings	0.041	82.7	0.21	0.00	0.21	0	1.70	32.810	456.06	38.17	89	3.14%	2.3	71%	0.80	0.00	0.80	0
4.593	5606.23	24.6	0.687	24.5	4.0	1.73	2.80%	Sand-Slime Tailin	0.047	93.3	0.22	0.00	0.22	0	1.70	41.701	579.64	48.48	110	2.82%	2.2	47%	0.80	0.00	0.80	0
4.757	5606.06	24.5	0.631	24.5	2.1	0.90	2.57%	Sand-Slime Tailin	0.047	93.3	0.23	0.00	0.23	0	1.70	41.684	579.41	48.44	106	2.60%	2.2	47%	0.81	0.00	0.81	0
4.921	5605.90	23.4	0.399	23.4	5.1	2.21	1.71%	Sand-Slime Tailin	0.047	93.3	0.24	0.00	0.24	0	1.70	39.712	552.00	46.19	98	1.72%	2.1	47%	0.82	0.00	0.82	0
5.085	5605.73	25.5	0.327	25.5	7.2	3.11	1.28%	Sand-Slime Tailin	0.047	93.3	0.24	0.00	0.24	0	1.70	43.282	601.62	50.36	103	1.29%	2.0	47%	0.83	0.00	0.83	0
5.249	5605.57	20.3	0.310	20.3	1.4	0.60	1.53%	Sand-Slime Tailin	0.047	93.3	0.25	0.00	0.25	0	1.70	34.425	478.51	40.00	79	1.55%	2.1	47%	0.84	0.00	0.84	0
5.413	5605.41	11.2	0.265	11.2	0.7	0.29	2.37%	Slime Tailings	0.041	82.7	0.26	0.00	0.26	0	1.70	19.040	264.66	22.12	42	2.42%	2.4	71%	0.84	0.00	0.84	0
5.577	5605.24	7.5	0.141	7.5	0.6	0.27	1.88%	Slime Tailings	0.057	113.1	0.27	0.00	0.27	1	1.70	12.750	177.23	14.82	27	1.95%	2.5	71%	0.85	0.00	0.85	0
5.741	5605.08	7.7	0.089	7.7	1.1	0.47	1.15%	Sand-Slime Tailin	0.059	119.0	0.28	0.01	0.27	1	1.70	13.090	181.95	15.22	27	1.20%	2.4	47%	0.86	0.00	0.86	0
5.905	5604.91	9.9	0.084	9.9	2.9	1.27	0.84%	Sand-Slime Tailin	0.059	119.0	0.29	0.01	0.28	1	1.70	16.881	234.65	19.64	35	0.87%	2.2	47%	0.87	0.00	0.87	0
6.069	5604.75	5.9	0.088	5.9	2.9	1.27	1.50%	Slime Tailings	0.057	113.1	0.30	0.02	0.28	1	1.70	9.962	138.47	11.61	20	1.58%	2.6	71%	0.88	0.00	0.88	0
6.234	5604.59	5.6	0.085	5.5	4.4	1.92	1.53%	Slime Tailings	0.057	113.1	0.31	0.02	0.28	1	1.70	9.418	130.91	10.99	19	1.62%	2.6	71%	0.89	0.00	0.89	0
6.398	5604.42	7.0	0.088	6.9	6.4	2.77	1.26%	Slime Tailings	0.057	113.1	0.32	0.03	0.29	1	1.70	11.798	163.99	13.78	23	1.32%	2.5	71%	0.90	0.00	0.90	0
6.562	5604.26	7.1	0.082	7.1	6.8	2.93	1.15%	Slime Tailings	0.057	113.1	0.32	0.03	0.29	1	1.70	12.019	167.06	14.04	23	1.21%	2.5	71%	0.91	0.00	0.91	0
6.726	5604.09	10.7	0.082	10.6	7.0	3.03	0.77%	Sand-Slime Tailin	0.059	119.0	0.33	0.04	0.30	1	1.70	18.088	251.42	21.09	35	0.79%	2.2	47%	0.92	0.00	0.92	0
6.890	5603.93	13.4	0.114	13.4	5.9	2.54	0.85%	Sand-Slime Tailin	0.059	119.0	0.34	0.04	0.30	1	1.70	22.746	316.17	26.49	43	0.87%	2.2	47%	0.93	0.00	0.93	0
7.054	5603.77	15.0	0.134	14.9	5.2	2.24	0.90%	Sand-Slime Tailin	0.059	119.0	0.35	0.05	0.31	1	1.70	25.364	352.56	29.52	48	0.92%	2.1	47%	0.94	0.00	0.94	0
7.218	5603.60	22.4	0.135	22.4	8.0	3.48	0.60%	Sand-Slime Tailin	0.059	119.0	0.36	0.05	0.31	1	1.70	38.029	528.60	44.27	71	0.61%	1.9	47%	0.95	0.00	0.95	0
7.382	5603.44	17.5	0.162	17.4	10.4	4.51	0.93%	Sand-Slime Tailin	0.059	119.0	0.37	0.06	0.32	1	1.70	29.580	411.16	34.48	54	0.95%	2.1	47%	0.96	0.00	0.96	0
7.546	5603.27	15.5	0.200	15.4	24.6	10.65	1.29%	Sand-Slime Tailin	0.059	119.0	0.38	0.06	0.32	1	1.70	26.112	362.96	30.63	47	1.32%	2.2	47%	0.97	0.00	0.97	0
7.710	5603.11	17.0	0.227	16.8	44.3	19.18	1.33%	Sand-Slime Tailin	0.059	119.0	0.39	0.07	0.32	1	1.70	28.492	396.04	33.64	51	1.36%	2.2	47%	0.98	0.00	0.98	0
7.874	5602.95	17.9	0.174	17.6	42.1	18.26	0.97%	Sand-Slime Tailin	0.059	119.0	0.40	0.07	0.33	1	1.70	29.903	415.65	35.25	53	1.00%	2.1	47%	0.99	0.00	0.99	0
8.038	5602.78	20.6	0.144	20.4	32.2	13.94	0.70%	Sand-Slime Tailin	0.059	119.0	0.41	0.08	0.33	1	1.70	34.680	482.05	40.68	60	0.71%	2.0	47%	1.00	0.00	1.00	0
8.202	5602.62	26.4	0.168	26.2	32.9	14.27	0.64%	Sand-Slime Tailin	0.059	119.0	0.42	0.08	0.34	1	1.70	44.557	619.34	52.16	77	0.65%	1.9	47%	1.01	0.00	1.01	0
8.366	5602.45	29.9	0.252	29.7	36.5	15.81	0.84%	Sand-Slime Tailin	0.059	119.0	0.43	0.09	0.34	1	1.70	50.405	700.63	58.99	86	0.86%	1.9	47%	1.02	0.00	1.02	0
8.530	5602.29	22.3	0.277	22.1	28.4	12.32	1.24%	Sand-Slime Tailin	0.059	119.0	0.44	0.09	0.35	1	1.70	37.621	522.93	44.04	63	1.27%	2.1	47%	1.03	0.00	1.03	0
8.694	5602.13	21.8	0.392	21.5	41.9	18.15	1.80%	Sand-Slime Tailin	0.059	119.0	0.45	0.10	0.35	1	1.70	36.533	507.81	42.95	60	1.84%	2.2	47%	1.04	0.00	1.04	0
8.858	5601.96	21.4	0.248	21.0	63.0	27.28	1.16%	Sand-Slime Tailin	0.059	119.0	0.46	0.10	0.36	1	1.70	35.768	497.18	42.32	59	1.18%	2.1	47%	1.04	0.00	1.04	0
9.022	5601.80	29.7	0.307	29.5	36.3	15.73	1.03%	Sand-Slime Tailin	0.059	119.0	0.47	0.11	0.36	1	1.70	50.044	695.61	58.57	81	1.05%	2.0	47%	1.05	0.00	1.05	0
9.186	5601.63	22.6	0.143	22.5	10.6	4.58	0.63%	Sand-Slime Tailin	0.059	119.0	0.48	0.11	0.37	1	1.70	38.267	531.91	44.58	60	0.65%	2.0	47%	1.06	0.00	1.06	0
9.350	5601.47	17.7	0.143	17.7	4.4	1.92	0.81%	Sand-Slime Tailin	0.059	119.0	0.49	0.12	0.37	1	1.70	30.039	417.54	34.94	46	0.83%	2.1	47%	1.07	0.00	1.07	0
9.514	5601.31	14.2	0.178	14.2	4.4	1.90	1.25%	Sand-Slime Tailin	0.059	119.0	0.50	0.12	0.38	1	1.70	24.072	334.60	28.01	36	1.30%	2.3	47%	1.08	0.00	1.08	0
9.678	5601.14	11.7	0.202	11.6	7.4	3.22	1.73%	Sand-Slime Tailin	0.059	119.0	0.51	0.13	0.38	1	1.70	19.737	274.34	23.01	29	1.81%	2.5	47%	1.09	0.00	1.09	0
9.842	5600.98	11.3	0.120	11.2	13.3	5.76	1.07%	Sand-Slime Tailin	0.059	119.0	0.52	0.13	0.38	1	1.70	18.989	263.95	22.22	28	1.12%	2.4	47%	1.10	0.00	1.10	0
10.006	5600.81	14.4	0.083	14.3	11.9	5.15	0.58%	Sand-Slime Tailin	0.059	119.0	0.53	0.14	0.39	1	1.70	24.293	337.67	28.36	36	0.60%	2.2	47%	1.11	0.00	1.11	0
10.170	5600.65	18.3	0.069	18.3	7.0	3.04	0.38%	Sand-Slime Tailin	0.059	119.0	0.54	0.15	0.39	1	1.70	31.110	432.43	36.22	45	0.39%	2.0	47%	1.12	0.00	1.12	0
10.335	5600.49	20.6	0.093	20.6	5.9	2.55	0.45%	Sand-Slime Tailin	0.059	119.0	0.55	0.15	0.40	1	1.68	34.682	482.08	40.35	50	0.46%	2.0	47%	1.13	0.00	1.13	0
10.499	5600.32	21.3	0.111	21.3	5.5	2.39	0.52%	Sand-Slime Tailin	0.059	119.0	0.56	0.16	0.40	1	1.67	35.475	493.10	41.27	51	0.53%	2.0	47%	1.14	0.00	1.14	0
10.663	5600.16	23.3	0.126	23.3	6.1	2.63	0.54%	Sand-Slime Tailin	0.059	119.0	0.57	0.16	0.41	1	1.64	38.112	529.76	44.34	56	0.55%	2.0	47%	1.15	0.00	1.15	0
10.827	5599.99	23.4	0.148	23.4	6.7	2.88	0.63%	Sand-Slime Tailin	0.059	119.0	0.58	0.17	0.41	1	1.63	38.033	528.66	44.25	55	0.65%	2.0	47%	1.16	0.00	1.16	0
10.991	5599.83	23.4	0.151	23.3	6.8	2.96	0.65%	Sand-Slime Tailin	0.059	119.0	0.59	0.17	0.42	1	1.62	37.699	524.02	43.87	55	0.66%	2.0	47%	1.17	0.00	1.17	0
11.155	5599.67	23.8	0.188	23.7	7.4	3.19	0.79%	Sand-Slime Tailin	0.059	119.0	0.60	0.18	0.42	1	1.60	37.995	528.13	44.21	55	0.81%	2.1	47%	1.18	0.00	1.18	0
11.319	5599.50	20.6	0.235	20.6	7.4	3.21	1.14%	Sand-Slime Tailin	0.059	119.0	0.61	0.18	0.43	1	1.62	33.296	462.82	38.76	47	1.17%	2.2	47%	1.19	0.00	1.19	0
11.483	5599.34	17.6	0.198	17.5	8.1	3.49	1.13%	Sand-Slime Tailin	0.059	119.0	0.62	0.19	0.43	1	1.63	28.640	398.09	33.36	39	1.17%	2.3	47%	1.20	0.00	1.20	0
11.647	5599.17	21.4	0.168	21.3	8.2	3.53	0.79%	Sand-Slime Tailin	0.059	119.0	0.63	0.19	0.44	1	1.59	33.858	470.62	39.42	48	0.81%	2.1	47%	1.21	0.00	1.21	0
11.811	5599.01	21.3	0.146	21.2	7.4	3.21	0.69%	Sand-Slime Tailin	0.059	119.0	0.64	0.20	0.44	1	1.58	33.555	466.42	39.06	47	0.71%	2.1	47%	1.22	0.00	1.22	0
11.975	5598.85	23.0	0.133	23.0	8.9	3.84	0.58%	Sand-Slime Tailin	0.059	119.0	0.65	0.20	0.45	1	1.56	35.751	496.95	41.62	50	0.59%	2.0	47%	1.23	0.00	1.23	0
12.139	5598.68	25.0	0.154	24.9	8.9	3.84	0.62%	Sand-Slime Tailin	0.059	119.0	0.66	0.21	0.45	1	1.53	38.252	531.70	44.53	54	0.63%	2.0	47%	1.24	0.00	1.24	0
12.303	5598.52	23.3	0.135	23.3	8.9	3.84	0.58%	Sand-Slime Tailin	0.059	119.0	0.67	0.21	0.45	1	1.54	35.751	496.94	41.62	50	0.60%	2.0	47%	1.25	0.00	1.25	0

Liquefaction Triggering Analyses

Idriss & Boulanger (2008): Cyclic Stress Ratio (r_d to CSR), Cyclic Resistance Ratio (Δqc_{1n} to CRR), FoS. Youd et al. (2001): Cyclic Stress Ratio (r_d to CSR), Kc to CRR, FoS. Right-hand block: Idriss & Boulanger (2008).

Depth (ft)	r_d	C_σ	K_σ	K_a	CSR M=7.5, s'v=1atm	Δqc_{1n}	$qc_{1n\text{-}cs}$	(CRR) M=7.5, s'v=1atm	FoS	r_d	D_r	f	f	K_σ	K_a	CSR M=7.5, s'v=1atm	Kc	$qc_{1n\text{-}cs}$	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No	CN	qc1 TSF	qc1 MPa	qc1N
0.164	1.00	0.05	1.02	1.0	0.059	36.93	55.75	0.083	1.41	0.97	0.25	0.80	0.80	2.53	1.0	0.017	1.65	31.02	0.076	183.93	92.67	2	1.7	16.209	1.5519	18.826
0.328	1.00	0.14	1.05	1.0	0.061	77.33	211.28	1.000	16.47	0.97	0.67	0.67	0.67	3.75	1.0	0.011	1.00	133.95	0.304	368.22	192.34	2	1.7	115.34	11.042	133.955
0.492	1.00	0.28	1.10	1.0	0.064	102.85	309.54	1.000	15.74	0.97	0.83	0.58	0.58	4.36	1.0	0.010	1.00	206.68	1.000	809.03	412.39	2	1.7	177.96	17.037	206.684
0.656	1.00	0.15	1.05	1.0	0.061	81.15	226.01	1.000	16.46	0.97	0.69	0.65	0.65	3.10	1.0	0.014	1.00	144.86	0.363	220.15	118.30	2	1.7	124.72	11.941	144.855
0.820	1.00	0.21	1.07	1.0	0.062	93.21	272.40	1.000	16.21	0.97	0.77	0.61	0.61	3.23	1.0	0.013	1.00	179.20	1.000	485.80	251.00	2	1.7	154.29	14.771	179.196
0.984	1.00	0.25	1.08	1.0	0.062	98.73	293.67	1.000	16.07	0.97	0.81	0.60	0.60	3.13	1.0	0.014	1.00	194.94	1.000	404.99	210.53	2	1.7	167.84	16.069	194.937
1.148	1.00	0.30	1.09	1.0	0.063	129.34	411.50	1.000	15.89	0.97	0.97	0.60	0.60	2.95	1.0	0.015	1.00	282.16	1.000	347.27	181.58	2	1.7	242.94	23.259	282.161
1.312	1.00	0.30	1.08	1.0	0.063	128.94	409.98	1.000	15.95	0.97	0.97	0.60	0.60	2.79	1.0	0.015	1.00	281.03	1.000	303.98	159.97	2	1.7	241.97	23.166	281.033
1.476	1.00	0.30	1.08	1.0	0.062	134.49	431.33	1.000	16.01	0.97	0.99	0.60	0.60	2.66	1.0	0.016	1.00	296.84	1.000	270.31	143.16	2	1.7	255.58	24.469	296.841
1.640	1.00	0.30	1.08	1.0	0.062	129.33	411.46	1.000	16.06	0.97	0.97	0.60	0.60	2.55	1.0	0.017	1.00	282.13	1.000	243.38	129.72	2	1.7	242.91	23.256	282.129
1.804	1.00	0.30	1.07	1.0	0.062	120.27	376.60	1.000	16.12	0.97	0.92	0.60	0.60	2.46	1.0	0.017	1.00	256.32	1.000	221.34	118.73	2	1.7	220.69	21.129	256.324
1.968	1.00	0.30	1.07	1.0	0.062	123.80	390.18	1.000	16.19	0.97	0.94	0.60	0.60	2.37	1.0	0.018	1.00	266.38	1.000	202.98	109.58	2	1.7	229.35	21.958	266.379
2.133	1.00	0.30	1.07	1.0	0.062	121.02	379.47	1.000	16.25	0.97	0.93	0.60	0.60	2.30	1.0	0.019	1.00	258.45	1.000	187.44	101.85	2	1.7	222.52	21.304	258.448
2.297	1.00	0.30	1.06	1.0	0.061	113.77	351.58	1.000	16.32	0.97	0.89	0.60	0.60	2.23	1.0	0.019	1.00	237.80	1.000	174.12	95.22	2	1.7	204.75	19.603	237.805
2.461	1.00	0.25	1.05	1.0	0.060	98.72	293.62	1.000	16.55	0.97	0.81	0.60	0.60	2.17	1.0	0.020	1.00	194.90	1.000	162.57	89.56	2	1.7	167.81	16.066	194.905
2.625	1.00	0.16	1.03	1.0	0.059	82.66	231.79	1.000	16.88	0.97	0.71	0.65	0.65	1.94	1.0	0.022	1.00	149.13	0.388	59.23	38.05	2	1.7	128.4	12.293	149.133
2.789	0.99	0.11	1.02	1.0	0.059	67.72	174.31	0.455	7.77	0.97	0.60	0.70	0.70	1.72	1.0	0.025	1.00	106.59	0.193	27.65	17.71	2	1.7	91.77	8.786	106.585
2.953	0.99	0.11	1.02	1.0	0.058	65.03	163.92	0.354	6.06	0.97	0.57	0.71	0.71	1.66	1.0	0.026	1.10	108.69	0.199	27.05	16.55	2	1.7	85.149	8.1522	98.895
3.117	0.99	0.12	1.02	1.0	0.058	69.75	182.11	0.572	9.79	0.97	0.61	0.69	0.69	1.68	1.0	0.025	1.08	121.15	0.245	31.54	20.67	2	1.7	96.742	9.2621	112.360
3.281	0.99	0.13	1.02	1.0	0.058	54.51	181.34	0.558	9.56	0.97	0.65	0.67	0.67	1.71	1.0	0.025	1.00	126.83	0.270	32.92	21.24	2	1.7	109.2	10.454	126.825
3.445	0.99	0.11	1.01	1.0	0.058	66.39	169.28	0.400	6.89	0.97	0.59	0.71	0.71	1.60	1.0	0.027	1.08	110.88	0.207	24.13	15.51	2	1.7	88.591	8.4817	102.893
3.609	0.99	0.08	1.01	1.0	0.058	50.09	107.51	0.155	2.69	0.97	0.44	0.78	0.78	1.41	1.0	0.030	1.62	93.01	0.155	17.39	10.04	2	1.7	49.443	4.7337	57.426
3.773	0.99	0.07	1.01	1.0	0.058	44.88	87.35	0.123	2.13	0.97	0.38	0.80	0.80	1.36	1.0	0.031	2.21	93.92	0.157	17.01	9.57	2	1.7	36.566	3.5008	42.469
3.937	0.99	0.06	1.01	1.0	0.058	41.32	73.59	0.104	1.81	0.97	0.33	0.80	0.80	1.35	1.0	0.032	2.34	75.43	0.120	12.54	7.17	2	1.7	27.779	2.6596	32.264
4.101	0.99	0.06	1.01	1.0	0.057	42.65	78.73	0.111	1.93	0.97	0.35	0.80	0.80	1.34	1.0	0.032	1.99	71.97	0.115	11.59	6.76	2	1.7	31.061	2.9738	36.076
4.265	0.99	0.06	1.01	1.0	0.057	40.45	70.19	0.100	1.74	0.97	0.31	0.80	0.80	1.33	1.0	0.032	2.49	74.20	0.118	11.54	6.64	2	1.7	25.611	2.452	29.746
4.429	0.99	0.06	1.00	1.0	0.057	43.38	81.55	0.115	2.00	0.96	0.36	0.80	0.80	1.32	1.0	0.032	1.92	73.46	0.117	11.07	6.54	2	1.7	32.861	3.1461	38.166
4.593	0.98	0.07	1.00	1.0	0.057	47.31	95.79	0.136	2.37	0.96	0.40	0.80	0.80	1.31	1.0	0.032	1.66	80.63	0.129	11.78	7.07	2	1.7	41.743	3.9965	48.482
4.757	0.98	0.07	1.00	1.0	0.057	47.29	95.73	0.136	2.38	0.96	0.40	0.80	0.80	1.30	1.0	0.033	1.62	78.55	0.125	11.06	6.72	2	1.7	41.706	3.9929	48.439
4.921	0.98	0.07	1.00	1.0	0.057	46.50	92.69	0.131	2.30	0.96	0.39	0.80	0.80	1.29	1.0	0.033	1.41	65.26	0.106	9.06	5.68	2	1.7	39.766	3.8072	46.186
5.085	0.98	0.07	1.00	1.0	0.057	47.96	98.32	0.140	2.46	0.96	0.41	0.80	0.80	1.29	1.0	0.033	1.27	63.77	0.104	8.64	5.55	2	1.7	43.358	4.1511	50.358
5.249	0.98	0.06	1.00	1.0	0.057	44.33	84.33	0.119	2.09	0.96	0.37	0.80	0.80	1.28	1.0	0.033	1.47	58.96	0.099	7.97	5.03	2	1.7	34.44	3.2973	40.000
5.413	0.98	0.05	1.00	1.0	0.057	37.79	59.91	0.088	1.55	0.96	0.27	0.80	0.80	1.27	1.0	0.033	2.50	55.31	0.096	7.51	4.53	2	1.7	19.047	1.8236	22.122
5.577	0.98	0.05	1.00	1.0	0.057	35.25	50.06	0.078	1.37	0.96	0.22	0.80	0.80	1.26	1.0	0.034	2.95	43.70	0.086	6.59	3.98	2	1.7	12.757	1.2213	14.816
5.741	0.98	0.05	1.00	1.0	0.057	35.64	50.85	0.078	1.39	0.96	0.23	0.80	0.80	1.26	1.0	0.034	2.36	35.90	0.080	5.99	3.69	2	1.7	13.102	1.2543	15.217
5.905	0.98	0.05	1.00	1.0	0.056	37.19	56.83	0.084	1.50	0.96	0.26	0.80	0.80	1.26	1.0	0.034	1.79	35.17	0.079	5.85	3.67	2	1.7	16.912	1.6192	19.642
6.069	0.98	0.05	1.00	1.0	0.056	34.13	45.74	0.074	1.30	0.96	0.20	0.80	0.80	1.25	1.0	0.034	3.28	38.05	0.082	5.94	3.62	2	1.7	9.993	0.9567	11.606
6.234	0.98	0.05	1.00	1.0	0.056	33.92	44.91	0.073	1.29	0.96	0.19	0.80	0.80	1.25	1.0	0.034	3.48	38.27	0.082	5.86	3.58	2	1.7	9.4649	0.9062	10.993
6.398	0.97	0.05	1.00	1.0	0.056	34.89	48.67	0.076	1.36	0.96	0.21	0.80	0.80	1.24	1.0	0.034	2.75	37.89	0.082	5.76	3.56	2	1.7	11.866	1.136	13.781
6.562	0.97	0.05	1.00	1.0	0.056	34.98	49.02	0.077	1.36	0.96	0.22	0.80	0.80	1.24	1.0	0.034	2.64	37.10	0.081	5.63	3.50	2	1.7	12.091	1.1576	14.043
6.726	0.97	0.05	1.00	1.0	0.056	37.70	58.79	0.087	1.54	0.96	0.27	0.80	0.80	1.24	1.0	0.034	1.74	36.71	0.081	5.53	3.54	2	1.7	18.162	1.7388	21.094
6.890	0.97	0.06	1.00	1.0	0.056	39.59	66.08	0.095	1.70	0.96	0.30	0.80	0.80	1.23	1.0	0.034	1.60	42.25	0.085	5.75	3.73	2	1.7	22.808	2.1837	26.490
7.054	0.97	0.06	1.00	1.0	0.056	40.66	70.18	0.100	1.79	0.96	0.31	0.80	0.80	1.23	1.0	0.034	1.55	45.64	0.088	5.86	3.82	2	1.7	25.419	2.4336	29.522
7.218	0.97	0.07	0.99	1.0	0.056	45.83	90.09	0.127	2.28	0.96	0.38	0.80	0.80	1.23	1.0	0.034	1.19	52.90	0.094	6.15	4.22	2	1.7	38.114	3.649	44.267
7.382	0.97	0.06	0.99	1.0	0.056	42.40	76.88	0.108	1.95	0.96	0.34	0.80	0.80	1.22	1.0	0.035	1.47	50.71	0.092	5.96	3.95	2	1.7	29.69	2.8426	34.484
7.546	0.97	0.06	0.99	1.0	0.056	41.04	71.67	0.102	1.83	0.96	0.32	0.80	0.80	1.22	1.0	0.035	1.77	54.31	0.095	6.05	3.94	2	1.7	26.373	2.5249	30.630
7.710	0.97	0.06	0.99	1.0	0.055	42.10	75.74	0.107	1.93	0.96	0.33	0.80	0.80	1.22	1.0	0.035	1.72	57.87	0.098	6.16	4.04	2	1.7	28.962	2.7728	33.637
7.874	0.96	0.06	0.99	1.0	0.055	42.66	77.91	0.110	1.99	0.96	0.34	0.80	0.80	1.21	1.0	0.035	1.51	53.23	0.094	5.83	3.91	2	1.7	30.35	2.9057	35.250
8.038	0.96	0.07	0.99	1.0	0.055	44.57	85.24	0.120	2.17	0.96	0.37	0.80	0.80	1.21	1.0	0.035	1.30	52.92	0.094	5.73	3.95	2	1.7	35.021	3.3529	40.675
8.202	0.96	0.07	0.99	1.0	0.055	48.59	100.75	0.144	2.61	0.96	0.42	0.79	0.79	1.21	1.0	0.035	1.18	61.54	0.102	6.13	4.37	2	1.7	44.906	4.2993	52.156
8.366	0.96	0.08	0.99	1.0	0.055	50.99	109.98	0.160	2.91	0.96	0.44	0.78	0.78	1.23	1.0	0.034	1.21	71.32	0.114	6.77	4.84	2	1.7	50.792	4.8629	58.992
8.530	0.96	0.07	0.99	1.0	0.055	45.75	89.79	0.127	2.31	0.96	0.38	0.80	0.80	1.20	1.0	0.035	1.52	66.73	0.108	6.33	4.32	2	1.7	37.923	3.6307	44.045
8.694	0.96	0.07	0.99	1.0	0.055	45.36	88.31	0.124	2.27	0.95	0.38	0.80	0.80	1.20	1.0	0.035	1.79	77.08	0.123	7.11	4.69	2	1.7	36.977	3.5402	42.947
8.858	0.96	0.07	0.99	1.0	0.055	45.14	87.46	0.123	2.25	0.95	0.38	0.80	0.80	1.19	1.0	0.035	1.53	64.55	0.105	6.02	4.13	2	1.7	36.436	3.4884	42.318
9.022	0.96	0.08	0.98	1.0	0.054	50.84	109.41	0.159	2.91	0.95	0.44	0.78	0.78	1.21	1.0	0.035	1.29	75.74	0.120	6.81	4.86	2	1.6952481	50.428	4.828	58.569
9.186	0.96	0.07	0.99	1.0	0.054	45.93	90.51	0.128	2.34	0.95	0.39	0.80	0.80	1.19	1.0	0.035	1.27	56.79	0.097	5.42	3.88	2	1.7	38.379	3.6744	44.575
9.350	0.96	0.06	0.99	1.0	0.054	42.56	77.50	0.109	2.01	0.95	0.34	0.80	0.80	1.18	1.0	0.036	1.52	53.08	0.094	5.18	3.60	2	1.7	30.086	2.8804	34.943
9.514	0.95	0.06	0.99	1.0	0.054	40.13	68.14	0.097	1.79	0.95	0.31	0.80	0.80	1.18	1.0	0.036	2.04	57.25	0.097	5.32	3.55	2	1.7	24.118	2.3091	28.012
9.678	0.95	0.05	0.99	1.0	0.054	38.37	61.39	0.089	1.64	0.95	0.28	0.80	0.80	1.18	1.0	0.036	2.72	62.50	0.103	5.54	3.59	2	1.7	19.816	1.8972	23.015
9.842	0.95	0.05	0.99	1.0	0.054	38.09	60.31	0.088	1.62	0.95	0.27	0.80	0.80	1.17	1.0	0.036	2.27	50.41	0.092	4.90	3.26	2	1.7	19.13	1.8315	22.219
10.006	0.95	0.06	0.99	1.0	0.054	40.25	68.61	0.098	1.81	0.95	0.31	0.80	0.80	1.17	1.0	0.036	1.58	44.88	0.087	4.60	3.20	2	1.7	24.419	2.3379	28.361
10.170	0.95	0.06	0.98	1.0	0.054	43.00	79.22	0.112	2.07	0.95	0.35	0.80	0.80	1.17	1.0	0.036	1.28	46.49	0.089	4.62	3.34	2	1.7	31.185	2.9856	36.219
10.335	0.95	0.07	0.98	1.0	0.054	44.45	84.81	0.119	2.22	0.95	0.37	0.80	0.80	1.17	1.0	0.036	1.27	51.31	0.093	4.76	3.49	2	1.6835791	34.744	3.3264	40.353
10.499	0.95	0.07	0.98	1.0	0.054	44.78	86.04	0.121	2.25	0.95	0.37	0.80	0.80	1.16	1.0	0.036	1.30	53.52	0.094	4.80	3.53	2	1.6654836	35.532	3.4019	41.268
10.663	0.95	0.07	0.98	1.0	0.054	45.85	90.19	0.127	2.37	0.95	0.38	0.80	0.80	1.16	1.0	0.036	1.27	56.24	0.097	4.86	3.62	2	1.6371138	38.174	3.6548	44.337
10.827	0.95	0.07	0.98	1.0	0.054	45.82	90.07	0.127	2.37	0.95	0.38	0.80	0.80	1.16	1.0	0.036	1.31	58.18	0.098	4.90	3.63	2	1.6253497	38.101	3.6478	44.252
10.991	0.94	0.07	0.98	1.0	0.053	45.69	89.55	0.126	2.36	0.95	0.38	0.80	0.80	1.16	1.0	0.036	1.33	58.30	0.098	4.85	3.61	2	1.6152194	37.768	3.6159	43.865
11.155	0.94	0.07	0.98	1.0	0.053	45.81	90.02	0.127	2.38	0.95	0.38	0.80	0.80	1.15	1.0	0.036	1.40	61.77	0.102	4.97	3.67	2	1.6018202	38.069	3.6447	44.214
11.319	0.94	0.06	0.98	1.0	0.053	43.89	82.65	0.116	2.18	0.95	0.36	0.80	0.80	1.15	1.0	0.036	1.70	65.83	0.107	5.14	3.66	2	1.6163248	33.371	3.1949	38.758
11.483	0.94	0.06	0.98	1.0	0.053	42.00	75.36	0.106	2.00	0.95	0.33	0.80	0.80	1.15	1.0	0.036	1.87	62.34	0.103	4.89	3.45	2	1.632818	28.722	2.7498	33.359
11.647	0.94	0.06	0.98	1.0	0.053	44.13	83.54	0.118	2.21	0.95	0.36	0.80	0.80	1.15	1.0	0.036	1.49	58.73	0.099	4.67	3.44	2	1.5895544	33.938	3.2493	39.417
11.811	0.94	0.06	0.98	1.0	0.053	44.00	83.06	0.117	2.20	0.95	0.36	0.80	0.80	1.14	1.0	0.037	1.44	56.33	0.097	4.52	3.36	2	1.5798159	33.628	3.2196	39.057
11.975	0.94	0.07	0.98	1.0	0.053	44.90	86.52	0.122	2.30	0.95	0.37	0.80	0.80	1.14	1.0	0.037	1.34	55.78	0.096	4.45	3.38	2	1.5571208	35.838	3.4311	41.623
12.139	0.94	0.07	0.98	1.0	0.053	45.92	90.44	0.128	2.42	0.95	0.39	0.80	0.80	1.14	1.0	0.037	1.32	58.78	0.099	4.53	3.48	2	1.5343587	38.336	3.6703	44.525
12.303	0.94	0.07	0.98	1.0	0.053	44.90	86.52	0.122	2.31	0.95	0.37	0.80	0.80	1.14	1.0	0.037	1.34	55.97	0.096	4.37	3.34	2	1.5357058	35.836	3.4309	41.621

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-2C

Data File: 13-52106_SP3-2C-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3 Field Data\2013 Field Investigation\Conetec Dat

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

5605.30	Water surface elevation during CPT investigation (ft a
5602.54	Water surface elevation at t_0 (ft amsl)
5591.64	Water surface elevation at t_1 (ft amsl)
5586.64	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Eartl
7.51	Equiv. Number of Uniform Strain Cycles, N

5610.82	Ground Surface Elevation at time of CPT (ft amsl)
5621.51	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after place
3.50	Thickness of Water Storage/Rooting Zone (ft)
3.50	Thickness of High Compaction Layer (ft)
3.19	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1167.12	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5586.64	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	5621.51	5621.26	5621.01	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	5621.01	5619.26	5617.51	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	5617.51	5615.76	5614.01	3.50	0.060	120	0.424	0.320	0.00	0.00	0.424	0.320
Platform/Random Fill Layer	5614.01	5612.415	5610.82	3.19	0.050	101	0.585	0.504	0.00	0.00	0.585	0.504

2013 CPT Data from ConeTec / CPT Data Interpretations

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %
12.467	5598.35	19.3	0.160	19.2	8.9	3.87	0.83%	Sand-Slime Tailin	0.059	119.0	0.68	0.22	0.46	1	1.56	29.859	415.03	34.78	40	0.86%	2.2	47%
12.631	5598.19	20.3	0.143	20.3	8.0	3.47	0.70%	Sand-Slime Tailin	0.059	119.0	0.69	0.22	0.46	1	1.54	31.205	433.74	36.33	42	0.73%	2.1	47%
12.795	5598.02	20.0	0.132	19.9	7.5	3.24	0.66%	Sand-Slime Tailin	0.059	119.0	0.70	0.23	0.47	1	1.53	30.469	423.52	35.47	41	0.69%	2.1	47%
12.959	5597.86	21.7	0.151	21.6	9.5	4.12	0.70%	Sand-Slime Tailin	0.059	119.0	0.71	0.23	0.47	1	1.51	32.643	453.73	38.02	44	0.72%	2.1	47%
13.123	5597.70	20.7	0.179	20.6	8.8	3.79	0.87%	Sand-Slime Tailin	0.059	119.0	0.72	0.24	0.48	1	1.51	31.051	431.61	36.16	42	0.90%	2.2	47%
13.287	5597.53	20.4	0.271	20.3	9.5	4.12	1.33%	Sand-Slime Tailin	0.059	119.0	0.72	0.24	0.48	1	1.50	30.438	423.09	35.45	41	1.38%	2.3	47%
13.451	5597.37	17.5	0.436	17.4	12.5	5.40	2.49%	Sand-Slime Tailin	0.059	119.0	0.73	0.25	0.49	1	1.51	26.315	365.78	30.70	34	2.60%	2.5	47%
13.615	5597.20	16.3	0.451	16.2	16.3	7.05	2.77%	Slime Tailings	0.057	113.1	0.74	0.25	0.49	1	1.51	24.409	339.29	28.53	32	2.91%	2.6	71%
13.779	5597.04	20.4	0.353	20.2	19.3	8.35	1.73%	Sand-Slime Tailin	0.059	119.0	0.75	0.26	0.50	1	1.47	29.819	414.48	34.84	40	1.80%	2.4	47%
13.943	5596.88	25.7	0.379	25.6	13.1	5.68	1.48%	Sand-Slime Tailin	0.059	119.0	0.76	0.26	0.50	1	1.44	36.753	510.87	42.82	50	1.52%	2.3	47%
14.107	5596.71	19.0	0.491	19.0	7.7	3.35	2.58%	Sand-Slime Tailin	0.059	119.0	0.77	0.27	0.51	1	1.46	27.769	385.99	32.33	36	2.69%	2.5	47%
14.271	5596.55	14.6	0.427	14.6	5.8	2.51	2.92%	Slime Tailings	0.057	113.1	0.78	0.27	0.51	1	1.49	21.650	300.93	25.21	27	3.09%	2.7	71%
14.436	5596.38	9.2	0.378	9.2	7.3	3.14	4.11%	Slime Tailings	0.057	113.1	0.79	0.28	0.51	1	1.50	13.706	190.52	16.00	16	4.50%	2.9	71%
14.600	5596.22	10.5	0.412	10.2	45.5	19.71	3.91%	Slime Tailings	0.057	113.1	0.80	0.28	0.52	1	1.49	15.242	211.87	18.19	19	4.24%	2.9	71%
14.764	5596.06	12.3	0.360	12.1	42.1	18.25	2.92%	Slime Tailings	0.057	113.1	0.81	0.29	0.52	1	1.48	17.857	248.22	21.19	22	3.12%	2.7	71%
14.928	5595.89	11.4	0.381	11.1	52.4	22.72	3.35%	Slime Tailings	0.057	113.1	0.82	0.29	0.53	1	1.47	16.259	226.00	19.44	20	3.61%	2.8	71%
15.092	5595.73	10.8	0.299	10.3	74.3	32.20	2.78%	Slime Tailings	0.057	113.1	0.83	0.30	0.53	1	1.46	15.049	209.18	18.27	19	3.01%	2.8	71%
15.256	5595.56	19.3	0.291	19.3	9.6	4.14	1.50%	Sand-Slime Tailin	0.059	119.0	0.84	0.30	0.53	1	1.41	27.158	377.49	31.64	35	1.57%	2.4	47%
15.420	5595.40	21.0	0.161	20.9	6.0	2.61	0.77%	Sand-Slime Tailin	0.059	119.0	0.85	0.31	0.54	1	1.39	29.142	405.07	33.91	37	0.80%	2.2	47%
15.584	5595.24	22.2	0.159	22.2	3.5	1.51	0.72%	Sand-Slime Tailin	0.059	119.0	0.86	0.31	0.54	1	1.38	30.532	424.40	35.50	39	0.75%	2.2	47%
15.748	5595.07	20.4	0.160	20.4	2.7	1.19	0.78%	Sand-Slime Tailin	0.059	119.0	0.87	0.32	0.55	1	1.38	28.088	390.43	32.65	36	0.82%	2.2	47%
15.912	5594.91	19.5	0.171	19.4	8.7	3.77	0.88%	Sand-Slime Tailin	0.059	119.0	0.88	0.32	0.55	1	1.38	26.698	371.11	31.10	34	0.92%	2.3	47%
16.076	5594.74	19.6	0.146	19.5	14.0	6.06	0.74%	Sand-Slime Tailin	0.059	119.0	0.89	0.33	0.56	1	1.37	26.712	371.29	31.16	34	0.78%	2.2	47%
16.240	5594.58	22.3	0.122	22.2	15.7	6.79	0.55%	Sand-Slime Tailin	0.059	119.0	0.90	0.33	0.56	1	1.35	29.952	416.34	34.94	38	0.57%	2.1	47%
16.404	5594.42	25.7	0.298	25.6	17.8	7.69	1.16%	Sand-Slime Tailin	0.059	119.0	0.91	0.34	0.57	1	1.33	34.002	472.62	39.66	44	1.20%	2.2	47%
16.568	5594.25	18.5	0.396	18.4	22.8	9.87	2.14%	Sand-Slime Tailin	0.059	119.0	0.92	0.34	0.57	1	1.35	24.813	344.89	29.04	31	2.25%	2.5	47%
16.732	5594.09	15.3	0.462	15.1	35.8	15.50	3.02%	Slime Tailings	0.057	113.1	0.93	0.35	0.58	1	1.36	20.475	284.61	24.13	25	3.21%	2.7	71%
16.896	5593.92	15.4	0.350	14.9	88.5	38.34	2.27%	Sand-Slime Tailin	0.059	119.0	0.94	0.35	0.58	1	1.35	20.091	279.26	24.20	25	2.41%	2.6	47%
17.060	5593.76	26.3	0.276	25.8	72.4	31.36	1.05%	Sand-Slime Tailin	0.059	119.0	0.95	0.36	0.59	1	1.30	33.545	466.27	39.64	43	1.09%	2.2	47%
17.224	5593.60	20.8	0.402	20.7	18.6	8.07	1.93%	Sand-Slime Tailin	0.059	119.0	0.96	0.37	0.59	1	1.31	27.153	377.43	31.71	34	2.02%	2.5	47%
17.388	5593.43	15.3	0.334	15.2	21.0	9.11	2.19%	Sand-Slime Tailin	0.059	119.0	0.96	0.37	0.59	1	1.33	20.107	279.49	23.56	24	2.33%	2.6	47%
17.552	5593.27	16.5	0.162	16.3	36.5	15.82	0.98%	Sand-Slime Tailin	0.059	119.0	0.97	0.38	0.60	1	1.31	21.424	297.79	25.23	26	1.04%	2.4	47%
17.716	5593.10	24.5	0.248	24.3	32.1	13.91	1.01%	Sand-Slime Tailin	0.059	119.0	0.98	0.38	0.60	1	1.28	31.128	432.68	36.45	39	1.05%	2.3	47%
17.880	5592.94	17.1	0.328	16.9	29.7	12.85	1.92%	Sand-Slime Tailin	0.059	119.0	0.99	0.39	0.61	1	1.30	21.982	305.54	25.81	27	2.03%	2.6	47%
18.044	5592.78	15.0	0.452	14.8	43.2	18.70	3.01%	Slime Tailings	0.057	113.1	1.00	0.39	0.61	1	1.30	19.195	266.82	22.70	23	3.22%	2.7	71%
18.208	5592.61	12.2	0.284	11.8	60.5	26.21	2.32%	Slime Tailings	0.057	113.1	1.01	0.40	0.62	1	1.30	15.367	213.60	18.42	18	2.53%	2.7	71%
18.372	5592.45	20.9	0.383	20.4	78.0	33.81	1.83%	Sand-Slime Tailin	0.059	119.0	1.02	0.40	0.62	1	1.27	25.871	359.60	30.76	32	1.92%	2.5	47%
18.537	5592.28	18.1	0.296	17.9	41.0	17.77	1.63%	Sand-Slime Tailin	0.059	119.0	1.03	0.41	0.63	1	1.27	22.684	315.30	26.72	27	1.73%	2.5	47%
18.701	5592.12	21.8	0.387	21.4	62.7	27.18	1.78%	Sand-Slime Tailin	0.059	119.0	1.04	0.41	0.63	1	1.25	26.759	371.95	31.65	33	1.87%	2.5	47%
18.865	5591.96	18.8	0.412	18.5	46.5	20.15	2.19%	Sand-Slime Tailin	0.059	119.0	1.05	0.42	0.64	1	1.25	23.212	322.65	27.38	28	2.32%	2.6	47%
19.029	5591.79	18.5	0.428	18.4	22.2	9.62	2.31%	Sand-Slime Tailin	0.059	119.0	1.06	0.42	0.64	1	1.25	22.958	319.11	26.86	27	2.45%	2.6	47%
19.193	5591.63	13.1	0.382	12.9	32.2	13.96	2.91%	Slime Tailings	0.057	113.1	1.07	0.43	0.64	1	1.25	16.221	225.48	19.13	19	3.17%	2.8	71%
19.357	5591.46	11.8	0.318	11.1	110.7	47.96	2.70%	Slime Tailings	0.057	113.1	1.08	0.43	0.65	1	1.25	13.843	192.42	17.08	17	2.97%	2.8	71%
19.521	5591.30	14.0	0.235	13.6	73.8	31.99	1.67%	Sand-Slime Tailin	0.059	119.0	1.09	0.44	0.65	1	1.24	16.857	234.31	20.24	20	1.81%	2.6	47%
19.685	5591.14	14.0	0.240	13.3	116.1	50.29	1.72%	Sand-Slime Tailin	0.059	119.0	1.10	0.44	0.66	1	1.23	16.369	227.53	20.05	20	1.86%	2.6	47%
19.849	5590.97	13.0	0.220	12.4	100.8	43.68	1.69%	Sand-Slime Tailin	0.059	119.0	1.11	0.45	0.66	1	1.23	15.187	211.09	18.54	18	1.85%	2.7	47%
20.013	5590.81	12.6	0.337	11.7	147.5	63.92	2.68%	Slime Tailings	0.057	113.1	1.12	0.45	0.67	1	1.22	14.257	198.18	17.87	17	2.94%	2.8	71%
20.177	5590.64	16.5	0.337	15.6	147.0	63.70	2.05%	Sand-Slime Tailin	0.059	119.0	1.13	0.46	0.67	1	1.21	18.838	261.85	23.17	23	2.20%	2.6	47%
20.341	5590.48	20.1	0.337	19.5	94.3	40.85	1.68%	Sand-Slime Tailin	0.059	119.0	1.14	0.46	0.68	1	1.20	23.344	324.48	27.93	28	1.78%	2.5	47%

Conditions at t_1 / Liquefaction Triggering Analyses – Idriss & Boulanger (2008)

Depth at time of CPT (ft)	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No	r_d	C_σ	K_σ	K_α	CSR M=7.5, s'v=1atm	Δqc_{1n}	$qc_{1n\text{-}cs}$	(CRR) M=7.5, s'v=1atm	FoS
12.467	1.26	0.00	1.26	0	0.93	0.06	0.98	1.0	0.053	42.50	77.28	0.109	2.07
12.631	1.27	0.00	1.27	0	0.93	0.06	0.98	1.0	0.053	43.04	79.37	0.112	2.12
12.795	1.28	0.00	1.28	0	0.93	0.06	0.98	1.0	0.053	42.74	78.21	0.110	2.10
12.959	1.29	0.00	1.29	0	0.93	0.06	0.97	1.0	0.052	43.63	81.65	0.115	2.19
13.123	1.30	0.00	1.30	0	0.93	0.06	0.97	1.0	0.052	42.98	79.14	0.111	2.13
13.287	1.31	0.00	1.31	0	0.93	0.06	0.97	1.0	0.052	42.74	78.19	0.110	2.11
13.451	1.32	0.00	1.32	0	0.93	0.06	0.97	1.0	0.052	41.07	71.77	0.102	1.95
13.615	1.33	0.00	1.33	0	0.93	0.05	0.97	1.0	0.052	40.02	68.55	0.098	1.88
13.779	1.34	0.00	1.34	0	0.92	0.06	0.97	1.0	0.052	42.52	77.36	0.109	2.10
13.943	1.35	0.00	1.35	0	0.92	0.07	0.97	1.0	0.052	45.32	88.14	0.124	2.40
14.107	1.36	0.00	1.36	0	0.92	0.06	0.97	1.0	0.052	41.64	73.98	0.105	2.02
14.271	1.37	0.00	1.37	0	0.92	0.06	0.97	1.0	0.052	38.87	64.07	0.092	1.78
14.436	1.38	0.00	1.38	0	0.92	0.05	0.98	1.0	0.052	35.66	51.66	0.079	1.52
14.600	1.38	0.00	1.38	0	0.92	0.05	0.98	1.0	0.052	36.42	54.62	0.082	1.59
14.764	1.39	0.00	1.39	0	0.92	0.05	0.97	1.0	0.052	37.47	58.66	0.086	1.67
14.928	1.40	0.00	1.40	0	0.92	0.05	0.97	1.0	0.052	36.86	56.30	0.084	1.63
15.092	1.41	0.00	1.41	0	0.91	0.05	0.97	1.0	0.052	36.45	54.71	0.082	1.60
15.256	1.42	0.00	1.42	0	0.91	0.06	0.97	1.0	0.051	41.40	73.04	0.103	2.02
15.420	1.43	0.00	1.43	0	0.91	0.06	0.97	1.0	0.051	42.19	76.10	0.107	2.10
15.584	1.44	0.00	1.44	0	0.91	0.06	0.97	1.0	0.051	42.75	78.25	0.110	2.16
15.748	1.45	0.00	1.45	0	0.91	0.06	0.97	1.0	0.051	41.75	74.40	0.105	2.07
15.912	1.46	0.00	1.46	0	0.91	0.06	0.97	1.0	0.051	41.21	72.30	0.102	2.02
16.076	1.47	0.00	1.47	0	0.91	0.06	0.97	1.0	0.051	41.23	72.39	0.103	2.02
16.240	1.48	0.00	1.48	0	0.91	0.06	0.97	1.0	0.051	42.56	77.50	0.109	2.16
16.404	1.49	0.00	1.49	0	0.90	0.06	0.96	1.0	0.050	44.21	83.87	0.118	2.34
16.568	1.50	0.00	1.50	0	0.90	0.06	0.97	1.0	0.051	40.49	69.53	0.099	1.96
16.732	1.51	0.00	1.51	0	0.90	0.06	0.97	1.0	0.051	38.49	62.62	0.091	1.80
16.896	1.52	0.00	1.52	0	0.90	0.06	0.97	1.0	0.050	38.79	62.99	0.091	1.81
17.060	1.53	0.00	1.53	0	0.90	0.06	0.96	1.0	0.050	44.20	83.85	0.118	2.36
17.224	1.54	0.00	1.54	0	0.90	0.06	0.97	1.0	0.050	41.42	73.14	0.104	2.07
17.388	1.55	0.00	1.55	0	0.90	0.05	0.97	1.0	0.050	38.56	62.12	0.090	1.80
17.552	1.56	0.00	1.56	0	0.90	0.06	0.97	1.0	0.050	39.15	64.38	0.093	1.85
17.716	1.57	0.00	1.57	0	0.89	0.06	0.96	1.0	0.050	43.09	79.54	0.112	2.25
17.880	1.58	0.00	1.58	0	0.89	0.06	0.97	1.0	0.050	39.35	65.16	0.094	1.88
18.044	1.59	0.00	1.59	0	0.89	0.05	0.97	1.0	0.050	37.99	60.69	0.089	1.78
18.208	1.60	0.00	1.60	0	0.89	0.05	0.97	1.0	0.050	36.50	54.92	0.082	1.65
18.372	1.61	0.00	1.61	0	0.89	0.06	0.96	1.0	0.050	41.09	71.85	0.102	2.06
18.537	1.62	0.00	1.62	0	0.89	0.06	0.96	1.0	0.049	39.67	66.40	0.095	1.92
18.701	1.63	0.00	1.63	0	0.89	0.06	0.96	1.0	0.049	41.40	73.05	0.103	2.10
18.865	1.64	0.00	1.64	0	0.89	0.06	0.96	1.0	0.049	39.90	67.29	0.096	1.95
19.029	1.65	0.00	1.65	0	0.88	0.06	0.96	1.0	0.049	39.72	66.59	0.095	1.94
19.193	1.65	0.00	1.65	1	0.88	0.05	0.97	1.0	0.049	36.75	55.88	0.083	1.69
19.357	1.66	0.01	1.66	1	0.88	0.05	0.97	1.0	0.049	36.04	53.12	0.081	1.63
19.521	1.67	0.01	1.66	1	0.88	0.05	0.97	1.0	0.049	37.40	57.64	0.085	1.73
19.685	1.68	0.01	1.67	1	0.88	0.05	0.97	1.0	0.050	37.33	57.38	0.085	1.72
19.849	1.69	0.02	1.67	1	0.88	0.05	0.97	1.0	0.050	36.80	55.34	0.083	1.67
20.013	1.70	0.03	1.68	1	0.88	0.05	0.97	1.0	0.050	36.31	54.17	0.082	1.64
20.177	1.71	0.03	1.68	1	0.87	0.05	0.96	1.0	0.050	38.43	61.60	0.090	1.81
20.341	1.72	0.04	1.69	1	0.87	0.06	0.96	1.0	0.050	40.10	68.03	0.097	1.96

Liquefaction Triggering Analyses – Youd et al. (2001) / Idriss & Boulanger (2008)

Depth at time of CPT (ft)	r_d	D_r	f	f	K_σ	K_a	CSR M=7.5, s'v=1atm	Kc	$qc_{1n\text{-}cs}$	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No	CN	qc1 TSF	qc1 MPa	qc1N
12.467	0.95	0.34	0.80	0.80	1.13	1.0	0.037	1.65	57.30	0.097	4.38	3.22	2	1.5551349	29.945	2.867	34.780
12.631	0.95	0.35	0.80	0.80	1.13	1.0	0.037	1.53	55.42	0.096	4.27	3.20	2	1.5371723	31.281	2.9949	36.331
12.795	0.95	0.34	0.80	0.80	1.13	1.0	0.037	1.52	54.00	0.095	4.17	3.14	2	1.5303446	30.541	2.924	35.471
12.959	0.94	0.36	0.80	0.80	1.13	1.0	0.037	1.49	56.54	0.097	4.23	3.21	2	1.5091412	32.732	3.1338	38.017
13.123	0.94	0.35	0.80	0.80	1.13	1.0	0.037	1.64	59.39	0.099	4.31	3.22	2	1.5066131	31.134	2.9807	36.160
13.287	0.94	0.34	0.80	0.80	1.12	1.0	0.037	1.96	69.60	0.111	4.77	3.44	2	1.4994011	30.527	2.9226	35.455
13.451	0.94	0.32	0.80	0.80	1.12	1.0	0.037	2.93	90.06	0.148	6.28	4.12	2	1.5097542	26.432	2.5306	30.700
13.615	0.94	0.31	0.80	0.80	1.12	1.0	0.037	3.28	93.45	0.156	6.57	4.22	2	1.5104631	24.562	2.3516	28.528
13.779	0.94	0.34	0.80	0.80	1.12	1.0	0.037	2.25	78.36	0.125	5.21	3.65	2	1.4732613	29.996	2.8718	34.838
13.943	0.94	0.38	0.80	0.80	1.11	1.0	0.037	1.83	78.27	0.125	5.16	3.78	2	1.4356655	36.871	3.53	42.823
14.107	0.94	0.33	0.80	0.80	1.11	1.0	0.037	2.90	93.82	0.157	6.43	4.23	2	1.4638491	27.84	2.6654	32.334
14.271	0.94	0.29	0.80	0.80	1.11	1.0	0.037	3.71	93.46	0.156	6.35	4.07	2	1.4859142	21.703	2.0779	25.207
14.436	0.94	0.23	0.80	0.80	1.11	1.0	0.037	6.02	96.32	0.163	6.59	4.06	2	1.4979452	13.774	1.3187	15.998
14.600	0.94	0.25	0.80	0.80	1.11	1.0	0.037	5.41	98.39	0.169	6.76	4.17	2	1.4885243	15.665	1.4998	18.194
14.764	0.94	0.27	0.80	0.80	1.11	1.0	0.038	4.23	89.55	0.147	5.84	3.76	2	1.4782492	18.246	1.7469	21.191
14.928	0.94	0.25	0.80	0.80	1.10	1.0	0.038	4.80	93.41	0.156	6.15	3.89	2	1.4700815	16.74	1.6027	19.443
15.092	0.94	0.25	0.80	0.80	1.10	1.0	0.038	4.59	83.90	0.135	5.29	3.44	2	1.4610537	15.727	1.5057	18.266
15.256	0.94	0.32	0.80	0.80	1.10	1.0	0.038	2.29	72.47	0.115	4.49	3.25	2	1.4078566	27.241	2.6081	31.639
15.420	0.94	0.34	0.80	0.80	1.10	1.0	0.038	1.68	56.97	0.097	3.75	2.92	2	1.3916875	29.194	2.7951	33.907
15.584	0.94	0.34	0.80	0.80	1.10	1.0	0.038	1.60	56.82	0.097	3.71	2.94	2	1.3784218	30.562	2.926	35.496
15.748	0.94	0.33	0.80	0.80	1.09	1.0	0.038	1.74	56.81	0.097	3.68	2.87	2	1.3788977	28.112	2.6914	32.650
15.912	0.94	0.32	0.80	0.80	1.09	1.0	0.038	1.87	58.26	0.098	3.70	2.86	2	1.3754991	26.773	2.5633	31.095
16.076	0.94	0.32	0.80	0.80	1.09	1.0	0.038	1.77	55.11	0.096	3.57	2.79	2	1.3670323	26.831	2.5688	31.163
16.240	0.94	0.34	0.80	0.80	1.09	1.0	0.038	1.50	52.57	0.094	3.46	2.81	2	1.3479919	30.084	2.8803	34.941
16.404	0.94	0.36	0.80	0.80	1.09	1.0	0.038	1.78	70.65	0.113	4.15	3.24	2	1.3281917	34.149	3.2694	39.662
16.568	0.94	0.31	0.80	0.80	1.09	1.0	0.038	2.92	84.80	0.137	4.99	3.47	2	1.3492412	25.004	2.3939	29.041
16.732	0.94	0.28	0.80	0.80	1.08	1.0	0.038	3.98	96.07	0.162	5.88	3.84	2	1.3577821	20.779	1.9893	24.133
16.896	0.94	0.28	0.80	0.80	1.08	1.0	0.038	3.45	83.47	0.134	4.82	3.31	2	1.3492937	20.836	1.9949	24.200
17.060	0.94	0.36	0.80	0.80	1.08	1.0	0.038	1.73	68.48	0.110	3.92	3.14	2	1.3001914	34.132	3.2678	39.643
17.224	0.93	0.33	0.80	0.80	1.08	1.0	0.038	2.62	83.22	0.134	4.73	3.40	2	1.3117576	27.306	2.6143	31.714
17.388	0.93	0.28	0.80	0.80	1.08	1.0	0.038	3.47	81.83	0.131	4.60	3.20	2	1.3272144	20.281	1.9417	23.556
17.552	0.93	0.29	0.80	0.80	1.08	1.0	0.038	2.31	58.30	0.098	3.43	2.64	2	1.314342	21.723	2.0798	25.230
17.716	0.93	0.35	0.80	0.80	1.07	1.0	0.038	1.81	65.83	0.107	3.69	2.97	2	1.2794019	31.384	3.0047	36.451
17.880	0.93	0.29	0.80	0.80	1.07	1.0	0.038	3.06	78.92	0.126	4.32	3.10	2	1.2976165	22.222	2.1275	25.809
18.044	0.93	0.28	0.80	0.80	1.07	1.0	0.038	4.20	95.31	0.161	5.48	3.63	2	1.2996199	19.546	1.8713	22.701
18.208	0.93	0.25	0.80	0.80	1.07	1.0	0.038	4.32	79.57	0.127	4.31	2.98	2	1.297855	15.857	1.5181	18.417
18.372	0.93	0.32	0.80	0.80	1.07	1.0	0.039	2.64	81.26	0.130	4.38	3.22	2	1.2656973	26.487	2.5359	30.764
18.537	0.93	0.30	0.80	0.80	1.07	1.0	0.039	2.78	74.25	0.118	3.95	2.94	2	1.2679476	23.008	2.2028	26.723
18.701	0.93	0.32	0.80	0.80	1.06	1.0	0.039	2.56	81.00	0.129	4.30	3.20	2	1.2504122	27.248	2.6088	31.647
18.865	0.93	0.30	0.80	0.80	1.06	1.0	0.039	3.15	86.26	0.140	4.61	3.28	2	1.2526649	23.576	2.2571	27.382
19.029	0.93	0.30	0.80	0.80	1.06	1.0	0.039	3.28	88.21	0.144	4.72	3.33	2	1.2470318	23.131	2.2145	26.865
19.193	0.93	0.25	0.80	0.80	1.06	1.0	0.039	4.71	90.11	0.148	4.82	3.26	2	1.2545588	16.474	1.5772	19.133
19.357	0.93	0.24	0.80	0.80	1.06	1.0	0.039	4.94	84.32	0.136	4.38	3.01	2	1.2482606	14.706	1.4079	17.080
19.521	0.93	0.26	0.80	0.80	1.06	1.0	0.039	3.50	70.92	0.113	3.62	2.67	2	1.2413212	17.429	1.6687	20.243
19.685	0.93	0.26	0.80	0.80	1.06	1.0	0.039	3.57	71.65	0.114	3.62	2.67	2	1.2344691	17.263	1.6528	20.050
19.849	0.93	0.25	0.80	0.80	1.05	1.0	0.039	3.77	69.95	0.112	3.52	2.59	2	1.2277026	15.959	1.5279	18.536
20.013	0.92	0.24	0.80	0.80	1.05	1.0	0.039	4.79	85.49	0.138	4.31	2.98	2	1.2217066	15.382	1.4727	17.866
20.177	0.92	0.28	0.80	0.80	1.05	1.0	0.039	3.49	80.79	0.129	4.00	2.90	2	1.2106766	19.949	1.9099	23.170
20.341	0.92	0.31	0.80	0.80	1.05	1.0	0.040	2.77	77.23	0.123	3.77	2.87	2	1.1958988	24.048	2.3023	27.930

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-3S

Data File: 13-52106_SP3-3S-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Dat

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

5605.60	Water surface elevation during CPT investigation (ft amsl)
5601.35	Water surface elevation at t_0 (ft amsl)
5582.14	Water surface elevation at t_1 (ft amsl)
5577.14	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Ear
7.51	Equiv. Number of Uniform Strain Cycles, N

5609.63	Ground Surface Elevation at time of CPT (ft amsl)
5620.49	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pl
3.50	Thickness of Water Storage/Rooting Zone (ft)
3.50	Thickness of High Compaction Layer (ft)
3.36	Thickness of Random/Platform Fill on top of existing interim cover (ft)
1184.24	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5577.14	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom (tsf)	Stress at Midpoint (tsf)
Erosion Protection Layer	######	5620.24	5619.99	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	######	5618.24	5616.49	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5614.74	5612.99	3.50	0.060	120	0.424	0.320	0.00	0.00	0.424	0.320
Platform/Random Fill Layer	######	5611.31	5609.63	3.36	0.050	101	0.593	0.509	0.00	0.00	0.593	0.509

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil. Pore Pressure at time of CPT (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil. Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
0.164	5609.47	13.9	0.034	13.9	1.5	0.64	0.25%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0	1.70	23.545	327.28	27.36	1677	0.25%	0.7	51%	0.60	0.00	0.60	0
0.328	5609.30	18.4	0.072	18.4	2.3	1.01	0.39%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	31.246	434.32	36.32	1112	0.39%	0.9	51%	0.61	0.00	0.61	0
0.492	5609.14	58.6	0.077	58.5	4.8	2.06	0.13%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	99.501	1383.06	115.62	2362	0.13%	0.4	51%	0.62	0.00	0.62	0
0.656	5608.97	73.3	0.296	73.3	3.9	1.68	0.40%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0	1.70	124.644	1732.55	144.81	2218	0.40%	0.8	51%	0.63	0.00	0.63	0
0.820	5608.81	81.4	0.267	81.4	3.7	1.62	0.33%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0	1.70	138.414	1923.95	160.81	1971	0.33%	0.8	51%	0.63	0.00	0.63	0
0.984	5608.65	84.2	0.326	84.2	3.9	1.68	0.39%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0	1.70	143.072	1988.70	166.22	1697	0.39%	0.8	51%	0.64	0.00	0.64	0
1.148	5608.48	84.7	0.187	84.7	2.9	1.27	0.22%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0	1.70	143.939	2000.75	167.21	1463	0.22%	0.6	51%	0.65	0.00	0.65	0
1.312	5608.32	73.0	0.231	72.9	3.0	1.31	0.32%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	123.998	1723.57	144.05	1103	0.32%	0.8	51%	0.66	0.00	0.66	0
1.476	5608.15	71.2	0.308	71.2	1.7	0.72	0.43%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	120.955	1681.27	140.50	956	0.43%	1.0	51%	0.67	0.00	0.67	0
1.640	5607.99	55.2	0.236	55.2	3.7	1.59	0.43%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0	1.70	93.772	1303.43	108.96	667	0.43%	1.1	51%	0.67	0.00	0.67	0
1.804	5607.83	55.4	0.150	55.4	1.9	0.82	0.27%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0	1.70	94.095	1307.92	109.31	608	0.27%	0.9	51%	0.68	0.00	0.68	0
1.968	5607.66	54.7	0.208	54.7	1.6	0.70	0.38%	Interim Cover	0.050	100.7	0.10	0.00	0.10	0	1.70	92.905	1291.38	107.92	550	0.38%	1.1	51%	0.69	0.00	0.69	0
2.133	5607.50	53.2	0.150	53.2	1.9	0.83	0.28%	Interim Cover	0.050	100.7	0.11	0.00	0.11	0	1.70	90.491	1257.82	105.12	495	0.28%	1.0	51%	0.70	0.00	0.70	0
2.297	5607.33	46.8	0.504	46.8	2.3	1.01	1.08%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	79.560	1105.88	92.43	404	1.08%	1.5	51%	0.71	0.00	0.71	0
2.461	5607.17	59.1	1.594	59.1	3.4	1.48	2.70%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	100.470	1396.53	116.73	476	2.70%	1.8	51%	0.72	0.00	0.72	0
2.625	5607.01	70.3	1.024	70.2	6.0	2.59	1.46%	Interim Cover	0.050	100.7	0.13	0.00	0.13	0	1.70	119.408	1659.77	138.76	531	1.46%	1.6	51%	0.72	0.00	0.72	0
2.789	5606.84	132.5	0.906	132.5	6.2	2.67	0.68%	Interim Cover	0.050	100.7	0.14	0.00	0.14	0	1.63	215.362	2993.54	250.20	942	0.68%	1.2	51%	0.73	0.00	0.73	0
2.953	5606.68	69.0	0.500	69.0	1.8	0.78	0.72%	Interim Cover	0.050	100.7	0.15	0.00	0.15	0	1.70	117.249	1629.76	136.20	463	0.73%	1.3	51%	0.74	0.00	0.74	0
3.117	5606.51	83.8	0.682	83.8	0.9	0.37	0.81%	Interim Cover	0.050	100.7	0.16	0.00	0.16	0	1.70	142.375	1979.01	165.37	533	0.82%	1.4	51%	0.75	0.00	0.75	0
3.281	5606.35	49.0	0.298	49.0	3.9	1.69	0.61%	Sand Tailings	0.051	102.8	0.17	0.00	0.17	0	1.70	83.334	1158.34	96.84	296	0.61%	1.4	18%	0.76	0.00	0.76	0
3.445	5606.19	47.2	0.382	47.2	0.2	0.09	0.81%	Sand Tailings	0.051	102.8	0.17	0.00	0.17	0	1.70	80.172	1114.39	93.12	270	0.81%	1.5	18%	0.77	0.00	0.77	0
3.609	5606.02	46.3	0.306	46.3	0.6	0.28	0.66%	Sand Tailings	0.051	102.8	0.18	0.00	0.18	0	1.70	78.761	1094.78	91.48	253	0.66%	1.5	18%	0.77	0.00	0.77	0
3.773	5605.86	55.3	0.508	55.3	1.0	0.42	0.92%	Sand Tailings	0.051	102.8	0.19	0.00	0.19	0	1.70	94.044	1307.21	109.24	289	0.92%	1.6	18%	0.78	0.00	0.78	0
3.937	5605.69	80.4	1.013	80.4	1.5	0.64	1.26%	Sand Tailings	0.051	102.8	0.20	0.00	0.20	0	1.70	136.731	1900.56	158.82	403	1.26%	1.6	18%	0.79	0.00	0.79	0
4.101	5605.53	74.3	1.624	74.3	3.7	1.58	2.19%	Sand-Slime Tailin	0.059	119.0	0.21	0.00	0.21	1	1.70	126.310	1755.71	146.75	359	2.19%	1.8	47%	0.80	0.00	0.80	0
4.265	5605.36	52.7	1.775	52.6	12.2	5.30	3.37%	Sand-Slime Tailin	0.059	119.0	0.22	0.01	0.21	1	1.70	89.471	1243.65	104.07	248	3.38%	2.1	47%	0.81	0.00	0.81	0
4.429	5605.20	70.0	1.960	69.6	74.7	32.37	2.80%	Sand-Slime Tailin	0.059	119.0	0.23	0.01	0.22	1	1.70	118.286	1644.18	138.30	323	2.81%	1.9	47%	0.82	0.00	0.82	0
4.593	5605.04	105.7	1.513	105.3	62.4	27.03	1.43%	Sand Tailings	0.062	123.5	0.24	0.02	0.22	1	1.58	166.632	2316.18	194.25	477	1.43%	1.6	18%	0.83	0.00	0.83	0
4.757	5604.87	102.3	1.285	102.2	16.0	6.92	1.26%	Sand Tailings	0.062	123.5	0.25	0.02	0.23	1	1.59	162.173	2254.20	188.54	452	1.26%	1.6	18%	0.84	0.00	0.84	0
4.921	5604.71	80.0	0.626	80.0	8.5	3.69	0.78%	Sand Tailings	0.062	123.5	0.26	0.03	0.23	1	1.68	134.193	1865.28	155.96	345	0.79%	1.5	18%	0.85	0.00	0.85	0
5.085	5604.54	81.2	0.386	81.2	9.8	4.26	0.48%	Sand Tailings	0.062	123.5	0.27	0.03	0.24	1	1.66	134.859	1874.54	156.75	343	0.48%	1.3	18%	0.86	0.00	0.86	0
5.249	5604.38	87.3	0.391	87.3	7.2	3.11	0.45%	Sand Tailings	0.062	123.5	0.28	0.04	0.24	1	1.62	141.629	1968.64	164.58	361	0.45%	1.3	18%	0.87	0.00	0.87	0
5.413	5604.22	72.7	0.332	72.7	2.6	1.13	0.46%	Sand Tailings	0.062	123.5	0.29	0.04	0.25	1	1.68	122.447	1702.01	142.25	294	0.46%	1.3	18%	0.88	0.00	0.88	0
5.577	5604.05	65.2	0.279	65.2	0.5	0.21	0.43%	Sand Tailings	0.062	123.5	0.30	0.05	0.25	1	1.70	110.874	1541.15	128.78	259	0.43%	1.4	18%	0.89	0.00	0.89	0
5.741	5603.89	56.7	0.216	56.7	-0.1	-0.05	0.38%	Sand Tailings	0.062	123.5	0.31	0.05	0.26	1	1.70	96.458	1340.77	112.03	220	0.38%	1.4	18%	0.90	0.00	0.90	0
5.905	5603.72	48.8	0.259	48.8	-0.3	-0.13	0.53%	Sand Tailings	0.062	123.5	0.32	0.06	0.26	1	1.70	83.028	1154.09	96.43	186	0.53%	1.5	18%	0.91	0.00	0.91	0
6.069	5603.56	32.1	0.220	32.1	-0.3	-0.12	0.68%	Sand-Slime Tailin	0.059	119.0	0.33	0.06	0.27	1	1.70	54.621	759.23	63.44	120	0.69%	1.7	47%	0.92	0.00	0.92	0
6.234	5603.40	28.8	0.202	28.8	2.7	1.18	0.70%	Sand-Slime Tailin	0.059	119.0	0.34	0.07	0.27	1	1.70	48.875	679.36	56.80	105	0.71%	1.8	47%	0.93	0.00	0.93	0
6.398	5603.23	33.3	0.244	33.3	9.5	4.10	0.73%	Sand-Slime Tailin	0.059	119.0	0.35	0.07	0.27	1	1.70	56.559	786.17	65.81	120	0.74%	1.8	47%	0.94	0.00	0.94	0
6.562	5603.07	23.8	0.288	23.8	5.0	2.17	1.21%	Sand-Slime Tailin	0.059	119.0	0.36	0.08	0.28	1	1.70	40.392	561.45	46.97	84	1.23%	2.0	47%	0.95	0.00	0.95	0
6.726	5602.90	18.2	0.238	18.1	12.5	5.43	1.31%	Sand-Slime Tailin	0.059	119.0	0.37	0.08	0.28	1	1.70	30.753	427.47	35.87	63	1.34%	2.1	47%	0.96	0.00	0.96	0
6.890	5602.74	11.8	0.147	11.7	14.5	6.28	1.25%	Sand-Slime Tailin	0.059	119.0	0.38	0.09	0.29	1	1.70	19.907	276.71	23.30	40	1.29%	2.3	47%	0.97	0.00	0.97	0
7.054	5602.58	9.2	0.122	9.1	23.8	10.33	1.32%	Sand-Slime Tailin	0.059	119.0	0.39	0.09	0.29	1	1.70	15.453	214.80	18.24	30	1.38%	2.4	47%	0.98	0.00	0.98	0
7.218	5602.41	9.2	0.089	9.0	30.6	13.24	0.97%	Sand-Slime Tailin	0.059	119.0	0.40	0.10	0.30	1	1.70	15.232	211.72	18.07	29	1.02%	2.3	47%	0.99	0.00	0.99	0
7.382	5602.25	9.9	0.100	9.7	31.6	13.69	1.01%	Sand-Slime Tailin	0.059	119.0	0.41	0.10	0.30	1	1.70	16.524	229.68	19.58	31	1.05%	2.3	47%	1.00	0.00	1.00	0
7.546	5602.08	8.5	0.080	8.3	34.3	14.88	0.94%	Sand-Slime Tailin	0.059	119.0	0.42	0.11	0.31	1	1.70	14.127	196.37	16.83	26	0.99%	2.4	47%	1.01	0.00	1.01	0
7.710	5601.92	10.2	0.068	10.0	38.1	16.51	0.67%	Sand-Slime Tailin	0.059	119.0	0.43	0.11	0.31	1	1.70	16.932	235.35	20.13	31	0.70%	2.2	47%	1.02	0.00	1.02	0
7.874	5601.76	8.5	0.060	8.2	38.1	16.49	0.71%	Sand-Slime Tailin	0.059	119.0	0.44	0.12	0.32	1	1.70	14.008	194.71	16.74	25	0.75%	2.3	47%	1.03	0.00	1.03	0
8.038	5601.59	7.6	0.064	7.3	45.6	19.77	0.84%	Sand-Slime Tailin	0.059	119.0	0.45	0.13	0.32	1	1.70	12.478	173.44	15.05	22	0.89%	2.4	47%	1.04	0.00	1.04	0
8.202	5601.43	8.1	0.076	7.8	53.2	23.04	0.94%	Sand-Slime Tailin	0.059	119.0	0.46	0.13	0.33	1	1.70	13.226	183.84	16.02	23	0.99%	2.4	47%	1.05	0.00	1.05	0
8.366	5601.26	9.0	0.102	8.6	58.4	25.30	1.14%	Sand-Slime Tailin	0.059	119.0	0.47	0.14	0.33	1	1.70	14.637	203.45	17.72	26	1.20%	2.4	47%	1.06	0.00	1.06	0
8.530	5601.10	9.6	0.210	9.2	60.7	26.28	2.18%	Slime Tailings	0.057	113.1	0.48	0.14	0.33	1	1.70	15.708	218.34	18.99	27	2.30%	2.6	71%	1.07	0.00	1.07	0
8.694	5600.94	9.5	0.212	9.1	55.4	24.01	2.24%	Slime Tailings	0.057	113.1	0.48	0.15	0.34	1	1.70	15.487	215.27	18.67	26	2.36%	2.6	71%	1.08	0.00	1.08	0
8.858	5600.77	13.5	0.188	13.3	28.4	12.31	1.39%	Sand-Slime Tailin	0.059	119.0	0.49	0.15	0.34	1	1.70	22.610	314.28	26.61	38	1.45%	2.3	47%	1.09	0.00	1.09	0
9.022	5600.61	9.0	0.166	8.9	12.6	5.48	1.85%	Slime Tailings	0.057	113.1	0.50	0.16	0.35	1	1.70	15.130	210.31	17.73	24	1.96%	2.6	71%	1.10	0.00	1.10	0
9.186	5600.44	7.1	0.173	6.9	30.7	13.29	2.45%	Slime Tailings	0.057	113.1	0.51	0.16	0.35	1	1.70	11.662	162.10	13.92	19	2.65%	2.7	71%	1.10	0.00	1.10	0
9.350	5600.28	12.4	0.106	12.1	47.2	20.44	0.86%	Sand-Slime Tailin	0.059	119.0	0.52	0.17	0.36	1	1.70	20.536	285.45	24.43	33	0.89%	2.3	47%	1.11	0.00	1.11	0
9.514	5600.12	15.4	0.097	15.3	14.9	6.47	0.63%	Sand-Slime Tailin	0.059	119.0	0.53	0.17	0.36	1	1.70	25.959	360.83	30.33	41	0.65%	2.1	47%	1.12	0.00	1.12	0
9.678	5599.95	15.1	0.080	15.0	11.2	4.83	0.53%	Sand-Slime Tailin	0.059	119.0	0.54	0.18	0.37	1	1.70	25.517	354.69	29.77	40	0.55%	2.1	47%	1.13	0.00	1.13	0
9.842	5599.79	22.9	0.122	22.8	15.7	6.78	0.53%	Sand-Slime Tailin	0.059	119.0	0.55	0.18	0.37	1	1.70	38.743	538.53	45.19	60	0.55%	1.9	47%	1.14	0.00	1.14	0
10.006	5599.62	18.5	0.100	18.4	10.4	4.49	0.54%	Sand-Slime Tailin	0.059	119.0	0.56	0.19	0.38	1	1.70	31.263	434.56	36.44	48	0.56%	2.0	47%	1.15	0.00	1.15	0
10.170	5599.46	16.5	0.082	16.5	6.1	2.66	0.50%	Sand-Slime Tailin	0.059	119.0	0.57	0.19	0.38	1	1.70	28.050	389.90	32.65	42	0.51%	2.1	47%	1.16	0.00	1.16	0
10.335	5599.30	11.5	0.074	11.5	5.9	2.54	0.64%	Sand-Slime Tailin	0.059	119.0	0.58	0.20	0.38	1	1.70	19.482	270.80	22.70	28	0.68%	2.3	47%	1.17	0.00	1.17	0
10.499	5599.13	8.2	0.078	8.2	6.6	2.85	0.95%	Sand-Slime Tailin	0.059	119.0	0.59	0.20	0.39	1	1.70	13.855	192.58	16.17	20	1.03%	2.5	47%	1.18	0.00	1.18	0
10.663	5598.97	8.3	0.043	8.3	9.0	3.92	0.52%	Sand-Slime Tailin	0.059	119.0	0.60	0.21	0.39	1	1.70	14.059	195.42	16.44	20	0.56%	2.4	47%	1.19	0.00	1.19	0
10.827	5598.80	9.2	0.024	9.2	10.5	4.53	0.26%	Sand-Slime Tailin	0.059	119.0	0.61	0.21	0.40	1	1.70	15.589	216.69	18.23	22	0.28%	2.2	47%	1.20	0.00	1.20	0
10.991	5598.64	8.6	0.074	8.5	13.3	5.75	0.87%	Sand-Slime Tailin	0.059	119.0	0.62	0.22	0.40	1	1.70	14.399	200.15	16.89	20	0.93%	2.5	47%	1.21	0.00	1.21	0
11.155	5598.48	6.3	0.099	6.2	15.1	6.52	1.58%	Slime Tailings	0.057	113.1	0.63	0.22	0.41	1	1.70	10.489	145.80	12.37	14	1.76%	2.8	71%	1.22	0.00	1.22	0
11.319	5598.31	5.1	0.105	5.0	18.6	8.07	2.06%	Slime Tailings	0.057	113.1	0.64	0.23	0.41	1	1.70	8.449	117.44	10.04	11	2.36%	2.9	71%	1.23	0.00	1.23	0
11.483	5598.15	4.3	0.115	4.1	26.9	11.65	2.67%	Slime Tailings	0.057	113.1	0.65	0.23	0.42	1	1.70	7.038	97.83	8.51	9	3.14%	3.1	71%	1.24	0.00	1.24	0
11.647	5597.98	7.3	0.094	7.1	44.1	19.13	1.28%	Slime Tailings	0.057	113.1	0.66	0.24	0.42	1	1.70	12.019	167.06	14.50	16	1.41%	2.6	71%	1.25	0.00	1.25	0
11.811	5597.82	9.0	0.165	8.8	27.6	11.97	1.84%	Slime Tailings	0.057	113.1	0.67	0.24	0.42	1	1.70	14.943	207.71	17.70	20	1.99%	2.7	71%	1.26	0.00	1.26	0
11.975	5597.66	8.6	0.084	8.5	20.2	8.75	0.98%	Sand-Slime Tailin	0.059	119.0	0.68	0.25	0.43	1	1.70	14.416	200.38	16.99	19	1.06%	2.5	47%	1.27	0.00	1.27	0

Liquefaction Triggering Analyses

Depth at time of CPT (ft)	I&B (2008) r_d	I&B C_σ	I&B K_σ	I&B K_α	I&B CSR M=7.5, s'v=1atm	I&B Δqc_{1n}	I&B $qc_{1n\text{-}cs}$	I&B (CRR) M=7.5, s'v=1atm	I&B FoS	Youd (2001) r_d	Youd D_r	Youd f	Youd K_σ	Youd K_α	Youd CSR M=7.5, s'v=1atm	Youd Kc	Youd $qc_{1n\text{-}cs}$	Youd (CRR) M=7.5, s'v=1atm	Youd FoS	Avg FoS	Liquefiable? 1=Yes 2=No	I&B (2008) CN	qc1 TSF	qc1 MPa	qc1N
0.164	1.00	0.06	1.02	1.0	0.059	39.92	67.29	0.096	1.63	0.97	0.30	0.80	2.53	1.0	0.017	1.00	27.36	0.073	176.61	89.12	2	1.7	23.561	2.2557	27.364
0.328	1.00	0.06	1.02	1.0	0.059	43.07	79.38	0.112	1.89	0.97	0.35	0.80	2.20	1.0	0.019	1.00	36.32	0.080	97.39	49.64	2	1.7	31.271	2.9938	36.319
0.492	1.00	0.12	1.04	1.0	0.060	70.90	186.52	0.662	11.01	0.97	0.62	0.69	3.01	1.0	0.014	1.00	115.62	0.224	181.10	96.05	2	1.7	99.552	9.5311	115.623
0.656	1.00	0.15	1.05	1.0	0.061	81.14	225.95	1.000	16.49	0.97	0.69	0.65	3.10	1.0	0.014	1.00	144.81	0.362	220.09	118.29	2	1.7	124.69	11.937	144.814
0.820	1.00	0.18	1.05	1.0	0.061	86.75	247.56	1.000	16.41	0.97	0.73	0.63	3.04	1.0	0.014	1.00	160.81	1.000	486.00	251.21	2	1.7	138.45	13.256	160.805
0.984	1.00	0.19	1.05	1.0	0.061	88.65	254.87	1.000	16.41	0.97	0.74	0.63	2.89	1.0	0.015	1.00	166.22	1.000	405.16	210.78	2	1.7	143.11	13.702	166.217
1.148	1.00	0.19	1.05	1.0	0.061	89.00	256.21	1.000	16.43	0.97	0.75	0.63	2.74	1.0	0.016	1.00	167.21	1.000	347.42	181.93	2	1.7	143.97	13.784	167.213
1.312	1.00	0.15	1.04	1.0	0.060	80.87	224.93	1.000	16.62	0.97	0.69	0.65	2.43	1.0	0.018	1.00	144.05	0.358	108.87	62.75	2	1.7	124.03	11.875	144.054
1.476	1.00	0.15	1.04	1.0	0.060	79.63	220.13	1.000	16.67	0.97	0.68	0.66	2.31	1.0	0.019	1.00	140.50	0.338	91.39	54.03	2	1.7	120.97	11.582	140.503
1.640	1.00	0.11	1.03	1.0	0.059	68.56	177.51	0.498	8.38	0.97	0.60	0.70	2.03	1.0	0.021	1.00	108.96	0.200	48.77	28.57	2	1.7	93.811	8.9815	108.956
1.804	1.00	0.11	1.03	1.0	0.059	68.68	177.99	0.505	8.50	0.97	0.60	0.70	1.97	1.0	0.022	1.00	109.31	0.201	44.61	26.56	2	1.7	94.115	9.0106	109.309
1.968	1.00	0.11	1.02	1.0	0.059	68.19	176.12	0.478	8.08	0.97	0.60	0.70	1.91	1.0	0.022	1.00	107.92	0.197	39.98	24.03	2	1.7	92.922	8.8964	107.924
2.133	1.00	0.11	1.02	1.0	0.059	67.21	172.33	0.432	7.32	0.97	0.59	0.70	1.85	1.0	0.023	1.00	105.12	0.188	35.26	21.29	2	1.7	90.511	8.6655	105.123
2.297	1.00	0.10	1.02	1.0	0.059	62.76	155.19	0.297	5.06	0.97	0.56	0.72	1.75	1.0	0.024	1.00	92.43	0.153	26.73	15.89	2	1.7	79.585	7.6194	92.433
2.461	1.00	0.12	1.02	1.0	0.059	71.29	188.02	0.698	11.85	0.97	0.62	0.69	1.83	1.0	0.023	1.13	131.98	0.294	47.78	29.82	2	1.7	100.51	9.6225	116.732
2.625	1.00	0.15	1.03	1.0	0.059	79.02	217.77	1.000	16.95	0.97	0.68	0.66	1.89	1.0	0.023	1.00	138.76	0.328	50.10	33.52	2	1.7	119.47	11.438	138.759
2.789	0.99	0.30	1.05	1.0	0.060	#####	368.33	1.000	16.58	0.97	0.91	0.60	2.07	1.0	0.021	1.00	250.20	1.000	143.62	80.10	2	1.62599	215.42	20.625	250.203
2.953	0.99	0.14	1.02	1.0	0.059	78.12	214.32	1.000	17.04	0.97	0.67	0.66	1.81	1.0	0.024	1.00	136.20	0.315	42.74	29.89	2	1.7	117.27	11.227	136.200
3.117	0.99	0.18	1.03	1.0	0.059	88.35	253.72	1.000	16.98	0.97	0.74	0.63	1.88	1.0	0.023	1.00	165.37	1.000	128.60	72.79	2	1.7	142.38	13.632	165.371
3.281	0.99	0.10	1.01	1.0	0.058	46.85	143.68	0.245	4.22	0.97	0.57	0.72	1.60	1.0	0.027	1.00	96.84	0.164	20.08	12.15	2	1.7	83.375	7.9824	96.836
3.445	0.99	0.10	1.01	1.0	0.058	45.89	139.01	0.229	3.95	0.97	0.56	0.72	1.56	1.0	0.027	1.00	93.12	0.155	18.02	10.99	2	1.7	80.174	7.6759	93.117
3.609	0.99	0.10	1.01	1.0	0.058	45.48	136.96	0.223	3.85	0.97	0.55	0.72	1.54	1.0	0.028	1.00	91.48	0.151	16.77	10.31	2	1.7	78.768	7.5412	91.484
3.773	0.99	0.11	1.01	1.0	0.058	50.02	159.25	0.321	5.56	0.97	0.60	0.70	1.58	1.0	0.027	1.00	109.24	0.201	21.33	13.45	2	1.7	94.054	9.0047	109.238
3.937	0.99	0.17	1.01	1.0	0.058	62.69	221.52	1.000	17.25	0.97	0.73	0.64	1.70	1.0	0.025	1.00	158.82	0.453	45.97	31.61	2	1.7	136.75	13.092	158.823
4.101	0.99	0.16	1.01	1.0	0.058	81.77	228.51	1.000	17.32	0.97	0.70	0.65	1.65	1.0	0.026	1.11	163.40	1.000	97.90	57.61	2	1.7	126.35	12.097	146.746
4.265	0.99	0.11	1.01	1.0	0.057	66.80	170.86	0.416	7.25	0.96	0.59	0.71	1.51	1.0	0.028	1.38	143.17	0.353	33.80	20.53	2	1.7	89.601	8.5784	104.066
4.429	0.99	0.14	1.01	1.0	0.057	78.81	217.11	1.000	17.43	0.96	0.68	0.66	1.60	1.0	0.027	1.21	167.80	1.000	93.77	55.60	2	1.7	119.08	11.401	138.303
4.593	0.98	0.25	1.01	1.0	0.057	71.75	266.00	1.000	17.41	0.96	0.80	0.60	1.72	1.0	0.025	1.00	194.25	1.000	91.68	54.55	2	1.581998	167.25	16.012	194.248
4.757	0.98	0.23	1.01	1.0	0.057	70.29	258.83	1.000	17.48	0.96	0.79	0.60	1.70	1.0	0.025	1.00	188.54	1.000	89.68	53.58	2	1.586663	162.33	15.542	188.538
4.921	0.98	0.17	1.00	1.0	0.057	61.96	217.92	1.000	17.56	0.96	0.72	0.64	1.61	1.0	0.026	1.00	155.96	0.433	37.99	27.78	2	1.678463	134.28	12.856	155.961
5.085	0.98	0.17	1.00	1.0	0.057	62.16	218.91	1.000	17.61	0.96	0.72	0.64	1.60	1.0	0.027	1.00	156.75	0.438	37.66	27.64	2	1.661641	134.96	12.921	156.749
5.249	0.98	0.18	1.00	1.0	0.057	64.16	228.74	1.000	17.67	0.96	0.74	0.63	1.60	1.0	0.026	1.00	164.58	1.000	84.19	50.93	2	1.622507	141.7	13.566	164.578
5.413	0.98	0.15	1.00	1.0	0.056	58.45	200.70	1.000	17.71	0.96	0.69	0.66	1.54	1.0	0.028	1.00	142.25	0.348	28.69	23.20	2	1.684504	122.47	11.726	142.246
5.577	0.98	0.13	1.00	1.0	0.056	55.01	183.79	0.604	10.72	0.96	0.66	0.67	1.50	1.0	0.028	1.00	128.78	0.279	22.54	16.63	2	1.7	110.88	10.616	128.779
5.741	0.98	0.12	0.99	1.0	0.056	50.73	162.76	0.345	6.14	0.96	0.61	0.69	1.45	1.0	0.029	1.00	112.03	0.211	16.72	11.43	2	1.7	96.457	9.2348	112.029
5.905	0.98	0.10	0.99	1.0	0.056	46.74	143.17	0.243	4.34	0.96	0.57	0.72	1.40	1.0	0.030	1.00	96.43	0.163	12.72	8.53	2	1.7	83.025	7.9488	96.428
6.069	0.98	0.08	0.99	1.0	0.056	52.55	115.98	0.171	3.05	0.96	0.46	0.77	1.31	1.0	0.032	1.07	67.96	0.109	8.36	5.70	2	1.7	54.618	5.2291	63.436
6.234	0.98	0.08	0.99	1.0	0.056	50.22	107.02	0.154	2.76	0.96	0.44	0.78	1.29	1.0	0.033	1.11	62.92	0.103	7.76	5.26	2	1.7	48.904	4.6821	56.799
6.398	0.97	0.08	0.99	1.0	0.056	53.38	119.19	0.178	3.18	0.96	0.47	0.77	1.31	1.0	0.032	1.08	71.27	0.114	8.41	5.80	2	1.7	56.659	5.4246	65.806
6.562	0.97	0.07	0.99	1.0	0.056	46.78	93.75	0.133	2.37	0.96	0.40	0.80	1.25	1.0	0.034	1.34	62.78	0.103	7.50	4.94	2	1.7	40.445	3.8722	46.974
6.726	0.97	0.06	0.99	1.0	0.056	42.88	78.75	0.111	1.99	0.96	0.35	0.80	1.25	1.0	0.034	1.55	55.52	0.096	6.87	4.43	2	1.7	30.886	2.957	35.872
6.890	0.97	0.05	0.99	1.0	0.056	38.47	61.77	0.090	1.61	0.96	0.28	0.80	1.24	1.0	0.034	1.94	45.17	0.088	6.18	3.90	2	1.7	20.061	1.9206	23.299
7.054	0.97	0.05	0.99	1.0	0.056	36.70	54.94	0.082	1.48	0.96	0.25	0.80	1.24	1.0	0.034	2.36	42.97	0.086	5.96	3.72	2	1.7	15.706	1.5037	18.242
7.218	0.97	0.05	0.99	1.0	0.056	36.64	54.71	0.082	1.48	0.96	0.25	0.80	1.24	1.0	0.034	2.11	38.20	0.082	5.59	3.54	2	1.7	15.556	1.4894	18.068
7.382	0.97	0.05	0.99	1.0	0.056	37.17	56.75	0.084	1.52	0.96	0.26	0.80	1.23	1.0	0.034	2.05	40.20	0.083	5.62	3.57	2	1.7	16.859	1.6141	19.581
7.546	0.97	0.05	0.99	1.0	0.055	36.20	53.04	0.080	1.45	0.96	0.24	0.80	1.23	1.0	0.034	2.24	37.68	0.081	5.40	3.43	2	1.7	14.491	1.3874	16.831
7.710	0.97	0.05	0.99	1.0	0.055	37.36	57.50	0.085	1.54	0.96	0.26	0.80	1.23	1.0	0.034	1.78	35.77	0.080	5.22	3.38	2	1.7	17.336	1.6598	20.135
7.874	0.96	0.05	0.99	1.0	0.055	36.17	52.91	0.080	1.45	0.96	0.24	0.80	1.22	1.0	0.035	2.07	34.68	0.079	5.09	3.27	2	1.7	14.412	1.3798	16.738
8.038	0.96	0.05	0.99	1.0	0.055	35.58	50.64	0.078	1.41	0.96	0.22	0.80	1.22	1.0	0.035	2.41	36.22	0.080	5.10	3.26	2	1.7	12.962	1.241	15.055
8.202	0.96	0.05	0.99	1.0	0.055	35.92	51.94	0.079	1.44	0.96	0.23	0.80	1.21	1.0	0.035	2.42	38.81	0.082	5.16	3.30	2	1.7	13.79	1.3203	16.017
8.366	0.96	0.05	0.99	1.0	0.055	36.52	54.24	0.082	1.49	0.96	0.24	0.80	1.21	1.0	0.035	2.46	43.59	0.086	5.34	3.41	2	1.7	15.257	1.4607	17.720
8.530	0.96	0.05	0.99	1.0	0.055	36.70	55.69	0.083	1.52	0.95	0.25	0.80	1.21	1.0	0.035	3.18	60.45	0.101	6.14	3.83	2	1.7	16.352	1.5655	18.991
8.694	0.96	0.05	0.99	1.0	0.055	36.59	55.26	0.083	1.51	0.95	0.25	0.80	1.20	1.0	0.035	3.29	61.47	0.102	6.13	3.82	2	1.7	16.075	1.539	18.670
8.858	0.96	0.06	0.99	1.0	0.055	39.63	66.24	0.095	1.74	0.95	0.30	0.80	1.20	1.0	0.035	2.09	55.72	0.096	5.72	3.73	2	1.7	22.912	2.1935	26.610
9.022	0.96	0.05	0.99	1.0	0.055	36.26	53.99	0.081	1.49	0.95	0.24	0.80	1.20	1.0	0.035	3.17	56.22	0.097	5.68	3.59	2	1.7	15.264	1.4614	17.728
9.186	0.96	0.05	0.99	1.0	0.055	34.94	48.86	0.076	1.40	0.95	0.22	0.80	1.20	1.0	0.035	4.35	60.51	0.101	5.86	3.63	2	1.7	11.987	1.1477	13.923
9.350	0.96	0.06	0.99	1.0	0.054	38.87	63.30	0.092	1.68	0.95	0.29	0.80	1.19	1.0	0.035	1.87	45.60	0.088	5.06	3.37	2	1.7	21.037	2.0141	24.433
9.514	0.95	0.06	0.98	1.0	0.054	40.94	71.27	0.101	1.86	0.95	0.32	0.80	1.19	1.0	0.035	1.50	45.61	0.088	4.99	3.43	2	1.7	26.118	2.5005	30.334
9.678	0.95	0.06	0.98	1.0	0.054	40.74	70.52	0.100	1.85	0.95	0.32	0.80	1.19	1.0	0.035	1.46	43.48	0.086	4.83	3.34	2	1.7	25.635	2.4543	29.774
9.842	0.95	0.07	0.98	1.0	0.054	46.15	91.34	0.129	2.39	0.95	0.39	0.80	1.18	1.0	0.035	1.23	55.64	0.096	5.32	3.85	2	1.7	38.909	3.7252	45.191
10.006	0.95	0.06	0.98	1.0	0.054	43.08	79.52	0.112	2.07	0.95	0.35	0.80	1.18	1.0	0.036	1.35	49.19	0.091	4.98	3.53	2	1.7	31.373	3.0036	36.438
10.170	0.95	0.06	0.98	1.0	0.054	41.75	74.41	0.105	1.95	0.95	0.33	0.80	1.18	1.0	0.036	1.40	45.68	0.088	4.76	3.36	2	1.7	28.115	2.6917	32.654
10.335	0.95	0.05	0.98	1.0	0.054	38.26	60.96	0.089	1.65	0.95	0.28	0.80	1.18	1.0	0.036	1.87	42.42	0.085	4.56	3.10	2	1.7	19.544	1.8712	22.699
10.499	0.95	0.05	0.98	1.0	0.054	35.97	52.15	0.080	1.48	0.95	0.23	0.80	1.17	1.0	0.036	2.78	45.02	0.087	4.62	3.05	2	1.7	13.925	1.3332	16.173
10.663	0.95	0.05	0.98	1.0	0.054	36.07	52.51	0.080	1.49	0.95	0.23	0.80	1.17	1.0	0.036	2.24	36.81	0.081	4.21	2.85	2	1.7	14.155	1.3552	16.440
10.827	0.95	0.05	0.98	1.0	0.054	36.70	54.93	0.082	1.53	0.95	0.25	0.80	1.17	1.0	0.036	1.76	32.06	0.077	3.96	2.75	2	1.7	15.7	1.5031	18.234
10.991	0.94	0.05	0.98	1.0	0.054	36.22	53.11	0.081	1.50	0.95	0.24	0.80	1.16	1.0	0.036	2.67	45.07	0.088	4.47	2.99	2	1.7	14.54	1.392	16.887
11.155	0.94	0.05	0.98	1.0	0.054	34.39	46.76	0.074	1.39	0.95	0.20	0.80	1.16	1.0	0.036	4.38	54.23	0.095	4.79	3.09	2	1.7	10.649	1.0195	12.368
11.319	0.94	0.05	0.98	1.0	0.054	33.58	43.63	0.072	1.34	0.95	0.18	0.80	1.16	1.0	0.036	5.80	58.28	0.098	4.93	3.13	2	1.7	8.6466	0.8278	10.043
11.483	0.94	0.04	0.98	1.0	0.054	33.05	41.56	0.070	1.31	0.95	0.17	0.80	1.16	1.0	0.036	7.36	62.61	0.103	5.10	3.20	2	1.7	7.3233	0.7011	8.506
11.647	0.94	0.05	0.98	1.0	0.053	35.14	49.64	0.077	1.45	0.95	0.22	0.80	1.15	1.0	0.036	3.63	52.71	0.094	4.60	3.02	2	1.7	12.487	1.1955	14.503
11.811	0.94	0.05	0.98	1.0	0.053	36.25	53.95	0.081	1.53	0.95	0.24	0.80	1.15	1.0	0.036	3.68	65.18	0.106	5.15	3.34	2	1.7	15.236	1.4587	17.696
11.975	0.94	0.05	0.98	1.0	0.053	36.26	53.25	0.081	1.52	0.95	0.24	0.80	1.15	1.0	0.036	2.93	49.71	0.091	4.40	2.96	2	1.7	14.63	1.4007	16.992

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-3S

Data File: 13-52106_SP3-3S-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3 Field Data\2013 Field Investigation\Conetec Dat

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Description
5605.60	Water surface elevation during CPT investigation (ft
5601.35	Water surface elevation at t_0 (ft amsl)
5582.14	Water surface elevation at t_1 (ft amsl)
5577.14	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Ear
7.51	Equiv. Number of Uniform Strain Cycles, N

Value	Description
5609.63	Ground Surface Elevation at time of CPT (ft amsl)
5620.49	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pl
3.50	Thickness of Water Storage/Rooting Zone (ft)
3.50	Thickness of High Compaction Layer (ft)
3.36	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1184.24	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5577.14	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	######	5620.24	5619.99	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
Water Storage/Rooting Zone Layer	######	5618.24	5616.49	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5614.74	5612.99	3.50	0.060	120	0.424	0.320	0.00	0.00	0.424	0.320
Platform/Random Fill Layer	######	5611.31	5609.63	3.36	0.050	101	0.593	0.509	0.00	0.00	0.593	0.509

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
12.139	5597.49	10.5	0.047	10.4	14.1	6.11	0.45%	Sand-Slime Tailings	0.059	119.0	0.69	0.25	0.43	1	1.70	17.663	245.52	20.69	23	0.48%	2.3	47%	1.28	0.00	1.28	0
12.303	5597.33	10.3	0.077	10.2	9.8	4.26	0.75%	Sand-Slime Tailings	0.059	119.0	0.70	0.26	0.44	1	1.70	17.362	241.32	20.29	22	0.80%	2.4	47%	1.29	0.00	1.29	0
12.467	5597.16	6.7	0.073	6.6	12.8	5.56	1.09%	Slime Tailings	0.057	113.1	0.71	0.26	0.44	1	1.68	11.118	154.55	13.07	14	1.22%	2.7	71%	1.30	0.00	1.30	0
12.631	5597.00	8.2	0.034	8.1	16.4	7.12	0.41%	Sand-Slime Tailings	0.059	119.0	0.71	0.27	0.45	1	1.67	13.584	188.82	15.98	17	0.45%	2.4	47%	1.31	0.00	1.31	0
12.795	5596.83	9.3	0.032	9.2	15.5	6.73	0.34%	Sand-Slime Tailings	0.059	119.0	0.72	0.27	0.45	1	1.66	15.282	212.42	17.94	19	0.37%	2.3	47%	1.32	0.00	1.32	0
12.959	5596.67	9.4	0.034	9.3	15.5	6.73	0.36%	Sand-Slime Tailings	0.059	119.0	0.73	0.28	0.46	1	1.64	15.259	212.10	17.91	19	0.39%	2.3	47%	1.33	0.00	1.33	0
13.123	5596.51	9.5	0.043	9.4	15.8	6.83	0.45%	Sand-Slime Tailings	0.059	119.0	0.74	0.28	0.46	1	1.63	15.350	213.37	18.02	19	0.49%	2.4	47%	1.34	0.00	1.34	0
13.287	5596.34	9.1	0.054	9.0	16.3	7.05	0.59%	Sand-Slime Tailings	0.059	119.0	0.75	0.29	0.47	1	1.62	14.632	203.38	17.18	18	0.64%	2.4	47%	1.35	0.00	1.35	0
13.451	5596.18	9.2	0.068	9.1	17.0	7.36	0.74%	Sand-Slime Tailings	0.059	119.0	0.76	0.29	0.47	1	1.61	14.615	203.15	17.17	18	0.81%	2.5	47%	1.36	0.00	1.36	0
13.615	5596.01	9.3	0.080	9.2	17.0	7.38	0.86%	Sand-Slime Tailings	0.059	119.0	0.77	0.30	0.47	1	1.59	14.710	204.47	17.28	18	0.93%	2.5	47%	1.37	0.00	1.37	0
13.779	5595.85	11.2	0.068	11.1	17.5	7.60	0.61%	Sand-Slime Tailings	0.059	119.0	0.78	0.30	0.48	1	1.58	17.525	243.59	20.55	22	0.65%	2.4	47%	1.38	0.00	1.38	0
13.943	5595.69	14.4	0.082	14.3	15.5	6.70	0.57%	Sand-Slime Tailings	0.059	119.0	0.79	0.31	0.48	1	1.54	22.107	307.29	25.85	28	0.60%	2.3	47%	1.39	0.00	1.39	0
14.107	5595.52	11.4	0.115	11.3	15.5	6.72	1.01%	Sand-Slime Tailings	0.059	119.0	0.80	0.31	0.49	1	1.56	17.669	245.60	20.70	22	1.08%	2.5	47%	1.39	0.00	1.39	0
14.271	5595.36	8.1	0.115	8.0	17.0	7.37	1.43%	Slime Tailings	0.057	113.1	0.81	0.32	0.49	1	1.55	12.321	171.26	14.50	15	1.59%	2.7	71%	1.40	0.00	1.40	0
14.436	5595.19	7.0	0.051	6.9	19.3	8.34	0.73%	Sand-Slime Tailings	0.059	119.0	0.82	0.32	0.50	1	1.54	10.571	146.94	12.49	12	0.83%	2.6	47%	1.41	0.00	1.41	0
14.600	5595.03	6.4	0.033	6.3	17.8	7.71	0.52%	Sand-Slime Tailings	0.059	119.0	0.83	0.33	0.50	1	1.53	9.534	132.52	11.27	11	0.60%	2.6	47%	1.42	0.00	1.42	0
14.764	5594.87	5.4	0.063	5.2	20.0	8.68	1.18%	Slime Tailings	0.057	113.1	0.84	0.33	0.51	1	1.52	7.926	110.18	9.43	9	1.40%	2.9	71%	1.43	0.00	1.43	0
14.928	5594.70	4.8	0.108	4.6	28.3	12.24	2.27%	Slime Tailings	0.057	113.1	0.85	0.34	0.51	1	1.51	6.912	96.08	8.34	8	2.76%	3.1	71%	1.44	0.00	1.44	0
15.092	5594.54	4.8	0.126	4.7	28.1	12.16	2.60%	Slime Tailings	0.057	113.1	0.86	0.35	0.51	1	1.50	6.988	97.13	8.42	8	3.16%	3.1	71%	1.45	0.00	1.45	0
15.256	5594.37	5.7	0.083	5.6	15.5	6.72	1.45%	Slime Tailings	0.057	113.1	0.87	0.35	0.52	1	1.49	8.357	116.16	9.87	9	1.71%	2.9	71%	1.46	0.00	1.46	0
15.420	5594.21	8.3	0.060	8.2	16.1	6.98	0.72%	Sand-Slime Tailings	0.059	119.0	0.88	0.36	0.52	1	1.48	12.153	168.92	14.29	14	0.81%	2.6	47%	1.47	0.00	1.47	0
15.584	5594.05	8.5	0.058	8.4	8.8	3.83	0.68%	Sand-Slime Tailings	0.059	119.0	0.89	0.36	0.53	1	1.47	12.348	171.63	14.44	14	0.76%	2.6	47%	1.48	0.00	1.48	0
15.748	5593.88	7.7	0.056	7.6	10.8	4.66	0.73%	Sand-Slime Tailings	0.059	119.0	0.90	0.37	0.53	1	1.46	11.084	154.06	12.99	13	0.83%	2.6	47%	1.49	0.00	1.49	0
15.912	5593.72	8.0	0.059	7.9	13.9	6.00	0.74%	Sand-Slime Tailings	0.059	119.0	0.91	0.37	0.54	1	1.45	11.457	159.25	13.45	13	0.83%	2.6	47%	1.50	0.00	1.50	0
16.076	5593.55	8.8	0.072	8.7	17.5	7.57	0.82%	Sand-Slime Tailings	0.059	119.0	0.92	0.38	0.54	1	1.44	12.487	173.57	14.68	15	0.91%	2.6	47%	1.51	0.00	1.51	0
16.240	5593.39	9.7	0.120	9.5	20.4	8.83	1.24%	Sand-Slime Tailings	0.059	119.0	0.93	0.38	0.55	1	1.43	13.603	189.08	16.01	16	1.37%	2.6	47%	1.52	0.00	1.52	0
16.404	5593.23	8.3	0.200	8.1	21.3	9.25	2.42%	Slime Tailings	0.057	113.1	0.94	0.39	0.55	1	1.42	11.536	160.35	13.62	13	2.73%	2.9	71%	1.53	0.00	1.53	0
16.568	5593.06	7.0	0.183	6.9	21.4	9.27	2.60%	Slime Tailings	0.057	113.1	0.95	0.39	0.55	1	1.41	9.747	135.49	11.54	11	3.00%	3.0	71%	1.54	0.00	1.54	0
16.732	5592.90	6.2	0.154	6.1	20.6	8.92	2.48%	Slime Tailings	0.057	113.1	0.95	0.40	0.56	1	1.40	8.540	118.71	10.13	9	2.93%	3.0	71%	1.55	0.00	1.55	0
16.896	5592.73	6.9	0.091	6.7	28.8	12.50	1.32%	Slime Tailings	0.057	113.1	0.96	0.40	0.56	1	1.39	9.383	130.43	11.19	11	1.53%	2.8	71%	1.56	0.00	1.56	0
17.060	5592.57	9.6	0.063	9.5	22.1	9.56	0.66%	Sand-Slime Tailings	0.059	119.0	0.97	0.41	0.57	1	1.39	13.119	182.36	15.46	15	0.73%	2.5	47%	1.57	0.00	1.57	0
17.224	5592.41	11.3	0.052	11.2	22.1	9.56	0.46%	Sand-Slime Tailings	0.059	119.0	0.98	0.41	0.57	1	1.38	15.417	214.30	18.13	18	0.50%	2.4	47%	1.58	0.00	1.58	0
17.388	5592.24	12.6	0.071	12.4	21.2	9.17	0.57%	Sand-Slime Tailings	0.059	119.0	0.99	0.42	0.58	1	1.37	16.989	236.15	19.94	20	0.61%	2.4	47%	1.59	0.00	1.59	0
17.552	5592.08	13.7	0.092	13.6	19.3	8.35	0.67%	Sand-Slime Tailings	0.059	119.0	1.00	0.42	0.58	1	1.36	18.404	255.82	21.57	22	0.73%	2.4	47%	1.60	0.00	1.60	0
17.716	5591.91	13.7	0.124	13.6	19.8	8.56	0.91%	Sand-Slime Tailings	0.059	119.0	1.01	0.43	0.59	1	1.35	18.297	254.32	21.44	22	0.98%	2.5	47%	1.61	0.00	1.61	0
17.880	5591.75	11.4	0.157	11.3	19.8	8.58	1.38%	Sand-Slime Tailings	0.059	119.0	1.02	0.43	0.59	1	1.34	15.145	210.51	17.78	18	1.51%	2.6	47%	1.61	0.00	1.61	0
18.044	5591.59	10.6	0.162	10.5	21.3	9.25	1.52%	Sand-Slime Tailings	0.059	119.0	1.03	0.44	0.60	1	1.33	14.025	194.94	16.50	16	1.69%	2.7	47%	1.62	0.00	1.62	0
18.208	5591.42	9.0	0.183	8.9	21.8	9.45	2.03%	Slime Tailings	0.057	113.1	1.04	0.44	0.60	1	1.33	11.759	163.45	13.87	13	2.30%	2.8	71%	1.63	0.00	1.63	0
18.372	5591.26	8.4	0.100	8.2	27.4	11.89	1.19%	Sand-Slime Tailings	0.059	119.0	1.05	0.45	0.60	1	1.32	10.844	150.73	12.86	12	1.36%	2.7	47%	1.64	0.00	1.64	0
18.537	5591.09	13.5	0.095	13.4	21.3	9.22	0.70%	Sand-Slime Tailings	0.059	119.0	1.06	0.45	0.61	1	1.31	17.559	244.07	20.60	20	0.76%	2.4	47%	1.65	0.00	1.65	0
18.701	5590.93	10.1	0.120	10.0	17.8	7.69	1.19%	Sand-Slime Tailings	0.059	119.0	1.07	0.46	0.61	1	1.30	12.971	180.29	15.23	15	1.33%	2.7	47%	1.66	0.00	1.66	0
18.865	5590.77	9.9	0.116	9.8	18.7	8.10	1.17%	Sand-Slime Tailings	0.059	119.0	1.08	0.46	0.62	1	1.30	12.648	175.81	14.87	14	1.32%	2.7	47%	1.67	0.00	1.67	0
19.029	5590.60	14.0	0.163	13.9	13.3	5.75	1.17%	Sand-Slime Tailings	0.059	119.0	1.09	0.47	0.62	1	1.29	17.870	248.39	20.88	21	1.27%	2.5	47%	1.68	0.00	1.68	0
19.193	5590.44	13.6	0.284	13.5	11.7	5.08	2.09%	Sand-Slime Tailings	0.059	119.0	1.10	0.47	0.63	1	1.28	17.279	240.18	20.18	20	2.28%	2.7	47%	1.69	0.00	1.69	0
19.357	5590.27	10.2	0.200	10.1	14.7	6.36	1.96%	Slime Tailings	0.057	113.1	1.11	0.48	0.63	1	1.27	12.883	179.08	15.10	14	2.20%	2.8	71%	1.70	0.00	1.70	0
19.521	5590.11	17.8	0.357	17.7	18.6	8.07	2.00%	Sand-Slime Tailings	0.059	119.0	1.12	0.48	0.64	1	1.25	22.210	308.72	25.96	26	2.14%	2.6	47%	1.71	0.00	1.71	0
19.685	5589.95	22.3	0.302	22.2	25.3	10.96	1.35%	Sand-Slime Tailings	0.059	119.0	1.13	0.49	0.64	1	1.24	27.383	380.62	32.03	33	1.43%	2.4	47%	1.72	0.00	1.72	0
19.849	5589.78	22.1	0.259	21.8	57.2	24.79	1.17%	Sand-Slime Tailings	0.059	119.0	1.14	0.49	0.65	1	1.23	26.790	372.39	31.63	33	1.23%	2.4	47%	1.73	0.00	1.73	0
20.013	5589.62	20.9	0.204	20.3	100.3	43.47	0.98%	Sand-Slime Tailings	0.059	119.0	1.15	0.50	0.65	1	1.23	24.850	345.41	29.75	30	1.03%	2.3	47%	1.74	0.00	1.74	0
20.177	5589.45	18.6	0.237	17.7	151.5	65.65	1.27%	Sand-Slime Tailings	0.059	119.0	1.16	0.50	0.65	1	1.23	21.715	301.84	26.57	27	1.36%	2.5	47%	1.75	0.00	1.75	0
20.341	5589.29	19.8	0.274	18.9	136.1	58.99	1.39%	Sand-Slime Tailings	0.059	119.0	1.17	0.51	0.66	1	1.22	23.028	320.09	27.95	28	1.47%	2.5	47%	1.76	0.00	1.76	0
20.505	5589.13	25.1	0.237	24.5	96.6	41.86	0.95%	Sand-Slime Tailings	0.059	119.0	1.18	0.51	0.66	1	1.20	29.354	408.02	34.93	36	0.99%	2.3	47%	1.77	0.00	1.77	0
20.669	5588.96	31.4	0.092	31.0	58.2	25.23	0.29%	Sand Tailings	0.062	123.5	1.19	0.52	0.67	1	1.18	36.693	510.03	43.12	45	0.30%	1.9	18%	1.78	0.00	1.78	0
20.833	5588.80	32.9	0.194	32.7	35.6	15.43	0.59%	Sand Tailings	0.062	123.5	1.20	0.52	0.67	1	1.17	38.397	533.72	44.90	47	0.61%	2.1	18%	1.79	0.00	1.79	0
20.997	5588.63	22.6	0.222	22.3	42.9	18.60	0.90%	Sand-Slime Tailings	0.059	119.0	1.21	0.53	0.68	1	1.19	26.475	368.01	31.12	31	0.95%	2.3	47%	1.80	0.00	1.80	0
21.161	5588.47	21.0	0.114	20.8	20.1	8.70	0.54%	Sand-Slime Tailings	0.059	119.0	1.22	0.53	0.68	1	1.18	24.679	343.04	28.84	29	0.58%	2.2	47%	1.81	0.00	1.81	0
21.325	5588.31	21.1	0.201	20.9	37.0	16.04	0.95%	Sand-Slime Tailings	0.059	119.0	1.23	0.54	0.69	1	1.18	24.625	342.29	28.92	29	1.01%	2.4	47%	1.82	0.00	1.82	0
21.489	5588.14	22.3	0.267	21.9	66.8	28.93	1.20%	Sand-Slime Tailings	0.059	119.0	1.24	0.54	0.69	1	1.17	25.657	356.63	30.37	30	1.27%	2.4	47%	1.83	0.00	1.83	0
21.653	5587.98	18.5	0.419	18.0	91.4	39.59	2.26%	Sand-Slime Tailings	0.059	119.0	1.25	0.55	0.70	1	1.17	21.059	292.72	25.24	25	2.42%	2.6	47%	1.84	0.00	1.84	0
21.817	5587.81	22.9	0.248	22.0	149.4	64.72	1.08%	Sand-Slime Tailings	0.059	119.0	1.26	0.55	0.70	1	1.16	25.478	354.15	30.85	31	1.15%	2.4	47%	1.85	0.00	1.85	0
21.981	5587.65	28.4	0.235	27.8	83.5	36.19	0.83%	Sand-Slime Tailings	0.059	119.0	1.27	0.56	0.71	1	1.15	31.904	443.46	37.75	38	0.87%	2.2	47%	1.86	0.00	1.86	0
22.145	5587.48	22.2	0.322	21.0	195.5	84.71	1.45%	Sand-Slime Tailings	0.059	119.0	1.28	0.57	0.71	1	1.15	24.097	334.94	29.62	29	1.54%	2.4	47%	1.87	0.00	1.87	0
22.309	5587.32	25.0	0.216	23.6	231.9	100.47	0.86%	Sand-Slime Tailings	0.059	119.0	1.29	0.57	0.72	1	1.14	26.878	373.60	33.13	33	0.91%	2.3	47%	1.88	0.00	1.88	0
22.473	5587.16	25.7	0.237	24.6	172.5	74.75	0.92%	Sand-Slime Tailings	0.059	119.0	1.30	0.58	0.72	1	1.13	27.896	387.75	33.82	34	0.97%	2.3	47%	1.89	0.00	1.89	0
22.638	5586.99	25.4	0.261	24.2	200.2	86.77	1.03%	Sand-Slime Tailings	0.059	119.0	1.31	0.58	0.72	1	1.13	27.284	379.24	33.33	33	1.08%	2.3	47%	1.90	0.00	1.90	0
22.802	5586.83	25.6	0.229	24.5	184.7	80.05	0.89%	Sand-Slime Tailings	0.059	119.0	1.32	0.59	0.73	1	1.12	27.506	382.34	33.45	33	0.94%	2.3	47%	1.91	0.00	1.91	0
22.966	5586.66	28.5	0.145	27.4	181.5	78.63	0.51%	Sand-Slime Tailings	0.059	119.0	1.33	0.59	0.73	1	1.12	30.592	425.22	37.00	37	0.53%	2.1	47%	1.92	0.00	1.92	0
23.130	5586.50	30.4	0.223	29.5	150.3	65.13	0.73%	Sand-Slime Tailings	0.059	119.0	1.33	0.60	0.74	1	1.11	32.742	455.12	39.24	39	0.77%	2.2	47%	1.93	0.00	1.93	0
23.294	5586.34	35.2	0.314	34.0	190.1	82.37	0.89%	Sand-Slime Tailings	0.059	119.0	1.34	0.60	0.74	1	1.10	37.465	520.76	45.03	46	0.93%	2.2	47%	1.94	0.00	1.94	0
23.458	5586.17	38.3	0.271	37.3	170.9	74.04	0.71%	Sand Tailings	0.062	123.5	1.35	0.61	0.75	1	1.09	40.792	567.01	48.73	49	0.73%	2.1	18%	1.95	0.00	1.95	0
23.622	5586.01	38.4	0.271	37.3	171.7	74.40	0.71%	Sand Tailings	0.062	123.5	1.36	0.61	0.75	1	1.09	40.621	564.64	48.54	49	0.73%	2.1	18%	1.96	0.00	1.96	0
23.786	5585.84	41.4	0.271	40.3	174.7	75.68	0.66%	Sand Tailings	0.062	123.5	1.37	0.62	0.76	1	1.08	43.621	606.34	52.04	53	0.68%	2.0	18%	1.97	0.00	1.97	0

Liquefaction Triggering Analyses

Depth (ft)	I&B (2008) CSR: r_d	C_σ	K_σ	K_α	CSR M=7.5, s'v=1atm	CRR: Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Youd et al. (2001) CSR: r_d	D_r	f	K_σ	K_α	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No
12.139	0.94	0.05	0.98	1.0	0.053	37.56	58.25	0.086	1.62	0.95	0.26	0.80	1.15	1.0	0.036	1.95	40.29	0.084	3.98	2.80	2
12.303	0.94	0.05	0.98	1.0	0.053	37.42	57.70	0.085	1.61	0.95	0.26	0.80	1.14	1.0	0.036	2.34	47.56	0.090	4.23	2.92	2
12.467	0.93	0.05	0.98	1.0	0.053	34.64	47.71	0.075	1.42	0.95	0.21	0.80	1.14	1.0	0.036	3.85	50.30	0.092	4.29	2.86	2
12.631	0.93	0.05	0.98	1.0	0.053	35.90	51.88	0.079	1.50	0.95	0.23	0.80	1.14	1.0	0.037	2.35	37.50	0.081	3.76	2.63	2
12.795	0.93	0.05	0.98	1.0	0.053	36.59	54.53	0.082	1.56	0.94	0.24	0.80	1.14	1.0	0.037	2.04	36.66	0.081	3.69	2.62	2
12.959	0.93	0.05	0.98	1.0	0.053	36.58	54.49	0.082	1.56	0.94	0.24	0.80	1.14	1.0	0.037	2.08	37.23	0.081	3.68	2.62	2
13.123	0.93	0.05	0.98	1.0	0.053	36.62	54.63	0.082	1.56	0.94	0.25	0.80	1.13	1.0	0.037	2.20	39.68	0.083	3.73	2.65	2
13.287	0.93	0.05	0.98	1.0	0.052	36.33	53.51	0.081	1.54	0.94	0.24	0.80	1.13	1.0	0.037	2.49	42.76	0.086	3.81	2.68	2
13.451	0.93	0.05	0.98	1.0	0.052	36.32	53.50	0.081	1.55	0.94	0.24	0.80	1.13	1.0	0.037	2.69	46.27	0.089	3.90	2.72	2
13.615	0.93	0.05	0.98	1.0	0.052	36.36	53.64	0.081	1.55	0.94	0.24	0.80	1.13	1.0	0.037	2.84	49.02	0.091	3.97	2.76	2
13.779	0.92	0.05	0.98	1.0	0.052	37.51	58.07	0.086	1.65	0.94	0.26	0.80	1.12	1.0	0.037	2.20	45.17	0.088	3.79	2.72	2
13.943	0.92	0.06	0.97	1.0	0.052	39.37	65.22	0.094	1.81	0.94	0.29	0.80	1.12	1.0	0.037	1.81	46.71	0.089	3.81	2.81	2
14.107	0.92	0.05	0.97	1.0	0.052	37.56	58.26	0.086	1.65	0.94	0.26	0.80	1.12	1.0	0.037	2.64	54.59	0.095	4.04	2.85	2
14.271	0.92	0.05	0.98	1.0	0.052	35.14	49.64	0.077	1.48	0.94	0.22	0.80	1.12	1.0	0.037	4.03	58.43	0.099	4.15	2.82	2
14.436	0.92	0.05	0.98	1.0	0.052	34.68	47.17	0.075	1.44	0.94	0.20	0.80	1.12	1.0	0.037	3.54	44.20	0.087	3.62	2.53	2
14.600	0.92	0.05	0.98	1.0	0.052	34.25	45.52	0.073	1.41	0.94	0.19	0.80	1.11	1.0	0.037	3.48	39.19	0.083	3.42	2.42	2
14.764	0.92	0.04	0.98	1.0	0.052	33.37	42.80	0.071	1.37	0.94	0.18	0.80	1.11	1.0	0.037	5.37	50.59	0.092	3.78	2.57	2
14.928	0.92	0.04	0.98	1.0	0.052	32.99	41.33	0.070	1.35	0.94	0.17	0.80	1.11	1.0	0.037	7.58	63.21	0.103	4.22	2.78	2
15.092	0.91	0.04	0.98	1.0	0.052	33.02	41.44	0.070	1.35	0.94	0.17	0.80	1.11	1.0	0.037	7.94	66.87	0.108	4.36	2.85	2
15.256	0.91	0.05	0.98	1.0	0.052	33.53	43.40	0.071	1.39	0.94	0.18	0.80	1.11	1.0	0.037	5.61	55.39	0.096	3.84	2.62	2
15.420	0.91	0.05	0.97	1.0	0.051	35.31	49.60	0.077	1.50	0.94	0.22	0.80	1.10	1.0	0.037	3.18	45.42	0.088	3.49	2.50	2
15.584	0.91	0.05	0.97	1.0	0.051	35.36	49.80	0.077	1.51	0.94	0.22	0.80	1.10	1.0	0.038	3.10	44.78	0.087	3.44	2.48	2
15.748	0.91	0.05	0.97	1.0	0.051	34.86	47.84	0.075	1.47	0.94	0.21	0.80	1.10	1.0	0.038	3.48	45.16	0.088	3.43	2.45	2
15.912	0.91	0.05	0.97	1.0	0.051	35.02	48.47	0.076	1.49	0.94	0.21	0.80	1.10	1.0	0.038	3.39	45.63	0.088	3.41	2.45	2
16.076	0.91	0.05	0.97	1.0	0.051	35.45	50.14	0.078	1.52	0.94	0.22	0.80	1.10	1.0	0.038	3.28	48.10	0.090	3.47	2.49	2
16.240	0.91	0.05	0.97	1.0	0.051	35.92	51.93	0.079	1.56	0.94	0.23	0.80	1.10	1.0	0.038	3.59	57.55	0.098	3.73	2.64	2
16.404	0.90	0.05	0.97	1.0	0.051	34.83	48.45	0.076	1.49	0.94	0.21	0.80	1.09	1.0	0.038	5.42	73.86	0.117	4.45	2.97	2
16.568	0.90	0.05	0.97	1.0	0.051	34.11	45.65	0.073	1.45	0.94	0.20	0.80	1.09	1.0	0.038	6.34	73.18	0.116	4.38	2.91	2
16.732	0.90	0.05	0.97	1.0	0.051	33.61	43.74	0.072	1.41	0.94	0.18	0.80	1.09	1.0	0.038	6.88	69.68	0.111	4.16	2.79	2
16.896	0.90	0.05	0.97	1.0	0.051	33.98	45.17	0.073	1.44	0.94	0.19	0.80	1.09	1.0	0.038	4.96	55.55	0.096	3.56	2.50	2
17.060	0.90	0.05	0.97	1.0	0.050	35.72	51.18	0.079	1.56	0.93	0.23	0.80	1.09	1.0	0.038	2.93	45.31	0.088	3.23	2.39	2
17.224	0.90	0.05	0.97	1.0	0.050	36.66	54.79	0.082	1.63	0.93	0.25	0.80	1.09	1.0	0.038	2.30	41.65	0.085	3.09	2.36	2
17.388	0.90	0.05	0.97	1.0	0.050	37.30	57.24	0.085	1.69	0.93	0.26	0.80	1.08	1.0	0.038	2.28	45.39	0.088	3.18	2.44	2
17.552	0.90	0.05	0.97	1.0	0.050	37.86	59.43	0.087	1.74	0.93	0.27	0.80	1.08	1.0	0.038	2.27	48.98	0.091	3.27	2.50	2
17.716	0.89	0.05	0.97	1.0	0.050	37.82	59.27	0.087	1.74	0.93	0.27	0.80	1.08	1.0	0.038	2.55	54.65	0.095	3.40	2.57	2
17.880	0.89	0.05	0.97	1.0	0.050	36.54	54.32	0.082	1.64	0.93	0.24	0.80	1.08	1.0	0.038	3.51	62.37	0.103	3.63	2.64	2
18.044	0.89	0.05	0.97	1.0	0.050	36.09	52.58	0.080	1.60	0.93	0.23	0.80	1.08	1.0	0.038	3.89	64.15	0.105	3.68	2.64	2
18.208	0.89	0.05	0.97	1.0	0.050	34.92	48.78	0.076	1.53	0.93	0.21	0.80	1.08	1.0	0.038	5.05	70.01	0.112	3.91	2.72	2
18.372	0.89	0.05	0.97	1.0	0.050	34.81	47.67	0.075	1.51	0.93	0.21	0.80	1.07	1.0	0.038	4.32	55.55	0.096	3.33	2.42	2
18.537	0.89	0.05	0.97	1.0	0.050	37.52	58.12	0.086	1.73	0.93	0.26	0.80	1.07	1.0	0.038	2.41	49.69	0.091	3.15	2.44	2
18.701	0.89	0.05	0.97	1.0	0.050	35.64	50.88	0.078	1.58	0.93	0.23	0.80	1.07	1.0	0.038	3.77	57.42	0.098	3.34	2.46	2
18.865	0.89	0.05	0.97	1.0	0.050	35.52	50.38	0.078	1.57	0.93	0.22	0.80	1.07	1.0	0.038	3.83	56.90	0.097	3.30	2.44	2
19.029	0.88	0.05	0.96	1.0	0.049	37.62	58.50	0.086	1.75	0.93	0.26	0.80	1.07	1.0	0.038	2.92	60.91	0.101	3.41	2.58	2
19.193	0.88	0.05	0.96	1.0	0.049	37.38	57.56	0.085	1.73	0.93	0.26	0.80	1.07	1.0	0.038	3.88	78.37	0.125	4.18	2.96	2
19.357	0.88	0.05	0.97	1.0	0.049	35.35	50.44	0.078	1.58	0.93	0.22	0.80	1.06	1.0	0.038	4.70	70.98	0.113	3.77	2.68	2
19.521	0.88	0.06	0.96	1.0	0.049	39.41	65.37	0.094	1.92	0.93	0.29	0.80	1.06	1.0	0.038	3.15	81.85	0.131	4.34	3.13	2
19.685	0.88	0.06	0.96	1.0	0.049	41.53	73.56	0.104	2.14	0.93	0.33	0.80	1.06	1.0	0.038	2.26	72.25	0.115	3.79	2.96	2
19.849	0.88	0.06	0.96	1.0	0.049	41.39	73.02	0.103	2.12	0.92	0.32	0.80	1.06	1.0	0.038	2.14	67.74	0.109	3.57	2.85	2
20.013	0.88	0.06	0.96	1.0	0.049	40.74	70.49	0.100	2.06	0.92	0.31	0.80	1.06	1.0	0.038	2.08	62.00	0.102	3.33	2.69	2
20.177	0.87	0.06	0.96	1.0	0.049	39.62	66.19	0.095	1.96	0.92	0.30	0.80	1.06	1.0	0.038	2.53	67.18	0.108	3.50	2.73	2
20.341	0.87	0.06	0.96	1.0	0.048	40.10	68.05	0.097	2.01	0.92	0.31	0.80	1.05	1.0	0.038	2.53	70.78	0.113	3.64	2.82	2
20.505	0.87	0.06	0.96	1.0	0.048	42.55	77.49	0.109	2.27	0.92	0.34	0.80	1.05	1.0	0.038	1.85	64.63	0.105	3.36	2.82	2
20.669	0.87	0.07	0.95	1.0	0.048	31.11	76.23	0.108	2.25	0.92	0.38	0.80	1.05	1.0	0.038	1.24	53.32	0.094	2.99	2.62	2
20.833	0.87	0.07	0.95	1.0	0.048	33.57	78.47	0.111	2.31	0.92	0.39	0.80	1.05	1.0	0.038	1.39	62.28	0.102	3.24	2.78	2
20.997	0.87	0.06	0.96	1.0	0.048	41.22	72.33	0.103	2.14	0.91	0.32	0.80	1.05	1.0	0.038	1.97	61.27	0.101	3.19	2.66	2
21.161	0.87	0.06	0.96	1.0	0.048	40.41	69.25	0.099	2.06	0.91	0.31	0.80	1.05	1.0	0.038	1.76	50.76	0.092	2.88	2.47	2
21.325	0.87	0.06	0.96	1.0	0.048	40.44	69.36	0.099	2.06	0.91	0.31	0.80	1.05	1.0	0.038	2.13	61.57	0.102	3.17	2.62	2
21.489	0.86	0.06	0.96	1.0	0.048	40.95	71.32	0.101	2.12	0.91	0.32	0.80	1.04	1.0	0.038	2.26	68.55	0.110	3.40	2.76	2
21.653	0.86	0.06	0.96	1.0	0.048	39.15	64.39	0.093	1.94	0.91	0.29	0.80	1.04	1.0	0.038	3.47	87.68	0.143	4.39	3.17	2
21.817	0.86	0.06	0.95	1.0	0.048	41.12	71.97	0.102	2.15	0.91	0.32	0.80	1.04	1.0	0.038	2.15	66.25	0.107	3.28	2.71	2
21.981	0.86	0.06	0.95	1.0	0.047	43.54	81.29	0.114	2.42	0.91	0.35	0.80	1.04	1.0	0.038	1.70	64.18	0.105	3.19	2.80	2
22.145	0.86	0.06	0.95	1.0	0.047	40.69	70.30	0.100	2.11	0.91	0.31	0.80	1.04	1.0	0.038	2.51	74.48	0.118	3.59	2.85	2
22.309	0.86	0.06	0.95	1.0	0.047	41.92	75.06	0.106	2.25	0.90	0.33	0.80	1.04	1.0	0.038	1.88	62.32	0.103	3.09	2.67	2
22.473	0.86	0.06	0.95	1.0	0.047	42.16	75.98	0.107	2.28	0.90	0.34	0.80	1.04	1.0	0.038	1.90	64.40	0.105	3.15	2.71	2
22.638	0.85	0.06	0.95	1.0	0.047	41.99	75.32	0.106	2.26	0.90	0.33	0.80	1.03	1.0	0.038	2.01	66.86	0.108	3.22	2.74	2
22.802	0.85	0.06	0.95	1.0	0.047	42.03	75.49	0.107	2.27	0.90	0.33	0.80	1.03	1.0	0.038	1.90	63.56	0.104	3.09	2.68	2
22.966	0.85	0.06	0.95	1.0	0.047	43.28	80.28	0.113	2.42	0.90	0.35	0.80	1.03	1.0	0.038	1.50	55.48	0.096	2.84	2.63	2
23.130	0.85	0.06	0.95	1.0	0.047	44.06	83.30	0.117	2.51	0.90	0.36	0.80	1.03	1.0	0.038	1.61	63.15	0.103	3.05	2.78	2
23.294	0.85	0.07	0.94	1.0	0.046	46.09	91.13	0.129	2.77	0.90	0.39	0.80	1.03	1.0	0.038	1.59	71.48	0.114	3.34	3.06	2
23.458	0.85	0.07	0.94	1.0	0.046	34.55	83.28	0.117	2.54	0.89	0.40	0.80	1.03	1.0	0.038	1.42	69.29	0.111	3.23	2.88	2
23.622	0.85	0.07	0.94	1.0	0.046	34.50	83.03	0.117	2.53	0.89	0.40	0.80	1.03	1.0	0.038	1.43	69.22	0.111	3.22	2.87	2
23.786	0.85	0.07	0.94	1.0	0.046	35.39	87.43	0.123	2.68	0.89	0.42	0.79	1.03	1.0	0.038	1.36	70.53	0.113	3.25	2.96	2

Idriss & Boulanger (2008)

Depth (ft)	CN	qc1 TSF	qc1 MPa	qc1N
12.139	1.7	17.813	1.7054	20.688
12.303	1.697117	17.466	1.6722	20.285
12.467	1.684611	11.253	1.0774	13.070
12.631	1.670909	13.756	1.317	15.977
12.795	1.657459	15.442	1.4785	17.935
12.959	1.644253	15.418	1.4761	17.907
13.123	1.631284	15.511	1.485	18.015
13.287	1.618546	14.796	1.4166	17.185
13.451	1.606033	14.785	1.4155	17.172
13.615	1.593738	14.88	1.4246	17.282
13.779	1.581655	17.698	1.6944	20.555
13.943	1.54164	22.256	2.1308	25.849
14.107	1.558105	17.82	1.7061	20.696
14.271	1.547803	12.485	1.1953	14.500
14.436	1.536496	10.756	1.0298	12.492
14.600	1.525376	9.703	0.929	11.269
14.764	1.515559	8.116	0.777	9.426
14.928	1.505884	7.1776	0.6872	8.336
15.092	1.49635	7.25	0.6941	8.420
15.256	1.486952	8.5006	0.8139	9.873
15.420	1.476628	12.301	1.1777	14.287
15.584	1.466466	12.429	1.1899	14.435
15.748	1.456463	11.182	1.0705	12.987
15.912	1.446613	11.582	1.1089	13.452
16.076	1.436914	12.643	1.2105	14.685
16.240	1.427362	13.784	1.3197	16.010
16.404	1.418919	11.725	1.1225	13.618
16.568	1.410589	9.9355	0.9512	11.540
16.732	1.40237	8.7206	0.8349	10.128
16.896	1.394258	9.6344	0.9224	11.190
17.060	1.385338	13.31	1.2743	15.459
17.224	1.376546	15.607	1.4942	18.127
17.388	1.367881	17.17	1.6438	19.942
17.552	1.357251	18.568	1.7777	21.565
17.716	1.349318	18.463	1.7677	21.444
17.880	1.342614	15.311	1.4658	17.782
18.044	1.334426	14.203	1.3598	16.495
18.208	1.32718	11.939	1.1431	13.867
18.372	1.319204	11.07	1.0598	12.857
18.537	1.311337	17.733	1.6978	20.596
18.701	1.303575	13.115	1.2556	15.232
18.865	1.295918	12.799	1.2254	14.866
19.029	1.288362	17.976	1.7211	20.878
19.193	1.280906	17.373	1.6633	20.178
19.357	1.274303	13	1.2446	15.099
19.521	1.254795	22.356	2.1403	25.965
19.685	1.235675	27.578	2.6403	32.030
19.849	1.230044	27.23	2.607	31.626
20.013	1.227142	25.618	2.4527	29.754
20.177	1.226825	22.875	2.1901	26.568
20.341	1.217786	24.063	2.3038	27.948
20.505	1.200092	30.078	2.8797	34.934
20.669	1.182877	37.123	3.5541	43.116
20.833	1.174936	38.658	3.7011	44.899
20.997	1.187235	26.793	2.5652	31.119
21.161	1.18478	24.827	2.377	28.836
21.325	1.178797	24.897	2.3837	28.917
21.489	1.170998	26.145	2.5031	30.365
21.653	1.172557	21.728	2.0802	25.236
21.817	1.159148	26.559	2.5427	30.847
21.981	1.145975	32.501	3.1117	37.748
22.145	1.149648	25.5	2.4413	29.616
22.309	1.140343	28.528	2.7313	33.134
22.473	1.134432	29.117	2.7877	33.818
22.638	1.129763	28.696	2.7474	33.329
22.802	1.124545	28.803	2.7576	33.453
22.966	1.116484	31.856	3.0499	36.999
23.130	1.109913	33.784	3.2345	39.238
23.294	1.101255	38.772	3.712	45.031
23.458	1.094205	41.959	4.0172	48.733
23.622	1.089628	41.789	4.0009	48.536
23.786	1.083221	44.802	4.2894	52.035

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-4N

Data File: 13-52106_SP3-4N-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Legend:
- Tailings Sands
- Tailings Sand-Slimes
- Tailings Slimes
- Interim Cover
- Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

5606.00	Water surface elevation during CPT investigation (ft
5600.42	Water surface elevation at t_0 (ft amsl)
5583.71	Water surface elevation at t_1 (ft amsl)
5578.71	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ratio, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Ear
7.51	Equiv. Number of Uniform Strain Cycles, N

5608.70	Ground Surface Elevation at time of CPT (ft amsl)
5623.35	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pl
3.50	Thickness of Water Storage/Rooting Zone (ft)
3.50	Thickness of High Compaction Layer (ft)
7.15	Thickness of Random/Platform Fill on top of existing interim cover (ft)
1565.99	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5578.71	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom (tsf)	Stress at Midpoint (tsf)
Erosion Protection Layer	######	5623.1	5622.85	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	######	5621.1	5619.35	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5617.6	5615.85	3.50	0.060	120	0.424	0.320	0.00	0.00	0.424	0.320
Platform/Random Fill Layer	######	5612.28	5608.70	7.15	0.050	101	0.784	0.604	0.00	0.00	0.784	0.604

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of CPT (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F, (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
0.164	5608.54	29.3	0.127	29.3	1.0	0.44	0.43%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0	1.70	49.810	692.36	57.86	3546	0.43%	0.9	51%	0.79	0.00	0.79	0
0.328	5608.37	57.0	0.266	57.0	1.3	0.55	0.47%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	96.951	1347.62	112.62	3451	0.47%	0.9	51%	0.80	0.00	0.80	0
0.492	5608.21	65.8	0.294	65.8	3.7	1.58	0.45%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	111.894	1555.33	130.00	2656	0.45%	0.9	51%	0.81	0.00	0.81	0
0.656	5608.04	65.5	0.343	65.4	1.6	0.71	0.52%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0	1.70	111.248	1546.35	129.23	1980	0.52%	1.0	51%	0.82	0.00	0.82	0
0.820	5607.88	64.9	0.350	64.9	2.1	0.89	0.54%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0	1.70	110.279	1532.88	128.11	1570	0.54%	1.0	51%	0.82	0.00	0.82	0
0.984	5607.72	63.6	0.317	63.6	-0.1	-0.04	0.50%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0	1.70	108.103	1502.63	125.55	1282	0.50%	1.0	51%	0.83	0.00	0.83	0
1.148	5607.55	65.1	0.361	65.1	0.3	0.12	0.55%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0	1.70	110.704	1538.79	128.58	1125	0.55%	1.1	51%	0.84	0.00	0.84	0
1.312	5607.39	54.3	0.552	54.3	0.6	0.24	1.02%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	92.293	1282.87	107.20	820	1.02%	1.3	51%	0.85	0.00	0.85	0
1.476	5607.22	52.5	0.448	52.5	1.4	0.61	0.85%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	89.250	1240.58	103.68	705	0.85%	1.3	51%	0.86	0.00	0.86	0
1.640	5607.06	62.6	0.320	62.6	0.2	0.10	0.51%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0	1.70	106.369	1478.53	123.54	756	0.51%	1.1	51%	0.87	0.00	0.87	0
1.804	5606.90	50.3	0.452	50.3	0.5	0.20	0.90%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0	1.70	85.459	1187.88	99.26	552	0.90%	1.4	51%	0.87	0.00	0.87	0
1.968	5606.73	47.8	0.549	47.8	1.6	0.68	1.15%	Interim Cover	0.050	100.7	0.10	0.00	0.10	0	1.70	81.243	1129.28	94.38	481	1.15%	1.5	51%	0.88	0.00	0.88	0
2.133	5606.57	63.2	0.574	63.2	4.1	1.77	0.91%	Interim Cover	0.050	100.7	0.11	0.00	0.11	0	1.70	107.355	1492.23	124.74	587	0.91%	1.4	51%	0.89	0.00	0.89	0
2.297	5606.40	106.2	0.582	106.2	6.9	2.99	0.55%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	180.489	2508.80	209.71	917	0.55%	1.1	51%	0.90	0.00	0.90	0
2.461	5606.24	97.4	0.552	97.4	1.7	0.72	0.57%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	165.546	2301.09	192.29	785	0.57%	1.1	51%	0.91	0.00	0.91	0
2.625	5606.08	86.1	0.510	86.1	0.3	0.11	0.59%	Interim Cover	0.050	100.7	0.13	0.00	0.13	0	1.70	146.370	2034.54	170.00	650	0.59%	1.2	51%	0.92	0.00	0.92	0
2.789	5605.91	76.9	0.485	76.9	0.2	0.09	0.63%	Interim Cover	0.050	100.7	0.14	0.00	0.14	1	1.70	130.764	1817.62	151.88	558	0.63%	1.3	51%	0.92	0.00	0.92	0
2.953	5605.75	71.5	0.471	71.5	0.3	0.11	0.66%	Interim Cover	0.050	100.7	0.15	0.01	0.14	1	1.70	121.567	1689.78	141.21	507	0.66%	1.3	51%	0.93	0.00	0.93	0
3.117	5605.58	59.8	0.416	59.8	-0.4	-0.18	0.70%	Interim Cover	0.050	100.7	0.16	0.01	0.14	1	1.70	101.728	1414.02	118.15	415	0.70%	1.4	51%	0.94	0.00	0.94	0
3.281	5605.42	51.6	0.323	51.6	-0.5	-0.22	0.63%	Sand Tailings	0.062	123.5	0.17	0.02	0.15	1	1.70	87.652	1218.36	101.80	345	0.63%	1.4	18%	0.95	0.00	0.95	0
3.445	5605.26	44.7	0.266	44.7	-0.6	-0.26	0.60%	Sand Tailings	0.062	123.5	0.18	0.02	0.15	1	1.70	75.956	1055.79	88.21	289	0.60%	1.4	18%	0.96	0.00	0.96	0
3.609	5605.09	39.4	0.205	39.4	-0.5	-0.22	0.52%	Sand Tailings	0.062	123.5	0.19	0.03	0.16	1	1.70	66.963	930.79	77.77	247	0.52%	1.4	18%	0.97	0.00	0.97	0
3.773	5604.93	37.6	0.191	37.6	-0.5	-0.22	0.51%	Sand Tailings	0.062	123.5	0.20	0.03	0.16	1	1.70	63.937	888.72	74.25	228	0.51%	1.4	18%	0.98	0.00	0.98	0
3.937	5604.76	39.1	0.168	39.1	1.0	0.43	0.43%	Sand Tailings	0.062	123.5	0.21	0.04	0.17	1	1.70	66.538	924.88	77.29	230	0.43%	1.4	18%	0.99	0.00	0.99	0
4.101	5604.60	40.3	0.180	40.4	-0.4	-0.16	0.45%	Sand Tailings	0.062	123.5	0.22	0.04	0.17	1	1.70	68.595	953.47	79.66	231	0.45%	1.4	18%	1.00	0.00	1.00	0
4.265	5604.43	39.7	0.206	39.7	0.2	0.07	0.52%	Sand Tailings	0.062	123.5	0.23	0.05	0.18	1	1.70	67.507	938.35	78.41	221	0.52%	1.5	18%	1.01	0.00	1.01	0
4.429	5604.27	38.6	0.225	38.6	0.9	0.39	0.58%	Sand Tailings	0.062	123.5	0.24	0.05	0.18	1	1.70	65.552	911.17	76.15	208	0.59%	1.5	18%	1.02	0.00	1.02	0
4.593	5604.11	38.4	0.229	38.4	1.2	0.52	0.60%	Sand Tailings	0.062	123.5	0.25	0.06	0.19	1	1.70	65.348	908.34	75.91	202	0.60%	1.5	18%	1.03	0.00	1.03	0
4.757	5603.94	38.8	0.235	38.8	1.1	0.48	0.61%	Sand Tailings	0.062	123.5	0.26	0.06	0.19	1	1.70	65.994	917.32	76.66	199	0.61%	1.5	18%	1.04	0.00	1.04	0
4.921	5603.78	37.7	0.214	37.7	1.2	0.54	0.57%	Sand Tailings	0.062	123.5	0.27	0.07	0.20	1	1.70	64.039	890.14	74.39	188	0.57%	1.5	18%	1.05	0.00	1.05	0
5.085	5603.61	35.6	0.246	35.6	1.2	0.52	0.69%	Sand Tailings	0.062	123.5	0.28	0.07	0.20	1	1.70	60.554	841.70	70.34	173	0.70%	1.6	18%	1.06	0.00	1.06	0
5.249	5603.45	30.5	0.236	30.5	0.3	0.13	0.77%	Sand-Slime Tailing	0.059	119.0	0.29	0.08	0.21	1	1.70	51.850	720.72	60.22	145	0.78%	1.7	47%	1.07	0.00	1.07	0
5.413	5603.29	27.1	0.216	27.1	1.1	0.48	0.80%	Sand-Slime Tailing	0.059	119.0	0.30	0.08	0.21	1	1.70	46.121	641.08	53.58	126	0.80%	1.8	47%	1.08	0.00	1.08	0
5.577	5603.12	26.7	0.176	26.7	1.6	0.68	0.66%	Sand-Slime Tailing	0.059	119.0	0.31	0.09	0.22	1	1.70	45.356	630.45	52.70	121	0.67%	1.7	47%	1.09	0.00	1.09	0
5.741	5602.96	25.2	0.169	25.2	1.8	0.76	0.67%	Sand-Slime Tailing	0.059	119.0	0.32	0.09	0.22	1	1.70	42.857	595.71	49.80	112	0.68%	1.8	47%	1.10	0.00	1.10	0
5.905	5602.79	22.4	0.156	22.3	1.8	0.78	0.70%	Sand-Slime Tailing	0.059	119.0	0.33	0.10	0.23	1	1.70	37.978	527.89	44.13	97	0.71%	1.8	47%	1.11	0.00	1.11	0
6.069	5602.63	20.9	0.135	20.9	2.6	1.11	0.64%	Sand-Slime Tailing	0.059	119.0	0.34	0.11	0.23	1	1.70	35.581	494.58	41.36	89	0.66%	1.8	47%	1.12	0.00	1.12	0
6.234	5602.47	20.2	0.127	20.2	2.1	0.93	0.63%	Sand-Slime Tailing	0.059	119.0	0.35	0.11	0.24	1	1.70	34.289	476.62	39.85	84	0.64%	1.9	47%	1.13	0.00	1.13	0
6.398	5602.30	20.6	0.117	20.6	2.6	1.13	0.57%	Sand-Slime Tailing	0.059	119.0	0.36	0.12	0.24	1	1.70	34.935	485.60	40.61	84	0.58%	1.8	47%	1.14	0.00	1.14	0
6.562	5602.14	22.3	0.113	22.3	2.7	1.16	0.51%	Sand-Slime Tailing	0.059	119.0	0.37	0.12	0.25	1	1.70	37.859	526.24	44.00	89	0.52%	1.8	47%	1.15	0.00	1.15	0
6.726	5601.97	22.1	0.120	22.1	2.6	1.14	0.54%	Sand-Slime Tailing	0.059	119.0	0.38	0.13	0.25	1	1.70	37.621	522.93	43.73	87	0.55%	1.8	47%	1.16	0.00	1.16	0
6.890	5601.81	21.1	0.125	21.1	3.5	1.52	0.59%	Sand-Slime Tailing	0.059	119.0	0.39	0.13	0.26	1	1.70	35.785	497.41	41.61	81	0.60%	1.9	47%	1.17	0.00	1.17	0
7.054	5601.65	19.4	0.130	19.3	4.1	1.77	0.67%	Sand-Slime Tailing	0.059	119.0	0.40	0.14	0.26	1	1.70	32.861	456.77	38.22	73	0.69%	1.9	47%	1.18	0.00	1.18	0
7.218	5601.48	18.3	0.128	18.3	4.2	1.81	0.70%	Sand-Slime Tailing	0.059	119.0	0.41	0.14	0.26	1	1.70	31.025	431.25	36.09	68	0.72%	2.0	47%	1.19	0.00	1.19	0
7.382	5601.32	17.3	0.127	17.3	4.7	2.05	0.73%	Sand-Slime Tailing	0.059	119.0	0.42	0.15	0.27	1	1.70	29.393	408.56	34.20	63	0.75%	2.0	47%	1.20	0.00	1.20	0
7.546	5601.15	16.0	0.118	16.0	4.7	2.05	0.74%	Sand-Slime Tailing	0.059	119.0	0.42	0.15	0.27	1	1.70	27.234	378.55	31.69	57	0.76%	2.0	47%	1.21	0.00	1.21	0
7.710	5600.99	15.9	0.100	15.8	4.8	2.10	0.63%	Sand-Slime Tailing	0.059	119.0	0.43	0.16	0.28	1	1.70	26.894	373.83	31.30	55	0.65%	2.0	47%	1.22	0.00	1.22	0
7.874	5600.83	14.1	0.079	14.0	5.5	2.40	0.56%	Sand-Slime Tailing	0.059	119.0	0.44	0.16	0.28	1	1.70	23.868	331.77	27.79	48	0.58%	2.0	47%	1.23	0.00	1.23	0
8.038	5600.66	12.3	0.079	12.3	7.0	3.05	0.64%	Sand-Slime Tailing	0.059	119.0	0.45	0.17	0.29	1	1.70	20.842	289.70	24.29	41	0.67%	2.1	47%	1.24	0.00	1.24	0
8.202	5600.50	10.1	0.079	10.1	7.8	3.40	0.78%	Sand-Slime Tailing	0.059	119.0	0.46	0.17	0.29	1	1.70	17.153	238.43	20.02	33	0.82%	2.3	47%	1.25	0.00	1.25	0
8.366	5600.33	10.5	0.074	10.5	7.9	3.42	0.70%	Sand-Slime Tailing	0.059	119.0	0.47	0.18	0.30	1	1.70	17.782	247.17	20.75	34	0.74%	2.2	47%	1.26	0.00	1.26	0
8.530	5600.17	11.2	0.094	11.1	7.1	3.07	0.84%	Sand-Slime Tailing	0.059	119.0	0.48	0.18	0.30	1	1.70	18.887	262.53	22.02	35	0.88%	2.2	47%	1.27	0.00	1.27	0
8.694	5600.01	9.4	0.107	9.4	7.9	3.44	1.13%	Sand-Slime Tailing	0.059	119.0	0.49	0.19	0.31	1	1.70	15.946	221.65	18.62	29	1.20%	2.4	47%	1.28	0.00	1.28	0
8.858	5599.84	8.8	0.081	8.7	12.4	5.35	0.92%	Sand-Slime Tailing	0.059	119.0	0.50	0.19	0.31	1	1.70	14.756	205.11	17.29	27	0.98%	2.4	47%	1.29	0.00	1.29	0
9.022	5599.68	11.1	0.076	11.1	5.6	2.43	0.68%	Sand-Slime Tailing	0.059	119.0	0.51	0.20	0.32	1	1.70	18.870	262.29	21.99	34	0.72%	2.2	47%	1.30	0.00	1.30	0
9.186	5599.51	9.6	0.061	9.6	2.1	0.91	0.63%	Sand-Slime Tailing	0.059	119.0	0.52	0.20	0.32	1	1.70	16.337	227.08	19.00	28	0.67%	2.3	47%	1.31	0.00	1.31	0
9.350	5599.35	12.2	0.050	12.2	2.4	1.04	0.41%	Sand-Slime Tailing	0.059	119.0	0.53	0.21	0.32	1	1.70	20.672	287.34	24.04	36	0.43%	2.1	47%	1.32	0.00	1.32	0
9.514	5599.19	10.4	0.053	10.4	2.6	1.12	0.51%	Sand-Slime Tailing	0.059	119.0	0.54	0.21	0.33	1	1.70	17.646	245.28	20.53	30	0.54%	2.2	47%	1.32	0.00	1.32	0
9.678	5599.02	8.2	0.072	8.2	6.3	2.75	0.87%	Sand-Slime Tailing	0.059	119.0	0.55	0.22	0.33	1	1.70	13.957	194.00	16.29	23	0.94%	2.4	47%	1.33	0.00	1.33	0
9.842	5598.86	6.7	0.056	6.7	7.3	3.18	0.83%	Slime Tailings	0.057	113.1	0.56	0.22	0.34	1	1.70	11.356	157.85	13.28	18	0.91%	2.5	71%	1.34	0.00	1.34	0
10.006	5598.69	5.1	0.106	5.0	9.4	4.07	2.09%	Slime Tailings	0.057	113.1	0.57	0.23	0.34	1	1.70	8.534	118.62	10.03	13	2.35%	2.8	71%	1.35	0.00	1.35	0
10.170	5598.53	3.9	0.092	3.9	4.9	2.13	2.36%	Slime Tailings	0.057	113.1	0.58	0.23	0.35	1	1.70	6.562	91.21	7.68	10	2.78%	3.0	71%	1.36	0.00	1.36	0
10.335	5598.37	5.5	0.171	5.5	6.9	2.99	3.11%	Slime Tailings	0.057	113.1	0.59	0.24	0.35	1	1.70	9.265	128.78	10.85	14	3.49%	2.9	71%	1.37	0.00	1.37	0
10.499	5598.20	10.4	0.222	10.4	3.4	1.48	2.14%	Slime Tailings	0.057	113.1	0.60	0.24	0.35	1	1.70	17.612	244.81	20.50	28	2.27%	2.6	71%	1.38	0.00	1.38	0
10.663	5598.04	4.3	0.241	4.2	13.2	5.72	5.67%	Slime Tailings	0.057	113.1	0.61	0.25	0.36	1	1.70	7.089	98.54	8.40	10	6.61%	3.2	71%	1.39	0.00	1.39	0
10.827	5597.87	5.7	0.239	5.6	23.2	10.07	4.17%	Slime Tailings	0.057	113.1	0.62	0.25	0.36	1	1.70	9.486	131.86	11.30	14	4.68%	3.0	71%	1.40	0.00	1.40	0
10.991	5597.71	11.2	0.225	11.1	15.4	6.69	2.01%	Slime Tailings	0.057	113.1	0.63	0.26	0.37	1	1.70	18.904	262.77	22.15	29	2.12%	2.5	71%	1.41	0.00	1.41	0
11.155	5597.55	3.0	0.253	2.9	12.9	5.59	8.49%	Slime Tailings	0.057	113.1	0.64	0.26	0.37	1	1.70	4.930	68.53	5.88	6	10.79%	3.5	71%	1.42	0.00	1.42	0
11.319	5597.38	2.8	0.251	2.7	7.9	3.44	9.10%	Slime Tailings	0.057	113.1	0.64	0.27	0.38	1	1.70	4.607	64.04	5.45	6	11.87%	3.6	71%	1.43	0.00	1.43	0
11.483	5597.22	12.0	0.174	12.0	3.9	1.69	1.45%	Sand-Slime Tailing	0.059	119.0	0.65	0.27	0.38	1	1.70	20.417	283.80	23.76	30	1.53%	2.4	47%	1.44	0.00	1.44	0
11.647	5597.05	28.9	0.523	28.8	10.2	4.41	1.81%	Sand-Slime Tailing	0.059	119.0	0.66	0.28	0.38	1	1.65	47.502	660.28	55.29	73	1.85%	2.2	47%	1.45	0.00	1.45	0
11.811	5596.89	85.4	0.752	85.2	32.0	13.87	0.88%	Sand Tailings	0.062	123.5	0.67	0.28	0.39	1	1.40	119.039	1654.64	138.58	217	0.89%	1.6	18%	1.46	0.00	1.46	0
11.975	5596.73	141.3	0.619	140.6	118.3	51.27	0.44%	Sand Tailings	0.062	123.5	0.68	0.29	0.39	1	1.28	179.877	2500.28	210.01	356	0.44%	1.3	18%	1.47	0.00	1.47	0

Liquefaction Triggering Analyses

Depth (ft)	Idriss & Boulanger (2008) Cyclic Stress Ratio r_d	C_σ	K_σ	K_α	CSR M=7.5, σ'v=1atm	Cyclic Resistance Ratio Δq_{c1n}	q_{c1n-cs}	(CRR) M=7.5, σ'v=1atm	FoS	Youd et al. (2001) Cyclic Stress Ratio r_d	D_r	f	K_σ	K_α	CSR M=7.5, σ'v=1atm	Kc	q_{c1n-cs}	(CRR) M=7.5, σ'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No
0.164	1.00	0.08	1.01	1.0	0.058	50.63	108.49	0.157	2.70	0.97	0.44	0.78	2.77	1.0	0.015	1.00	57.86	0.098	239.99	121.34	2
0.328	1.00	0.12	1.01	1.0	0.058	69.84	182.46	0.578	9.92	0.97	0.61	0.69	3.36	1.0	0.013	1.00	112.62	0.213	260.65	135.29	2
0.492	1.00	0.14	1.01	1.0	0.058	75.94	205.95	1.000	17.15	0.96	0.66	0.67	3.21	1.0	0.013	1.00	130.00	0.284	232.24	124.69	2
0.656	1.00	0.13	1.01	1.0	0.058	75.67	204.90	1.000	17.17	0.96	0.66	0.67	2.92	1.0	0.015	1.00	129.23	0.281	172.02	94.60	2
0.820	1.00	0.13	1.01	1.0	0.058	75.28	203.39	1.000	17.20	0.96	0.65	0.67	2.70	1.0	0.016	1.00	128.11	0.276	135.13	76.17	2
0.984	1.00	0.13	1.00	1.0	0.058	74.38	199.94	1.000	17.22	0.96	0.65	0.68	2.52	1.0	0.017	1.00	125.55	0.264	107.97	62.60	2
1.148	1.00	0.13	1.00	1.0	0.058	75.44	204.02	1.000	17.24	0.96	0.65	0.67	2.42	1.0	0.018	1.00	128.58	0.278	97.36	57.30	2
1.312	1.00	0.11	1.00	1.0	0.058	67.94	175.14	0.466	8.04	0.96	0.60	0.70	2.15	1.0	0.020	1.00	107.20	0.195	59.71	33.88	2
1.476	1.00	0.11	1.00	1.0	0.058	66.70	170.38	0.411	7.11	0.96	0.59	0.71	2.05	1.0	0.021	1.00	103.68	0.184	50.12	28.61	2
1.640	1.00	0.13	1.00	1.0	0.058	73.68	197.22	1.000	17.31	0.96	0.64	0.68	2.12	1.0	0.020	1.00	123.54	0.255	62.75	40.03	2
1.804	1.00	0.11	1.00	1.0	0.058	65.15	164.42	0.358	6.20	0.96	0.58	0.71	1.91	1.0	0.022	1.00	99.26	0.171	38.20	22.20	2
1.968	1.00	0.10	1.00	1.0	0.058	63.44	157.82	0.312	5.42	0.96	0.56	0.72	1.83	1.0	0.023	1.00	94.38	0.158	32.42	18.92	2
2.133	1.00	0.13	1.00	1.0	0.057	74.09	198.83	1.000	17.40	0.96	0.64	0.68	1.96	1.0	0.022	1.00	124.74	0.260	49.30	33.35	2
2.297	1.00	0.30	0.99	1.0	0.057	#####	313.63	1.000	17.56	0.96	0.84	0.60	2.23	1.0	0.019	1.00	209.71	1.000	175.79	96.68	2
2.461	1.00	0.24	0.99	1.0	0.057	97.80	290.09	1.000	17.58	0.96	0.80	0.60	2.17	1.0	0.019	1.00	192.29	1.000	164.14	90.86	2
2.625	1.00	0.19	0.99	1.0	0.057	89.98	259.98	1.000	17.58	0.96	0.75	0.62	2.02	1.0	0.021	1.00	170.00	1.000	153.94	85.76	2
2.789	0.99	0.16	0.99	1.0	0.057	83.62	235.50	1.000	17.59	0.96	0.71	0.64	1.92	1.0	0.022	1.00	151.88	0.406	60.00	38.79	2
2.953	0.99	0.15	0.99	1.0	0.057	79.87	221.07	1.000	17.61	0.96	0.69	0.66	1.86	1.0	0.023	1.00	141.20	0.342	49.43	33.52	2
3.117	0.99	0.12	0.99	1.0	0.057	71.78	189.93	0.749	13.18	0.96	0.63	0.69	1.75	1.0	0.024	1.00	118.15	0.233	33.02	23.10	2
3.281	0.99	0.11	0.99	1.0	0.057	48.11	149.91	0.271	4.77	0.96	0.58	0.71	1.67	1.0	0.025	1.00	101.80	0.178	24.37	14.57	2
3.445	0.99	0.10	0.99	1.0	0.057	44.64	132.85	0.211	3.72	0.96	0.54	0.73	1.59	1.0	0.026	1.00	88.21	0.144	19.04	11.38	2
3.609	0.99	0.09	0.99	1.0	0.057	41.97	119.74	0.179	3.16	0.96	0.51	0.75	1.54	1.0	0.027	1.00	77.77	0.124	15.87	9.52	2
3.773	0.99	0.09	0.99	1.0	0.057	41.07	115.32	0.170	3.01	0.96	0.50	0.75	1.51	1.0	0.028	1.00	74.25	0.118	14.69	8.85	2
3.937	0.99	0.09	0.99	1.0	0.056	41.85	119.14	0.178	3.15	0.96	0.51	0.75	1.51	1.0	0.028	1.00	77.29	0.123	14.85	9.00	2
4.101	0.99	0.09	0.99	1.0	0.056	42.46	122.12	0.184	3.27	0.96	0.52	0.74	1.51	1.0	0.028	1.00	79.66	0.127	14.91	9.09	2
4.265	0.99	0.09	0.99	1.0	0.056	42.13	120.54	0.181	3.21	0.96	0.51	0.74	1.49	1.0	0.028	1.00	78.41	0.125	14.24	8.73	2
4.429	0.99	0.09	0.98	1.0	0.056	41.56	117.70	0.175	3.11	0.96	0.50	0.75	1.48	1.0	0.029	1.00	76.15	0.121	13.44	8.28	2
4.593	0.98	0.09	0.98	1.0	0.056	41.50	117.41	0.174	3.11	0.96	0.50	0.75	1.46	1.0	0.029	1.00	75.91	0.121	13.05	8.08	2
4.757	0.98	0.09	0.98	1.0	0.056	41.69	118.35	0.176	3.15	0.95	0.51	0.75	1.46	1.0	0.029	1.00	76.66	0.122	12.85	8.00	2
4.921	0.98	0.09	0.98	1.0	0.056	41.11	115.50	0.170	3.05	0.95	0.50	0.75	1.44	1.0	0.029	1.00	74.39	0.118	12.16	7.60	2
5.085	0.98	0.08	0.98	1.0	0.056	40.07	110.42	0.161	2.88	0.95	0.48	0.76	1.42	1.0	0.030	1.00	70.34	0.112	11.27	7.08	2
5.249	0.98	0.08	0.98	1.0	0.056	51.42	111.65	0.163	2.92	0.95	0.45	0.78	1.37	1.0	0.031	1.05	63.25	0.104	10.16	6.54	2
5.413	0.98	0.07	0.98	1.0	0.056	49.09	102.67	0.147	2.64	0.95	0.42	0.79	1.34	1.0	0.031	1.09	58.28	0.098	9.45	6.04	2
5.577	0.98	0.07	0.98	1.0	0.056	48.78	101.48	0.145	2.61	0.95	0.42	0.79	1.33	1.0	0.032	1.06	55.98	0.096	9.06	5.83	2
5.741	0.98	0.07	0.98	1.0	0.056	47.77	97.56	0.139	2.49	0.95	0.41	0.80	1.32	1.0	0.032	1.08	53.98	0.095	8.71	5.60	2
5.905	0.98	0.07	0.98	1.0	0.056	45.78	89.91	0.127	2.28	0.95	0.38	0.80	1.31	1.0	0.032	1.13	49.81	0.091	8.26	5.27	2
6.069	0.98	0.07	0.98	1.0	0.055	44.81	86.16	0.121	2.19	0.95	0.37	0.80	1.30	1.0	0.032	1.14	47.05	0.089	7.89	5.04	2
6.234	0.98	0.06	0.98	1.0	0.055	44.28	84.13	0.118	2.14	0.95	0.36	0.80	1.29	1.0	0.032	1.15	45.83	0.088	7.65	4.89	2
6.398	0.97	0.07	0.98	1.0	0.055	44.54	85.15	0.120	2.17	0.95	0.37	0.80	1.29	1.0	0.033	1.13	45.93	0.088	7.51	4.84	2
6.562	0.97	0.07	0.98	1.0	0.055	45.73	89.74	0.127	2.29	0.95	0.38	0.80	1.28	1.0	0.033	1.09	48.16	0.090	7.53	4.91	2
6.726	0.97	0.07	0.98	1.0	0.055	45.64	89.36	0.126	2.29	0.95	0.38	0.80	1.28	1.0	0.033	1.11	48.64	0.091	7.43	4.86	2
6.890	0.97	0.07	0.98	1.0	0.055	44.89	86.50	0.122	2.21	0.95	0.37	0.80	1.28	1.0	0.033	1.15	47.80	0.090	7.24	4.73	2
7.054	0.97	0.06	0.98	1.0	0.055	43.70	81.92	0.115	2.10	0.95	0.36	0.80	1.27	1.0	0.033	1.21	46.28	0.089	7.01	4.55	2
7.218	0.97	0.06	0.98	1.0	0.055	42.96	79.04	0.111	2.03	0.95	0.35	0.80	1.27	1.0	0.033	1.25	45.19	0.088	6.82	4.42	2
7.382	0.97	0.06	0.98	1.0	0.055	42.29	76.49	0.108	1.97	0.95	0.34	0.80	1.26	1.0	0.033	1.30	44.41	0.087	6.66	4.31	2
7.546	0.97	0.06	0.98	1.0	0.055	41.42	73.10	0.104	1.89	0.95	0.33	0.80	1.26	1.0	0.033	1.35	42.74	0.086	6.44	4.17	2
7.710	0.97	0.06	0.98	1.0	0.055	41.28	72.57	0.103	1.88	0.95	0.32	0.80	1.25	1.0	0.033	1.32	41.16	0.084	6.24	4.06	2
7.874	0.96	0.06	0.98	1.0	0.055	40.05	67.84	0.097	1.77	0.95	0.30	0.80	1.25	1.0	0.033	1.36	37.67	0.081	5.93	3.85	2
8.038	0.96	0.06	0.98	1.0	0.055	38.82	63.12	0.091	1.67	0.95	0.28	0.80	1.25	1.0	0.034	1.51	36.66	0.081	5.77	3.72	2
8.202	0.96	0.05	0.98	1.0	0.055	37.32	57.34	0.085	1.56	0.95	0.26	0.80	1.24	1.0	0.034	1.81	36.27	0.080	5.66	3.61	2
8.366	0.96	0.05	0.98	1.0	0.054	37.58	58.33	0.086	1.58	0.95	0.26	0.80	1.24	1.0	0.034	1.73	35.90	0.080	5.55	3.57	2
8.530	0.96	0.05	0.98	1.0	0.054	38.03	60.05	0.088	1.62	0.95	0.27	0.80	1.23	1.0	0.034	1.79	39.40	0.083	5.67	3.64	2
8.694	0.96	0.05	0.98	1.0	0.054	36.83	55.45	0.083	1.53	0.95	0.25	0.80	1.23	1.0	0.034	2.27	42.18	0.085	5.74	3.63	2
8.858	0.96	0.05	0.98	1.0	0.054	36.37	53.66	0.081	1.49	0.95	0.24	0.80	1.23	1.0	0.034	2.22	38.45	0.082	5.45	3.47	2
9.022	0.96	0.05	0.98	1.0	0.054	38.01	60.00	0.088	1.62	0.94	0.27	0.80	1.22	1.0	0.034	1.72	37.76	0.081	5.34	3.48	2
9.186	0.96	0.05	0.98	1.0	0.054	36.97	55.97	0.084	1.54	0.94	0.25	0.80	1.22	1.0	0.034	1.86	35.35	0.079	5.13	3.34	2
9.350	0.96	0.06	0.98	1.0	0.054	38.73	62.77	0.091	1.69	0.94	0.28	0.80	1.22	1.0	0.034	1.45	34.83	0.079	5.03	3.36	2
9.514	0.95	0.05	0.98	1.0	0.054	37.50	58.03	0.086	1.59	0.94	0.26	0.80	1.21	1.0	0.034	1.69	34.67	0.079	4.96	3.27	2
9.678	0.95	0.05	0.98	1.0	0.054	36.01	52.30	0.080	1.48	0.94	0.23	0.80	1.21	1.0	0.034	2.40	39.07	0.083	5.12	3.30	2
9.842	0.95	0.05	0.98	1.0	0.054	34.71	47.99	0.076	1.40	0.94	0.21	0.80	1.21	1.0	0.034	2.79	37.02	0.081	4.95	3.18	2
10.006	0.95	0.05	0.98	1.0	0.054	33.58	43.61	0.072	1.33	0.94	0.18	0.80	1.20	1.0	0.035	5.12	51.34	0.093	5.60	3.47	2
10.170	0.95	0.04	0.98	1.0	0.054	32.76	40.44	0.069	1.28	0.94	0.16	0.80	1.20	1.0	0.035	6.68	51.34	0.093	5.54	3.41	2
10.335	0.95	0.05	0.98	1.0	0.054	33.86	44.71	0.073	1.35	0.94	0.19	0.80	1.20	1.0	0.035	5.87	63.62	0.104	6.15	3.75	2
10.499	0.95	0.05	0.98	1.0	0.053	37.23	57.72	0.085	1.60	0.94	0.26	0.80	1.19	1.0	0.035	3.14	64.46	0.105	6.13	3.87	2
10.663	0.95	0.04	0.98	1.0	0.054	33.01	41.41	0.070	1.30	0.94	0.17	0.80	1.19	1.0	0.035	9.23	77.49	0.123	7.13	4.21	2
10.827	0.95	0.05	0.98	1.0	0.053	34.02	45.33	0.073	1.37	0.94	0.19	0.80	1.19	1.0	0.035	6.68	75.46	0.120	6.86	4.11	2
10.991	0.94	0.05	0.97	1.0	0.053	37.80	59.95	0.088	1.65	0.94	0.27	0.80	1.19	1.0	0.035	2.96	65.57	0.106	6.01	3.83	2
11.155	0.94	0.04	0.98	1.0	0.053	32.14	38.02	0.067	1.26	0.94	0.14	0.80	1.18	1.0	0.035	13.96	82.18	0.132	7.36	4.31	2
11.319	0.94	0.04	0.98	1.0	0.053	31.99	37.43	0.067	1.25	0.94	0.13	0.80	1.18	1.0	0.035	15.18	82.68	0.133	7.34	4.29	2
11.483	0.94	0.05	0.97	1.0	0.053	38.63	62.40	0.091	1.71	0.94	0.28	0.80	1.18	1.0	0.035	2.48	58.88	0.099	5.41	3.56	2
11.647	0.94	0.07	0.96	1.0	0.052	49.69	104.99	0.151	2.89	0.94	0.43	0.79	1.19	1.0	0.035	1.64	90.56	0.149	8.06	5.47	2
11.811	0.94	0.14	0.92	1.0	0.050	57.52	196.10	0.958	19.11	0.94	0.68	0.66	1.31	1.0	0.032	1.00	138.58	0.328	17.48	18.30	2
11.975	0.94	0.30	0.84	1.0	0.046	75.78	285.79	1.000	21.92	0.94	0.84	0.60	1.37	1.0	0.030	1.00	210.01	1.000	52.72	37.32	2

Idriss & Boulanger (2008)

Depth (ft)	CN	qc1 TSF	qc1 MPa	qc1N
0.164	1.7	49.821	4.7698	57.864
0.328	1.7	96.964	9.2834	112.618
0.492	1.7	111.93	10.716	130.003
0.656	1.7	111.27	10.653	129.228
0.820	1.7	110.3	10.56	128.108
0.984	1.7	108.1	10.35	125.554
1.148	1.7	110.71	10.599	128.579
1.312	1.7	92.299	8.8367	107.200
1.476	1.7	89.265	8.5462	103.676
1.640	1.7	106.37	10.184	123.544
1.804	1.7	85.464	8.1823	99.261
1.968	1.7	81.26	7.7798	94.378
2.133	1.7	107.4	10.282	124.737
2.297	1.7	180.56	17.287	209.712
2.461	1.7	165.56	15.851	192.292
2.625	1.7	146.37	14.014	170.003
2.789	1.7	130.77	12.52	151.877
2.953	1.7	121.57	11.639	141.196
3.117	1.7	101.72	9.739	118.146
3.281	1.7	87.647	8.3913	101.796
3.445	1.7	75.95	7.2714	88.211
3.609	1.7	66.958	6.4105	77.767
3.773	1.7	63.932	6.1208	74.253
3.937	1.7	66.549	6.3714	77.292
4.101	1.7	68.591	6.5669	79.665
4.265	1.7	67.509	6.4633	78.407
4.429	1.7	65.562	6.2769	76.146
4.593	1.7	65.361	6.2576	75.912
4.757	1.7	66.006	6.3194	76.662
4.921	1.7	64.052	6.1324	74.393
5.085	1.7	60.567	5.7986	70.344
5.249	1.7	51.853	4.9644	60.224
5.413	1.7	46.133	4.4167	53.580
5.577	1.7	45.373	4.344	52.698
5.741	1.7	42.876	4.1049	49.798
5.905	1.7	37.997	3.6379	44.131
6.069	1.7	35.608	3.4091	41.357
6.234	1.7	34.312	3.285	39.851
6.398	1.7	34.963	3.3473	40.607
6.562	1.7	37.887	3.6273	44.004
6.726	1.7	37.649	3.6045	43.727
6.890	1.7	35.822	3.4296	41.605
7.054	1.7	32.904	3.1503	38.216
7.218	1.7	31.069	2.9746	36.085
7.382	1.7	29.443	2.8189	34.196
7.546	1.7	27.284	2.6122	31.689
7.710	1.7	26.945	2.5797	31.295
7.874	1.7	23.927	2.2908	27.790
8.038	1.7	20.917	2.0026	24.293
8.202	1.7	17.236	1.6502	20.019
8.366	1.7	17.866	1.7105	20.750
8.530	1.7	18.962	1.8154	22.024
8.694	1.7	16.03	1.5347	18.618
8.858	1.7	14.887	1.4253	17.290
9.022	1.7	18.929	1.8123	21.985
9.186	1.7	16.359	1.5662	19.000
9.350	1.7	20.697	1.9816	24.039
9.514	1.7	17.673	1.6921	20.527
9.678	1.7	14.024	1.3427	16.288
9.842	1.7	11.434	1.0947	13.280
10.006	1.7	8.6337	0.8266	10.027
10.170	1.7	6.6142	0.6332	7.682
10.335	1.7	9.3382	0.894	10.846
10.499	1.7	17.648	1.6896	20.497
10.663	1.7	7.229	0.6921	8.396
10.827	1.7	9.7325	0.9318	11.304
10.991	1.7	19.068	1.8256	22.146
11.155	1.7	5.0669	0.4851	5.885
11.319	1.7	4.6912	0.4491	5.448
11.483	1.7	20.458	1.9587	23.761
11.647	1.647094	47.607	4.5579	55.293
11.811	1.397659	119.32	11.423	138.580
11.975	1.279714	180.82	17.312	210.014

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-4N

Data File: 13-52106_SP3-4N-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3 Field Data\2013 Field Investigation\Conetec Da

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)

Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69

Youd, et al (2001)

Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

5606.00	Water surface elevation during CPT investigation (ft
5600.42	Water surface elevation at t_0 (ft amsl)
5583.71	Water surface elevation at t_1 (ft amsl)
5578.71	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Ear
7.51	Equiv. Number of Uniform Strain Cycles, N

5608.70	Ground Surface Elevation at time of CPT (ft amsl)
5623.35	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pl
3.50	Thickness of Water Storage/Rooting Zone (ft)
3.50	Thickness of High Compaction Layer (ft)
7.15	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1565.99	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5578.71	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	######	5623.1	5622.85	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	######	5621.1	5619.35	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5617.6	5615.85	3.50	0.060	120	0.424	0.320	0.00	0.00	0.424	0.320
Platform/Random Fill Layer	######	5612.28	5608.70	7.15	0.050	101	0.784	0.604	0.00	0.00	0.784	0.604

2013 CPT Data from ConeTec / CPT Data Interpretations

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No
12.139	5596.56	153.1	1.039	152.7	76.3	33.05	0.68%	Sand Tailings	0.062	123.5	0.69	0.29	0.40	1
12.303	5596.40	126.4	0.970	126.3	17.7	7.67	0.77%	Sand Tailings	0.062	123.5	0.70	0.30	0.40	1
12.467	5596.23	12.1	0.808	12.0	22.2	9.64	6.66%	Slime Tailings	0.057	113.1	0.71	0.30	0.41	1
12.631	5596.07	18.2	0.402	18.1	12.5	5.41	2.21%	Sand-Slime Tailing	0.059	119.0	0.72	0.31	0.41	1
12.795	5595.90	26.5	0.286	26.5	1.9	0.81	1.08%	Sand-Slime Tailing	0.059	119.0	0.73	0.31	0.42	1
12.959	5595.74	36.4	0.258	36.4	1.4	0.59	0.71%	Sand Tailings	0.062	123.5	0.74	0.32	0.42	1
13.123	5595.58	11.0	0.376	10.9	16.2	7.02	3.43%	Slime Tailings	0.057	113.1	0.75	0.33	0.43	1
13.287	5595.41	24.7	0.375	24.6	16.4	7.12	1.52%	Sand-Slime Tailing	0.059	119.0	0.76	0.33	0.43	1
13.451	5595.25	8.9	0.177	8.8	15.2	6.59	1.99%	Slime Tailings	0.057	113.1	0.77	0.34	0.44	1
13.615	5595.08	3.6	0.140	3.4	36.3	15.72	3.88%	Slime Tailings	0.057	113.1	0.78	0.34	0.44	1
13.779	5594.92	4.3	0.102	4.0	46.1	19.97	2.37%	Slime Tailings	0.057	113.1	0.79	0.35	0.44	1
13.943	5594.76	4.7	0.064	4.4	49.6	21.48	1.35%	Slime Tailings	0.057	113.1	0.80	0.35	0.45	1
14.107	5594.59	5.1	0.026	4.8	50.7	21.98	0.51%	Slime Tailings	0.057	113.1	0.81	0.36	0.45	1
14.271	5594.43	9.8	0.045	9.6	29.9	12.96	0.46%	Sand-Slime Tailing	0.059	119.0	0.82	0.36	0.46	1
14.436	5594.26	8.9	0.082	8.9	8.8	3.82	0.92%	Sand-Slime Tailing	0.059	119.0	0.83	0.37	0.46	1
14.600	5594.10	6.1	0.065	6.0	10.0	4.33	1.07%	Slime Tailings	0.057	113.1	0.84	0.37	0.47	1
14.764	5593.94	6.3	0.071	6.2	13.9	6.00	1.13%	Slime Tailings	0.057	113.1	0.85	0.38	0.47	1
14.928	5593.77	9.5	0.050	9.4	12.9	5.57	0.53%	Sand-Slime Tailing	0.059	119.0	0.86	0.38	0.48	1
15.092	5593.61	8.2	0.031	8.1	11.9	5.14	0.38%	Sand-Slime Tailing	0.059	119.0	0.87	0.39	0.48	1
15.256	5593.44	12.5	0.026	12.4	11.9	5.14	0.21%	Sand-Slime Tailing	0.059	119.0	0.88	0.39	0.48	1
15.420	5593.28	13.4	0.032	13.4	10.3	4.47	0.24%	Sand-Slime Tailing	0.059	119.0	0.89	0.40	0.49	1
15.584	5593.12	13.2	0.032	13.1	11.4	4.95	0.24%	Sand-Slime Tailing	0.059	119.0	0.90	0.40	0.49	1
15.748	5592.95	12.9	0.034	12.9	12.5	5.42	0.26%	Sand-Slime Tailing	0.059	119.0	0.91	0.41	0.50	1
15.912	5592.79	13.3	0.033	13.2	12.9	5.61	0.25%	Sand-Slime Tailing	0.059	119.0	0.92	0.41	0.50	1
16.076	5592.62	12.7	0.033	12.6	12.9	5.58	0.26%	Sand-Slime Tailing	0.059	119.0	0.93	0.42	0.51	1
16.240	5592.46	12.7	0.036	12.6	13.1	5.68	0.28%	Sand-Slime Tailing	0.059	119.0	0.93	0.42	0.51	1
16.404	5592.30	13.4	0.038	13.3	13.6	5.91	0.28%	Sand-Slime Tailing	0.059	119.0	0.94	0.43	0.52	1
16.568	5592.13	14.1	0.045	14.0	13.7	5.93	0.32%	Sand-Slime Tailing	0.059	119.0	0.95	0.43	0.52	1
16.732	5591.97	13.5	0.052	13.4	13.7	5.93	0.39%	Sand-Slime Tailing	0.059	119.0	0.96	0.44	0.53	1
16.896	5591.80	13.5	0.050	13.5	14.1	6.13	0.37%	Sand-Slime Tailing	0.059	119.0	0.97	0.44	0.53	1
17.060	5591.64	14.2	0.052	14.1	14.4	6.25	0.37%	Sand-Slime Tailing	0.059	119.0	0.98	0.45	0.54	1
17.224	5591.48	15.7	0.057	15.6	14.5	6.26	0.36%	Sand-Slime Tailing	0.059	119.0	0.99	0.45	0.54	1
17.388	5591.31	16.7	0.068	16.6	14.7	6.37	0.41%	Sand-Slime Tailing	0.059	119.0	1.00	0.46	0.54	1
17.552	5591.15	17.4	0.079	17.3	15.0	6.49	0.45%	Sand-Slime Tailing	0.059	119.0	1.01	0.46	0.55	1
17.716	5590.98	17.4	0.085	17.3	15.1	6.52	0.49%	Sand-Slime Tailing	0.059	119.0	1.02	0.47	0.55	1
17.880	5590.82	16.7	0.082	16.7	15.2	6.57	0.49%	Sand-Slime Tailing	0.059	119.0	1.03	0.47	0.56	1
18.044	5590.66	15.6	0.083	15.5	15.5	6.70	0.53%	Sand-Slime Tailing	0.059	119.0	1.04	0.48	0.56	1
18.208	5590.49	15.5	0.082	15.4	15.8	6.83	0.53%	Sand-Slime Tailing	0.059	119.0	1.05	0.48	0.57	1
18.372	5590.33	15.5	0.076	15.4	15.9	6.89	0.49%	Sand-Slime Tailing	0.059	119.0	1.06	0.49	0.57	1
18.537	5590.16	15.0	0.075	14.9	15.9	6.90	0.50%	Sand-Slime Tailing	0.059	119.0	1.07	0.49	0.58	1
18.701	5590.00	14.3	0.060	14.2	15.9	6.90	0.42%	Sand-Slime Tailing	0.059	119.0	1.08	0.50	0.58	1
18.865	5589.84	14.4	0.060	14.3	15.9	6.90	0.42%	Sand-Slime Tailing	0.059	119.0	1.09	0.50	0.59	1
19.029	5589.67	13.4	0.061	13.3	15.9	6.87	0.46%	Sand-Slime Tailing	0.059	119.0	1.10	0.51	0.59	1
19.193	5589.51	13.3	0.066	13.2	16.5	7.15	0.50%	Sand-Slime Tailing	0.059	119.0	1.11	0.51	0.60	1
19.357	5589.34	13.3	0.073	13.2	16.6	7.18	0.55%	Sand-Slime Tailing	0.059	119.0	1.12	0.52	0.60	1
19.521	5589.18	13.2	0.076	13.1	16.9	7.33	0.58%	Sand-Slime Tailing	0.059	119.0	1.13	0.52	0.61	1
19.685	5589.02	13.3	0.078	13.2	17.3	7.51	0.59%	Sand-Slime Tailing	0.059	119.0	1.14	0.53	0.61	1
19.849	5588.85	14.4	0.075	14.3	17.5	7.57	0.52%	Sand-Slime Tailing	0.059	119.0	1.15	0.54	0.61	1
20.013	5588.69	17.2	0.080	17.1	18.1	7.83	0.47%	Sand-Slime Tailing	0.059	119.0	1.16	0.54	0.62	1
20.177	5588.52	20.3	0.100	20.2	18.0	7.79	0.49%	Sand-Slime Tailing	0.059	119.0	1.17	0.55	0.62	1
20.341	5588.36	21.7	0.131	21.6	18.0	7.79	0.60%	Sand-Slime Tailing	0.059	119.0	1.18	0.55	0.63	1
20.505	5588.20	22.7	0.153	22.6	18.4	7.99	0.67%	Sand-Slime Tailing	0.059	119.0	1.19	0.56	0.63	1
20.669	5588.03	23.1	0.172	23.0	18.7	8.09	0.74%	Sand-Slime Tailing	0.059	119.0	1.20	0.56	0.64	1
20.833	5587.87	23.6	0.180	23.5	18.7	8.09	0.76%	Sand-Slime Tailing	0.059	119.0	1.21	0.57	0.64	1
20.997	5587.70	23.1	0.180	23.0	18.8	8.16	0.78%	Sand-Slime Tailing	0.059	119.0	1.22	0.57	0.65	1
21.161	5587.54	23.7	0.180	23.6	19.2	8.33	0.76%	Sand-Slime Tailing	0.059	119.0	1.23	0.58	0.65	1

CPT Data Interpretations / Conditions at t_1 / Liquefaction Triggering Analyses – Idriss & Boulanger (2008)

Depth (ft)	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No	r_d	C_σ	K_σ	K_α	CSR M=7.5, s'v=1atm	Δqc_{1n}	$qc_{1n\text{-}cs}$	(CRR) M=7.5, s'v=1atm	FoS
12.139	1.26	192.043	2669.40	223.74	381	0.68%	1.4	18%	1.48	0.00	1.48	0	0.94	0.30	0.84	1.0	0.045	79.29	303.03	1.000	22.05
12.303	1.30	163.560	2273.49	190.13	310	0.77%	1.5	18%	1.49	0.00	1.49	0	0.94	0.24	0.87	1.0	0.047	70.70	260.83	1.000	21.23
12.467	1.70	20.400	283.56	23.97	28	7.07%	2.9	71%	1.50	0.00	1.50	0	0.93	0.06	0.97	1.0	0.052	38.43	62.40	0.091	1.73
12.631	1.67	30.267	420.71	35.30	42	2.30%	2.4	47%	1.51	0.00	1.51	0	0.93	0.06	0.97	1.0	0.052	42.68	77.99	0.110	2.11
12.795	1.59	42.092	585.08	48.91	62	1.11%	2.1	47%	1.52	0.00	1.52	0	0.93	0.07	0.96	1.0	0.052	47.45	96.36	0.137	2.64
12.959	1.52	55.343	768.51	64.23	84	0.72%	1.9	18%	1.53	0.00	1.53	0	0.93	0.08	0.95	1.0	0.051	38.51	102.74	0.147	2.87
13.123	1.70	18.462	256.62	21.64	24	3.68%	2.8	71%	1.54	0.00	1.54	0	0.93	0.05	0.97	1.0	0.052	37.62	59.27	0.087	1.67
13.287	1.57	38.712	538.09	45.15	55	1.57%	2.2	47%	1.55	0.00	1.55	0	0.93	0.07	0.96	1.0	0.052	46.14	91.28	0.129	2.50
13.451	1.70	14.960	207.94	17.56	19	2.18%	2.7	71%	1.55	0.00	1.55	0	0.93	0.05	0.97	1.0	0.052	36.20	53.77	0.081	1.56
13.615	1.69	5.708	79.34	7.07	6	4.95%	3.3	71%	1.56	0.00	1.56	0	0.93	0.04	0.97	1.0	0.052	32.55	39.62	0.068	1.31
13.779	1.68	6.739	93.67	8.39	8	2.90%	3.1	71%	1.57	0.00	1.57	0	0.92	0.04	0.97	1.0	0.052	33.01	41.40	0.070	1.34
13.943	1.66	7.355	102.24	9.14	9	1.63%	2.9	71%	1.58	0.00	1.58	0	0.92	0.04	0.97	1.0	0.052	33.27	42.41	0.071	1.36
14.107	1.65	7.897	109.77	9.78	9	0.61%	2.7	71%	1.59	0.00	1.59	0	0.92	0.05	0.97	1.0	0.052	33.49	43.27	0.071	1.38
14.271	1.64	15.784	219.40	18.69	20	0.50%	2.4	47%	1.60	0.00	1.60	0	0.92	0.05	0.97	1.0	0.052	36.86	55.54	0.083	1.61
14.436	1.63	14.408	200.27	16.84	17	1.01%	2.5	47%	1.61	0.00	1.61	0	0.92	0.05	0.97	1.0	0.051	36.21	53.04	0.080	1.56
14.600	1.61	9.689	134.68	11.37	11	1.24%	2.8	71%	1.62	0.00	1.62	0	0.92	0.05	0.97	1.0	0.052	34.05	45.42	0.073	1.42
14.764	1.60	9.927	137.98	11.69	12	1.31%	2.8	71%	1.63	0.00	1.63	0	0.92	0.05	0.97	1.0	0.051	34.16	45.85	0.074	1.43
14.928	1.59	15.023	208.82	17.60	18	0.58%	2.4	47%	1.64	0.00	1.64	0	0.92	0.05	0.97	1.0	0.051	36.47	54.07	0.082	1.59
15.092	1.58	12.809	178.04	15.01	15	0.42%	2.4	47%	1.65	0.00	1.65	0	0.91	0.05	0.97	1.0	0.051	35.57	50.58	0.078	1.52
15.256	1.56	19.333	268.72	22.59	24	0.22%	2.2	47%	1.66	0.00	1.66	0	0.91	0.05	0.96	1.0	0.051	38.22	60.81	0.089	1.74
15.420	1.54	20.554	285.71	23.99	26	0.26%	2.2	47%	1.67	0.00	1.67	0	0.91	0.06	0.96	1.0	0.051	38.71	62.70	0.091	1.79
15.584	1.53	20.065	278.90	23.43	25	0.26%	2.2	47%	1.68	0.00	1.68	0	0.91	0.05	0.96	1.0	0.051	38.52	61.95	0.090	1.77
15.748	1.52	19.566	271.97	22.86	24	0.28%	2.2	47%	1.69	0.00	1.69	0	0.91	0.05	0.96	1.0	0.051	38.32	61.18	0.089	1.76
15.912	1.51	19.983	277.76	23.35	25	0.27%	2.2	47%	1.70	0.00	1.70	0	0.91	0.05	0.96	1.0	0.051	38.49	61.84	0.090	1.78
16.076	1.50	18.976	263.76	22.18	23	0.28%	2.2	47%	1.71	0.00	1.71	0	0.91	0.05	0.96	1.0	0.051	38.08	60.26	0.088	1.75
16.240	1.49	18.852	262.04	22.04	23	0.31%	2.2	47%	1.72	0.00	1.72	0	0.91	0.05	0.96	1.0	0.050	38.03	60.07	0.088	1.74
16.404	1.48	19.694	273.75	23.02	24	0.31%	2.2	47%	1.73	0.00	1.73	0	0.90	0.05	0.96	1.0	0.050	38.38	61.39	0.089	1.78
16.568	1.46	20.524	285.29	23.98	25	0.34%	2.2	47%	1.74	0.00	1.74	0	0.90	0.06	0.96	1.0	0.050	38.71	62.70	0.091	1.81
16.732	1.46	19.527	271.42	22.82	24	0.42%	2.3	47%	1.75	0.00	1.75	0	0.90	0.05	0.96	1.0	0.050	38.31	61.13	0.089	1.78
16.896	1.45	19.512	271.22	22.81	24	0.40%	2.3	47%	1.76	0.00	1.76	0	0.90	0.05	0.96	1.0	0.050	38.30	61.11	0.089	1.78
17.060	1.44	20.251	281.48	23.67	25	0.39%	2.2	47%	1.77	0.00	1.77	0	0.90	0.05	0.96	1.0	0.050	38.60	62.27	0.090	1.81
17.224	1.42	22.160	308.02	25.89	27	0.39%	2.2	47%	1.78	0.00	1.78	0	0.90	0.06	0.96	1.0	0.050	39.38	65.27	0.094	1.88
17.388	1.40	23.276	323.53	27.18	29	0.43%	2.2	47%	1.79	0.00	1.79	0	0.90	0.06	0.96	1.0	0.050	39.84	67.02	0.096	1.93
17.552	1.39	24.051	334.31	28.09	30	0.48%	2.2	47%	1.80	0.00	1.80	0	0.90	0.06	0.96	1.0	0.050	40.15	68.24	0.097	1.96
17.716	1.38	24.003	333.64	28.03	30	0.52%	2.2	47%	1.81	0.00	1.81	0	0.89	0.06	0.96	1.0	0.050	40.13	68.16	0.097	1.97
17.880	1.38	22.974	319.34	26.83	28	0.52%	2.2	47%	1.82	0.00	1.82	0	0.89	0.06	0.96	1.0	0.049	39.71	66.55	0.095	1.93
18.044	1.38	21.358	296.87	24.96	26	0.57%	2.3	47%	1.83	0.00	1.83	0	0.89	0.06	0.96	1.0	0.049	39.06	64.02	0.092	1.87
18.208	1.37	21.066	292.82	24.62	25	0.57%	2.3	47%	1.83	0.00	1.83	0	0.89	0.06	0.96	1.0	0.049	38.94	63.56	0.092	1.86
18.372	1.36	21.021	292.19	24.57	25	0.53%	2.3	47%	1.84	0.00	1.84	0	0.89	0.06	0.96	1.0	0.049	38.92	63.49	0.092	1.86
18.537	1.36	20.261	281.63	23.69	24	0.54%	2.3	47%	1.85	0.00	1.85	0	0.89	0.05	0.96	1.0	0.049	38.61	62.30	0.090	1.84
18.701	1.35	19.251	267.59	22.51	23	0.45%	2.3	47%	1.86	0.00	1.86	0	0.89	0.05	0.96	1.0	0.049	38.20	60.71	0.089	1.80
18.865	1.34	19.229	267.28	22.49	23	0.45%	2.3	47%	1.87	0.00	1.87	0	0.89	0.05	0.96	1.0	0.049	38.19	60.68	0.089	1.81
19.029	1.34	17.843	248.02	20.88	21	0.50%	2.3	47%	1.88	0.00	1.88	0	0.88	0.05	0.96	1.0	0.049	37.62	58.50	0.086	1.76
19.193	1.33	17.561	244.10	20.56	20	0.54%	2.4	47%	1.89	0.00	1.89	0	0.88	0.05	0.96	1.0	0.049	37.51	58.07	0.086	1.75
19.357	1.33	17.469	242.81	20.45	20	0.60%	2.4	47%	1.90	0.00	1.90	0	0.88	0.05	0.96	1.0	0.049	37.47	57.92	0.086	1.75
19.521	1.32	17.192	238.98	20.13	20	0.63%	2.4	47%	1.91	0.00	1.91	0	0.88	0.05	0.96	1.0	0.049	37.36	57.49	0.085	1.75
19.685	1.31	17.260	239.92	20.21	20	0.64%	2.4	47%	1.92	0.00	1.92	0	0.88	0.05	0.96	1.0	0.049	37.39	57.60	0.085	1.75
19.849	1.30	18.534	257.63	21.69	22	0.57%	2.3	47%	1.93	0.00	1.93	0	0.88	0.05	0.96	1.0	0.049	37.91	59.60	0.087	1.80
20.013	1.28	21.877	304.09	25.58	26	0.50%	2.3	47%	1.94	0.00	1.94	0	0.88	0.06	0.95	1.0	0.048	39.27	64.85	0.093	1.93
20.177	1.26	25.566	355.37	29.86	31	0.52%	2.2	47%	1.95	0.00	1.95	0	0.87	0.06	0.95	1.0	0.048	40.77	70.63	0.100	2.09
20.341	1.25	27.037	375.81	31.57	33	0.64%	2.2	47%	1.96	0.00	1.96	0	0.87	0.06	0.95	1.0	0.048	41.37	72.94	0.103	2.15
20.505	1.24	28.112	390.75	32.82	34	0.71%	2.2	47%	1.97	0.00	1.97	0	0.87	0.06	0.95	1.0	0.048	41.81	74.63	0.105	2.20
20.669	1.24	28.492	396.03	33.26	34	0.78%	2.2	47%	1.98	0.00	1.98	0	0.87	0.06	0.95	1.0	0.048	41.97	75.22	0.106	2.22
20.833	1.23	28.892	401.60	33.72	35	0.80%	2.2	47%	1.99	0.00	1.99	0	0.87	0.06	0.95	1.0	0.048	42.13	75.85	0.107	2.24
20.997	1.23	28.155	391.36	32.87	34	0.82%	2.2	47%	2.00	0.00	2.00	0	0.87	0.06	0.95	1.0	0.048	41.83	74.70	0.106	2.22
21.161	1.22	28.695	398.86	33.50	34	0.80%	2.2	47%	2.01	0.00	2.01	0	0.87	0.06	0.95	1.0	0.048	42.05	75.55	0.107	2.24

Liquefaction Triggering Analyses – Youd et al. (2001) / Idriss & Boulanger (2008)

Depth (ft)	r_d	D_r	f	K_σ	K_a	CSR M=7.5, s'v=1atm	Kc	$qc_{1n\text{-}cs}$	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No	CN	qc1 TSF	qc1 MPa	qc1N
12.139	0.94	0.86	0.60	1.36	1.0	0.030	1.00	223.74	1.000	52.09	37.07	2	1.257897	192.64	18.444	223.742
12.303	0.94	0.80	0.60	1.35	1.0	0.031	1.00	190.13	1.000	51.46	36.35	2	1.29522	163.7	15.673	190.132
12.467	0.94	0.28	0.80	1.16	1.0	0.036	5.65	135.34	0.311	15.83	8.78	2	1.7	20.636	1.9757	23.967
12.631	0.94	0.34	0.80	1.16	1.0	0.036	2.44	86.07	0.139	7.02	4.57	2	1.670343	30.397	2.9102	35.304
12.795	0.94	0.40	0.80	1.16	1.0	0.036	1.46	71.51	0.114	5.69	4.16	2	1.59017	42.11	4.0317	48.909
12.959	0.94	0.46	0.77	1.18	1.0	0.035	1.18	75.48	0.120	5.92	4.39	2	1.521009	55.302	5.2946	64.229
13.123	0.94	0.27	0.80	1.15	1.0	0.036	4.38	94.82	0.159	7.78	4.73	2	1.7	18.634	1.784	21.642
13.287	0.93	0.39	0.80	1.15	1.0	0.036	1.75	78.95	0.126	6.08	4.29	2	1.573002	38.873	3.7217	45.149
13.451	0.93	0.24	0.80	1.15	1.0	0.036	3.97	69.67	0.111	5.34	3.45	2	1.7	15.121	1.4477	17.563
13.615	0.93	0.15	0.80	1.14	1.0	0.036	10.41	73.64	0.117	5.56	3.43	2	1.688661	6.0901	0.5831	7.073
13.779	0.93	0.17	0.80	1.14	1.0	0.036	7.60	63.70	0.104	4.89	3.12	2	1.676296	7.221	0.6913	8.387
13.943	0.93	0.17	0.80	1.14	1.0	0.036	5.75	52.54	0.093	4.36	2.86	2	1.664136	7.8703	0.7535	9.141
14.107	0.93	0.18	0.80	1.14	1.0	0.036	3.91	38.23	0.082	3.78	2.58	2	1.652174	8.4206	0.8062	9.780
14.271	0.93	0.25	0.80	1.13	1.0	0.036	2.17	40.47	0.084	3.83	2.72	2	1.639063	16.09	1.5405	18.688
14.436	0.93	0.24	0.80	1.13	1.0	0.036	2.99	50.37	0.092	4.16	2.86	2	1.626187	14.498	1.388	16.838
14.600	0.93	0.19	0.80	1.13	1.0	0.036	4.41	50.17	0.092	4.12	2.77	2	1.614836	9.7898	0.9373	11.370
14.764	0.93	0.20	0.80	1.13	1.0	0.036	4.41	51.51	0.093	4.13	2.78	2	1.603663	10.065	0.9637	11.690
14.928	0.93	0.24	0.80	1.13	1.0	0.036	2.38	41.96	0.085	3.75	2.67	2	1.591409	15.151	1.4505	17.597
15.092	0.93	0.22	0.80	1.12	1.0	0.037	2.48	37.18	0.081	3.54	2.53	2	1.579367	12.926	1.2375	15.012
15.256	0.93	0.27	0.80	1.12	1.0	0.037	1.59	35.90	0.080	3.46	2.60	2	1.55782	19.448	1.862	22.588
15.420	0.93	0.28	0.80	1.12	1.0	0.037	1.56	37.47	0.081	3.49	2.64	2	1.5385	20.653	1.9774	23.988
15.584	0.93	0.28	0.80	1.12	1.0	0.037	1.59	37.37	0.081	3.46	2.62	2	1.5305	20.174	1.9315	23.431
15.748	0.93	0.28	0.80	1.12	1.0	0.037	1.65	37.72	0.081	3.44	2.60	2	1.522657	19.685	1.8846	22.863
15.912	0.93	0.28	0.80	1.11	1.0	0.037	1.61	37.58	0.081	3.41	2.59	2	1.509265	20.105	1.9248	23.350
16.076	0.92	0.27	0.80	1.11	1.0	0.037	1.69	37.43	0.081	3.38	2.56	2	1.504808	19.097	1.8283	22.180
16.240	0.92	0.27	0.80	1.11	1.0	0.037	1.73	38.09	0.082	3.38	2.56	2	1.494996	18.974	1.8166	22.037
16.404	0.92	0.28	0.80	1.11	1.0	0.037	1.68	38.59	0.082	3.37	2.57	2	1.479659	19.82	1.8976	23.020
16.568	0.92	0.28	0.80	1.11	1.0	0.037	1.67	40.09	0.083	3.39	2.60	2	1.464979	20.649	1.977	23.983
16.732	0.92	0.28	0.80	1.10	1.0	0.037	1.82	41.47	0.085	3.42	2.60	2	1.460499	19.652	1.8814	22.824
16.896	0.92	0.28	0.80	1.10	1.0	0.037	1.80	41.05	0.084	3.38	2.58	2	1.450728	19.64	1.8804	22.811
17.060	0.92	0.28	0.80	1.10	1.0	0.037	1.75	41.43	0.085	3.36	2.59	2	1.437236	20.38	1.9512	23.670
17.224	0.91	0.29	0.80	1.10	1.0	0.037	1.64	42.48	0.085	3.38	2.63	2	1.418689	22.288	2.1338	25.886
17.388	0.91	0.30	0.80	1.10	1.0	0.037	1.63	44.44	0.087	3.42	2.67	2	1.404698	23.405	2.2408	27.183
17.552	0.91	0.31	0.80	1.09	1.0	0.037	1.65	46.24	0.089	3.45	2.71	2	1.392652	24.181	2.3151	28.085
17.716	0.91	0.31	0.80	1.09	1.0	0.037	1.68	47.14	0.089	3.45	2.71	2	1.384238	24.133	2.3105	28.029
17.880	0.91	0.30	0.80	1.09	1.0	0.037	1.74	46.63	0.089	3.42	2.67	2	1.379835	23.105	2.212	26.835
18.044	0.91	0.29	0.80	1.09	1.0	0.037	1.88	46.89	0.089	3.40	2.64	2	1.377916	21.491	2.0575	24.960
18.208	0.91	0.29	0.80	1.09	1.0	0.037	1.90	46.75	0.089	3.37	2.62	2	1.370589	21.201	2.0298	24.623
18.372	0.91	0.29	0.80	1.08	1.0	0.037	1.86	45.70	0.088	3.32	2.59	2	1.362343	21.156	2.0255	24.572
18.537	0.90	0.28	0.80	1.08	1.0	0.037	1.93	45.62	0.088	3.29	2.57	2	1.357054	20.396	1.9527	23.688
18.701	0.90	0.27	0.80	1.08	1.0	0.037	1.91	42.96	0.086	3.19	2.50	2	1.352831	19.385	1.8559	22.515
18.865	0.90	0.27	0.80	1.08	1.0	0.037	1.91	42.95	0.086	3.17	2.49	2	1.34466	19.362	1.8537	22.488
19.029	0.90	0.26	0.80	1.08	1.0	0.037	2.08	43.40	0.086	3.16	2.46	2	1.341616	17.976	1.721	20.878
19.193	0.90	0.26	0.80	1.08	1.0	0.037	2.16	44.45	0.087	3.17	2.46	2	1.333442	17.699	1.6945	20.556
19.357	0.90	0.26	0.80	1.07	1.0	0.037	2.24	45.86	0.088	3.20	2.47	2	1.32538	17.606	1.6856	20.448
19.521	0.90	0.26	0.80	1.07	1.0	0.037	2.31	46.52	0.089	3.20	2.47	2	1.317429	17.332	1.6593	20.130
19.685	0.89	0.26	0.80	1.07	1.0	0.037	2.32	46.87	0.089	3.19	2.47	2	1.309586	17.402	1.6661	20.211
19.849	0.89	0.27	0.80	1.07	1.0	0.037	2.11	45.87	0.088	3.14	2.47	2	1.299751	18.676	1.7881	21.691
20.013	0.89	0.29	0.80	1.07	1.0	0.037	1.81	46.18	0.088	3.13	2.53	2	1.281587	22.021	2.1083	25.576
20.177	0.89	0.32	0.80	1.07	1.0	0.037	1.65	49.26	0.091	3.20	2.64	2	1.264406	25.708	2.4613	29.859
20.341	0.89	0.32	0.80	1.07	1.0	0.037	1.69	53.33	0.094	3.29	2.72	2	1.254035	27.178	2.602	31.565
20.505	0.89	0.33	0.80	1.06	1.0	0.037	1.71	55.97	0.096	3.35	2.77	2	1.244973	28.255	2.7051	32.816
20.669	0.89	0.33	0.80	1.06	1.0	0.037	1.75	58.12	0.098	3.39	2.81	2	1.23769	28.636	2.7416	33.259
20.833	0.89	0.34	0.80	1.06	1.0	0.037	1.75	58.98	0.099	3.40	2.82	2	1.230504	29.036	2.7799	33.723
20.997	0.88	0.33	0.80	1.06	1.0	0.037	1.79	58.98	0.099	3.38	2.80	2	1.225743	28.299	2.7094	32.868
21.161	0.88	0.33	0.80	1.06	1.0	0.037	1.76	58.94	0.099	3.36	2.80	2	1.218455	28.841	2.7612	33.497

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-6N

Data File: 13-52106_SP3-6N-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

5604.20	Water surface elevation during CPT investigation (ft a
5599.16	Water surface elevation at t_0 (ft amsl)
5590.44	Water surface elevation at t_1 (ft amsl)
5585.44	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earth
7.51	Equiv. Number of Uniform Strain Cycles, N

5607.44	Ground Surface Elevation at time of CPT (ft amsl)
5623.62	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pla
3.50	Thickness of Water Storage/Rooting Zone (ft)
3.50	Thickness of High Compaction Layer (ft)
8.68	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1720.10	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5585.44	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	######	5623.37	5623.12	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	######	5621.37	5619.62	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5617.87	5616.12	3.50	0.060	120	0.424	0.320	0.00	0.00	0.424	0.320
Platform/Random Fill Layer	######	5611.78	5607.44	8.68	0.050	101	0.861	0.643	0.00	0.00	0.861	0.643

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
0.164	5607.28	10.8	0.029	10.8	8.7	3.75	0.27%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0	1.70	18.326	254.73	21.39	1310	0.27%	0.7	51%	0.87	0.00	0.87	0
0.328	5607.11	17.1	0.110	17.0	4.0	1.74	0.64%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	28.968	402.66	33.69	1032	0.65%	1.1	51%	0.88	0.00	0.88	0
0.492	5606.95	38.1	0.119	38.1	2.8	1.21	0.31%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	64.804	900.78	75.30	1538	0.31%	0.8	51%	0.88	0.00	0.88	0
0.656	5606.78	56.7	0.134	56.7	2.8	1.21	0.24%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0	1.70	96.339	1339.11	111.93	1714	0.24%	0.6	51%	0.89	0.00	0.89	0
0.820	5606.62	78.5	0.600	78.5	2.0	0.88	0.76%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0	1.70	133.399	1854.25	154.96	1899	0.76%	1.1	51%	0.90	0.00	0.90	0
0.984	5606.46	88.8	0.411	88.8	7.3	3.17	0.46%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0	1.70	150.909	2097.64	175.36	1791	0.46%	0.9	51%	0.91	0.00	0.91	0
1.148	5606.29	97.1	0.455	97.1	6.7	2.89	0.47%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0	1.70	165.002	2293.53	191.72	1678	0.47%	0.9	51%	0.92	0.00	0.92	0
1.312	5606.13	120.3	0.621	120.3	5.6	2.42	0.52%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	204.459	2841.98	237.54	1819	0.52%	1.0	51%	0.93	0.00	0.93	0
1.476	5605.96	117.5	1.100	117.5	6.9	2.99	0.94%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	199.682	2775.58	232.00	1579	0.94%	1.2	51%	0.93	0.00	0.93	0
1.640	5605.80	118.4	1.817	118.4	11.4	4.95	1.53%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0	1.70	201.212	2796.85	233.84	1433	1.54%	1.4	51%	0.94	0.00	0.94	0
1.804	5605.64	123.5	2.268	123.4	21.1	9.14	1.84%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0	1.70	209.780	2915.94	243.91	1358	1.84%	1.5	51%	0.95	0.00	0.95	0
1.968	5605.47	160.8	1.984	160.8	3.6	1.57	1.23%	Interim Cover	0.050	100.7	0.10	0.00	0.10	0	1.70	273.394	3800.18	317.58	1621	1.23%	1.3	51%	0.96	0.00	0.96	0
2.133	5605.31	176.8	1.510	176.8	2.1	0.90	0.85%	Interim Cover	0.050	100.7	0.11	0.00	0.11	0	1.70	300.577	4178.02	349.13	1645	0.85%	1.2	51%	0.97	0.00	0.97	0
2.297	5605.14	139.6	1.524	139.5	6.6	2.87	1.09%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	236.977	3293.98	275.32	1206	1.09%	1.3	51%	0.98	0.00	0.98	0
2.461	5604.98	107.1	1.707	107.0	5.4	2.32	1.59%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	181.951	2529.12	211.39	863	1.60%	1.5	51%	0.98	0.00	0.98	0
2.625	5604.82	84.4	1.333	84.4	6.6	2.87	1.58%	Interim Cover	0.050	100.7	0.13	0.00	0.13	0	1.70	143.480	1994.37	166.72	638	1.58%	1.6	51%	0.99	0.00	0.99	0
2.789	5604.65	89.6	1.432	89.6	-4.7	-2.02	1.60%	Interim Cover	0.050	100.7	0.14	0.00	0.14	0	1.70	152.388	2118.19	176.93	637	1.60%	1.6	51%	1.00	0.00	1.00	0
2.953	5604.49	77.3	1.421	77.3	-4.6	-2.00	1.84%	Interim Cover	0.050	100.7	0.15	0.00	0.15	0	1.70	131.376	1826.13	152.53	518	1.84%	1.7	51%	1.01	0.00	1.01	0
3.117	5604.32	57.2	1.269	57.2	-3.2	-1.37	2.22%	Interim Cover	0.050	100.7	0.16	0.00	0.16	0	1.70	97.240	1351.64	112.90	363	2.23%	1.8	51%	1.02	0.00	1.02	0
3.281	5604.16	57.1	1.231	57.1	-3.1	-1.33	2.16%	Sand-Slime Tailing	0.059	119.0	0.17	0.00	0.17	1	1.70	97.019	1348.56	112.64	344	2.16%	1.8	47%	1.03	0.00	1.03	0
3.445	5604.00	105.1	0.904	105.1	-2.7	-1.16	0.86%	Sand Tailings	0.062	123.5	0.18	0.01	0.17	1	1.68	177.110	2461.83	205.67	616	0.86%	1.3	18%	1.04	0.00	1.04	0
3.609	5603.83	60.4	0.451	60.5	-1.3	-0.55	0.75%	Sand Tailings	0.062	123.5	0.19	0.01	0.18	1	1.70	102.765	1428.43	119.34	343	0.75%	1.4	18%	1.05	0.00	1.05	0
3.773	5603.67	36.8	0.568	36.8	-6.9	-2.99	1.55%	Sand-Slime Tailing	0.059	119.0	0.20	0.02	0.18	1	1.70	62.560	869.58	72.57	203	1.55%	1.8	47%	1.06	0.00	1.06	0
3.937	5603.50	18.3	0.393	18.4	-6.8	-2.95	2.14%	Sand-Slime Tailing	0.059	119.0	0.21	0.02	0.18	1	1.70	31.246	434.32	36.21	98	2.17%	2.1	47%	1.07	0.00	1.07	0
4.101	5603.34	6.8	0.370	6.8	-1.7	-0.72	5.47%	Slime Tailings	0.057	113.1	0.22	0.03	0.19	1	1.70	11.526	160.21	13.37	35	5.65%	2.8	71%	1.08	0.00	1.08	0
4.265	5603.17	7.9	0.213	7.9	1.0	0.42	2.68%	Slime Tailings	0.057	113.1	0.23	0.03	0.19	1	1.70	13.481	187.39	15.67	40	2.76%	2.5	71%	1.09	0.00	1.09	0
4.429	5603.01	9.1	0.198	9.1	0.7	0.29	2.18%	Slime Tailings	0.057	113.1	0.23	0.04	0.20	1	1.70	15.436	214.56	17.94	45	2.24%	2.4	71%	1.09	0.00	1.09	0
4.593	5602.85	7.9	0.200	7.9	1.4	0.59	2.54%	Slime Tailings	0.057	113.1	0.24	0.04	0.20	1	1.70	13.362	185.73	15.54	38	2.62%	2.5	71%	1.10	0.00	1.10	0
4.757	5602.68	14.7	0.112	14.6	6.6	2.87	0.76%	Sand-Slime Tailing	0.059	119.0	0.25	0.05	0.21	1	1.70	24.837	345.23	28.93	70	0.78%	2.0	47%	1.11	0.00	1.11	0
4.921	5602.52	29.5	0.077	29.5	0.6	0.26	0.26%	Sand-Slime Tailing	0.059	119.0	0.26	0.05	0.21	1	1.70	50.201	697.79	58.31	139	0.26%	1.5	47%	1.12	0.00	1.12	0
5.085	5602.35	24.5	0.105	24.5	-1.1	-0.49	0.43%	Sand-Slime Tailing	0.059	119.0	0.27	0.06	0.22	1	1.70	41.633	578.70	48.34	112	0.43%	1.7	47%	1.13	0.00	1.13	0
5.249	5602.19	21.8	0.186	21.8	2.1	0.91	0.85%	Sand-Slime Tailing	0.059	119.0	0.28	0.06	0.22	1	1.70	37.094	515.61	43.11	98	0.86%	1.9	47%	1.14	0.00	1.14	0
5.413	5602.03	13.2	0.258	13.2	3.3	1.43	1.95%	Sand-Slime Tailing	0.059	119.0	0.29	0.07	0.22	1	1.70	22.474	312.39	26.14	58	1.99%	2.3	47%	1.15	0.00	1.15	0
5.577	5601.86	10.1	0.292	10.0	11.1	4.81	2.89%	Slime Tailings	0.057	113.1	0.30	0.07	0.23	1	1.70	17.068	237.25	19.96	43	2.98%	2.5	71%	1.16	0.00	1.16	0
5.741	5601.70	8.4	0.248	8.3	11.7	5.07	2.95%	Slime Tailings	0.057	113.1	0.31	0.08	0.23	1	1.70	14.144	196.60	16.57	35	3.07%	2.6	71%	1.17	0.00	1.17	0
5.905	5601.53	7.3	0.202	7.2	12.6	5.46	2.76%	Slime Tailings	0.057	113.1	0.32	0.08	0.24	1	1.70	12.308	171.08	14.45	30	2.89%	2.6	71%	1.18	0.00	1.18	0
6.069	5601.37	11.4	0.159	11.3	23.0	9.95	1.40%	Sand-Slime Tailing	0.059	119.0	0.33	0.09	0.24	1	1.70	19.125	265.84	22.50	46	1.44%	2.3	47%	1.19	0.00	1.19	0
6.234	5601.21	13.4	0.202	13.4	8.1	3.51	1.51%	Sand-Slime Tailing	0.059	119.0	0.34	0.09	0.25	1	1.70	22.712	315.70	26.48	53	1.55%	2.2	47%	1.20	0.00	1.20	0
6.398	5601.04	17.4	0.135	17.4	8.8	3.83	0.77%	Sand-Slime Tailing	0.059	119.0	0.35	0.10	0.25	1	1.70	29.529	410.45	34.41	68	0.79%	2.0	47%	1.21	0.00	1.21	0
6.562	5600.88	33.6	0.152	33.5	8.1	3.50	0.45%	Sand Tailings	0.062	123.5	0.36	0.10	0.26	1	1.70	56.967	791.84	66.26	130	0.46%	1.6	18%	1.22	0.00	1.22	0
6.726	5600.71	25.5	0.167	25.5	1.3	0.57	0.65%	Sand-Slime Tailing	0.059	119.0	0.37	0.11	0.26	1	1.70	43.418	603.51	50.44	97	0.66%	1.8	47%	1.23	0.00	1.23	0
6.890	5600.55	13.1	0.130	13.1	2.1	0.90	0.99%	Sand-Slime Tailing	0.059	119.0	0.38	0.11	0.27	1	1.70	22.287	309.79	25.91	48	1.02%	2.2	47%	1.24	0.00	1.24	0
7.054	5600.39	6.0	0.125	5.9	15.6	6.76	2.08%	Slime Tailings	0.057	113.1	0.39	0.12	0.27	1	1.70	10.047	139.65	11.86	21	2.22%	2.7	71%	1.25	0.00	1.25	0
7.218	5600.22	6.6	0.062	6.4	28.5	12.36	0.94%	Slime Tailings	0.057	113.1	0.40	0.12	0.27	1	1.70	10.914	151.70	13.03	23	1.00%	2.4	71%	1.26	0.00	1.26	0
7.382	5600.06	19.6	0.120	19.5	19.3	8.36	0.61%	Sand-Slime Tailing	0.059	119.0	0.41	0.13	0.28	1	1.70	33.133	460.55	38.72	69	0.62%	1.9	47%	1.27	0.00	1.27	0
7.546	5599.89	11.8	0.165	11.8	7.7	3.32	1.40%	Sand-Slime Tailing	0.059	119.0	0.42	0.13	0.28	1	1.70	20.009	278.13	23.33	40	1.45%	2.3	47%	1.28	0.00	1.28	0
7.710	5599.73	11.2	0.230	11.1	15.6	6.75	2.06%	Slime Tailings	0.057	113.1	0.43	0.14	0.29	1	1.70	18.819	261.58	22.05	37	2.14%	2.5	71%	1.29	0.00	1.29	0
7.874	5599.57	9.4	0.185	9.3	9.2	4.00	1.98%	Slime Tailings	0.057	113.1	0.44	0.14	0.29	1	1.70	15.810	219.76	18.48	31	2.07%	2.5	71%	1.30	0.00	1.30	0
8.038	5599.40	7.2	0.119	7.1	13.2	5.73	1.66%	Slime Tailings	0.057	113.1	0.45	0.15	0.30	1	1.70	12.019	167.06	14.12	23	1.77%	2.6	71%	1.31	0.00	1.31	0
8.202	5599.24	6.0	0.067	5.9	26.0	11.28	1.11%	Slime Tailings	0.057	113.1	0.45	0.15	0.30	1	1.70	9.962	138.47	11.89	19	1.20%	2.6	71%	1.31	0.00	1.31	0
8.366	5599.07	6.1	0.081	5.9	31.3	13.56	1.34%	Slime Tailings	0.057	113.1	0.46	0.16	0.30	1	1.70	9.962	138.47	11.96	18	1.45%	2.6	71%	1.32	0.00	1.32	0
8.530	5598.91	13.2	0.065	12.9	48.6	21.04	0.49%	Sand-Slime Tailing	0.059	119.0	0.47	0.17	0.31	1	1.70	21.981	305.54	26.13	41	0.51%	2.1	47%	1.33	0.00	1.33	0
8.694	5598.75	13.3	0.116	13.3	8.9	3.84	0.87%	Sand-Slime Tailing	0.059	119.0	0.48	0.17	0.31	1	1.70	22.525	313.10	26.27	41	0.90%	2.2	47%	1.34	0.00	1.34	0
8.858	5598.58	6.7	0.132	6.6	9.6	4.14	1.98%	Slime Tailings	0.057	113.1	0.49	0.18	0.32	1	1.70	11.254	156.43	13.19	20	2.13%	2.7	71%	1.35	0.00	1.35	0
9.022	5598.42	3.7	0.117	3.6	7.2	3.11	3.20%	Slime Tailings	0.057	113.1	0.50	0.18	0.32	1	1.70	6.137	85.30	7.22	10	3.71%	3.1	71%	1.36	0.00	1.36	0
9.186	5598.25	2.3	0.054	2.2	18.5	8.01	2.32%	Slime Tailings	0.057	113.1	0.51	0.19	0.33	1	1.70	3.757	52.22	4.59	6	2.98%	3.2	71%	1.37	0.00	1.37	0
9.350	5598.09	2.4	0.024	2.2	24.5	10.62	1.02%	Slime Tailings	0.057	113.1	0.52	0.19	0.33	1	1.70	3.757	52.22	4.67	6	1.30%	3.0	71%	1.38	0.00	1.38	0
9.514	5597.93	2.6	0.011	2.4	34.3	14.85	0.42%	Slime Tailings	0.057	113.1	0.53	0.20	0.33	1	1.70	4.080	56.71	5.16	6	0.53%	2.8	71%	1.39	0.00	1.39	0
9.678	5597.76	2.8	0.016	2.6	37.8	16.39	0.57%	Slime Tailings	0.057	113.1	0.54	0.20	0.34	1	1.70	4.403	61.20	5.58	7	0.70%	2.8	71%	1.40	0.00	1.40	0
9.842	5597.60	3.2	0.010	2.9	39.6	17.14	0.32%	Slime Tailings	0.057	113.1	0.55	0.21	0.34	1	1.70	4.947	68.76	6.23	8	0.38%	2.7	71%	1.41	0.00	1.41	0
10.006	5597.43	4.5	0.016	4.3	44.0	19.08	0.35%	Slime Tailings	0.057	113.1	0.56	0.21	0.35	1	1.70	7.225	100.43	8.93	11	0.40%	2.5	71%	1.42	0.00	1.42	0
10.170	5597.27	22.4	0.010	22.4	7.4	3.19	0.04%	Sand-Slime Tailing	0.059	119.0	0.57	0.22	0.35	1	1.70	37.995	528.13	44.22	62	0.05%	1.7	47%	1.43	0.00	1.43	0
10.335	5597.11	9.5	0.106	9.4	6.7	2.89	1.12%	Sand-Slime Tailing	0.059	119.0	0.58	0.22	0.36	1	1.70	15.997	222.36	18.66	25	1.19%	2.4	47%	1.44	0.00	1.44	0
10.499	5596.94	7.7	0.177	7.6	9.0	3.88	2.30%	Slime Tailings	0.057	113.1	0.59	0.23	0.36	1	1.70	12.971	180.30	15.18	20	2.49%	2.7	71%	1.45	0.00	1.45	0
10.663	5596.78	6.4	0.128	6.3	17.8	7.70	2.00%	Slime Tailings	0.057	113.1	0.60	0.23	0.36	1	1.70	10.693	148.63	12.64	16	2.20%	2.8	71%	1.46	0.00	1.46	0
10.827	5596.61	4.4	0.090	4.2	34.3	14.84	2.04%	Slime Tailings	0.057	113.1	0.60	0.24	0.37	1	1.70	7.123	99.01	8.70	10	2.37%	2.9	71%	1.46	0.00	1.46	0
10.991	5596.45	5.0	0.031	4.7	52.3	22.65	0.62%	Slime Tailings	0.057	113.1	0.61	0.24	0.37	1	1.70	7.990	111.06	9.92	12	0.70%	2.6	71%	1.47	0.00	1.47	0
11.155	5596.29	3.9	0.027	3.6	49.3	21.35	0.70%	Slime Tailings	0.057	113.1	0.62	0.25	0.38	1	1.70	6.052	84.12	7.64	9	0.83%	2.8	71%	1.48	0.00	1.48	0
11.319	5596.12	3.6	0.014	3.2	58.6	25.37	0.39%	Slime Tailings	0.057	113.1	0.63	0.25	0.38	1	1.70	5.508	76.56	7.12	8	0.47%	2.7	71%	1.49	0.00	1.49	0
11.483	5595.96	3.7	0.010	3.3	65.7	28.48	0.27%	Slime Tailings	0.057	113.1	0.64	0.26	0.38	1	1.70	5.610	77.98	7.33	8	0.33%	2.7	71%	1.50	0.00	1.50	0
11.647	5595.79	3.5	0.010	3.1	63.3	27.45	0.29%	Slime Tailings	0.057	113.1	0.65	0.26	0.39	1	1.70	5.270	73.25	6.90	7	0.35%	2.7	71%	1.51	0.00	1.51	0
11.811	5595.63	3.3	0.010	2.9	65.8	28.52	0.31%	Slime Tailings	0.057	113.1	0.66	0.27	0.39	1	1.70	4.862	67.58	6.46	7	0.38%	2.8	71%	1.52	0.00	1.52	0
11.975	5595.47	3.0	0.010	2.6	62.5	27.10	0.33%	Slime Tailings	0.057	113.1	0.67	0.27	0.40	1	1.70	4.420	61.44	5.90	6	0.43%	2.8	71%	1.53	0.00	1.53	0

Liquefaction Triggering Analyses: Idriss & Boulanger (2008) / Youd et al. (2001); Idriss & Boulanger (2008)

Depth (ft)	I&B Cyclic Stress Ratio r_d	C_σ	K_σ	K_a	CSR M=7.5, s'v=1atm	Cyclic Resistance Ratio Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Youd Cyclic Stress Ratio r_d	D_r	f	K_σ	K_a	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No	CN	qc1 TSF	qc1 MPa	qc1N
0.164	1.00	0.05	1.00	1.0	0.058	37.83	59.22	0.087	1.51	0.96	0.27	0.80	2.53	1.0	0.017	1.00	21.39	0.068	166.66	84.08	2	1.7	18.418	1.7633	21.391
0.328	1.00	0.06	1.00	1.0	0.058	42.14	75.84	0.107	1.85	0.96	0.34	0.80	2.20	1.0	0.019	1.00	33.69	0.078	95.96	48.91	2	1.7	29.011	2.7775	33.694
0.492	1.00	0.09	1.00	1.0	0.058	56.75	132.05	0.208	3.61	0.96	0.50	0.75	2.43	1.0	0.017	1.00	75.30	0.120	98.14	50.88	2	1.7	64.834	6.2072	75.300
0.656	1.00	0.12	1.00	1.0	0.058	69.60	181.53	0.561	9.75	0.96	0.61	0.69	2.71	1.0	0.016	1.00	111.93	0.210	129.42	69.59	2	1.7	96.369	9.2263	111.926
0.820	1.00	0.17	0.99	1.0	0.057	84.70	239.66	1.000	17.43	0.96	0.72	0.64	2.98	1.0	0.014	1.00	154.96	0.426	209.74	113.58	2	1.7	133.42	12.774	154.960
0.984	1.00	0.20	0.99	1.0	0.057	91.86	267.22	1.000	17.49	0.96	0.76	0.62	2.98	1.0	0.014	1.00	175.36	1.000	410.39	213.94	2	1.7	150.99	14.455	175.362
1.148	1.00	0.24	0.98	1.0	0.057	97.60	289.32	1.000	17.57	0.96	0.80	0.60	2.94	1.0	0.014	1.00	191.72	1.000	351.91	184.74	2	1.7	165.07	15.804	191.722
1.312	1.00	0.30	0.98	1.0	0.057	113.68	351.21	1.000	17.69	0.96	0.89	0.60	2.79	1.0	0.015	1.00	237.54	1.000	308.04	162.86	2	1.7	204.52	19.581	237.536
1.476	1.00	0.30	0.98	1.0	0.056	111.74	343.74	1.000	17.73	0.96	0.88	0.60	2.66	1.0	0.016	1.00	232.00	1.000	273.92	145.83	2	1.7	199.76	19.125	232.004
1.640	1.00	0.30	0.97	1.0	0.056	112.38	346.22	1.000	17.78	0.96	0.88	0.60	2.55	1.0	0.017	1.00	233.84	1.000	246.63	132.21	2	1.7	201.33	19.276	233.836
1.804	1.00	0.30	0.97	1.0	0.056	115.92	359.82	1.000	17.83	0.96	0.90	0.60	2.46	1.0	0.017	1.00	243.91	1.000	224.30	121.06	2	1.7	210	20.106	243.907
1.968	1.00	0.30	0.97	1.0	0.056	141.77	459.34	1.000	17.89	0.96	1.03	0.60	2.37	1.0	0.018	1.00	317.58	1.000	205.69	111.79	2	1.7	273.43	26.178	317.575
2.133	1.00	0.30	0.97	1.0	0.056	152.84	501.97	1.000	17.96	0.96	1.08	0.60	2.30	1.0	0.018	1.00	349.13	1.000	189.94	103.95	2	1.7	300.6	28.779	349.128
2.297	1.00	0.30	0.96	1.0	0.055	126.94	402.25	1.000	18.02	0.96	0.96	0.60	2.23	1.0	0.019	1.00	275.32	1.000	176.45	97.23	2	1.69827	237.05	22.695	275.316
2.461	1.00	0.30	0.96	1.0	0.055	104.50	315.90	1.000	18.08	0.96	0.84	0.60	2.17	1.0	0.019	1.00	211.39	1.000	164.75	91.41	2	1.7	182.01	17.425	211.391
2.625	1.00	0.19	0.97	1.0	0.056	88.83	255.55	1.000	17.84	0.96	0.75	0.63	2.01	1.0	0.021	1.00	166.72	1.000	154.51	86.18	2	1.7	143.55	13.744	166.725
2.789	0.99	0.21	0.97	1.0	0.056	92.41	269.34	1.000	17.94	0.96	0.77	0.62	2.01	1.0	0.021	1.00	176.93	1.000	145.48	81.71	2	1.7	152.34	14.585	176.932
2.953	0.99	0.16	0.97	1.0	0.056	83.85	236.38	1.000	17.87	0.96	0.71	0.64	1.87	1.0	0.023	1.01	154.81	0.425	58.42	38.14	2	1.7	131.33	12.573	152.528
3.117	0.99	0.12	0.98	1.0	0.056	69.94	182.84	0.585	10.40	0.96	0.61	0.69	1.69	1.0	0.025	1.12	125.96	0.266	34.64	22.52	2	1.7	97.207	9.3066	112.900
3.281	0.99	0.12	0.98	1.0	0.056	69.81	182.45	0.578	10.29	0.95	0.61	0.69	1.66	1.0	0.025	1.12	125.82	0.265	32.80	21.54	2	1.7	96.987	9.2855	112.644
3.445	0.99	0.28	0.95	1.0	0.054	74.67	280.34	1.000	18.41	0.95	0.83	0.60	1.91	1.0	0.022	1.00	205.67	1.000	120.06	69.23	2	1.684674	177.08	16.954	205.670
3.609	0.99	0.12	0.98	1.0	0.056	52.60	171.94	0.428	7.66	0.95	0.63	0.68	1.65	1.0	0.025	1.00	119.34	0.238	27.78	17.72	2	1.7	102.75	9.8374	119.340
3.773	0.99	0.09	0.98	1.0	0.056	55.75	128.33	0.199	3.54	0.95	0.49	0.75	1.47	1.0	0.029	1.13	81.86	0.131	14.90	9.22	2	1.7	62.487	5.9825	72.574
3.937	0.99	0.06	0.99	1.0	0.056	43.00	79.21	0.112	1.98	0.95	0.35	0.80	1.36	1.0	0.031	1.54	55.93	0.096	10.68	6.33	2	1.7	31.174	2.9846	36.206
4.101	0.99	0.05	0.99	1.0	0.056	34.74	48.11	0.076	1.34	0.95	0.21	0.80	1.35	1.0	0.031	4.45	59.42	0.100	10.80	6.07	2	1.7	11.508	1.1018	13.366
4.265	0.99	0.05	0.99	1.0	0.056	35.54	51.21	0.079	1.40	0.95	0.23	0.80	1.35	1.0	0.031	2.77	43.40	0.086	9.15	5.27	2	1.7	13.491	1.2917	15.669
4.429	0.99	0.05	0.99	1.0	0.056	36.33	54.27	0.082	1.45	0.95	0.24	0.80	1.34	1.0	0.031	2.32	41.62	0.085	8.81	5.13	2	1.7	15.443	1.4785	17.936
4.593	0.98	0.05	0.99	1.0	0.056	35.50	51.03	0.078	1.40	0.95	0.23	0.80	1.34	1.0	0.031	2.78	43.24	0.086	8.77	5.08	2	1.7	13.376	1.2807	15.536
4.757	0.98	0.06	0.99	1.0	0.056	40.45	69.38	0.099	1.76	0.95	0.31	0.80	1.33	1.0	0.032	1.26	36.49	0.080	8.01	4.89	2	1.7	24.907	2.3846	28.928
4.921	0.98	0.08	0.98	1.0	0.056	50.75	109.07	0.158	2.84	0.95	0.44	0.78	1.36	1.0	0.031	1.00	58.31	0.098	9.60	6.22	2	1.7	50.207	4.8069	58.313
5.085	0.98	0.07	0.98	1.0	0.056	47.26	95.60	0.135	2.43	0.95	0.40	0.80	1.32	1.0	0.032	1.01	48.77	0.091	8.65	5.54	2	1.7	41.621	3.9848	48.340
5.249	0.98	0.07	0.98	1.0	0.056	45.42	88.53	0.125	2.24	0.95	0.38	0.80	1.31	1.0	0.032	1.17	50.35	0.092	8.59	5.41	2	1.7	37.116	3.5535	43.108
5.413	0.98	0.06	0.98	1.0	0.056	39.47	65.61	0.094	1.69	0.95	0.30	0.80	1.31	1.0	0.032	1.91	49.87	0.092	8.38	5.04	2	1.7	22.509	2.155	26.143
5.577	0.98	0.05	0.98	1.0	0.056	37.04	57.00	0.085	1.52	0.95	0.26	0.80	1.30	1.0	0.032	2.76	55.19	0.096	8.60	5.06	2	1.7	17.186	1.6454	19.960
5.741	0.98	0.05	0.98	1.0	0.056	35.86	52.43	0.080	1.43	0.95	0.24	0.80	1.30	1.0	0.032	3.18	52.77	0.094	8.28	4.86	2	1.7	14.268	1.366	16.572
5.905	0.98	0.05	0.98	1.0	0.056	35.12	49.57	0.077	1.39	0.95	0.22	0.80	1.29	1.0	0.032	3.40	49.16	0.091	7.90	4.64	2	1.7	12.442	1.1912	14.450
6.069	0.98	0.05	0.98	1.0	0.055	38.19	60.69	0.089	1.60	0.95	0.27	0.80	1.29	1.0	0.032	1.87	42.03	0.085	7.24	4.42	2	1.7	19.369	1.8544	22.496
6.234	0.98	0.06	0.98	1.0	0.055	39.59	66.07	0.095	1.71	0.95	0.30	0.80	1.28	1.0	0.033	1.78	47.10	0.089	7.46	4.59	2	1.7	22.798	2.1827	26.478
6.398	0.97	0.06	0.98	1.0	0.055	42.37	76.77	0.108	1.96	0.95	0.34	0.80	1.28	1.0	0.033	1.28	43.97	0.087	7.11	4.54	2	1.7	29.623	2.8361	34.405
6.562	0.97	0.08	0.97	1.0	0.055	39.03	105.29	0.151	2.77	0.95	0.47	0.77	1.33	1.0	0.031	1.00	66.26	0.107	8.62	5.70	2	1.7	57.053	5.4622	66.263
6.726	0.97	0.07	0.97	1.0	0.055	47.99	98.44	0.140	2.56	0.95	0.41	0.79	1.28	1.0	0.033	1.12	56.34	0.097	7.65	5.10	2	1.7	43.432	4.1582	50.444
6.890	0.97	0.06	0.98	1.0	0.055	39.48	65.30	0.094	1.71	0.95	0.29	0.80	1.27	1.0	0.033	1.60	41.35	0.084	6.57	4.14	2	1.7	22.309	2.1359	25.911
7.054	0.97	0.05	0.98	1.0	0.055	34.22	46.08	0.074	1.34	0.95	0.20	0.80	1.26	1.0	0.033	3.72	44.16	0.087	6.65	3.99	2	1.7	10.212	0.9777	11.861
7.218	0.97	0.05	0.98	1.0	0.055	34.62	47.65	0.075	1.37	0.95	0.21	0.80	1.26	1.0	0.033	2.49	32.43	0.077	5.81	3.59	2	1.7	11.217	1.0739	13.028
7.382	0.97	0.06	0.98	1.0	0.055	43.88	82.60	0.116	2.13	0.95	0.36	0.80	1.25	1.0	0.033	1.21	46.84	0.089	6.61	4.37	2	1.7	33.338	3.1918	38.720
7.546	0.97	0.05	0.98	1.0	0.055	38.48	61.82	0.090	1.64	0.94	0.28	0.80	1.25	1.0	0.033	2.02	47.02	0.089	6.52	4.08	2	1.7	20.09	1.9234	23.334
7.710	0.97	0.05	0.98	1.0	0.055	37.77	59.82	0.088	1.60	0.94	0.27	0.80	1.25	1.0	0.033	2.53	55.75	0.096	6.92	4.26	2	1.7	18.984	1.8176	22.049
7.874	0.96	0.05	0.98	1.0	0.055	36.52	55.00	0.082	1.51	0.94	0.25	0.80	1.24	1.0	0.034	2.82	52.03	0.093	6.61	4.06	2	1.7	15.908	1.523	18.476
8.038	0.96	0.05	0.98	1.0	0.055	35.01	49.13	0.077	1.40	0.94	0.22	0.80	1.24	1.0	0.034	3.17	44.79	0.087	6.12	3.76	2	1.7	12.159	1.1641	14.122
8.202	0.96	0.05	0.98	1.0	0.055	34.23	46.12	0.074	1.35	0.94	0.20	0.80	1.24	1.0	0.034	3.07	36.49	0.080	5.56	3.46	2	1.7	10.238	0.9802	11.891
8.366	0.96	0.05	0.98	1.0	0.054	34.25	46.21	0.074	1.36	0.94	0.20	0.80	1.23	1.0	0.034	3.34	39.89	0.083	5.68	3.52	2	1.7	10.294	0.9856	11.956
8.530	0.96	0.06	0.98	1.0	0.054	39.47	65.59	0.094	1.74	0.94	0.30	0.80	1.23	1.0	0.034	1.41	36.75	0.081	5.42	3.58	2	1.7	22.496	2.1538	26.128
8.694	0.96	0.06	0.97	1.0	0.054	39.52	65.79	0.094	1.75	0.94	0.30	0.80	1.22	1.0	0.034	1.66	43.71	0.086	5.72	3.74	2	1.7	22.619	2.1655	26.271
8.858	0.96	0.05	0.98	1.0	0.054	34.68	47.87	0.075	1.39	0.94	0.21	0.80	1.22	1.0	0.034	3.81	50.27	0.092	6.00	3.70	2	1.7	11.355	1.0872	13.189
9.022	0.96	0.04	0.98	1.0	0.054	32.60	39.82	0.068	1.26	0.94	0.16	0.80	1.22	1.0	0.034	7.40	53.38	0.094	6.08	3.67	2	1.7	6.2132	0.5949	7.216
9.186	0.96	0.04	0.98	1.0	0.054	31.69	36.28	0.066	1.21	0.94	0.12	0.80	1.21	1.0	0.034	9.35	42.94	0.086	5.47	3.34	2	1.7	3.9532	0.3785	4.591
9.350	0.96	0.04	0.98	1.0	0.054	31.71	36.38	0.066	1.21	0.94	0.12	0.80	1.21	1.0	0.034	7.11	33.17	0.078	4.89	3.05	2	1.7	4.017	0.3846	4.666
9.514	0.95	0.04	0.98	1.0	0.054	31.88	37.05	0.066	1.23	0.94	0.13	0.80	1.21	1.0	0.034	5.10	26.30	0.072	4.48	2.85	2	1.7	4.4436	0.4254	5.161
9.678	0.95	0.04	0.98	1.0	0.054	32.03	37.61	0.067	1.24	0.94	0.14	0.80	1.21	1.0	0.034	5.19	28.96	0.074	4.56	2.90	2	1.7	4.8045	0.46	5.580
9.842	0.95	0.04	0.98	1.0	0.054	32.26	38.49	0.067	1.25	0.94	0.14	0.80	1.20	1.0	0.034	4.07	25.35	0.071	4.32	2.79	2	1.7	5.3668	0.5138	6.233
10.006	0.95	0.04	0.98	1.0	0.054	33.20	42.13	0.070	1.31	0.94	0.17	0.80	1.20	1.0	0.035	3.02	27.02	0.073	4.36	2.83	2	1.7	7.6922	0.7364	8.934
10.170	0.95	0.07	0.97	1.0	0.053	45.81	90.03	0.127	2.39	0.94	0.38	0.80	1.20	1.0	0.035	1.02	45.30	0.088	5.20	3.80	2	1.7	38.073	3.6451	44.220
10.335	0.95	0.05	0.97	1.0	0.053	36.85	55.51	0.083	1.55	0.94	0.25	0.80	1.19	1.0	0.035	2.51	46.77	0.089	5.21	3.38	2	1.7	16.068	1.5383	18.662
10.499	0.95	0.05	0.97	1.0	0.053	35.37	50.55	0.078	1.46	0.94	0.22	0.80	1.19	1.0	0.035	4.07	61.73	0.102	5.90	3.68	2	1.7	13.066	1.2509	15.175
10.663	0.95	0.05	0.98	1.0	0.053	34.49	47.13	0.075	1.40	0.94	0.21	0.80	1.19	1.0	0.035	4.41	55.68	0.096	5.50	3.45	2	1.7	10.882	1.0418	12.638
10.827	0.95	0.04	0.98	1.0	0.053	33.12	41.81	0.070	1.31	0.94	0.17	0.80	1.19	1.0	0.035	5.98	52.01	0.093	5.27	3.29	2	1.7	7.4865	0.7168	8.695
10.991	0.94	0.05	0.98	1.0	0.053	33.54	43.47	0.072	1.34	0.94	0.18	0.80	1.18	1.0	0.035	3.47	34.43	0.079	4.41	2.88	2	1.7	8.5447	0.8181	9.924
11.155	0.94	0.04	0.98	1.0	0.053	32.75	40.38	0.069	1.29	0.94	0.16	0.80	1.18	1.0	0.035	4.61	35.20	0.079	4.40	2.85	2	1.7	6.5749	0.6295	7.636
11.319	0.94	0.04	0.98	1.0	0.053	32.57	39.69	0.068	1.29	0.94	0.15	0.80	1.18	1.0	0.035	4.20	29.90	0.075	4.11	2.70	2	1.7	6.1294	0.5868	7.119
11.483	0.94	0.04	0.98	1.0	0.053	32.64	39.96	0.069	1.29	0.94	0.16	0.80	1.17	1.0	0.035	3.79	27.75	0.073	3.97	2.63	2	1.7	6.3076	0.6039	7.326
11.647	0.94	0.04	0.98	1.0	0.053	32.49	39.39	0.068	1.28	0.94	0.15	0.80	1.17	1.0	0.035	4.11	28.39	0.074	3.96	2.62	2	1.7	5.9422	0.5689	6.902
11.811	0.94	0.04	0.98	1.0	0.053	32.34	38.79	0.068	1.28	0.93	0.15	0.80	1.17	1.0	0.035	4.51	29.12	0.074	3.95	2.61	2	1.7	5.5605	0.5324	6.458
11.975	0.94	0.04	0.98	1.0	0.053	32.14	38.05	0.067	1.27	0.93	0.14	0.80	1.17	1.0	0.035	5.09	30.06	0.075	3.95	2.61	2	1.7	5.0837	0.4867	5.904

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-6N

Data File: 13-52106_SP3-6N-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

5604.20	Water surface elevation during CPT investigation (ft a
5599.16	Water surface elevation at t_0 (ft amsl)
5590.44	Water surface elevation at t_1 (ft amsl)
5585.44	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earth
7.51	Equiv. Number of Uniform Strain Cycles, N

5607.44	Ground Surface Elevation at time of CPT (ft amsl)
5623.62	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pla
3.50	Thickness of Water Storage/Rooting Zone (ft)
3.50	Thickness of High Compaction Layer (ft)
8.68	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1720.10	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5585.44	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	######	5623.37	5623.12	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	######	5621.37	5619.62	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5617.87	5616.12	3.50	0.060	120	0.424	0.320	0.00	0.00	0.424	0.320
Platform/Random Fill Layer	######	5611.78	5607.44	8.68	0.050	101	0.861	0.643	0.00	0.00	0.861	0.643

2013 CPT Data from ConeTec / CPT Data Interpretations

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of CPT (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No
12.139	5595.30	3.0	0.010	2.6	63.4	27.46	0.33%	Slime Tailings	0.057	113.1	0.68	0.28	0.40	1
12.303	5595.14	3.8	0.019	3.3	76.0	32.92	0.50%	Slime Tailings	0.057	113.1	0.69	0.28	0.41	1
12.467	5594.97	8.7	0.151	8.2	74.0	32.08	1.74%	Slime Tailings	0.057	113.1	0.70	0.29	0.41	1
12.631	5594.81	7.3	0.133	7.1	27.0	11.70	1.82%	Slime Tailings	0.057	113.1	0.71	0.29	0.41	1
12.795	5594.64	3.8	0.056	3.5	42.3	18.33	1.49%	Slime Tailings	0.057	113.1	0.72	0.30	0.42	1
12.959	5594.48	3.5	0.039	3.2	47.7	20.68	1.12%	Slime Tailings	0.057	113.1	0.73	0.30	0.42	1
13.123	5594.32	3.6	0.039	3.3	47.0	20.38	1.08%	Slime Tailings	0.057	113.1	0.73	0.31	0.43	1
13.287	5594.15	3.8	0.053	3.5	53.2	23.07	1.38%	Slime Tailings	0.057	113.1	0.74	0.31	0.43	1
13.451	5593.99	4.6	0.055	4.3	58.0	25.13	1.19%	Slime Tailings	0.057	113.1	0.75	0.32	0.43	1
13.615	5593.82	5.4	0.050	5.1	51.5	22.33	0.92%	Slime Tailings	0.057	113.1	0.76	0.32	0.44	1
13.779	5593.66	4.7	0.059	4.3	53.8	23.30	1.26%	Slime Tailings	0.057	113.1	0.77	0.33	0.44	1
13.943	5593.50	4.5	0.065	4.2	53.8	23.33	1.45%	Slime Tailings	0.057	113.1	0.78	0.33	0.45	1
14.107	5593.33	4.6	0.067	4.3	54.2	23.47	1.45%	Slime Tailings	0.057	113.1	0.79	0.34	0.45	1
14.271	5593.17	4.6	0.064	4.3	55.3	23.95	1.38%	Slime Tailings	0.057	113.1	0.80	0.34	0.46	1
14.436	5593.00	4.7	0.050	4.3	52.5	22.75	1.07%	Slime Tailings	0.057	113.1	0.81	0.35	0.46	1
14.600	5592.84	3.9	0.045	3.6	48.9	21.19	1.14%	Slime Tailings	0.057	113.1	0.82	0.35	0.46	1
14.764	5592.68	3.7	0.025	3.4	47.0	20.37	0.68%	Slime Tailings	0.057	113.1	0.83	0.36	0.47	1
14.928	5592.51	3.7	0.014	3.5	43.2	18.70	0.38%	Slime Tailings	0.057	113.1	0.84	0.36	0.47	1
15.092	5592.35	4.0	0.031	3.7	46.9	20.31	0.77%	Slime Tailings	0.057	113.1	0.85	0.37	0.48	1
15.256	5592.18	6.6	0.057	6.5	28.1	12.19	0.86%	Slime Tailings	0.057	113.1	0.86	0.37	0.48	1
15.420	5592.02	6.4	0.065	6.1	51.6	22.37	1.02%	Slime Tailings	0.057	113.1	0.86	0.38	0.48	1
15.584	5591.86	6.4	0.063	6.0	64.8	28.06	0.98%	Slime Tailings	0.057	113.1	0.87	0.39	0.49	1
15.748	5591.69	6.6	0.049	6.2	68.5	29.69	0.74%	Sand-Slime Tailing	0.059	119.0	0.88	0.39	0.49	1
15.912	5591.53	7.0	0.046	6.5	70.8	30.66	0.66%	Sand-Slime Tailing	0.059	119.0	0.89	0.40	0.50	1
16.076	5591.36	7.2	0.048	6.7	83.5	36.19	0.67%	Sand-Slime Tailing	0.059	119.0	0.90	0.40	0.50	1
16.240	5591.20	7.2	0.050	6.7	88.8	38.47	0.69%	Sand-Slime Tailing	0.059	119.0	0.91	0.41	0.51	1
16.404	5591.04	9.0	0.044	8.4	98.8	42.80	0.49%	Sand-Slime Tailing	0.059	119.0	0.92	0.41	0.51	1
16.568	5590.87	9.0	0.056	8.4	104.5	45.27	0.62%	Sand-Slime Tailing	0.059	119.0	0.93	0.42	0.52	1
16.732	5590.71	8.9	0.052	8.3	94.1	40.78	0.58%	Sand-Slime Tailing	0.059	119.0	0.94	0.42	0.52	1
16.896	5590.54	8.2	0.074	7.6	99.3	43.01	0.90%	Sand-Slime Tailing	0.059	119.0	0.95	0.43	0.53	1
17.060	5590.38	8.3	0.057	7.7	101.1	43.83	0.68%	Sand-Slime Tailing	0.059	119.0	0.96	0.43	0.53	1
17.224	5590.22	8.1	0.045	7.5	92.6	40.14	0.56%	Sand-Slime Tailing	0.059	119.0	0.97	0.44	0.54	1
17.388	5590.05	6.7	0.047	6.0	104.9	45.45	0.70%	Sand-Slime Tailing	0.059	119.0	0.98	0.44	0.54	1
17.552	5589.89	6.6	0.046	6.0	96.3	41.71	0.70%	Sand-Slime Tailing	0.059	119.0	0.99	0.45	0.54	1
17.716	5589.72	6.0	0.052	5.5	92.4	40.06	0.86%	Slime Tailings	0.057	113.1	1.00	0.45	0.55	1
17.880	5589.56	5.7	0.042	5.2	93.9	40.69	0.73%	Slime Tailings	0.057	113.1	1.01	0.46	0.55	1
18.044	5589.40	6.1	0.034	5.6	77.5	33.57	0.56%	Slime Tailings	0.057	113.1	1.02	0.46	0.56	1
18.208	5589.23	5.2	0.036	4.7	84.2	36.50	0.69%	Slime Tailings	0.057	113.1	1.03	0.47	0.56	1
18.372	5589.07	5.4	0.036	4.9	84.8	36.76	0.66%	Slime Tailings	0.057	113.1	1.04	0.47	0.57	1
18.537	5588.90	6.0	0.036	5.4	86.7	37.59	0.60%	Slime Tailings	0.057	113.1	1.05	0.48	0.57	1

CPT Data Interpretations / Conditions at t_1 / Liquefaction Triggering Analyses – Idriss & Boulanger (2008)

Depth at time of CPT (ft)	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No	r_d	C_σ	K_σ	K_a	CSR M=7.5, s'v=1atm	Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS
12.139	1.70	4.420	61.44	5.91	6	0.43%	2.8	71%	1.54	0.00	1.54	0	0.94	0.04	0.98	1.0	0.053	32.15	38.06	0.067	1.27
12.303	1.70	5.610	77.98	7.45	8	0.62%	2.8	71%	1.55	0.00	1.55	0	0.94	0.04	0.97	1.0	0.053	32.68	40.13	0.069	1.30
12.467	1.70	13.957	194.00	17.12	19	1.89%	2.6	71%	1.56	0.00	1.56	0	0.93	0.05	0.97	1.0	0.052	36.05	53.17	0.081	1.54
12.631	1.70	12.121	168.48	14.41	16	2.02%	2.7	71%	1.57	0.00	1.57	0	0.93	0.05	0.97	1.0	0.052	35.11	49.52	0.077	1.47
12.795	1.70	5.950	82.71	7.43	7	1.84%	3.0	71%	1.58	0.00	1.58	0	0.93	0.04	0.97	1.0	0.052	32.68	40.11	0.069	1.31
12.959	1.70	5.423	75.38	6.89	7	1.41%	3.0	71%	1.59	0.00	1.59	0	0.93	0.04	0.97	1.0	0.052	32.49	39.37	0.068	1.30
13.123	1.70	5.627	78.22	7.12	7	1.36%	3.0	71%	1.59	0.00	1.59	0	0.93	0.04	0.97	1.0	0.052	32.57	39.68	0.068	1.31
13.287	1.70	5.950	82.71	7.57	7	1.72%	3.0	71%	1.60	0.00	1.60	0	0.93	0.04	0.97	1.0	0.052	32.72	40.29	0.069	1.32
13.451	1.70	7.259	100.90	9.15	9	1.42%	2.9	71%	1.61	0.00	1.61	0	0.93	0.04	0.97	1.0	0.052	33.27	42.42	0.071	1.36
13.615	1.69	8.639	120.08	10.67	11	1.07%	2.7	71%	1.62	0.00	1.62	0	0.93	0.05	0.97	1.0	0.052	33.80	44.47	0.072	1.39
13.779	1.68	7.298	101.44	9.13	9	1.51%	2.9	71%	1.63	0.00	1.63	0	0.92	0.04	0.97	1.0	0.052	33.27	42.40	0.071	1.36
13.943	1.67	6.927	96.29	8.70	8	1.75%	2.9	71%	1.64	0.00	1.64	0	0.92	0.04	0.97	1.0	0.052	33.12	41.81	0.070	1.35
14.107	1.66	7.093	98.59	8.89	8	1.75%	2.9	71%	1.65	0.00	1.65	0	0.92	0.04	0.97	1.0	0.052	33.18	42.07	0.070	1.36
14.271	1.65	7.042	97.88	8.84	8	1.67%	2.9	71%	1.66	0.00	1.66	0	0.92	0.04	0.97	1.0	0.052	33.17	42.00	0.070	1.36
14.436	1.63	7.090	98.55	8.86	8	1.30%	2.9	71%	1.67	0.00	1.67	0	0.92	0.04	0.97	1.0	0.052	33.17	42.03	0.070	1.36
14.600	1.62	5.905	82.08	7.43	7	1.44%	3.0	71%	1.68	0.00	1.68	0	0.92	0.04	0.97	1.0	0.052	32.68	40.11	0.069	1.33
14.764	1.61	5.477	76.13	6.91	6	0.87%	2.9	71%	1.69	0.00	1.69	0	0.92	0.04	0.97	1.0	0.051	32.49	39.40	0.068	1.32
14.928	1.60	5.535	76.94	6.93	6	0.48%	2.8	71%	1.70	0.00	1.70	0	0.92	0.04	0.97	1.0	0.051	32.50	39.43	0.068	1.33
15.092	1.59	5.911	82.16	7.40	7	0.98%	2.9	71%	1.71	0.00	1.71	0	0.91	0.04	0.97	1.0	0.051	32.67	40.07	0.069	1.34
15.256	1.58	10.179	141.48	12.14	12	0.99%	2.7	71%	1.72	0.00	1.72	0	0.91	0.05	0.97	1.0	0.051	34.32	46.46	0.074	1.45
15.420	1.57	9.515	132.25	11.64	11	1.18%	2.7	71%	1.72	0.00	1.72	0	0.91	0.05	0.97	1.0	0.051	34.14	45.78	0.074	1.44
15.584	1.56	9.358	130.07	11.60	11	1.14%	2.7	71%	1.73	0.00	1.73	0	0.91	0.05	0.97	1.0	0.051	34.13	45.73	0.074	1.44
15.748	1.55	9.583	133.20	11.90	12	0.85%	2.7	47%	1.74	0.00	1.74	0	0.91	0.05	0.97	1.0	0.051	34.47	46.37	0.074	1.46
15.912	1.53	10.004	139.05	12.41	12	0.76%	2.6	47%	1.75	0.00	1.75	0	0.91	0.05	0.97	1.0	0.051	34.65	47.06	0.075	1.47
16.076	1.52	10.129	140.80	12.69	12	0.77%	2.6	47%	1.76	0.00	1.76	0	0.91	0.05	0.97	1.0	0.051	34.75	47.44	0.075	1.48
16.240	1.51	10.072	140.00	12.67	12	0.79%	2.6	47%	1.77	0.00	1.77	0	0.91	0.05	0.97	1.0	0.051	34.75	47.42	0.075	1.48
16.404	1.50	12.583	174.91	15.69	16	0.54%	2.5	47%	1.78	0.00	1.78	0	0.90	0.05	0.96	1.0	0.050	35.80	51.49	0.079	1.57
16.568	1.49	12.495	173.68	15.64	16	0.69%	2.5	47%	1.79	0.00	1.79	0	0.90	0.05	0.96	1.0	0.050	35.79	51.43	0.079	1.57
16.732	1.48	12.319	171.23	15.32	15	0.65%	2.5	47%	1.80	0.00	1.80	0	0.90	0.05	0.96	1.0	0.050	35.67	50.99	0.078	1.56
16.896	1.47	11.205	155.74	14.07	14	1.02%	2.6	47%	1.81	0.00	1.81	0	0.90	0.05	0.96	1.0	0.050	35.24	49.31	0.077	1.53
17.060	1.46	11.230	156.10	14.11	14	0.77%	2.6	47%	1.82	0.00	1.82	1	0.90	0.05	0.96	1.0	0.050	35.25	49.37	0.077	1.53
17.224	1.45	10.878	151.21	13.61	13	0.63%	2.6	47%	1.83	0.01	1.82	1	0.90	0.05	0.96	1.0	0.050	35.07	48.68	0.076	1.52
17.388	1.44	8.687	120.75	11.19	11	0.82%	2.7	47%	1.84	0.01	1.83	1	0.90	0.05	0.97	1.0	0.050	34.22	45.41	0.073	1.45
17.552	1.43	8.544	118.76	10.92	10	0.82%	2.7	47%	1.85	0.02	1.83	1	0.90	0.05	0.97	1.0	0.050	34.13	45.05	0.073	1.45
17.716	1.42	7.782	108.16	9.99	9	1.03%	2.8	71%	1.86	0.02	1.84	1	0.89	0.05	0.97	1.0	0.051	33.57	43.56	0.072	1.42
17.880	1.41	7.283	101.24	9.42	9	0.89%	2.8	71%	1.87	0.03	1.84	1	0.89	0.04	0.97	1.0	0.051	33.37	42.79	0.071	1.40
18.044	1.41	7.873	109.44	9.93	9	0.67%	2.7	71%	1.88	0.03	1.85	1	0.89	0.05	0.97	1.0	0.051	33.55	43.48	0.072	1.41
18.208	1.40	6.570	91.32	8.48	7	0.86%	2.8	71%	1.89	0.04	1.85	1	0.89	0.04	0.97	1.0	0.051	33.04	41.53	0.070	1.38
18.372	1.39	6.824	94.85	8.78	8	0.82%	2.8	71%	1.90	0.04	1.85	1	0.89	0.04	0.97	1.0	0.051	33.15	41.93	0.070	1.38
18.537	1.38	7.489	104.10	9.57	9	0.73%	2.8	71%	1.91	0.05	1.86	1	0.89	0.04	0.97	1.0	0.051	33.42	42.99	0.071	1.40

Liquefaction Triggering Analyses – Youd et al. (2001); Idriss & Boulanger (2008)

Depth at time of CPT (ft)	r_d	D_r	f	K_σ	K_a	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No	CN	qc1 TSF	qc1 MPa	qc1N
12.139	0.93	0.14	0.80	1.16	1.0	0.035	5.14	30.39	0.075	3.92	2.60	2	1.7	5.0926	0.4876	5.915
12.303	0.93	0.16	0.80	1.16	1.0	0.035	4.60	34.31	0.079	4.05	2.68	2	1.7	6.4161	0.6143	7.452
12.467	0.93	0.24	0.80	1.16	1.0	0.035	3.62	61.90	0.102	5.21	3.38	2	1.7	14.743	1.4115	17.123
12.631	0.93	0.22	0.80	1.16	1.0	0.036	4.24	61.11	0.101	5.12	3.30	2	1.7	12.408	1.1879	14.411
12.795	0.93	0.16	0.80	1.16	1.0	0.036	6.74	50.12	0.092	4.60	2.95	2	1.7	6.3988	0.6126	7.432
12.959	0.93	0.15	0.80	1.15	1.0	0.036	6.60	45.43	0.088	4.36	2.83	2	1.7	5.9295	0.5677	6.887
13.123	0.93	0.15	0.80	1.15	1.0	0.036	6.40	45.53	0.088	4.32	2.82	2	1.7	6.1261	0.5865	7.115
13.287	0.93	0.16	0.80	1.15	1.0	0.036	6.65	50.32	0.092	4.47	2.90	2	1.7	6.5149	0.6237	7.567
13.451	0.93	0.17	0.80	1.15	1.0	0.036	5.40	49.36	0.091	4.40	2.88	2	1.7	7.8745	0.7539	9.146
13.615	0.93	0.19	0.80	1.14	1.0	0.036	4.34	46.27	0.089	4.24	2.81	2	1.693906	9.1838	0.8793	10.666
13.779	0.93	0.17	0.80	1.14	1.0	0.036	5.57	50.85	0.092	4.37	2.87	2	1.681453	7.862	0.7527	9.131
13.943	0.93	0.17	0.80	1.14	1.0	0.036	6.12	53.22	0.094	4.42	2.89	2	1.669208	7.4881	0.7169	8.697
14.107	0.93	0.17	0.80	1.14	1.0	0.036	6.02	53.54	0.094	4.40	2.88	2	1.657163	7.6529	0.7327	8.888
14.271	0.93	0.17	0.80	1.14	1.0	0.036	5.96	52.69	0.094	4.33	2.85	2	1.645315	7.6096	0.7285	8.838
14.436	0.92	0.17	0.80	1.13	1.0	0.036	5.44	48.21	0.090	4.14	2.75	2	1.633658	7.6255	0.7301	8.857
14.600	0.92	0.16	0.80	1.13	1.0	0.036	6.51	48.41	0.090	4.12	2.73	2	1.622188	6.3999	0.6127	7.433
14.764	0.92	0.15	0.80	1.13	1.0	0.036	5.93	40.97	0.084	3.81	2.57	2	1.6109	5.9497	0.5696	6.910
14.928	0.92	0.15	0.80	1.13	1.0	0.036	5.06	35.03	0.079	3.56	2.44	2	1.599789	5.9662	0.5712	6.929
15.092	0.92	0.16	0.80	1.13	1.0	0.036	5.81	42.99	0.086	3.83	2.58	2	1.588851	6.3753	0.6104	7.405
15.256	0.92	0.20	0.80	1.12	1.0	0.036	3.86	46.90	0.089	3.94	2.70	2	1.578083	10.456	1.001	12.144
15.420	0.92	0.20	0.80	1.12	1.0	0.036	4.27	49.65	0.091	4.02	2.73	2	1.567479	10.02	0.9593	11.637
15.584	0.92	0.20	0.80	1.12	1.0	0.036	4.23	49.10	0.091	3.97	2.71	2	1.557036	9.9872	0.9562	11.599
15.748	0.91	0.20	0.80	1.12	1.0	0.036	3.75	44.62	0.087	3.77	2.62	2	1.545575	10.244	0.9807	11.897
15.912	0.91	0.20	0.80	1.12	1.0	0.036	3.49	43.25	0.086	3.70	2.58	2	1.534305	10.681	1.0226	12.406
16.076	0.91	0.21	0.80	1.11	1.0	0.036	3.44	43.65	0.086	3.68	2.58	2	1.52322	10.924	1.0458	12.687
16.240	0.91	0.21	0.80	1.11	1.0	0.036	3.49	44.25	0.087	3.67	2.58	2	1.512317	10.91	1.0445	12.671
16.404	0.91	0.23	0.80	1.11	1.0	0.036	2.60	40.77	0.084	3.52	2.55	2	1.501589	13.509	1.2934	15.690
16.568	0.91	0.23	0.80	1.11	1.0	0.036	2.82	44.05	0.087	3.61	2.59	2	1.491034	13.467	1.2894	15.642
16.732	0.91	0.23	0.80	1.11	1.0	0.036	2.81	43.12	0.086	3.55	2.56	2	1.480646	13.189	1.2627	15.318
16.896	0.90	0.22	0.80	1.10	1.0	0.036	3.53	49.61	0.091	3.75	2.64	2	1.470421	12.116	1.16	14.072
17.060	0.90	0.22	0.80	1.10	1.0	0.036	3.20	45.13	0.088	3.57	2.55	2	1.460356	12.152	1.1635	14.114
17.224	0.90	0.21	0.80	1.10	1.0	0.036	3.09	42.01	0.085	3.43	2.47	2	1.450447	11.717	1.1218	13.609
17.388	0.90	0.19	0.80	1.10	1.0	0.036	3.97	44.45	0.087	3.47	2.46	2	1.440689	9.6307	0.922	11.185
17.552	0.90	0.19	0.80	1.10	1.0	0.037	4.06	44.36	0.087	3.44	2.44	2	1.43108	9.4034	0.9003	10.922
17.716	0.90	0.18	0.80	1.09	1.0	0.037	4.73	47.21	0.089	3.50	2.46	2	1.422587	8.6025	0.8236	9.991
17.880	0.90	0.18	0.80	1.09	1.0	0.037	4.73	44.60	0.087	3.38	2.39	2	1.414208	8.1121	0.7767	9.422
18.044	0.90	0.18	0.80	1.09	1.0	0.037	4.15	41.21	0.084	3.25	2.33	2	1.405941	8.5532	0.8189	9.934
18.208	0.89	0.17	0.80	1.09	1.0	0.037	5.14	43.60	0.086	3.29	2.33	2	1.397782	7.3045	0.6993	8.484
18.372	0.89	0.17	0.80	1.09	1.0	0.037	4.92	43.24	0.086	3.25	2.32	2	1.389731	7.5595	0.7238	8.780
18.537	0.89	0.18	0.80	1.09	1.0	0.037	4.42	42.33	0.085	3.20	2.30	2	1.381785	8.2375	0.7887	9.567

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-8N

Data File: 13-52106_SP3-8N-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3 Field Data\2013 Field Investigation\Conetec Da

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69

Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

Value	Parameter
5604.90	Water surface elevation during CPT investigation (f
5600.09	Water surface elevation at t_0 (ft amsl)
5595.24	Water surface elevation at t_1 (ft amsl)
5590.24	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Ea
7.51	Equiv. Number of Uniform Strain Cycles, N

Value	Parameter
5608.37	Ground Surface Elevation at time of CPT (ft amsl)
5623.82	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pla
3.50	Thickness of Water Storage/Rooting Zone (ft)
3.50	Thickness of High Compaction Layer (ft)
7.95	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1646.57	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5590.24	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	######	5623.57	5623.32	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	######	5621.57	5619.82	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5618.07	5616.32	3.50	0.060	120	0.424	0.320	0.00	0.00	0.424	0.320
Platform/Random Fill Layer	######	5612.35	5608.37	7.95	0.050	101	0.825	0.624	0.00	0.00	0.825	0.624

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
0.164	5608.21	4.6	0.040	4.6	1.7	0.73	0.87%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0	1.70	7.837	108.93	9.12	558	0.87%	1.4	51%	0.83	0.00	0.83	0
0.328	5608.04	22.0	0.044	22.0	2.8	1.22	0.20%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	37.315	518.68	43.37	1329	0.20%	0.6	51%	0.84	0.00	0.84	0
0.492	5607.88	41.2	0.114	41.1	4.2	1.81	0.28%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	69.938	972.14	81.28	1660	0.28%	0.7	51%	0.85	0.00	0.85	0
0.656	5607.71	59.5	0.362	59.4	4.7	2.05	0.61%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0	1.70	101.031	######	117.40	1798	0.61%	1.0	51%	0.86	0.00	0.86	0
0.820	5607.55	65.8	0.430	65.7	4.5	1.93	0.65%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0	1.70	111.758	######	129.86	1591	0.65%	1.1	51%	0.86	0.00	0.86	0
0.984	5607.39	69.7	0.402	69.6	3.8	1.66	0.58%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0	1.70	118.371	######	137.53	1404	0.58%	1.0	51%	0.87	0.00	0.87	0
1.148	5607.22	68.4	0.655	68.4	3.8	1.64	0.96%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0	1.70	116.314	######	135.14	1183	0.96%	1.3	51%	0.88	0.00	0.88	0
1.312	5607.06	77.9	0.651	77.9	3.0	1.29	0.84%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	132.464	######	153.89	1178	0.84%	1.2	51%	0.89	0.00	0.89	0
1.476	5606.89	71.1	0.676	71.0	6.8	2.96	0.95%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	120.768	######	140.35	955	0.95%	1.3	51%	0.90	0.00	0.90	0
1.640	5606.73	61.8	0.871	61.7	6.0	2.61	1.41%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0	1.70	104.941	######	121.96	747	1.41%	1.5	51%	0.91	0.00	0.91	0
1.804	5606.57	70.3	1.290	70.3	5.1	2.22	1.83%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0	1.70	119.476	######	138.83	773	1.84%	1.6	51%	0.91	0.00	0.91	0
1.968	5606.40	106.9	2.471	106.9	8.4	3.62	2.31%	Interim Cover	0.050	100.7	0.10	0.00	0.10	0	1.70	181.679	######	211.11	1078	2.31%	1.6	51%	0.92	0.00	0.92	0
2.133	5606.24	99.5	2.832	99.4	11.5	4.99	2.85%	Interim Cover	0.050	100.7	0.11	0.00	0.11	0	1.70	168.997	######	196.42	925	2.85%	1.7	51%	0.93	0.00	0.93	0
2.297	5606.07	93.6	3.017	93.6	6.8	2.93	3.22%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	159.035	######	184.79	808	3.23%	1.8	51%	0.94	0.00	0.94	0
2.461	5605.91	68.6	2.531	68.6	1.4	0.62	3.69%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	116.569	######	135.41	552	3.70%	1.9	51%	0.95	0.00	0.95	0
2.625	5605.75	95.3	2.541	95.3	9.0	3.88	2.67%	Interim Cover	0.050	100.7	0.13	0.00	0.13	0	1.70	161.976	######	188.24	720	2.67%	1.8	51%	0.96	0.00	0.96	0
2.789	5605.58	99.4	3.003	99.4	5.2	2.27	3.02%	Interim Cover	0.050	100.7	0.14	0.00	0.14	0	1.70	168.912	######	196.25	707	3.03%	1.8	51%	0.96	0.00	0.96	0
2.953	5605.42	96.2	3.312	96.2	12.2	5.30	3.44%	Interim Cover	0.050	100.7	0.15	0.00	0.15	0	1.70	163.489	######	190.03	646	3.45%	1.9	51%	0.97	0.00	0.97	0
3.117	5605.25	92.1	3.557	92.0	12.7	5.51	3.86%	Interim Cover	0.050	100.7	0.16	0.00	0.16	0	1.70	156.451	######	181.87	586	3.87%	1.9	51%	0.98	0.00	0.98	0
3.281	5605.09	80.8	3.387	80.6	37.5	16.27	4.19%	Slime Tailings	0.041	82.7	0.16	0.00	0.16	0	1.70	137.037	######	159.62	493	4.20%	2.0	71%	0.99	0.00	0.99	0
3.445	5604.93	122.2	2.584	121.9	40.5	17.53	2.12%	Sand Tailings	0.051	102.8	0.17	0.00	0.17	0	1.61	195.753	######	227.83	708	2.12%	1.7	18%	1.00	0.00	1.00	0
3.609	5604.76	107.6	2.292	107.6	12.0	5.18	2.13%	Sand-Slime Tailing	0.059	119.0	0.18	0.00	0.18	1	1.66	178.278	######	207.20	605	2.13%	1.7	47%	1.01	0.00	1.01	0
3.773	5604.60	78.1	1.653	78.1	6.0	2.59	2.12%	Sand-Slime Tailing	0.059	119.0	0.19	0.01	0.18	1	1.70	132.702	######	154.20	427	2.12%	1.8	47%	1.01	0.00	1.01	0
3.937	5604.43	66.3	1.592	66.2	9.0	3.89	2.40%	Sand-Slime Tailing	0.059	119.0	0.20	0.01	0.19	1	1.70	112.540	######	130.82	353	2.41%	1.8	47%	1.02	0.00	1.02	0
4.101	5604.27	57.7	1.714	57.7	8.7	3.75	2.97%	Sand-Slime Tailing	0.059	119.0	0.21	0.02	0.19	1	1.70	98.005	######	113.93	300	2.98%	2.0	47%	1.03	0.00	1.03	0
4.265	5604.10	99.5	1.694	99.3	20.2	8.74	1.70%	Sand Tailings	0.062	123.5	0.22	0.02	0.20	1	1.66	164.464	######	191.26	505	1.71%	1.6	18%	1.04	0.00	1.04	0
4.429	5603.94	96.3	1.854	96.2	10.5	4.55	1.93%	Sand Tailings	0.062	123.5	0.23	0.03	0.20	1	1.66	159.735	######	185.65	477	1.93%	1.7	18%	1.05	0.00	1.05	0
4.593	5603.78	87.1	1.742	87.0	10.5	4.55	2.00%	Sand-Slime Tailing	0.059	119.0	0.24	0.04	0.21	1	1.70	147.593	######	171.55	421	2.01%	1.7	47%	1.06	0.00	1.06	0
4.757	5603.61	81.0	1.555	81.0	10.4	4.50	1.92%	Sand-Slime Tailing	0.059	119.0	0.25	0.04	0.21	1	1.70	137.632	######	159.98	383	1.93%	1.7	47%	1.07	0.00	1.07	0
4.921	5603.45	82.4	1.088	82.4	10.5	4.56	1.32%	Sand Tailings	0.062	123.5	0.26	0.05	0.22	1	1.70	139.914	######	162.63	381	1.32%	1.6	18%	1.08	0.00	1.08	0
5.085	5603.28	81.0	1.231	80.9	13.0	5.62	1.52%	Sand Tailings	0.062	123.5	0.27	0.05	0.22	1	1.70	137.217	######	159.53	366	1.52%	1.7	18%	1.09	0.00	1.09	0
5.249	5603.12	70.7	1.164	70.7	9.2	3.98	1.65%	Sand Tailings	0.062	123.5	0.28	0.06	0.23	1	1.70	120.105	######	139.61	312	1.65%	1.7	18%	1.10	0.00	1.10	0
5.413	5602.96	85.1	0.966	85.1	8.1	3.51	1.14%	Sand Tailings	0.062	123.5	0.29	0.06	0.23	1	1.65	140.603	######	163.40	367	1.14%	1.6	18%	1.11	0.00	1.11	0
5.577	5602.79	64.0	0.689	64.0	6.3	2.74	1.08%	Sand Tailings	0.062	123.5	0.30	0.07	0.24	1	1.70	108.817	######	126.46	270	1.08%	1.6	18%	1.12	0.00	1.12	0
5.741	5602.63	47.9	0.475	47.9	3.6	1.57	0.99%	Sand Tailings	0.062	123.5	0.31	0.07	0.24	1	1.70	81.396	######	94.58	198	1.00%	1.7	18%	1.14	0.00	1.14	0
5.905	5602.46	40.9	0.332	40.9	2.7	1.18	0.81%	Sand Tailings	0.062	123.5	0.32	0.08	0.25	1	1.70	69.462	965.52	80.71	165	0.82%	1.7	18%	1.15	0.00	1.15	0
6.069	5602.30	39.0	0.287	39.0	2.6	1.11	0.74%	Sand Tailings	0.062	123.5	0.33	0.08	0.25	1	1.70	66.317	921.81	77.05	154	0.74%	1.7	18%	1.16	0.00	1.16	0
6.234	5602.14	40.0	0.341	40.0	2.0	0.85	0.85%	Sand Tailings	0.062	123.5	0.34	0.09	0.26	1	1.70	67.932	944.25	78.92	155	0.86%	1.7	18%	1.17	0.00	1.17	0
6.398	5601.97	40.0	0.355	40.0	2.8	1.20	0.89%	Sand Tailings	0.062	123.5	0.35	0.09	0.26	1	1.70	67.915	944.02	78.91	152	0.90%	1.7	18%	1.18	0.00	1.18	0
6.562	5601.81	40.0	0.387	40.0	3.0	1.30	0.97%	Sand Tailings	0.062	123.5	0.36	0.10	0.27	1	1.70	67.915	944.02	78.92	149	0.98%	1.8	18%	1.19	0.00	1.19	0
6.726	5601.64	43.0	0.411	42.9	3.4	1.47	0.96%	Sand Tailings	0.062	123.5	0.37	0.10	0.27	1	1.70	72.998	######	84.82	157	0.97%	1.8	18%	1.20	0.00	1.20	0
6.890	5601.48	43.2	0.434	43.2	4.0	1.72	1.00%	Sand Tailings	0.062	123.5	0.38	0.11	0.28	1	1.70	73.406	######	85.31	155	1.01%	1.8	18%	1.21	0.00	1.21	0
7.054	5601.32	39.0	0.417	39.0	3.6	1.56	1.07%	Sand-Slime Tailing	0.059	119.0	0.39	0.11	0.28	1	1.70	66.249	920.86	76.99	138	1.08%	1.8	47%	1.22	0.00	1.22	0
7.218	5601.15	35.2	0.330	35.2	3.4	1.46	0.94%	Sand-Slime Tailing	0.059	119.0	0.40	0.12	0.29	1	1.70	59.840	831.78	69.54	122	0.95%	1.8	47%	1.23	0.00	1.23	0
7.382	5600.99	32.9	0.239	32.9	3.5	1.53	0.73%	Sand-Slime Tailing	0.059	119.0	0.41	0.12	0.29	1	1.70	55.845	776.25	64.90	112	0.74%	1.8	47%	1.24	0.00	1.24	0
7.546	5600.82	30.1	0.219	30.0	3.5	1.51	0.73%	Sand-Slime Tailing	0.059	119.0	0.42	0.13	0.29	1	1.70	51.051	709.61	59.34	101	0.74%	1.8	47%	1.24	0.00	1.24	0
7.710	5600.66	27.5	0.248	27.5	4.2	1.82	0.90%	Sand-Slime Tailing	0.059	119.0	0.43	0.13	0.30	1	1.70	46.716	649.35	54.31	91	0.92%	1.9	47%	1.25	0.00	1.25	0
7.874	5600.50	19.6	0.239	19.6	6.2	2.68	1.22%	Sand-Slime Tailing	0.059	119.0	0.44	0.14	0.30	1	1.70	33.269	462.44	38.72	63	1.25%	2.1	47%	1.26	0.00	1.26	0
8.038	5600.33	18.1	0.197	18.0	10.3	4.48	1.09%	Sand-Slime Tailing	0.059	119.0	0.45	0.14	0.31	1	1.70	30.651	426.05	35.73	57	1.12%	2.1	47%	1.27	0.00	1.27	0
8.202	5600.17	23.6	0.205	23.5	21.5	9.32	0.87%	Sand-Slime Tailing	0.059	119.0	0.46	0.15	0.31	1	1.70	39.865	554.12	46.57	74	0.89%	2.0	47%	1.28	0.00	1.28	0
8.366	5600.00	25.6	0.288	25.5	14.2	6.17	1.13%	Sand-Slime Tailing	0.059	119.0	0.47	0.15	0.32	1	1.70	43.316	602.09	50.48	79	1.15%	2.0	47%	1.29	0.00	1.29	0
8.530	5599.84	29.3	0.323	29.2	8.4	3.65	1.10%	Sand-Slime Tailing	0.059	119.0	0.48	0.16	0.32	1	1.70	49.708	690.94	57.84	89	1.12%	2.0	47%	1.30	0.00	1.30	0
8.694	5599.68	30.7	0.209	30.7	6.5	2.83	0.68%	Sand-Slime Tailing	0.059	119.0	0.49	0.16	0.33	1	1.70	52.173	725.20	60.68	92	0.69%	1.8	47%	1.31	0.00	1.31	0
8.858	5599.51	33.0	0.238	32.9	7.2	3.11	0.72%	Sand-Slime Tailing	0.059	119.0	0.50	0.17	0.33	1	1.70	55.964	777.90	65.09	98	0.73%	1.8	47%	1.32	0.00	1.32	0
9.022	5599.35	32.8	0.289	32.7	11.2	4.85	0.88%	Sand-Slime Tailing	0.059	119.0	0.51	0.17	0.34	1	1.70	55.573	772.46	64.68	96	0.90%	1.9	47%	1.33	0.00	1.33	0
9.186	5599.18	31.3	0.342	31.3	6.6	2.86	1.09%	Sand-Slime Tailing	0.059	119.0	0.52	0.18	0.34	1	1.70	53.193	739.38	61.86	90	1.11%	2.0	47%	1.34	0.00	1.34	0
9.350	5599.02	29.8	0.381	29.8	8.8	3.81	1.28%	Sand-Slime Tailing	0.059	119.0	0.53	0.18	0.35	1	1.70	50.575	702.99	58.85	85	1.30%	2.0	47%	1.35	0.00	1.35	0
9.514	5598.86	25.7	0.381	25.6	10.2	4.40	1.48%	Sand-Slime Tailing	0.059	119.0	0.54	0.19	0.35	1	1.70	43.537	605.16	50.69	72	1.52%	2.1	47%	1.36	0.00	1.36	0
9.678	5598.69	21.5	0.318	21.5	11.1	4.80	1.48%	Sand-Slime Tailing	0.059	119.0	0.55	0.19	0.35	1	1.70	36.482	507.10	42.51	59	1.52%	2.2	47%	1.37	0.00	1.37	0
9.842	5598.53	16.4	0.157	16.3	10.5	4.54	0.96%	Sand-Slime Tailing	0.059	119.0	0.56	0.20	0.36	1	1.70	27.693	384.93	32.29	44	0.99%	2.2	47%	1.38	0.00	1.38	0
10.006	5598.36	14.2	0.105	14.1	11.9	5.14	0.74%	Sand-Slime Tailing	0.059	119.0	0.57	0.20	0.36	1	1.70	24.004	333.66	28.03	37	0.77%	2.2	47%	1.39	0.00	1.39	0
10.170	5598.20	15.4	0.103	15.4	7.0	3.05	0.67%	Sand-Slime Tailing	0.059	119.0	0.58	0.21	0.37	1	1.70	26.180	363.90	30.49	40	0.69%	2.1	47%	1.40	0.00	1.40	0
10.335	5598.04	16.1	0.128	16.1	4.8	2.09	0.79%	Sand-Slime Tailing	0.059	119.0	0.59	0.21	0.37	1	1.70	27.370	380.44	31.85	42	0.82%	2.2	47%	1.41	0.00	1.41	0
10.499	5597.87	14.5	0.162	14.4	6.6	2.86	1.12%	Sand-Slime Tailing	0.059	119.0	0.60	0.22	0.38	1	1.70	24.548	341.22	28.59	37	1.17%	2.3	47%	1.42	0.00	1.42	0
10.663	5597.71	14.4	0.178	14.4	8.8	3.80	1.23%	Sand-Slime Tailing	0.059	119.0	0.61	0.22	0.38	1	1.70	24.446	339.80	28.50	36	1.29%	2.3	47%	1.43	0.00	1.43	0
10.827	5597.54	16.9	0.242	16.8	10.1	4.39	1.44%	Sand-Slime Tailing	0.059	119.0	0.62	0.23	0.39	1	1.70	28.560	396.98	33.30	42	1.49%	2.3	47%	1.44	0.00	1.44	0
10.991	5597.38	15.0	0.248	14.9	10.7	4.62	1.66%	Sand-Slime Tailing	0.059	119.0	0.63	0.23	0.39	1	1.70	25.313	351.85	29.53	37	1.73%	2.4	47%	1.45	0.00	1.45	0
11.155	5597.21	12.9	0.198	12.8	12.5	5.43	1.54%	Sand-Slime Tailing	0.059	119.0	0.64	0.24	0.40	1	1.70	21.726	301.99	25.39	31	1.62%	2.4	47%	1.46	0.00	1.46	0
11.319	5597.05	11.6	0.168	11.5	17.1	7.40	1.45%	Sand-Slime Tailing	0.059	119.0	0.65	0.24	0.40	1	1.70	19.567	271.98	22.94	27	1.53%	2.5	47%	1.47	0.00	1.47	0
11.483	5596.89	11.7	0.133	11.5	23.8	10.31	1.14%	Sand-Slime Tailing	0.059	119.0	0.66	0.25	0.41	1	1.70	19.567	271.98	23.02	27	1.21%	2.4	47%	1.48	0.00	1.48	0
11.647	5596.72	12.6	0.172	12.4	30.6	13.24	1.37%	Sand-Slime Tailing	0.059	119.0	0.67	0.26	0.41	1	1.70	21.080	293.01	24.86	29	1.44%	2.4	47%	1.49	0.00	1.49	0
11.811	5596.56	15.5	0.198	15.4	20.6	8.94	1.28%	Sand-Slime Tailing	0.059	119.0	0.68	0.26	0.42	1	1.70	26.210	362.93	30.58	36	1.33%	2.3	47%	1.50	0.00	1.50	0
11.975	5596.40	18.6	0.272	18.5	20.1	8.70	1.46%	Sand-Slime Tailing	0.059	119.0	0.69	0.27	0.42	1	1.65	30.471	423.55	35.63	43	1.52%	2.3	47%	1.51	0.00	1.51	0

Liquefaction Triggering Analyses / Idriss & Boulanger (2008)

Depth (ft)	I&B CSR: r_d	C_σ	K_σ	K_a	CSR M=7.5, s'v=1atm	I&B CRR: Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Youd CSR: r_d	D_r	f	K_σ	K_a	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No	I&B (2008) CN	qc1 TSF	qc1 MPa	qc1N
0.164	1.00	0.04	1.00	1.0	0.058	33.52	42.65	0.071	1.22	0.96	0.17	0.80	2.53	1.0	0.017	1.00	9.12	0.058	141.30	71.26	2	1.7	7.8549	0.752	9.123
0.328	1.00	0.07	1.00	1.0	0.058	45.54	88.92	0.125	2.16	0.96	0.38	0.80	2.20	1.0	0.019	1.00	43.37	0.086	105.69	53.93	2	1.7	37.345	3.5754	43.374
0.492	1.00	0.09	1.00	1.0	0.058	58.84	140.12	0.233	4.02	0.96	0.52	0.74	2.52	1.0	0.017	1.00	81.28	0.130	106.34	55.18	2	1.7	69.982	6.7001	81.280
0.656	1.00	0.12	1.00	1.0	0.058	71.52	188.92	0.721	12.47	0.96	0.63	0.69	2.77	1.0	0.015	1.00	117.40	0.230	141.52	76.99	2	1.7	101.08	9.6775	117.400
0.820	1.00	0.13	1.00	1.0	0.058	75.89	205.75	1.000	17.31	0.96	0.66	0.67	2.72	1.0	0.016	1.00	129.86	0.284	139.38	78.34	2	1.7	111.81	10.704	129.855
0.984	1.00	0.14	1.00	1.0	0.058	78.58	216.11	1.000	17.33	0.96	0.68	0.66	2.63	1.0	0.016	1.00	137.53	0.322	131.88	74.60	2	1.7	118.41	11.337	137.528
1.148	1.00	0.14	1.00	1.0	0.058	77.74	212.88	1.000	17.35	0.96	0.67	0.66	2.48	1.0	0.017	1.00	135.14	0.310	108.73	63.04	2	1.7	116.35	11.14	135.138
1.312	1.00	0.17	0.99	1.0	0.057	84.32	238.21	1.000	17.39	0.96	0.72	0.64	2.51	1.0	0.017	1.00	153.89	0.419	128.81	73.10	2	1.7	132.5	12.685	153.886
1.476	1.00	0.15	0.99	1.0	0.057	79.57	219.92	1.000	17.41	0.96	0.68	0.66	2.31	1.0	0.018	1.00	140.35	0.337	92.18	54.79	2	1.7	120.84	11.569	140.349
1.640	1.00	0.13	0.99	1.0	0.057	73.12	195.08	0.917	15.97	0.96	0.64	0.68	2.11	1.0	0.020	1.00	121.96	0.249	61.23	38.60	2	1.7	105	10.053	121.957
1.804	1.00	0.15	0.99	1.0	0.057	79.04	217.87	1.000	17.45	0.96	0.68	0.66	2.15	1.0	0.020	1.00	138.83	0.329	73.63	45.54	2	1.7	119.53	11.444	138.827
1.968	1.00	0.30	0.98	1.0	0.057	104.41	315.52	1.000	17.68	0.96	0.84	0.60	2.37	1.0	0.018	1.00	210.84	1.000	205.32	111.50	2	1.7	181.77	17.402	211.112
2.133	1.00	0.25	0.98	1.0	0.057	99.25	295.67	1.000	17.67	0.96	0.81	0.60	2.30	1.0	0.018	1.07	210.34	1.000	189.61	103.64	2	1.7	169.12	16.191	196.422
2.297	1.00	0.22	0.98	1.0	0.057	95.17	279.96	1.000	17.68	0.96	0.78	0.61	2.20	1.0	0.019	1.12	206.98	1.000	176.13	96.91	2	1.7	159.11	15.233	184.793
2.461	1.00	0.14	0.99	1.0	0.057	77.84	213.24	1.000	17.59	0.96	0.67	0.66	1.92	1.0	0.022	1.22	165.03	1.000	164.46	91.02	2	1.7	116.58	11.162	135.406
2.625	1.00	0.23	0.98	1.0	0.056	96.38	284.61	1.000	17.80	0.96	0.79	0.60	2.10	1.0	0.020	1.08	202.56	1.000	154.24	86.02	2	1.7	162.07	15.517	188.236
2.789	0.99	0.25	0.97	1.0	0.056	99.19	295.43	1.000	17.90	0.96	0.81	0.60	2.07	1.0	0.020	1.11	218.70	1.000	145.22	81.56	2	1.7	168.97	16.177	196.246
2.953	0.99	0.24	0.97	1.0	0.056	97.01	287.04	1.000	17.91	0.96	0.80	0.60	2.01	1.0	0.021	1.17	221.96	1.000	137.21	77.56	2	1.7	163.62	15.665	190.033
3.117	0.99	0.22	0.97	1.0	0.056	94.14	276.01	1.000	17.92	0.96	0.78	0.61	1.94	1.0	0.022	1.23	223.34	1.000	130.04	73.98	2	1.7	156.59	14.992	181.865
3.281	0.99	0.17	0.98	1.0	0.056	85.67	245.30	1.000	17.86	0.96	0.73	0.64	1.83	1.0	0.023	1.30	207.57	1.000	124.71	71.28	2	1.7	137.44	13.158	159.623
3.445	0.99	0.30	0.96	1.0	0.055	80.33	308.16	1.000	18.24	0.96	0.87	0.60	1.90	1.0	0.022	1.01	231.08	1.000	118.64	68.44	2	1.605714	196.16	18.78	227.826
3.609	0.99	0.29	0.96	1.0	0.055	102.97	310.17	1.000	18.28	0.96	0.83	0.60	1.88	1.0	0.022	1.03	214.34	1.000	115.07	66.67	2	1.657319	178.4	17.08	207.203
3.773	0.99	0.17	0.97	1.0	0.056	84.38	238.58	1.000	17.97	0.96	0.72	0.64	1.74	1.0	0.024	1.08	166.26	1.000	112.18	65.08	2	1.7	132.77	12.711	154.199
3.937	0.99	0.14	0.98	1.0	0.056	76.18	207.00	1.000	17.92	0.95	0.66	0.67	1.66	1.0	0.025	1.14	149.61	0.391	42.84	30.38	2	1.7	112.64	10.784	130.819
4.101	0.99	0.12	0.98	1.0	0.056	70.26	184.19	0.612	10.95	0.95	0.62	0.69	1.59	1.0	0.026	1.26	143.03	0.352	37.62	24.29	2	1.7	98.097	9.3918	113.934
4.265	0.99	0.24	0.95	1.0	0.054	70.98	262.24	1.000	18.38	0.95	0.80	0.60	1.80	1.0	0.023	1.00	190.83	1.000	104.15	61.26	2	1.655735	164.67	15.766	191.257
4.429	0.99	0.22	0.95	1.0	0.054	69.55	255.20	1.000	18.38	0.95	0.79	0.61	1.77	1.0	0.024	1.04	192.83	1.000	101.60	59.99	2	1.660272	159.84	15.303	185.649
4.593	0.98	0.19	0.96	1.0	0.055	90.47	262.02	1.000	18.32	0.95	0.76	0.62	1.72	1.0	0.024	1.07	182.82	1.000	99.36	58.84	2	1.695881	147.7	14.141	171.549
4.757	0.98	0.17	0.96	1.0	0.055	86.41	246.39	1.000	18.29	0.95	0.73	0.63	1.67	1.0	0.025	1.07	171.03	1.000	97.21	57.75	2	1.7	137.74	13.187	159.979
4.921	0.98	0.18	0.96	1.0	0.054	63.67	226.30	1.000	18.36	0.95	0.74	0.63	1.66	1.0	0.025	1.00	162.63	1.000	94.99	56.67	2	1.699019	140.03	13.406	162.632
5.085	0.98	0.17	0.96	1.0	0.054	62.87	222.40	1.000	18.38	0.95	0.73	0.64	1.64	1.0	0.026	1.02	162.38	1.000	92.87	55.63	2	1.695288	137.35	13.15	159.528
5.249	0.98	0.15	0.96	1.0	0.055	57.78	197.39	1.000	18.30	0.95	0.68	0.66	1.58	1.0	0.027	1.06	148.48	0.384	34.93	26.61	2	1.7	120.2	11.508	139.608
5.413	0.98	0.18	0.95	1.0	0.054	63.86	227.26	1.000	18.51	0.95	0.74	0.63	1.63	1.0	0.026	1.00	163.40	1.000	88.91	53.71	2	1.653181	140.69	13.469	163.399
5.577	0.98	0.13	0.96	1.0	0.055	54.42	180.88	0.550	10.08	0.95	0.65	0.68	1.52	1.0	0.028	1.00	126.46	0.268	23.34	16.71	2	1.7	108.88	10.425	126.462
5.741	0.98	0.10	0.97	1.0	0.055	46.27	140.85	0.235	4.28	0.95	0.56	0.72	1.43	1.0	0.029	1.03	97.70	0.167	14.22	9.25	2	1.7	81.434	7.7965	94.581
5.905	0.98	0.09	0.97	1.0	0.055	42.72	123.43	0.187	3.40	0.95	0.52	0.74	1.38	1.0	0.030	1.03	83.17	0.134	11.16	7.28	2	1.7	69.491	6.6531	80.710
6.069	0.98	0.09	0.97	1.0	0.055	41.79	118.84	0.177	3.22	0.95	0.51	0.75	1.37	1.0	0.031	1.03	79.07	0.126	10.32	6.77	2	1.7	66.344	6.3518	77.055
6.234	0.98	0.09	0.97	1.0	0.055	42.27	121.19	0.182	3.32	0.95	0.51	0.74	1.36	1.0	0.031	1.05	83.18	0.134	10.73	7.03	2	1.7	67.953	6.5058	78.923
6.398	0.97	0.09	0.97	1.0	0.055	42.26	121.18	0.182	3.33	0.95	0.51	0.74	1.36	1.0	0.031	1.07	84.14	0.135	10.68	7.00	2	1.7	67.944	6.505	78.913
6.562	0.97	0.09	0.97	1.0	0.055	42.26	121.18	0.182	3.33	0.95	0.51	0.74	1.35	1.0	0.031	1.09	85.86	0.139	10.75	7.04	2	1.7	67.947	6.5052	78.916
6.726	0.97	0.09	0.97	1.0	0.054	43.77	128.60	0.199	3.66	0.95	0.53	0.73	1.36	1.0	0.031	1.07	91.07	0.150	11.42	7.54	2	1.7	73.034	6.9923	84.825
6.890	0.97	0.09	0.97	1.0	0.054	43.90	129.20	0.201	3.70	0.95	0.53	0.73	1.35	1.0	0.031	1.09	92.69	0.154	11.50	7.60	2	1.7	73.448	7.0319	85.306
7.054	0.97	0.09	0.97	1.0	0.054	57.30	134.29	0.215	3.95	0.95	0.51	0.75	1.33	1.0	0.031	1.13	86.86	0.141	10.35	7.15	2	1.7	66.287	6.3463	76.989
7.218	0.97	0.08	0.97	1.0	0.054	54.69	124.23	0.189	3.47	0.95	0.48	0.76	1.30	1.0	0.032	1.13	78.48	0.125	9.03	6.25	2	1.7	59.876	5.7325	69.542
7.382	0.97	0.08	0.97	1.0	0.054	53.06	117.97	0.175	3.23	0.95	0.47	0.77	1.29	1.0	0.032	1.10	71.31	0.114	8.09	5.66	2	1.7	55.882	5.3502	64.904
7.546	0.97	0.08	0.97	1.0	0.054	51.11	110.45	0.161	2.96	0.95	0.44	0.78	1.27	1.0	0.033	1.13	66.87	0.108	7.55	5.26	2	1.7	51.088	4.8912	59.336
7.710	0.97	0.07	0.97	1.0	0.054	49.35	103.66	0.149	2.74	0.95	0.43	0.79	1.25	1.0	0.033	1.21	65.63	0.106	7.33	5.04	2	1.7	46.761	4.4769	54.310
7.874	0.96	0.06	0.98	1.0	0.054	43.88	82.60	0.116	2.14	0.95	0.36	0.80	1.23	1.0	0.034	1.50	58.23	0.098	6.69	4.41	2	1.7	33.335	3.1915	38.716
8.038	0.96	0.06	0.98	1.0	0.054	42.83	78.56	0.111	2.04	0.95	0.35	0.80	1.23	1.0	0.034	1.51	54.07	0.095	6.34	4.19	2	1.7	30.761	2.945	35.727
8.202	0.96	0.07	0.97	1.0	0.054	46.63	93.20	0.132	2.43	0.94	0.39	0.80	1.22	1.0	0.034	1.28	59.48	0.100	6.57	4.50	2	1.7	40.093	3.8385	46.566
8.366	0.96	0.07	0.97	1.0	0.054	48.01	98.49	0.140	2.59	0.94	0.41	0.79	1.23	1.0	0.034	1.34	67.52	0.109	7.07	4.83	2	1.7	43.467	4.1615	50.484
8.530	0.96	0.08	0.97	1.0	0.054	50.59	108.42	0.157	2.92	0.94	0.44	0.78	1.24	1.0	0.034	1.27	73.69	0.117	7.52	5.22	2	1.7	49.797	4.7676	57.837
8.694	0.96	0.08	0.97	1.0	0.054	51.58	112.26	0.164	3.06	0.94	0.45	0.78	1.24	1.0	0.033	1.14	68.98	0.111	6.99	5.03	2	1.7	52.242	5.0017	60.676
8.858	0.96	0.08	0.97	1.0	0.053	53.13	118.22	0.176	3.29	0.94	0.47	0.77	1.25	1.0	0.033	1.13	73.73	0.117	7.32	5.30	2	1.7	56.04	5.3653	65.087
9.022	0.96	0.08	0.96	1.0	0.053	52.99	117.67	0.175	3.27	0.94	0.46	0.77	1.24	1.0	0.033	1.18	76.56	0.122	7.50	5.38	2	1.7	55.692	5.3319	64.683
9.186	0.96	0.08	0.97	1.0	0.053	52.00	113.86	0.167	3.13	0.94	0.45	0.77	1.23	1.0	0.034	1.27	78.34	0.127	7.58	5.36	2	1.7	53.263	5.0994	61.862
9.350	0.96	0.08	0.97	1.0	0.053	50.94	109.79	0.159	2.99	0.94	0.44	0.78	1.22	1.0	0.034	1.35	79.72	0.127	7.63	5.31	2	1.7	50.668	4.851	58.848
9.514	0.95	0.07	0.97	1.0	0.053	48.08	98.77	0.141	2.63	0.94	0.41	0.79	1.20	1.0	0.035	1.53	77.35	0.123	7.29	4.96	2	1.7	43.645	4.1786	50.691
9.678	0.95	0.07	0.97	1.0	0.053	45.21	87.72	0.124	2.31	0.94	0.38	0.80	1.19	1.0	0.035	1.67	70.98	0.113	6.62	4.47	2	1.7	36.599	3.504	42.508
9.842	0.95	0.06	0.97	1.0	0.053	41.63	73.92	0.105	1.96	0.94	0.33	0.80	1.19	1.0	0.035	1.66	53.47	0.094	5.44	3.70	2	1.7	27.804	2.662	32.293
10.006	0.95	0.06	0.97	1.0	0.053	40.13	68.16	0.097	1.82	0.94	0.31	0.80	1.19	1.0	0.035	1.66	46.45	0.089	5.06	3.44	2	1.7	24.13	2.3102	28.026
10.170	0.95	0.06	0.97	1.0	0.053	41.00	71.49	0.101	1.90	0.94	0.32	0.80	1.18	1.0	0.035	1.54	47.04	0.089	5.02	3.46	2	1.7	26.255	2.5136	30.493
10.335	0.95	0.06	0.97	1.0	0.053	41.47	73.32	0.104	1.95	0.94	0.33	0.80	1.18	1.0	0.035	1.60	50.94	0.092	5.14	3.54	2	1.7	27.421	2.6253	31.848
10.499	0.95	0.06	0.97	1.0	0.053	40.33	68.92	0.098	1.85	0.94	0.31	0.80	1.18	1.0	0.035	1.95	55.63	0.096	5.28	3.56	2	1.7	24.618	2.3569	28.592
10.663	0.95	0.06	0.97	1.0	0.053	40.30	68.80	0.098	1.85	0.94	0.31	0.80	1.18	1.0	0.035	2.05	58.29	0.098	5.35	3.60	2	1.7	24.539	2.3494	28.501
10.827	0.95	0.06	0.97	1.0	0.053	41.98	75.27	0.106	2.01	0.94	0.33	0.80	1.17	1.0	0.035	1.99	66.37	0.107	5.76	3.88	2	1.7	28.668	2.7446	33.296
10.991	0.94	0.06	0.97	1.0	0.053	40.66	70.19	0.100	1.89	0.94	0.31	0.80	1.17	1.0	0.035	2.31	68.36	0.110	5.83	3.86	2	1.7	25.426	2.4343	29.531
11.155	0.94	0.06	0.97	1.0	0.053	39.21	64.59	0.093	1.76	0.94	0.29	0.80	1.17	1.0	0.035	2.50	63.39	0.104	5.44	3.60	2	1.7	21.859	2.0928	25.388
11.319	0.94	0.05	0.97	1.0	0.053	38.35	61.28	0.089	1.69	0.94	0.28	0.80	1.16	1.0	0.035	2.63	60.28	0.100	5.21	3.45	2	1.7	19.748	1.8907	22.936
11.483	0.94	0.05	0.97	1.0	0.053	38.37	61.39	0.089	1.69	0.94	0.28	0.80	1.16	1.0	0.036	2.39	54.92	0.095	4.90	3.30	2	1.7	19.819	1.8975	23.019
11.647	0.94	0.05	0.97	1.0	0.053	39.02	63.88	0.092	1.75	0.94	0.29	0.80	1.16	1.0	0.036	2.46	61.18	0.101	5.14	3.45	2	1.7	21.404	2.0492	24.860
11.811	0.94	0.06	0.97	1.0	0.052	41.03	71.60	0.102	1.94	0.94	0.32	0.80	1.16	1.0	0.036	2.09	63.85	0.104	5.23	3.59	2	1.695444	26.328	2.5207	30.579
11.975	0.94	0.06	0.97	1.0	0.052	42.80	78.43	0.111	2.11	0.94	0.34	0.80	1.15	1.0	0.036	1.99	71.01	0.113	5.63	3.87	2	1.651564	30.678	2.9371	35.631

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-8N

Data File: 13-52106_SP3-8N-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Da

Legend:
- Tailings Sands
- Tailings Sand-Slimes
- Tailings Slimes
- Interim Cover
- Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69

Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

5604.90	Water surface elevation during CPT investigation (f
5600.09	Water surface elevation at t_0 (ft amsl)
5595.24	Water surface elevation at t_1 (ft amsl)
5590.24	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Ea
7.51	Equiv. Number of Uniform Strain Cycles, N

5608.37	Ground Surface Elevation at time of CPT (ft amsl)
5623.82	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after pla
3.50	Thickness of Water Storage/Rooting Zone (ft)
3.50	Thickness of High Compaction Layer (ft)
7.95	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1646.57	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5590.24	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	######	5623.57	5623.32	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
ater Storage/Rooting Zone Layer	######	5621.57	5619.82	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	######	5618.07	5616.32	3.50	0.060	120	0.424	0.320	0.00	0.00	0.424	0.320
Platform/Random Fill Layer	######	5612.35	5608.37	7.95	0.050	101	0.825	0.624	0.00	0.00	0.825	0.624

2013 CPT Data from ConeTec / CPT Data Interpretations

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No
12.139	5596.23	20.8	0.332	20.7	20.6	8.93	1.59%	Sand-Slime Tailing	0.059	119.0	0.69	0.27	0.42	1
12.303	5596.07	20.6	0.354	20.4	21.5	9.33	1.72%	Sand-Slime Tailing	0.059	119.0	0.70	0.28	0.43	1
12.467	5595.90	21.7	0.293	21.6	21.5	9.33	1.35%	Sand-Slime Tailing	0.059	119.0	0.71	0.28	0.43	1
12.631	5595.74	19.6	0.242	19.4	23.8	10.31	1.24%	Sand-Slime Tailing	0.059	119.0	0.72	0.29	0.44	1
12.795	5595.57	25.2	0.298	25.1	16.3	7.06	1.18%	Sand-Slime Tailing	0.059	119.0	0.73	0.29	0.44	1
12.959	5595.41	21.9	0.407	21.8	10.3	4.45	1.86%	Sand-Slime Tailing	0.059	119.0	0.74	0.30	0.45	1
13.123	5595.25	15.7	0.413	15.6	13.9	6.04	2.63%	Slime Tailings	0.057	113.1	0.75	0.30	0.45	1
13.287	5595.08	12.5	0.244	12.3	29.1	12.59	1.95%	Sand-Slime Tailing	0.059	119.0	0.76	0.31	0.46	1
13.451	5594.92	23.9	0.277	23.7	39.2	16.99	1.16%	Sand-Slime Tailing	0.059	119.0	0.77	0.31	0.46	1
13.615	5594.75	17.1	0.257	16.9	21.6	9.34	1.51%	Sand-Slime Tailing	0.059	119.0	0.78	0.32	0.47	1
13.779	5594.59	13.5	0.216	13.4	24.5	10.62	1.60%	Sand-Slime Tailing	0.059	119.0	0.79	0.32	0.47	1
13.943	5594.43	12.3	0.109	12.1	31.7	13.73	0.89%	Sand-Slime Tailing	0.059	119.0	0.80	0.33	0.47	1
14.107	5594.26	13.7	0.109	13.5	35.9	15.56	0.80%	Sand-Slime Tailing	0.059	119.0	0.81	0.33	0.48	1
14.271	5594.10	14.3	0.105	14.1	40.0	17.33	0.73%	Sand-Slime Tailing	0.059	119.0	0.82	0.34	0.48	1
14.436	5593.93	15.6	0.141	15.4	38.1	16.50	0.90%	Sand-Slime Tailing	0.059	119.0	0.83	0.34	0.49	1
14.600	5593.77	13.6	0.133	13.4	36.6	15.87	0.98%	Sand-Slime Tailing	0.059	119.0	0.84	0.35	0.49	1
14.764	5593.61	12.7	0.142	12.5	36.6	15.85	1.11%	Sand-Slime Tailing	0.059	119.0	0.85	0.35	0.50	1
14.928	5593.44	11.6	0.159	11.4	38.9	16.85	1.37%	Sand-Slime Tailing	0.059	119.0	0.86	0.36	0.50	1
15.092	5593.28	12.1	0.159	11.8	38.7	16.79	1.32%	Sand-Slime Tailing	0.059	119.0	0.87	0.36	0.51	1
15.256	5593.11	18.8	0.159	18.6	31.2	13.52	0.85%	Sand-Slime Tailing	0.059	119.0	0.88	0.37	0.51	1

CPT Data Interpretations (cont.) / Conditions at t_1

Depth at time of CPT (ft)	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
12.139	1.62	33.523	465.97	39.18	47	1.65%	2.3	47%	1.52	0.00	1.52	0
12.303	1.61	32.926	457.68	38.49	46	1.78%	2.3	47%	1.53	0.00	1.53	0
12.467	1.59	34.352	477.50	40.15	48	1.40%	2.2	47%	1.54	0.00	1.54	0
12.631	1.60	31.035	431.38	36.32	43	1.28%	2.3	47%	1.55	0.00	1.55	0
12.795	1.55	38.791	539.19	45.24	55	1.22%	2.2	47%	1.56	0.00	1.56	0
12.959	1.56	34.046	473.24	39.66	47	1.93%	2.3	47%	1.57	0.00	1.57	0
13.123	1.60	25.057	348.29	29.26	33	2.76%	2.6	71%	1.58	0.00	1.58	0
13.287	1.62	20.028	278.39	23.60	26	2.08%	2.6	47%	1.59	0.00	1.58	1
13.451	1.52	35.953	499.74	42.19	50	1.20%	2.2	47%	1.60	0.01	1.59	1
13.615	1.56	26.372	366.57	30.87	35	1.58%	2.4	47%	1.61	0.02	1.59	1
13.779	1.58	21.097	293.25	24.78	27	1.70%	2.5	47%	1.62	0.02	1.60	1
13.943	1.58	19.096	265.43	22.54	24	0.95%	2.4	47%	1.63	0.03	1.60	1
14.107	1.56	20.976	291.56	24.77	27	0.85%	2.3	47%	1.63	0.03	1.60	1
14.271	1.54	21.657	301.03	25.60	28	0.78%	2.3	47%	1.64	0.04	1.61	1
14.436	1.52	23.383	325.02	27.58	30	0.95%	2.3	47%	1.65	0.04	1.61	1
14.600	1.53	20.462	284.42	24.17	26	1.04%	2.4	47%	1.66	0.05	1.62	1
14.764	1.52	19.076	265.16	22.56	24	1.19%	2.5	47%	1.67	0.05	1.62	1
14.928	1.52	17.298	240.44	20.52	21	1.48%	2.6	47%	1.68	0.06	1.63	1
15.092	1.51	17.844	248.04	21.15	22	1.42%	2.5	47%	1.69	0.06	1.63	1
15.256	1.45	26.955	374.67	31.63	35	0.89%	2.3	47%	1.70	0.07	1.64	1

Liquefaction Triggering Analyses — Idriss & Boulanger (2008)

Depth at time of CPT (ft)	CSR: r_d	CSR: C_σ	CSR: K_σ	CSR: K_a	CSR (M=7.5, s'v=1atm)	CRR: Δqc_{1n}	CRR: qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS
12.139	0.94	0.06	0.96	1.0	0.052	44.04	83.22	0.117	2.25
12.303	0.94	0.06	0.96	1.0	0.052	43.80	82.30	0.116	2.22
12.467	0.93	0.07	0.96	1.0	0.052	44.38	84.53	0.119	2.29
12.631	0.93	0.06	0.96	1.0	0.052	43.04	79.36	0.112	2.15
12.795	0.93	0.07	0.96	1.0	0.052	46.17	91.40	0.129	2.50
12.959	0.93	0.06	0.96	1.0	0.052	44.21	83.87	0.118	2.28
13.123	0.93	0.06	0.96	1.0	0.052	40.28	69.54	0.099	1.91
13.287	0.93	0.05	0.97	1.0	0.052	38.58	62.18	0.090	1.74
13.451	0.93	0.07	0.96	1.0	0.052	45.10	87.29	0.123	2.38
13.615	0.93	0.06	0.96	1.0	0.052	41.13	72.00	0.102	1.96
13.779	0.92	0.06	0.97	1.0	0.052	38.99	63.78	0.092	1.76
13.943	0.92	0.05	0.97	1.0	0.052	38.21	60.75	0.089	1.69
14.107	0.92	0.06	0.97	1.0	0.052	38.99	63.76	0.092	1.76
14.271	0.92	0.06	0.96	1.0	0.052	39.28	64.88	0.093	1.78
14.436	0.92	0.06	0.96	1.0	0.053	39.97	67.55	0.097	1.84
14.600	0.92	0.06	0.97	1.0	0.053	38.78	62.95	0.091	1.73
14.764	0.92	0.05	0.97	1.0	0.053	38.21	60.77	0.089	1.68
14.928	0.92	0.05	0.97	1.0	0.053	37.50	58.02	0.086	1.62
15.092	0.91	0.05	0.97	1.0	0.053	37.72	58.87	0.087	1.63
15.256	0.91	0.06	0.96	1.0	0.053	41.40	73.03	0.103	1.96

Liquefaction Triggering Analyses — Youd et al. (2001)

Depth at time of CPT (ft)	CSR: r_d	CSR: D_r	CSR: f	CSR: K_σ	CSR: K_a	CSR (M=7.5, s'v=1atm)	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No
12.139	0.94	0.36	0.80	1.15	1.0	0.036	1.95	76.21	0.121	5.96	4.10	2
12.303	0.94	0.36	0.80	1.15	1.0	0.036	2.04	78.62	0.125	6.09	4.16	2
12.467	0.93	0.37	0.80	1.15	1.0	0.036	1.79	71.84	0.114	5.51	3.90	2
12.631	0.93	0.35	0.80	1.14	1.0	0.036	1.85	67.11	0.108	5.15	3.65	2
12.795	0.93	0.39	0.80	1.14	1.0	0.036	1.59	71.85	0.114	5.40	3.95	2
12.959	0.93	0.36	0.80	1.14	1.0	0.036	2.09	83.02	0.133	6.22	4.25	2
13.123	0.93	0.31	0.80	1.14	1.0	0.036	3.10	90.60	0.149	6.91	4.41	2
13.287	0.93	0.28	0.80	1.14	1.0	0.036	3.15	74.30	0.118	5.40	3.57	2
13.451	0.93	0.38	0.80	1.13	1.0	0.037	1.65	69.75	0.112	5.03	3.71	2
13.615	0.93	0.32	0.80	1.13	1.0	0.037	2.28	70.46	0.113	5.01	3.49	2
13.779	0.93	0.29	0.80	1.13	1.0	0.037	2.78	68.81	0.110	4.85	3.31	2
13.943	0.93	0.27	0.80	1.13	1.0	0.037	2.34	52.74	0.094	4.07	2.88	2
14.107	0.93	0.29	0.80	1.12	1.0	0.037	2.09	51.73	0.093	3.99	2.87	2
14.271	0.93	0.29	0.80	1.12	1.0	0.037	1.98	50.75	0.092	3.91	2.84	2
14.436	0.93	0.30	0.80	1.12	1.0	0.038	2.02	55.83	0.096	4.03	2.93	2
14.600	0.93	0.28	0.80	1.12	1.0	0.038	2.31	55.88	0.096	3.98	2.86	2
14.764	0.93	0.27	0.80	1.12	1.0	0.038	2.58	58.26	0.098	4.03	2.85	2
14.928	0.93	0.26	0.80	1.11	1.0	0.038	3.05	62.52	0.103	4.16	2.89	2
15.092	0.93	0.27	0.80	1.11	1.0	0.038	2.93	62.03	0.102	4.10	2.87	2
15.256	0.92	0.32	0.80	1.11	1.0	0.038	1.81	57.25	0.097	3.86	2.91	2

Idriss & Boulanger (2008)

Depth at time of CPT (ft)	CN	qc1 TSF	qc1 MPa	qc1N
12.139	1.620237	33.731	3.2294	39.177
12.303	1.611669	33.143	3.1731	38.494
12.467	1.59186	34.566	3.3094	40.147
12.631	1.598899	31.272	2.994	36.321
12.795	1.547297	38.948	3.7289	45.236
12.959	1.5603	34.146	3.2691	39.658
13.123	1.602078	25.196	2.4123	29.264
13.287	1.624325	20.323	1.9457	23.603
13.451	1.518912	36.324	3.4777	42.189
13.615	1.558637	26.582	2.5449	30.873
13.779	1.580327	21.339	2.043	24.784
13.943	1.58209	19.409	1.8582	22.542
14.107	1.557223	21.325	2.0416	24.768
14.271	1.541392	22.041	2.1102	25.600
14.436	1.520342	23.744	2.2733	27.578
14.600	1.527025	20.811	1.9925	24.171
14.764	1.52486	19.424	1.8597	22.560
14.928	1.522673	17.667	1.6915	20.519
15.092	1.510945	18.21	1.7434	21.149
15.256	1.45231	27.238	2.6077	31.635

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-8S

Data File: 13-52106_SP3-8S-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Data

Legend: Tailings Sands; Tailings Sand-Slimes; Tailings Slimes; Interim Cover; Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69

Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	2.21

5603.50	Water surface elevation during CPT investigation (ft amsl)
5600.42	Water surface elevation at t_0 (ft amsl)
5590.63	Water surface elevation at t_1 (ft amsl)
5585.63	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ratio, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earthquake
7.51	Equiv. Number of Uniform Stress Cycles, N

5608.70	Ground Surface Elevation at time of CPT (ft amsl)
5620.45	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement
3.50	Thickness of Water Storage/Rooting Zone (ft)
3.50	Thickness of High Compaction Layer (ft)
4.25	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1273.89	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5585.63	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	5620.45	5620.2	5619.95	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
Water Storage/Rooting Zone Layer	5619.95	5618.2	5616.45	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	5616.45	5614.7	5612.95	3.50	0.060	120	0.424	0.320	0.00	0.00	0.424	0.320
Platform/Random Fill Layer	5612.95	5610.825	5608.70	4.25	0.050	101	0.638	0.531	0.00	0.00	0.638	0.531

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of CPT (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No
0.164	5608.54	17.2	0.175	17.2	1.2	0.54	1.02%	Interim Cover	0.050	100.7	0.01	0.00	0.01	0	1.70	29.240	406.44	33.98	2082	1.02%	1.2	51%	0.65	0.00	0.65	0
0.328	5608.37	63.5	0.285	63.5	10.1	4.36	0.45%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	107.899	1499.80	125.44	3844	0.45%	0.9	51%	0.65	0.00	0.65	0
0.492	5608.21	90.9	0.503	90.8	10.4	4.50	0.55%	Interim Cover	0.050	100.7	0.02	0.00	0.02	0	1.70	154.394	2146.08	179.45	3666	0.55%	1.0	51%	0.66	0.00	0.66	0
0.656	5608.04	111.9	0.700	111.9	7.7	3.35	0.63%	Interim Cover	0.050	100.7	0.03	0.00	0.03	0	1.70	190.145	2643.02	220.94	3385	0.63%	1.0	51%	0.67	0.00	0.67	0
0.820	5607.88	126.5	0.864	126.4	5.8	2.51	0.68%	Interim Cover	0.050	100.7	0.04	0.00	0.04	0	1.70	214.948	2987.78	249.72	3061	0.68%	1.1	51%	0.68	0.00	0.68	0
0.984	5607.72	125.0	0.813	125.0	3.0	1.31	0.65%	Interim Cover	0.050	100.7	0.05	0.00	0.05	0	1.70	212.466	2953.28	246.80	2521	0.65%	1.0	51%	0.69	0.00	0.69	0
1.148	5607.55	117.6	0.695	117.6	1.1	0.48	0.59%	Interim Cover	0.050	100.7	0.06	0.00	0.06	0	1.70	199.903	2778.65	232.19	2032	0.59%	1.0	51%	0.69	0.00	0.69	0
1.312	5607.39	104.2	0.601	104.2	1.5	0.66	0.58%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	177.140	2462.25	205.76	1576	0.58%	1.0	51%	0.70	0.00	0.70	0
1.476	5607.22	81.5	0.591	81.5	0.0	0.01	0.73%	Interim Cover	0.050	100.7	0.07	0.00	0.07	0	1.70	138.465	1924.66	160.82	1094	0.73%	1.2	51%	0.71	0.00	0.71	0
1.640	5607.06	72.9	0.416	72.9	-0.0	-0.01	0.57%	Interim Cover	0.050	100.7	0.08	0.00	0.08	0	1.70	123.947	1722.86	143.96	882	0.57%	1.1	51%	0.72	0.00	0.72	0
1.804	5606.90	64.8	0.713	64.8	0.1	0.05	1.10%	Interim Cover	0.050	100.7	0.09	0.00	0.09	0	1.70	110.075	1530.04	127.85	712	1.10%	1.4	51%	0.73	0.00	0.73	0
1.968	5606.73	61.1	0.519	61.1	0.6	0.27	0.85%	Interim Cover	0.050	100.7	0.10	0.00	0.10	0	1.70	103.887	1444.03	120.67	615	0.85%	1.3	51%	0.74	0.00	0.74	0
2.133	5606.57	57.5	0.435	57.5	2.3	0.98	0.76%	Interim Cover	0.050	100.7	0.11	0.00	0.11	0	1.70	97.801	1359.43	113.62	535	0.76%	1.3	51%	0.74	0.00	0.74	0
2.297	5606.40	54.3	0.512	54.3	5.3	2.29	0.94%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	92.276	1282.64	107.24	469	0.94%	1.4	51%	0.75	0.00	0.75	0
2.461	5606.24	53.3	1.269	53.3	2.3	0.99	2.38%	Interim Cover	0.050	100.7	0.12	0.00	0.12	0	1.70	90.542	1258.53	105.19	429	2.39%	1.8	51%	0.76	0.00	0.76	0
2.625	5606.08	76.9	1.662	76.9	5.5	2.37	2.16%	Interim Cover	0.050	100.7	0.13	0.00	0.13	0	1.70	130.747	1817.38	151.92	581	2.16%	1.7	51%	0.77	0.00	0.77	0
2.789	5605.91	222.0	2.940	221.9	14.3	6.21	1.32%	Interim Cover	0.050	100.7	0.14	0.00	0.14	0	1.61	358.013	4976.38	415.98	1580	1.33%	1.4	51%	0.78	0.00	0.78	0
2.953	5605.75	222.9	2.175	222.9	15.8	6.86	0.98%	Interim Cover	0.050	100.7	0.15	0.00	0.15	0	1.59	354.180	4923.11	411.54	1498	0.98%	1.2	51%	0.79	0.00	0.79	0
3.117	5605.58	213.5	2.265	213.3	28.9	12.50	1.06%	Interim Cover	0.050	100.7	0.16	0.00	0.16	0	1.57	334.170	4644.96	388.45	1359	1.06%	1.3	51%	0.79	0.00	0.79	0
3.281	5605.42	207.8	1.697	207.7	13.6	5.90	0.82%	Sand Tailings	0.051	102.8	0.17	0.00	0.17	0	1.55	320.918	4460.77	372.88	1255	0.82%	1.2	18%	0.80	0.00	0.80	0
3.445	5605.26	155.2	1.444	155.1	11.4	4.92	0.93%	Sand Tailings	0.051	102.8	0.17	0.00	0.17	0	1.53	236.617	3288.98	274.94	892	0.93%	1.3	18%	0.81	0.00	0.81	0
3.609	5605.09	125.3	1.613	125.3	6.9	2.98	1.29%	Sand Tailings	0.051	102.8	0.18	0.00	0.18	0	1.57	197.324	2742.80	229.26	687	1.29%	1.5	18%	0.82	0.00	0.82	0
3.773	5604.93	100.1	0.839	100.1	7.6	3.29	0.84%	Sand Tailings	0.051	102.8	0.19	0.00	0.19	0	1.66	166.576	2315.41	193.56	524	0.84%	1.4	18%	0.83	0.00	0.83	0
3.937	5604.76	82.6	1.213	82.5	16.4	7.12	1.47%	Sand Tailings	0.051	102.8	0.20	0.00	0.20	0	1.70	140.267	1949.71	163.11	414	1.47%	1.6	18%	0.84	0.00	0.84	0
4.101	5604.60	116.5	1.585	116.5	3.6	1.57	1.36%	Sand Tailings	0.051	102.8	0.21	0.00	0.21	0	1.56	182.193	2532.48	211.65	560	1.36%	1.5	18%	0.84	0.00	0.84	0
4.265	5604.43	95.5	1.860	95.4	10.8	4.68	1.95%	Sand Tailings	0.051	102.8	0.22	0.00	0.22	0	1.63	155.946	2167.64	181.25	441	1.95%	1.7	18%	0.85	0.00	0.85	0
4.429	5604.27	82.7	1.658	82.6	23.5	10.20	2.00%	Sand-Slime Tailin	0.047	93.3	0.22	0.00	0.22	0	1.68	138.765	1928.83	161.45	369	2.01%	1.8	47%	0.86	0.00	0.86	0
4.593	5604.11	86.3	1.621	85.5	118.1	51.17	1.88%	Sand-Slime Tailin	0.047	93.3	0.23	0.00	0.23	0	1.65	140.841	1957.68	164.99	372	1.88%	1.7	47%	0.87	0.00	0.87	0
4.757	5603.94	76.9	1.353	76.5	64.1	27.77	1.76%	Sand Tailings	0.051	102.8	0.24	0.00	0.24	0	1.68	128.249	1782.67	149.73	320	1.76%	1.8	18%	0.88	0.00	0.88	0
4.921	5603.78	61.2	1.819	60.2	164.5	71.28	2.97%	Sand-Slime Tailin	0.047	93.3	0.25	0.00	0.25	0	1.70	102.374	1423.00	120.93	247	2.98%	2.0	47%	0.88	0.00	0.88	0
5.085	5603.61	58.0	1.686	56.9	179.6	77.81	2.91%	Sand-Slime Tailin	0.047	93.3	0.26	0.00	0.26	0	1.70	96.747	1344.78	114.58	227	2.92%	2.0	47%	0.89	0.00	0.89	0
5.249	5603.45	60.7	1.440	60.7	-1.3	-0.55	2.37%	Sand-Slime Tailin	0.059	119.0	0.26	0.00	0.26	1	1.70	103.139	1433.63	119.77	229	2.38%	1.9	47%	0.90	0.00	0.90	0
5.413	5603.29	46.9	1.368	46.8	16.1	6.96	2.92%	Sand-Slime Tailin	0.059	119.0	0.27	0.01	0.27	1	1.70	79.509	1105.18	92.54	174	2.94%	2.1	47%	0.91	0.00	0.91	0
5.577	5603.12	43.9	1.137	43.5	70.6	30.59	2.59%	Sand-Slime Tailin	0.059	119.0	0.28	0.01	0.27	1	1.70	73.882	1026.96	86.68	160	2.61%	2.1	47%	0.92	0.00	0.92	0
5.741	5602.96	101.5	1.244	99.3	344.3	#####	1.23%	Sand Tailings	0.062	123.5	0.29	0.02	0.28	1	1.50	149.486	2077.86	177.38	365	1.23%	1.6	18%	0.93	0.00	0.93	0
5.905	5602.79	130.7	1.385	130.5	35.7	15.48	1.06%	Sand Tailings	0.062	123.5	0.30	0.02	0.28	1	1.41	184.468	2564.11	214.62	462	1.06%	1.5	18%	0.94	0.00	0.94	0
6.069	5602.63	99.5	1.248	99.5	9.3	4.02	1.25%	Sand Tailings	0.062	123.5	0.31	0.03	0.29	1	1.50	148.832	2068.77	172.96	345	1.26%	1.6	18%	0.95	0.00	0.95	0
6.234	5602.47	80.3	0.821	80.3	4.9	2.11	1.02%	Sand Tailings	0.062	123.5	0.32	0.03	0.29	1	1.56	125.079	1738.59	145.33	273	1.03%	1.6	18%	0.96	0.00	0.96	0
6.398	5602.30	62.4	0.678	62.4	1.2	0.50	1.09%	Sand Tailings	0.062	123.5	0.33	0.04	0.30	1	1.63	101.688	1413.46	118.12	208	1.09%	1.7	18%	0.97	0.00	0.97	0
6.562	5602.14	65.4	0.430	65.4	1.8	0.78	0.66%	Sand Tailings	0.062	123.5	0.35	0.04	0.30	1	1.61	105.030	1459.92	122.01	215	0.66%	1.5	18%	0.98	0.00	0.98	0
6.726	5601.97	100.8	0.407	100.8	5.9	2.54	0.40%	Sand Tailings	0.062	123.5	0.36	0.05	0.31	1	1.46	147.482	2050.01	171.35	327	0.41%	1.3	18%	0.99	0.00	0.99	0
6.890	5601.81	94.6	0.393	94.5	3.2	1.37	0.42%	Sand Tailings	0.062	123.5	0.37	0.05	0.31	1	1.48	139.500	1939.05	162.05	301	0.42%	1.3	18%	1.00	0.00	1.00	0
7.054	5601.65	89.5	0.390	89.5	2.8	1.22	0.44%	Sand Tailings	0.062	123.5	0.38	0.06	0.32	1	1.48	132.877	1846.99	154.36	281	0.44%	1.3	18%	1.01	0.00	1.01	0
7.218	5601.48	87.6	0.521	87.5	3.6	1.56	0.60%	Sand Tailings	0.062	123.5	0.39	0.06	0.32	1	1.48	129.857	1805.02	150.86	270	0.60%	1.4	18%	1.02	0.00	1.02	0
7.382	5601.32	81.6	0.625	81.5	3.4	1.48	0.77%	Sand Tailings	0.062	123.5	0.40	0.07	0.33	1	1.50	122.012	1695.96	141.75	248	0.77%	1.5	18%	1.03	0.00	1.03	0
7.546	5601.15	73.8	0.669	73.8	2.8	1.20	0.91%	Sand Tailings	0.062	123.5	0.41	0.07	0.33	1	1.52	111.871	1555.01	129.96	221	0.91%	1.6	18%	1.04	0.00	1.04	0
7.710	5600.99	67.0	0.509	67.0	2.8	1.20	0.76%	Sand Tailings	0.062	123.5	0.42	0.08	0.34	1	1.53	102.854	1429.67	119.49	197	0.76%	1.6	18%	1.05	0.00	1.05	0
7.874	5600.83	74.0	0.388	74.0	2.7	1.16	0.52%	Sand Tailings	0.062	123.5	0.43	0.08	0.34	1	1.50	111.005	1542.97	128.95	215	0.53%	1.5	18%	1.06	0.00	1.06	0
8.038	5600.66	73.6	0.370	73.6	3.4	1.48	0.50%	Sand Tailings	0.062	123.5	0.44	0.09	0.35	1	1.49	109.856	1527.01	127.63	210	0.51%	1.5	18%	1.07	0.00	1.07	0
8.202	5600.50	70.8	0.387	70.8	3.7	1.61	0.55%	Sand Tailings	0.062	123.5	0.45	0.09	0.35	1	1.50	105.908	1472.12	123.05	200	0.55%	1.5	18%	1.08	0.00	1.08	0
8.366	5600.33	61.3	0.408	61.3	4.3	1.88	0.67%	Sand Tailings	0.062	123.5	0.46	0.10	0.36	1	1.52	93.454	1299.01	108.59	170	0.67%	1.6	18%	1.09	0.00	1.09	0
8.530	5600.17	54.8	0.384	54.8	3.9	1.69	0.70%	Sand Tailings	0.062	123.5	0.47	0.10	0.36	1	1.54	84.591	1175.81	98.29	150	0.71%	1.7	18%	1.10	0.00	1.10	0
8.694	5600.01	51.9	0.384	51.9	4.9	2.12	0.74%	Sand Tailings	0.062	123.5	0.48	0.11	0.37	1	1.55	80.294	1116.09	93.31	140	0.75%	1.7	18%	1.11	0.00	1.11	0
8.858	5599.84	50.9	0.369	50.9	5.6	2.43	0.73%	Sand Tailings	0.062	123.5	0.49	0.11	0.37	1	1.54	78.492	1091.04	91.23	135	0.73%	1.7	18%	1.12	0.00	1.12	0
9.022	5599.68	49.7	0.378	49.7	5.8	2.50	0.76%	Sand Tailings	0.062	123.5	0.50	0.12	0.38	1	1.54	76.518	1063.60	88.94	130	0.77%	1.7	18%	1.13	0.00	1.13	0
9.186	5599.51	42.3	0.401	42.3	5.9	2.56	0.95%	Sand Tailings	0.062	123.5	0.51	0.12	0.38	1	1.57	66.297	921.53	77.07	109	0.96%	1.9	18%	1.14	0.00	1.14	0
9.350	5599.35	35.3	0.359	35.3	5.1	2.19	1.02%	Sand-Slime Tailin	0.059	119.0	0.52	0.13	0.39	1	1.60	56.332	783.02	65.48	90	1.03%	2.0	47%	1.15	0.00	1.15	0
9.514	5599.19	31.3	0.268	31.2	5.2	2.24	0.86%	Sand-Slime Tailin	0.059	119.0	0.53	0.13	0.39	1	1.61	50.398	700.54	58.60	78	0.87%	2.0	47%	1.16	0.00	1.16	0
9.678	5599.02	41.5	0.241	41.4	6.6	2.87	0.58%	Sand Tailings	0.062	123.5	0.54	0.14	0.40	1	1.54	63.961	889.06	74.36	103	0.59%	1.8	18%	1.17	0.00	1.17	0
9.842	5598.86	40.4	0.177	40.3	6.1	2.63	0.44%	Sand Tailings	0.062	123.5	0.55	0.14	0.40	1	1.54	62.123	863.51	72.22	99	0.44%	1.7	18%	1.18	0.00	1.18	0
10.006	5598.69	28.6	0.177	28.5	5.9	2.55	0.62%	Sand-Slime Tailin	0.059	119.0	0.56	0.15	0.41	1	1.60	45.687	635.05	53.13	69	0.63%	1.9	47%	1.19	0.00	1.19	0
10.170	5598.53	30.6	0.160	30.5	5.3	2.29	0.52%	Sand-Slime Tailin	0.059	119.0	0.57	0.16	0.41	1	1.58	48.157	669.38	55.99	73	0.53%	1.9	47%	1.20	0.00	1.20	0
10.335	5598.37	30.2	0.173	30.1	5.8	2.51	0.57%	Sand-Slime Tailin	0.059	119.0	0.58	0.16	0.42	1	1.57	47.326	657.83	55.03	71	0.58%	1.9	47%	1.21	0.00	1.21	0
10.499	5598.20	28.4	0.178	28.4	6.7	2.89	0.63%	Sand-Slime Tailin	0.059	119.0	0.59	0.17	0.42	1	1.57	44.580	619.66	51.85	66	0.64%	1.9	47%	1.22	0.00	1.22	0
10.663	5598.04	24.0	0.188	24.0	6.8	2.94	0.78%	Sand-Slime Tailin	0.059	119.0	0.60	0.17	0.43	1	1.59	38.157	530.38	44.40	55	0.80%	2.1	47%	1.23	0.00	1.23	0
10.827	5597.87	22.1	0.178	22.0	7.3	3.16	0.81%	Sand-Slime Tailin	0.059	119.0	0.61	0.18	0.43	1	1.60	35.208	489.40	40.98	50	0.83%	2.1	47%	1.24	0.00	1.24	0
10.991	5597.71	19.0	0.177	19.0	8.1	3.53	0.93%	Sand-Slime Tailin	0.059	119.0	0.62	0.18	0.43	1	1.61	30.600	425.34	35.64	42	0.96%	2.2	47%	1.25	0.00	1.25	0
11.155	5597.55	14.9	0.165	14.8	11.6	5.03	1.11%	Sand-Slime Tailin	0.059	119.0	0.62	0.19	0.44	1	1.64	24.349	338.45	28.42	33	1.15%	2.3	47%	1.26	0.00	1.26	0
11.319	5597.38	13.9	0.096	13.8	17.0	7.37	0.69%	Sand-Slime Tailin	0.059	119.0	0.63	0.19	0.44	1	1.64	22.664	315.02	26.52	30	0.72%	2.3	47%	1.27	0.00	1.27	0
11.483	5597.22	19.1	0.146	19.1	12.4	5.36	0.76%	Sand-Slime Tailin	0.059	119.0	0.64	0.20	0.45	1	1.58	30.094	418.31	35.09	41	0.79%	2.2	47%	1.28	0.00	1.28	0
11.647	5597.05	13.8	0.173	13.8	11.9	5.15	1.25%	Sand-Slime Tailin	0.059	119.0	0.65	0.20	0.45	1	1.62	22.264	309.47	26.00	29	1.31%	2.4	47%	1.29	0.00	1.29	0
11.811	5596.89	11.6	0.154	11.5	16.0	6.92	1.33%	Sand-Slime Tailin	0.059	119.0	0.66	0.21	0.46	1	1.63	18.706	260.01	21.91	24	1.41%	2.5	47%	1.30	0.00	1.30	0
11.975	5596.73	15.5	0.105	15.4	21.0	9.12	0.68%	Sand-Slime Tailin	0.059	119.0	0.67	0.21	0.46	1	1.58	24.265	337.29	28.42	32	0.71%	2.2	47%	1.31	0.00	1.31	0
12.139	5596.56	15.7	0.104	15.6	11.4	4.93	0.66%	Sand-Slime Tailin	0.059	119.0	0.68	0.22	0.47	1	1.57	24.469	340.12	28.55	32	0.69%	2.2	47%	1.32	0.00	1.32	0
12.303	5596.40	14.7	0.073	14.6	11.8	5.11	0.50%	Sand-Slime Tailin	0.059	119.0	0.69	0.22	0.47	1	1.57	22.852	317.64	26.67	30	0.52%	2.2	47%	1.33	0.00	1.33	0

Liquefaction Triggering Analyses

Idriss & Boulanger (2008): Cyclic Stress Ratio (r_d to CSR), Cyclic Resistance Ratio (Δqc_{1n} to CRR), FoS. Youd et al. (2001): Cyclic Stress Ratio (r_d to CSR), Kc, qc_{1n-cs}, CRR, FoS. Last four columns: Idriss & Boulanger (2008).

Depth (ft)	I&B r_d	C_σ	K_σ	K_α	CSR M=7.5, s'v=1atm	Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Youd r_d	D_r	f	f	K_σ	K_α	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No	CN	qc1 TSF	qc1 MPa	qc1N
0.164	1.00	0.06	1.02	1.0	0.059	42.24	76.22	0.108	1.83	0.97	0.34	0.80	0.80	2.53	1.0	0.017	1.00	33.98	0.078	190.38	96.10	2	1.7	29.253	2.8007	33.976
0.328	1.00	0.13	1.04	1.0	0.060	74.34	199.78	1.000	16.70	0.97	0.65	0.68	0.68	3.59	1.0	0.012	1.00	125.44	0.264	320.55	168.62	2	1.7	108.01	10.34	125.442
0.492	1.00	0.21	1.06	1.0	0.061	93.29	272.74	1.000	16.39	0.97	0.77	0.61	0.61	3.94	1.0	0.011	1.00	179.45	1.000	811.09	413.74	2	1.7	154.5	14.792	179.447
0.656	1.00	0.30	1.08	1.0	0.062	#####	328.79	1.000	16.09	0.97	0.86	0.60	0.60	3.68	1.0	0.012	1.00	220.94	1.000	608.56	312.32	2	1.7	190.23	18.212	220.937
0.820	1.00	0.30	1.07	1.0	0.062	#####	367.68	1.000	16.14	0.97	0.91	0.60	0.60	3.37	1.0	0.013	1.00	249.72	1.000	487.04	251.59	2	1.7	215.01	20.585	249.720
0.984	1.00	0.30	1.07	1.0	0.062	#####	363.74	1.000	16.20	0.97	0.91	0.60	0.60	3.13	1.0	0.014	1.00	246.80	1.000	406.03	211.11	2	1.7	212.5	20.345	246.804
1.148	1.00	0.30	1.06	1.0	0.062	#####	343.99	1.000	16.25	0.97	0.88	0.60	0.60	2.95	1.0	0.015	1.00	232.19	1.000	348.16	182.21	2	1.7	199.91	19.14	232.189
1.312	1.00	0.28	1.06	1.0	0.061	#####	308.28	1.000	16.36	0.97	0.83	0.60	0.60	2.79	1.0	0.015	1.00	205.76	1.000	304.76	160.56	2	1.7	177.16	16.961	205.756
1.476	1.00	0.18	1.03	1.0	0.060	86.76	247.58	1.000	16.74	0.97	0.73	0.63	0.63	2.45	1.0	0.017	1.00	160.82	1.000	271.00	143.87	2	1.7	138.47	13.257	160.819
1.640	1.00	0.15	1.03	1.0	0.059	80.84	224.80	1.000	16.84	0.97	0.69	0.65	0.65	2.25	1.0	0.019	1.00	143.96	0.357	87.22	52.03	2	1.7	123.95	11.867	143.957
1.804	1.00	0.13	1.02	1.0	0.059	75.19	203.03	1.000	16.92	0.97	0.65	0.67	0.67	2.08	1.0	0.020	1.00	127.85	0.274	60.88	38.90	2	1.7	110.08	10.539	127.847
1.968	1.00	0.13	1.02	1.0	0.059	72.67	193.33	0.854	14.50	0.97	0.63	0.68	0.68	1.98	1.0	0.022	1.00	120.67	0.243	49.53	32.02	2	1.7	103.89	9.9468	120.666
2.133	1.00	0.12	1.02	1.0	0.059	70.19	183.81	0.604	10.29	0.97	0.62	0.69	0.69	1.90	1.0	0.022	1.00	113.62	0.216	40.67	25.48	2	1.7	97.825	9.3658	113.618
2.297	1.00	0.11	1.02	1.0	0.059	67.95	175.19	0.466	7.97	0.97	0.60	0.70	0.70	1.82	1.0	0.023	1.00	107.24	0.195	33.99	20.98	2	1.7	92.332	8.8399	107.238
2.461	1.00	0.11	1.01	1.0	0.058	67.23	172.42	0.433	7.42	0.97	0.59	0.70	0.70	1.78	1.0	0.024	1.11	116.73	0.228	37.15	22.28	2	1.7	90.566	8.6708	105.187
2.625	1.00	0.16	1.02	1.0	0.059	83.63	235.56	1.000	17.06	0.97	0.71	0.64	0.64	1.95	1.0	0.022	1.04	158.48	0.450	68.81	42.94	2	1.7	130.81	12.523	151.922
2.789	0.99	0.30	1.03	1.0	0.059	#####	592.28	1.000	16.87	0.97	1.18	0.60	0.60	2.07	1.0	0.021	1.00	415.98	1.000	143.93	80.40	2	1.6134701	358.16	34.29	415.978
2.953	0.99	0.30	1.03	1.0	0.059	#####	586.29	1.000	16.94	0.97	1.17	0.60	0.60	2.02	1.0	0.021	1.00	411.54	1.000	135.98	76.46	2	1.5893219	354.34	33.924	411.542
3.117	0.99	0.30	1.02	1.0	0.059	#####	555.08	1.000	17.00	0.97	1.14	0.60	0.60	1.98	1.0	0.022	1.00	388.45	1.000	128.88	72.94	2	1.5668124	334.45	32.02	388.446
3.281	0.99	0.30	1.02	1.0	0.059	#####	490.30	1.000	17.07	0.96	1.11	0.60	0.60	1.93	1.0	0.022	1.00	372.88	1.000	122.36	69.71	2	1.5453286	321.05	30.737	372.880
3.445	0.99	0.30	1.02	1.0	0.058	92.38	367.32	1.000	17.14	0.96	0.96	0.60	0.60	1.90	1.0	0.022	1.00	274.94	1.000	116.47	66.80	2	1.5251865	236.73	22.664	274.942
3.609	0.99	0.30	1.01	1.0	0.058	80.70	309.96	1.000	17.21	0.96	0.87	0.60	0.60	1.86	1.0	0.023	1.00	229.26	1.000	111.12	64.17	2	1.5748132	197.39	18.898	229.259
3.773	0.99	0.24	1.01	1.0	0.058	71.57	265.13	1.000	17.31	0.96	0.80	0.60	0.60	1.83	1.0	0.023	1.00	193.56	1.000	106.25	61.78	2	1.6649266	166.65	15.956	193.559
3.937	0.99	0.18	1.01	1.0	0.057	63.79	226.90	1.000	17.41	0.96	0.74	0.63	0.63	1.72	1.0	0.025	1.00	163.11	1.000	101.79	59.60	2	1.7	140.44	13.446	163.114
4.101	0.99	0.30	1.01	1.0	0.057	76.20	287.84	1.000	17.41	0.96	0.84	0.60	0.60	1.77	1.0	0.024	1.00	211.65	1.000	97.69	57.55	2	1.5638874	182.23	17.447	211.647
4.265	0.99	0.21	1.00	1.0	0.057	68.43	249.68	1.000	17.50	0.96	0.78	0.61	0.61	1.71	1.0	0.025	1.05	190.74	1.000	93.92	55.71	2	1.6346491	156.06	14.941	181.249
4.429	0.99	0.18	1.00	1.0	0.057	86.93	248.38	1.000	17.55	0.96	0.73	0.63	0.63	1.64	1.0	0.026	1.09	175.31	1.000	90.74	54.14	2	1.6801632	139.01	13.309	161.453
4.593	0.98	0.18	1.00	1.0	0.057	88.16	253.15	1.000	17.59	0.96	0.74	0.63	0.63	1.63	1.0	0.026	1.07	176.22	1.000	87.77	52.68	2	1.6466803	142.05	13.6	164.988
4.757	0.98	0.16	1.00	1.0	0.057	60.37	210.10	1.000	17.63	0.96	0.71	0.65	0.65	1.57	1.0	0.027	1.08	161.01	1.000	84.72	51.18	2	1.6755875	128.92	12.343	149.733
4.921	0.98	0.13	1.00	1.0	0.057	72.71	193.64	0.865	15.27	0.96	0.63	0.68	0.68	1.49	1.0	0.029	1.31	158.55	0.451	37.01	26.14	2	1.7	104.12	9.9684	120.929
5.085	0.98	0.12	1.00	1.0	0.057	70.49	185.07	0.630	11.14	0.96	0.62	0.69	0.69	1.46	1.0	0.029	1.33	152.13	0.407	32.47	21.81	2	1.7	98.653	9.445	114.579
5.249	0.98	0.12	0.99	1.0	0.056	72.31	192.08	0.813	14.42	0.96	0.63	0.68	0.68	1.45	1.0	0.029	1.23	147.82	0.380	29.38	21.90	2	1.7	103.13	9.8732	119.774
5.413	0.98	0.10	0.99	1.0	0.056	62.76	155.30	0.298	5.29	0.96	0.56	0.72	0.72	1.38	1.0	0.031	1.43	132.68	0.297	22.57	13.93	2	1.7	79.679	7.6285	92.543
5.577	0.98	0.10	0.99	1.0	0.056	60.70	147.38	0.260	4.62	0.96	0.54	0.73	0.73	1.36	1.0	0.031	1.40	121.40	0.246	18.40	11.51	2	1.7	74.631	7.1452	86.680
5.741	0.98	0.21	0.98	1.0	0.056	67.44	244.81	1.000	17.98	0.96	0.77	0.62	0.62	1.55	1.0	0.027	1.00	177.38	1.000	73.35	45.66	2	1.5047946	152.72	14.622	177.376
5.905	0.98	0.30	0.97	1.0	0.055	76.96	291.57	1.000	18.19	0.96	0.85	0.60	0.60	1.56	1.0	0.027	1.00	214.62	1.000	72.08	45.14	2	1.4134425	184.78	17.691	214.615
6.069	0.98	0.20	0.98	1.0	0.055	66.31	239.27	1.000	18.08	0.96	0.76	0.62	0.62	1.52	1.0	0.028	1.00	172.96	1.000	70.85	44.47	2	1.4962526	148.92	14.257	172.960
6.234	0.98	0.15	0.98	1.0	0.055	59.24	204.57	1.000	18.04	0.96	0.70	0.65	0.65	1.46	1.0	0.029	1.00	145.33	0.365	25.46	21.75	2	1.5584195	125.13	11.98	145.326
6.398	0.97	0.12	0.99	1.0	0.055	52.29	170.40	0.412	7.42	0.96	0.63	0.69	0.69	1.40	1.0	0.030	1.04	123.04	0.253	17.35	12.38	2	1.630915	101.7	9.7367	118.118
6.562	0.97	0.13	0.98	1.0	0.055	53.28	175.29	0.468	8.45	0.96	0.64	0.68	0.68	1.40	1.0	0.030	1.00	122.01	0.249	16.78	12.62	2	1.6057202	105.05	10.057	122.007
6.726	0.97	0.19	0.97	1.0	0.055	65.90	237.25	1.000	18.30	0.96	0.76	0.62	0.62	1.48	1.0	0.029	1.00	171.35	1.000	66.34	42.32	2	1.4632651	147.54	14.125	171.354
6.890	0.97	0.18	0.97	1.0	0.055	63.52	225.57	1.000	18.31	0.96	0.73	0.63	0.63	1.45	1.0	0.029	1.00	162.05	1.000	65.31	41.81	2	1.4755629	139.53	13.358	162.054
7.054	0.97	0.17	0.97	1.0	0.055	61.55	215.91	1.000	18.32	0.96	0.72	0.64	0.64	1.43	1.0	0.029	1.00	154.36	0.422	27.14	22.73	2	1.4844968	132.9	12.724	154.359
7.218	0.97	0.16	0.97	1.0	0.054	60.66	211.52	1.000	18.36	0.96	0.71	0.65	0.65	1.42	1.0	0.030	1.00	150.86	0.399	25.29	21.82	2	1.4835763	129.89	12.436	150.860
7.382	0.97	0.15	0.97	1.0	0.054	58.33	200.07	1.000	18.37	0.96	0.69	0.66	0.66	1.39	1.0	0.030	1.00	141.75	0.345	21.51	19.94	2	1.4963405	122.04	11.684	141.746
7.546	0.97	0.13	0.97	1.0	0.054	55.31	185.28	0.634	11.65	0.96	0.66	0.67	0.67	1.37	1.0	0.031	1.00	129.96	0.284	17.47	14.56	2	1.5166927	111.9	10.713	129.962
7.710	0.97	0.12	0.98	1.0	0.054	52.64	172.13	0.430	7.89	0.95	0.63	0.68	0.68	1.34	1.0	0.031	1.00	119.49	0.239	14.46	11.18	2	1.5349015	102.88	9.8497	119.489
7.874	0.96	0.13	0.97	1.0	0.054	55.06	184.01	0.608	11.22	0.95	0.66	0.67	0.67	1.35	1.0	0.031	1.00	128.95	0.279	16.69	13.95	2	1.4996592	111.03	10.63	128.954
8.038	0.96	0.13	0.97	1.0	0.054	54.72	182.35	0.576	10.65	0.95	0.65	0.67	0.67	1.34	1.0	0.031	1.00	127.63	0.273	16.10	13.37	2	1.493427	109.89	10.521	127.629
8.202	0.96	0.13	0.97	1.0	0.054	53.55	176.59	0.485	8.97	0.95	0.64	0.68	0.68	1.33	1.0	0.032	1.00	123.05	0.253	14.71	11.84	2	1.4954504	105.94	10.143	123.046
8.366	0.96	0.11	0.97	1.0	0.054	49.85	158.44	0.316	5.84	0.95	0.60	0.70	0.70	1.30	1.0	0.032	1.00	108.59	0.199	11.40	8.62	2	1.5240349	93.495	8.9512	108.589
8.530	0.96	0.10	0.97	1.0	0.054	47.22	145.51	0.252	4.66	0.95	0.57	0.71	0.71	1.28	1.0	0.033	1.02	100.58	0.175	9.87	7.27	2	1.5433477	84.629	8.1023	98.291
8.694	0.96	0.10	0.97	1.0	0.054	45.94	139.26	0.230	4.25	0.95	0.56	0.72	0.72	1.27	1.0	0.033	1.05	97.92	0.167	9.33	6.79	2	1.5476904	80.342	7.6919	93.312
8.858	0.96	0.10	0.97	1.0	0.054	45.41	136.64	0.222	4.11	0.95	0.55	0.72	0.72	1.26	1.0	0.033	1.05	96.09	0.163	8.95	6.53	2	1.5433018	78.546	7.52	91.227
9.022	0.96	0.10	0.97	1.0	0.054	44.83	133.76	0.213	3.96	0.95	0.54	0.73	0.73	1.25	1.0	0.034	1.07	95.21	0.160	8.71	6.33	2	1.539604	76.574	7.3312	88.936
9.186	0.96	0.09	0.97	1.0	0.054	41.79	118.86	0.177	3.29	0.95	0.51	0.75	0.75	1.23	1.0	0.034	1.16	89.46	0.147	7.86	5.57	2	1.5669354	66.355	6.3528	77.067
9.350	0.96	0.08	0.98	1.0	0.054	53.27	118.75	0.177	3.28	0.95	0.47	0.77	0.77	1.21	1.0	0.035	1.25	81.59	0.131	6.92	5.10	2	1.5980729	56.383	5.3981	65.485
9.514	0.95	0.08	0.98	1.0	0.054	50.85	109.45	0.159	2.95	0.95	0.44	0.78	0.78	1.19	1.0	0.035	1.25	73.12	0.116	6.10	4.52	2	1.6142974	50.45	4.8301	58.595
9.678	0.95	0.09	0.97	1.0	0.054	41.10	115.46	0.170	3.18	0.95	0.50	0.75	0.75	1.21	1.0	0.035	1.08	80.27	0.128	6.63	4.90	2	1.5442154	64.025	6.1298	74.361
9.842	0.95	0.09	0.97	1.0	0.054	40.55	112.77	0.165	3.08	0.95	0.49	0.75	0.75	1.21	1.0	0.035	1.05	75.47	0.120	6.14	4.61	2	1.5403705	62.182	5.9533	72.220
10.006	0.95	0.07	0.98	1.0	0.054	48.94	102.07	0.146	2.72	0.95	0.42	0.79	0.79	1.17	1.0	0.036	1.21	64.44	0.105	5.31	4.01	2	1.6008107	45.746	4.3797	53.131
10.170	0.95	0.07	0.97	1.0	0.054	49.94	105.93	0.153	2.85	0.95	0.43	0.78	0.78	1.17	1.0	0.036	1.16	64.84	0.105	5.27	4.06	2	1.5778694	48.209	4.6155	55.991
10.335	0.95	0.07	0.97	1.0	0.053	49.60	104.63	0.150	2.81	0.95	0.43	0.79	0.79	1.17	1.0	0.036	1.18	65.18	0.106	5.23	4.02	2	1.5707235	47.383	4.5364	55.032
10.499	0.95	0.07	0.97	1.0	0.053	48.49	100.34	0.143	2.68	0.95	0.42	0.79	0.79	1.16	1.0	0.036	1.23	63.89	0.104	5.11	3.89	2	1.5724903	44.646	4.2744	51.853
10.663	0.95	0.07	0.98	1.0	0.053	45.87	90.27	0.127	2.38	0.95	0.38	0.80	0.80	1.15	1.0	0.036	1.39	61.79	0.102	4.94	3.66	2	1.5931884	38.224	3.6596	44.395
10.827	0.95	0.07	0.98	1.0	0.053	44.67	85.65	0.121	2.26	0.95	0.37	0.80	0.80	1.15	1.0	0.036	1.46	60.03	0.100	4.80	3.53	2	1.5974781	35.281	3.3778	40.977
10.991	0.94	0.06	0.98	1.0	0.053	42.80	78.43	0.111	2.07	0.95	0.34	0.80	0.80	1.15	1.0	0.036	1.67	59.45	0.100	4.72	3.40	2	1.6122245	30.682	2.9375	35.635
11.155	0.94	0.06	0.98	1.0	0.053	40.27	68.69	0.098	1.84	0.95	0.31	0.80	0.80	1.14	1.0	0.036	2.09	59.25	0.099	4.67	3.25	2	1.6407745	24.468	2.3426	28.418
11.319	0.94	0.06	0.98	1.0	0.053	39.60	66.13	0.095	1.78	0.95	0.30	0.80	0.80	1.14	1.0	0.037	1.85	48.98	0.091	4.22	3.00	2	1.6399091	22.838	2.1865	26.525
11.483	0.94	0.06	0.98	1.0	0.053	42.61	77.70	0.110	2.06	0.95	0.34	0.80	0.80	1.14	1.0	0.037	1.59	55.68	0.096	4.42	3.24	2	1.5797597	30.216	2.8929	35.094
11.647	0.94	0.06	0.98	1.0	0.053	39.42	65.42	0.094	1.77	0.95	0.29	0.80	0.80	1.14	1.0	0.037	2.36	61.36	0.101	4.63	3.20	2	1.6180172	22.384	2.143	25.998
11.811	0.94	0.05	0.98	1.0	0.053	37.99	59.90	0.088	1.65	0.95	0.27	0.80	0.80	1.13	1.0	0.037	2.78	60.88	0.101	4.56	3.11	2	1.6322579	18.868	1.8065	21.915
11.975	0.94	0.06	0.98	1.0	0.053	40.27	68.69	0.098	1.85	0.94	0.31	0.80	0.80	1.13	1.0	0.037	1.76	50.09	0.092	4.10	2.98	2	1.5797785	24.473	2.343	28.424
12.139	0.94	0.06	0.98	1.0	0.053	40.31	68.86	0.098	1.86	0.94	0.31	0.80	0.80	1.13	1.0	0.037	1.75	49.90	0.092	4.05	2.96	2	1.5675475	24.581	2.3534	28.549
12.303	0.94	0.06	0.98	1.0	0.053	39.66	66.33	0.095	1.80	0.94	0.30	0.80	0.80	1.13	1.0	0.037	1.69	44.97	0.087	3.84	2.82	2	1.5662713	22.967	2.1989	26.675

WHITE MESA TAILINGS REPOSITORY LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES - 3-8S

Data File: 13-52106_SP3-8S-BSC-CPT
Location: White Mesa 2013 CPT Investigation
..\..\..\6.2.3_Field Data\2013 Field Investigation\Conetec Data

Legend:
- Tailings Sands
- Tailings Sand-Slimes
- Tailings Slimes
- Interim Cover
- Cells Requiring User Input/Manipulation

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.15
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69

Youd, et al (2001)		
Max. Horiz. Acceleration, Amax/g:	0.15	
Earthquake Moment Magnitude, M:	5.5	
Magnitude Scaling Factor, MSF:	2.21	2.21

5603.50	Water surface elevation during CPT investigation (ft amsl)
5600.42	Water surface elevation at t_0 (ft amsl)
5590.63	Water surface elevation at t_1 (ft amsl)
5585.63	Water surface elevation at t_2 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earthquake
7.51	Equiv. Number of Uniform Strain Cycles, N

5608.70	Ground Surface Elevation at time of CPT (ft amsl)
5620.45	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
0.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement
3.50	Thickness of Water Storage/Rooting Zone (ft)
3.50	Thickness of High Compaction Layer (ft)
4.25	Thickness of Random/Platform Fill on on top of existing interim cover (ft)
1273.89	Additional Stress due to Final Cover Placement, $\Delta\sigma_{FC}$ (psf)
5585.63	Elevation of bottom of tailings (liner) (ft amsl)

FINAL COVER	Elev. at Top of Layer (ft)		Elev. At Midpoint of Layer (ft)	Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)	Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Stress at Bottom of Layer (tsf)	Stress at Midpoint of Layer (tsf)
Erosion Protection Layer	5620.45		5620.2	5619.95	0.50	0.055	110	0.028	0.014	0.00	0.00	0.028	0.014
Water Storage/Rooting Zone Layer	5619.95		5618.2	5616.45	3.50	0.054	107	0.215	0.121	0.00	0.00	0.215	0.121
High Compaction Layer	5616.45		5614.7	5612.95	3.50	0.060	120	0.424	0.320	0.00	0.00	0.424	0.320
Platform/Random Fill Layer	5612.95		5610.825	5608.70	4.25	0.050	101	0.638	0.531	0.00	0.00	0.638	0.531

2013 CPT Data from ConeTec / Material Type / CPT Data Interpretations

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (as determined by fines)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %
12.467	5596.23	12.9	0.081	12.8	12.1	5.25	0.63%	Sand-Slime Tailin	0.059	119.0	0.70	0.23	0.48	1	1.57	20.146	280.04	23.54	26	0.66%	2.3	47%
12.631	5596.07	13.9	0.074	13.8	9.8	4.25	0.53%	Sand-Slime Tailin	0.059	119.0	0.71	0.23	0.48	1	1.55	21.485	298.64	25.06	27	0.56%	2.3	47%
12.795	5595.90	13.8	0.074	13.8	10.5	4.55	0.53%	Sand-Slime Tailin	0.059	119.0	0.72	0.24	0.49	1	1.54	21.243	295.27	24.79	27	0.56%	2.3	47%
12.959	5595.74	14.6	0.071	14.5	12.1	5.22	0.49%	Sand-Slime Tailin	0.059	119.0	0.73	0.24	0.49	1	1.53	22.185	308.37	25.90	28	0.51%	2.2	47%
13.123	5595.58	15.1	0.085	15.0	12.9	5.59	0.56%	Sand-Slime Tailin	0.059	119.0	0.74	0.25	0.49	1	1.51	22.654	314.89	26.45	29	0.59%	2.2	47%
13.287	5595.41	18.1	0.188	18.0	15.1	6.54	1.04%	Sand-Slime Tailin	0.059	119.0	0.75	0.25	0.50	1	1.48	26.626	370.11	31.09	35	1.09%	2.3	47%
13.451	5595.25	14.3	0.276	14.2	17.2	7.45	1.93%	Sand-Slime Tailin	0.059	119.0	0.76	0.26	0.50	1	1.50	21.326	296.43	24.96	27	2.03%	2.5	47%
13.615	5595.08	12.3	0.228	12.1	23.3	10.08	1.86%	Sand-Slime Tailin	0.059	119.0	0.77	0.26	0.51	1	1.51	18.270	253.95	21.47	23	1.98%	2.6	47%
13.779	5594.92	10.8	0.190	10.7	27.0	11.70	1.75%	Sand-Slime Tailin	0.059	119.0	0.78	0.27	0.51	1	1.50	15.970	221.98	18.84	20	1.89%	2.6	47%
13.943	5594.76	8.0	0.181	7.7	47.3	20.48	2.26%	Slime Tailings	0.057	113.1	0.79	0.27	0.52	1	1.49	11.507	159.95	13.88	14	2.50%	2.8	71%
14.107	5594.59	10.0	0.115	9.6	60.9	26.40	1.15%	Sand-Slime Tailin	0.059	119.0	0.80	0.28	0.52	1	1.48	14.251	198.09	17.20	18	1.25%	2.6	47%
14.271	5594.43	12.7	0.137	12.5	34.5	14.95	1.08%	Sand-Slime Tailin	0.059	119.0	0.81	0.28	0.53	1	1.46	18.326	254.73	21.65	23	1.15%	2.5	47%
14.436	5594.26	8.1	0.129	7.9	39.8	17.23	1.59%	Slime Tailings	0.057	113.1	0.82	0.29	0.53	1	1.46	11.483	159.62	13.76	14	1.77%	2.8	71%
14.600	5594.10	6.3	0.101	6.0	61.5	26.64	1.59%	Slime Tailings	0.057	113.1	0.83	0.29	0.54	1	1.45	8.629	119.94	10.67	10	1.83%	2.9	71%
14.764	5593.94	6.0	0.095	5.6	71.3	30.89	1.58%	Slime Tailings	0.057	113.1	0.84	0.30	0.54	1	1.44	8.029	111.61	10.07	10	1.83%	2.9	71%
14.928	5593.77	5.9	0.056	5.5	66.0	28.61	0.95%	Slime Tailings	0.057	113.1	0.85	0.30	0.54	1	1.43	7.895	109.74	9.86	9	1.10%	2.8	71%
15.092	5593.61	6.8	0.056	6.5	47.2	20.44	0.82%	Sand-Slime Tailin	0.059	119.0	0.86	0.31	0.55	1	1.42	9.295	129.20	11.28	11	0.94%	2.7	47%
15.256	5593.44	9.0	0.056	8.7	40.6	17.59	0.63%	Sand-Slime Tailin	0.059	119.0	0.87	0.31	0.55	1	1.41	12.302	171.00	14.70	15	0.69%	2.5	47%

Conditions at t_1 / Liquefaction Triggering Analyses – Idriss & Boulanger (2008)

Depth at time of CPT (ft)	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1 (tsf)	Effective Stress at t_1 (tsf)	Saturated at t_1 1=Yes 0=No	Cyclic Stress Ratio r_d	C_σ	K_σ	K_a	CSR M=7.5, s'v=1atm	Cyclic Resistance Ratio Δqc_{1n}	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS
12.467	1.34	0.00	1.34	0	0.93	0.05	0.98	1.0	0.053	38.56	62.09	0.090	1.71
12.631	1.35	0.00	1.35	0	0.93	0.06	0.97	1.0	0.053	39.09	64.16	0.093	1.76
12.795	1.36	0.00	1.36	0	0.93	0.06	0.97	1.0	0.052	39.00	63.79	0.092	1.76
12.959	1.37	0.00	1.37	0	0.93	0.06	0.97	1.0	0.052	39.39	65.28	0.094	1.79
13.123	1.38	0.00	1.38	0	0.93	0.06	0.97	1.0	0.052	39.58	66.03	0.095	1.81
13.287	1.39	0.00	1.39	0	0.93	0.06	0.97	1.0	0.052	41.20	72.29	0.102	1.97
13.451	1.40	0.00	1.40	0	0.93	0.06	0.97	1.0	0.052	39.05	64.01	0.092	1.77
13.615	1.41	0.00	1.41	0	0.93	0.05	0.97	1.0	0.052	37.83	59.31	0.087	1.67
13.779	1.42	0.00	1.42	0	0.92	0.05	0.97	1.0	0.052	36.91	55.75	0.083	1.60
13.943	1.43	0.00	1.43	0	0.92	0.05	0.98	1.0	0.052	34.92	48.80	0.076	1.47
14.107	1.44	0.00	1.44	0	0.92	0.05	0.97	1.0	0.052	36.34	53.54	0.081	1.56
14.271	1.45	0.00	1.45	0	0.92	0.05	0.97	1.0	0.052	37.89	59.55	0.087	1.69
14.436	1.46	0.00	1.46	0	0.92	0.05	0.97	1.0	0.052	34.88	48.64	0.076	1.47
14.600	1.47	0.00	1.47	0	0.92	0.05	0.98	1.0	0.052	33.80	44.47	0.072	1.40
14.764	1.47	0.00	1.47	0	0.92	0.05	0.98	1.0	0.052	33.59	43.67	0.072	1.39
14.928	1.48	0.00	1.48	0	0.92	0.05	0.98	1.0	0.052	33.52	43.38	0.071	1.38
15.092	1.49	0.00	1.49	0	0.91	0.05	0.97	1.0	0.052	34.26	45.54	0.073	1.42
15.256	1.50	0.00	1.50	0	0.91	0.05	0.97	1.0	0.051	35.46	50.16	0.078	1.51

Liquefaction Triggering Analyses – Youd et al. (2001); Idriss & Boulanger (2008)

Depth at time of CPT (ft)	Cyclic Stress Ratio r_d	D_r	f	f	K_σ	K_a	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Avg FoS	Liquefiable? 1=Yes 2=No	Idriss & Boulanger (2008) CN	qc1 TSF	qc1 MPa	qc1N
12.467	0.94	0.28	0.80	0.80	1.13	1.0	0.037	1.98	46.69	0.089	3.86	2.79	2	1.572711	20.265	1.9402	23.537
12.631	0.94	0.29	0.80	0.80	1.12	1.0	0.037	1.80	45.15	0.088	3.77	2.77	2	1.5523965	21.58	2.0661	25.064
12.795	0.94	0.29	0.80	0.80	1.12	1.0	0.037	1.82	45.16	0.088	3.74	2.75	2	1.542676	21.344	2.0435	24.789
12.959	0.94	0.29	0.80	0.80	1.12	1.0	0.037	1.72	44.57	0.087	3.68	2.74	2	1.5257894	22.3	2.135	25.900
13.123	0.94	0.30	0.80	0.80	1.12	1.0	0.037	1.77	46.90	0.089	3.73	2.77	2	1.5122892	22.776	2.1806	26.453
13.287	0.94	0.32	0.80	0.80	1.12	1.0	0.037	1.96	60.82	0.101	4.19	3.08	2	1.480883	26.766	2.5626	31.087
13.451	0.94	0.29	0.80	0.80	1.11	1.0	0.037	3.03	75.54	0.120	4.94	3.36	2	1.4986703	21.487	2.0572	24.956
13.615	0.94	0.27	0.80	0.80	1.11	1.0	0.037	3.35	71.88	0.115	4.67	3.17	2	1.506168	18.489	1.7701	21.473
13.779	0.94	0.25	0.80	0.80	1.11	1.0	0.037	3.60	67.84	0.109	4.41	3.00	2	1.4981009	16.222	1.5531	18.841
13.943	0.94	0.22	0.80	0.80	1.11	1.0	0.037	5.07	70.29	0.112	4.51	2.99	2	1.4886778	11.947	1.1438	13.875
14.107	0.94	0.24	0.80	0.80	1.11	1.0	0.037	3.23	55.51	0.096	3.82	2.69	2	1.478327	14.813	1.4182	17.205
14.271	0.94	0.27	0.80	0.80	1.10	1.0	0.038	2.64	57.06	0.097	3.84	2.76	2	1.4648967	18.641	1.7847	21.651
14.436	0.94	0.21	0.80	0.80	1.10	1.0	0.038	4.42	60.74	0.101	3.95	2.71	2	1.4591381	11.846	1.1341	13.758
14.600	0.94	0.19	0.80	0.80	1.10	1.0	0.038	5.42	57.80	0.098	3.81	2.60	2	1.4502622	9.1857	0.8794	10.669
14.764	0.94	0.18	0.80	0.80	1.10	1.0	0.038	5.66	57.05	0.097	3.75	2.57	2	1.4415084	8.6707	0.8301	10.071
14.928	0.94	0.18	0.80	0.80	1.10	1.0	0.038	4.79	47.20	0.089	3.42	2.40	2	1.4328741	8.4858	0.8124	9.856
15.092	0.94	0.19	0.80	0.80	1.09	1.0	0.038	4.07	45.87	0.088	3.35	2.39	2	1.4233829	9.7137	0.93	11.282
15.256	0.94	0.22	0.80	0.80	1.09	1.0	0.038	2.96	43.56	0.086	3.25	2.38	2	1.4140338	12.66	1.2121	14.704

ATTACHMENT F

SUPPORTING DOCUMENTATION FOR INTERROGATORY 08/1:

REVISED APPENDIX G, EROSIONAL STABILITY EVALUATION, TO THE UPDATED TAILINGS COVER DESIGN REPORT (APPENDIX D OF THE RECLAMATION PLAN, REVISION 5.0)

APPENDIX G

EROSIONAL STABILITY EVALUATION

G.1 INTRODUCTION

This appendix presents the hydrologic analysis and evaluation of erosion protection for the cover surface of the White Mesa Mill tailings disposal cells, and for the discharge channel and sedimentation basin. These analyses are an update to the analyses presented in MWH (2011) to incorporate revisions to the analyses to address State of Utah, Division of Waste Management and Radiation Control (DWMRC) (formerly Utah Division of Radiation Control, DRC) interrogatories (DRC, 2012) and review comments on EFRI responses to 2012 interrogatories (DRC, 2013). These analyses also incorporate the revised cover grading design and results of cover material testing conducted in 2010 and 2012 (summarized in Attachment B of EFRI, 2012). These analyses have been conducted in a manner consistent with Nuclear Regulatory Commission (NRC) guidelines documented in NRC (1990) and Johnson (2002). The analyses include the tasks listed below.

1. Selection of the Probable Maximum Precipitation (PMP) as the design event for the site.
2. Calculation of the peak discharge (due to the PMP) from the surfaces of Cells 1, 2, 3, 4A and 4B for the cover surface, and for the drainage basin for the discharge channel.
3. Evaluation of reclaimed tailings disposal cell surfaces for erosional stability (the top surfaces and the reclaimed embankment slopes) and evaluation of the discharge channel and sedimentation basin for erosional stability.
4. Evaluation of the need for filter material between erosional protection riprap and underlying soil layers on the transition slopes on the top surface, the reclaimed embankment slopes, and the rock aprons.
5. Evaluation of the need for a rock apron at the toe of the reclaimed embankment slopes to accommodate flow transitioning from embankment slopes to native ground.
6. Evaluation of surface sheet erosion of top surface of cells due to action of surface water and wind.

These tasks are presented in the following sections of this appendix.

G.2 CONCEPTUAL EROSIONAL PROTECTION DESIGN

Erosional protection was evaluated for the proposed monolithic ET cover design based on the following proposed cover surface of the tailings disposal cells, as well as for the sedimentation basin and diversion channel:

- Cells 2 and 3 top surfaces graded to 0.5 percent slope: Erosional protection is provided by 6 inches of topsoil vegetated with a grass mixture providing poor or better vegetated conditions with a minimum of 30 percent plant coverage (representing drought conditions).
- Portions of Cell 1 and 2 with top surfaces graded at 1 percent slope and Cells 4A and 4B with top surfaces at 0.8 percent slope: Erosional protection is provided by 6 inches of topsoil mixed with 25 percent (by weight) of 1-inch minus (D_{100} = 1 inch) gravel, vegetated with a grass mixture providing poor or better vegetated conditions with a minimum of 30 percent plant coverage (representing drought conditions).

- External side slopes graded to 5 horizontal to 1 vertical (5H:1V): Erosional protection is provided by various sized angular and rounded riprap with thicknesses ranging from 6 to 8 inches and minimum D_{50}'s ranging from 1.5 to 5.3 inches. Filter material will be placed between the erosional protection and the underlying soil layer.
- Cover transition slopes graded to 10H:1V: Erosional protection is provided by 7 inches of angular riprap with a minimum D_{50} of 4.5 inches. Filter material will be placed between the erosional protection and the underlying soil layer.
- A rock apron at the toe of 5H:1V slopes: Erosional protection and scour protection on the west and east sides of the cells is provided by a rock apron measuring 10.2 inches deep and 4.25 feet in width, with a D_{50} of 3.4 inches. On the south side of cells 4A and 4B, and east side of Cell 4A, the rock apron measures 2.7 feet in depth, 13.2 feet in width, and has a D_{50} of 10.6 inches. On the north side slope of the Cell 1 disposal area, the rock apron measures 2.3 feet deep, 11.3 feet wide, and contains a minimum D_{50} of 9.0 inches.
- Sedimentation Basin area graded to 0.1 percent slope: Erosional protection is provided by 6 inches of topsoil vegetated with a grass mixture providing poor or better vegetated conditions with a minimum of 30 percent plant coverage (representing drought conditions).
- Diversion Channel: The diversion channel will be excavated into bedrock.

G.3 PROBABLE MAXIMUM PRECIPITATION EVENT

As outlined in NRC (1990) and Johnson (2002), the design event for evaluation of long-term erosional stability of the reclaimed tailings disposal cells is the PMP. The selected PMP events used to calculate the peak discharges for evaluation of erosional stability were the six-hour duration PMP (with a precipitation total of 9.6 inches) and the one-hour duration PMP (with a precipitation total of 8.3 inches). These events were determined for the site area using "Hydrometeorological Report (HMR) No. 49: Probable Maximum Precipitation Estimates, Colorado River and Great Basin Drainages (Hansen et al. 1984) , as well as Jensen (1995). Rainfall depth versus duration for short-term events (less than 1 hour) was developed using procedures in HMR 49 and NUREG/CR-4620 (Nelson et al., 1986). PMP calculations were provided in Denison (2009) and updated in Denison (2012). The calculations are provided in Attachment G.1.

G.4 CALCULATION OF PEAK DISCHARGE

The peak discharge calculations were made using the Rational Method as described in Johnson (2002) and Nelson et al. (1986). The time of concentration was calculated for the longest flow path (see Figure G.1) across the tailings disposal cells using procedures by Kirpich, Soil Conservation Service (SCS) and Brant and Oberman as presented in Nelson et al. (1986) and DOE (1989). Equal weight was given to each of the three methods. A runoff coefficient of 1.0 was used to represent PMP conditions (DOE, 1989). These characteristics represent high runoff quantities and peak flow velocities.

The PMP discharge results across the tailings disposal cells are presented in Table G.1. These discharges represent flow across a unit-width across the slope.

Table G.1. Peak Reclaimed Surface Discharges

Location	Slope Length (feet)	Time of Concentration (min)	Rainfall Intensity (in/hr)	Runoff Coefficient	Peak Unit Discharge (cfs/ft)
Upper reach of Cell 2 at 1 % slope	900	9.4	32.7	1.0	0.68
Lower reach of Cell 2 at 0.5 % slope	550	18.5	21.4	1.0	0.71
Cell 3 at 0.5 % slope	830	30.0	14.8	1.0	0.78
Cell 4A at 0.8 % slope	1200	42.2	11.2	1.0	0.90
Cell 4A side slopes at 20% slope	100	42.2	11.2	1.0	0.92

Note: Flow accumulates as it flows from Cell 2 to Cell 4A

The unit discharge values in Table G.1 above were used to evaluate the erosional stability of the reclaimed surfaces and size erosion protection materials where necessary. These evaluations are presented in Sections G.5 and G.6.

G.5 EROSIONAL STABILITY OF VEGETATED SLOPES

The surface of the reclaimed tailings disposal cells was evaluated for erosional stability using the methods recommended in NRC (1990) and Johnson (2002).

Temple Method. Temple et al. (1987) outlines procedures for grass-lined channel design. These procedures are recommended in Johnson (2002) for areas of vegetated cover and include methods for estimating stresses on channel vegetation as well as the channel surface soils. The evaluation for the tailings disposal cells used the peak discharge values from the PMP (summarized in Table G.1) to conservatively represent the effective stresses from runoff on the cover surface. The stresses on both the vegetation and the soil were evaluated.

The erosional stability of the cover surface for the tailings disposal cells was evaluated by calculating a factor of safety against erosion due to the peak runoff from the PMP. Factor-of-safety values were calculated as the ratio of the allowable stresses (the resisting strength of the cover vegetation or soils) to the effective stresses (the stresses impacted by the runoff flowing over the cover). Two factors of safety were calculated for each analysis to evaluate both the resistance of the vegetation, and the resistance of the silty topsoil layer. The peak unit discharge flow for the tailings disposal cells (from Table G.1) was conservatively multiplied by a concentration factor of 3 to account for channelization of flow.

Allowable stresses. Allowable stresses for the cover soils were calculated using the equations in Temple et al. (1987). Material planned for the upper layer of the cover system is the on-site stockpiled topsoil. Laboratory testing of the topsoil conducted in 2010 (see Appendix A) indicates the topsoil classifies as either a silty clay with sand or a sandy silty clay. The D_{75} (diameter of which 75 percent of the material is finer) is approximately 0.08 mm to 0.1 mm (.003 in to .004 in) with a plasticity index (PI) of approximately 4 to 7. The resistance of a silty soil with a PI less than 10 is estimated to be approximately 0.02 psf (Temple et al., 1987). For noncohesive soils with a D_{75} greater than 0.05 in., the resistance is calculated as follows:

$$\tau_a = 0.4D_{75} \text{ , for soils with } D_{75}>0.05 \text{ in,}$$
$$\tau_a = 0.02\text{, for noncohesive soils with } D_{75}\leq 0.05 \text{ in.}$$

Where

τ_a = allowable shear strength (psf), and
D_{75} = particle diameter in which 75 percent of the soil is finer (inch).

For areas where 1-inch gravel is added to the topsoil (25 percent by weight), the D_{75} of the topsoil mixture will increase to approximately 0.2 inches.

As discussed in Appendix J of this report, the cover will be vegetated with a mixture of perennial grasses (primarily wheatgrass, ricegrass, squirreltail, and fescue) and forbs (yarrow and sage). The allowable vegetation shear strength is calculated as:

$$\tau_{va} = 0.75C_I$$

Where

τ_{va} = allowable vegetation shear strength (in psf),
C_I =cover index = 2.5 $[h(M)^{1/2}]^{1/3}$,
h = stem length (ft), and
M = stem density factor (stems per square ft).

Conservatively using poor vegetation conditions, h=1.0, M=67, and C_I=5.03, the resulting vegetation shear strength value is 3.78 psf.

Effective stresses. The effective shear stress on soil due to peak runoff from the PMP was calculated as:

$$\tau_e = \gamma dS\left(1 - C_f\right)(n_s/n)^2$$

Where

τ_e = effective shear stress (psf),
γ = unit weight of water = 62.4 pcf,
d = depth of flow (ft), from Table G.2,
S = slope of cover surface (ft/ft), from Table G.1,
C_f = cover factor (0.375 for poor vegetation),
n_s = soil roughness factor (0.0156 for soils with $D_{75}\leq$0.05 in., or $0.0256(D_{75})^{1/6}$ for D_{75} > 0.05 in), and
n = Manning's roughness coefficient for vegetated surface.

$$n = e^{C_i\left(0.0133[\ln q]^2 - 0.0954 \ln q + 0.297\right) - 4.16}$$

The effective shear stress on vegetation is calculated as:

$$\tau_v = \gamma dS - \tau_e$$

Where

τ_v = effective vegetal stress (psf).

Conservatively using poor vegetation conditions, the effective shear stresses on soil and vegetation on the tailings cover surfaces are summarized in Table G.2.

Table G.2. Effective Shear Stresses on Soil and Vegetation

			Soil			Vegetation		
Location	Description of Erosion Protection	Depth of Flow[1] (ft)	Effective Shear Stress (psf)	Allowable Shear Stress (psf)	Factor of Safety	Effective Shear Stress (psf)	Allowable Shear Stress (psf)	Factor of Safety
Cell 1 at 1% slope	Vegetation and Gravel (D_{75}=0.2 in)	0.80	0.040	0.08	2.0	0.449	3.78	8.4
Cell 2 at 0.5 % slope	Vegetation (D_{75} = 0.003 in)	1.01	0.019	0.02	1.1	0.297	3.78	12.7
Cell 2 at 1 % slope	Vegetation and gravel (D_{75} = 0.2 in)	0.82	0.044	0.08	1.8	0.467	3.78	8.1
Cell 3 at 0.5 % slope	Vegetation (D_{75} = 0.003 in)	1.05	0.021	0.02	1.0	0.306	3.78	12.4
Cells 4A and 4B at 0.8 % slope	Vegetation and gravel (D_{75} = 0.2 in)	0.97	0.050	0.08	1.6	0.433	3.78	8.7

[1] Calculated using a concentration factor of 3 for peak unit discharge

The calculated factors of safety above show that for poor vegetation conditions, the allowable shear strengths are equal to or higher than the effective shear stresses on both the vegetation and the soil during peak discharge from the PMP. When vegetation conditions are good or better, the soil factor of safety improves significantly, while the vegetation factor of safety decreases slightly, but remains well above 1.0. Further details of calculations can be found in Attachment G.2.

These analyses indicate that the cover on the top surface of the tailings disposal cells can be constructed as a vegetated slope. Top slopes at 0.5 percent slopes are adequately stable without the addition of gravel, while the 1 percent slope in Cell 2, and the 0.8 percent slope in Cells 4A and 4B will require the addition of approximately 25 percent of 1-inch-minus gravel.

G.6 EROSIONAL STABILITY OF ROCK-PROTECTED SIDE-SLOPES

Because of the difficulty in maintaining vegetation on side slopes, the 5:1 side slopes have been designed for erosional protection assuming vegetation is minimal. The maximum unit discharge value from Table G.1 was used to size riprap for the embankment slopes. The Johnson and Abt method referenced in Johnson (2002) was used for the side slopes. The required angular rock size is calculated as follows:

$$D_{50} = 5.23S^{0.43}q_{design}{}^{0.56}$$

Where

D_{50} = median particle diameter of which 50 percent of the soil is finer (inch),
S = slope (ft/ft), and
q_{design} = design flow (cfs/ft).

Flow Characteristics. The peak unit discharge values from Table G.1 were used to represent flow conditions across the cover surface and down the embankment side slopes south of Cells 4A and 4B. Concentration factors of 3 were used to account for channelization of flow.

Rock Characteristics. A specific gravity of 2.65 was assumed for the riprap. The overall erosion protection design uses rounded and angular rock for the embankment side slopes. Angular rock was selected for slopes where the required minimum D_{50} for rounded rock was too large to produce. For areas where rounded rock was selected, the minimum D_{50} was increased by 40 percent in the design to account for rounded rock characteristics (Abt and Johnson, 1991). The results of the riprap sizing for the embankment slopes are summarized in Table G.3 below.

Table G.3. Results of Riprap Sizing

Location	Design Unit Discharge (cfs/ft)	Slope (ft/ft)	Concentration Factor	Median Rock Size (inches)
Non-Accumulating Side Slopes (Rounded Rock)	0.06	0.20	3	1.7
Cell 4A and 4B southern side slopes(Angular Rock)	0.87	0.20	3	5.3
Cell 1 Disposal Area side slope (Angular Rock)	0.65	0.20	3	4.5

Filter Requirements. NUREG-1623 (Johnson, 2002) recommends a filter or bedding layer be placed under the erosion protection if interstitial velocities are greater than 1 ft/s, in order to prevent erosion of the underlying soils. Bedding is not required if interstitial velocities are less than 0.5 ft/s, and are recommended depending on the characteristics of the underlying soil if velocities are between 0.5 and 1.0 ft/s.

Interstitial velocities are calculated by procedures presented by Abt et al. (1991) as given in the following equation:

$$V_i = 0.23(g \times D_{10} \times S)^{0.5}$$

Where

Vi = interstitial velocities (ft/s),
G = acceleration due to gravity (ft/s^2),
D_{10} = stone diameter at which 10 percent is finer (inches), and
S = gradient in decimal form.

The maximum D_{10} of the erosion protection is estimated based on the D_{50} required for erosion protection, assuming the erosion protection will have a coefficient of uniformity (CU) of 6 and a band width of 5. Band width refers to the ratio of the minimum and maximum allowed particle sizes acceptable for any given percent finer designation. USDA (1994) recommends CU to be a maximum of 6 in order to prevent gap-grading of filters. Table G.4 summarizes the results for the side slopes.

Table G.4. Results of Filter Requirements for Side Slopes

Location	Non-Accumulating Side Slopes (Rounded Rock)	Cell 4A and 4B southern side slopes(Angular Rock)	Cell 1 Disposal Area side slope (Angular Rock)
Minimum D_{50} (inches)	1.7	5.3	4.5
Maximum D_{10} (inches)	0.53	1.65	1.40
Slope (%)	20	20	20
Interstitial Velocity (ft/s)	0.43	0.75	0.69
Filter Requirement	No	Recommended	Recommended

Based on the results in Table G.4 and the fine-grained nature of the top soil, it is recommended that a filter be placed between the soil and the rock protection for the side slope areas that require angular riprap. These areas include the southern side slopes of Cells 4A and 4B as well as the northern side slope of the Cell 1 disposal area as shown in Figure G.1. The interstitial velocity results confirm that a filter is not necessary for the non-accumulating side slopes where rounded rock is proposed on the west and east sides of Cells 2, 3 and 4.

Gradation for proposed Filter. The procedure from USDA (1994) for determining the gradation limits for a sand or gravel filter was used to evaluate the type of material needed to satisfy filter requirements between the soil and rock protection for the side slopes. The method details twelve steps to determine an appropriate gradation range for the filter layer. The steps can be found in Chapter 26 of the USDA Handbook and are shown in the Attachment G.2 for supporting calculations. In addition, Equation 5.3 from Cedegren (1989) and Equation 4.36 from Nelson et al. (1986) were used to determine the filter gradation requirements. Table G.5 presents the recommended gradation.

Table G.5. Results of Filter Gradation Requirements

Diameter (mm)	Sieve Sizes	Percent Passing
76.2	3"	100
4.75	No. 4	70-100
0.85	No. 20	40-60
0.075	No. 200	0-5

Based on the results of Table G.5, the filter material should be a medium sand that will be placed between the erosion protection and the base layer on the side slopes.

Sheet Erosion. The Modified Universal Soil Loss Equation (MUSLE) as presented in NUREG/CR4620 (Nelson et al., 1986) was used to evaluate the potential for soil loss due to sheet flows across the gravel/topsoil surface layer of the cover.

The MUSLE is defined as: $A = R * K * LS * VM$

Where:

A = soil loss, in tons per acre per year,
R = rainfall factor,
K = soil erodibility factor,
LS = topographic factor, and
VM = dimensionless erosion factor relating to vegetative and mechanical factors

The rainfall factor, R, is 30, as given in NUREG/CR-4620 for the eastern third of Utah. The soil erodibility factor, K, was estimated to be 0.28 for the topsoil and 0.16 for the gravel and topsoil mixture, based on the nomograph (Fig. 5.1) in NUREG/CR-4620.

The topographic factor, LS, is calculated based on the following equation:

$$LS = \frac{650 + 450s + 65s^2}{10{,}000 + s^2} * \left(\frac{L}{72.6}\right)^m$$

Where:

s = slope steepness, in percent (%),
L = slope length in feet,
m = slope steepness dependent exponent

The topographic factor was calculated using a slope of 0.82 percent and a slope length of 1,300 feet. From the Table 5.2 in NUREG/CR-4620, the slope steepness exponent, m, is 0.2 for slopes less than or equal to 1.0 percent.

The erosion factor, VM, used was 0.4, from Table 5.3 of NUREG/CR-4620, to represent seedlings of 0 to 60 days, to mimic light vegetation on the cover. Table G.5 summarizes the MUSLE results for the proposed topsoil and the proposed topsoil mixed with 25 percent gravel, by weight.

Table G.6. Results of MUSLE

Soil Cover	Proposed Topsoil	Proposed Topsoil with 25% Gravel
Rainfall factor, R	30	30
Silt and very fine sand (%)	43.6	32.7
Sand (%)	39.2	29.4
Organic matter (%)	1.5	1.5
Soil structure	Fine granular	Medium or coarse granular
Relative permeability	Moderate	Moderate to rapid
Erodibility factor, K	0.28	0.12
Topographic Factor, LS	0.16	0.19
Erosion factor, VM – low density seedings	0.4	0.4
Soil loss (tons/acre/year)	0.54	0.27
Soil loss (inches/1,000 years)	3.0	1.4

The soil loss equation shows the potential for erosion will be reduced by almost one half, by using 25 percent gravel in the topsoil mixture. The topsoil loss of 1.5 to 3.0 inches over the life of the cover (1,000 years) is less than the minimum design thickness of 6 inches.

G.7 ROCK SIZING FOR APRON

Additional erosion protection will be provided for runoff from the south side slopes of the reclaimed surfaces of Cells 4A and 4B, the east side of Cell 4A, and the north side of Cell 1 with a rock apron. The perimeter apron will: (1) serve as an impact basin and provide for energy dissipation of runoff, (2) provide erosion protection, and (3) transition flow from side slopes to natural ground. The median rock size required in the perimeter apron was calculated using the equations derived by Abt et al. (1998) as outlined in NUREG 1623 (Johnson, 2002) as follows:

$$D_{50\ energy\ dissipation} = 10.46S^{0.43}q^{0.56}$$

Flow Characteristics. The peak unit discharge values from Table G.1 were used to represent flow conditions down the embankment side slopes south of Cells 4A and 4B. Concentration factors of 3 were used to account for channelization of flow.

Rock Characteristics. A specific gravity of 2.65 was assumed for the riprap. Both rounded and angular rock was used in the apron design.

Based on the above equation, the rock apron (Apron A) along the toe of the non-accumulating slopes covered with rounded riprap (west and east side slopes of Cells 2 and 3) should be constructed using rounded rock with a median rock diameter of 3.4 inches. The width of the apron should be a minimum of 15 times the median rock size (4.25 ft) and the apron thickness should be a minimum of three times the median rock size (10.2 inches). Rock Apron B should be placed on the toes of the south slope of Cells 4A and 4B and along the east of Cell 4A. Apron B should have a median angular rock size of 10.6 inches, with a minimum width of 13.2 feet and a minimum thickness of 2.7 feet. Rock Apron C should be placed on the toes of the remaining slope (Cell 1 disposal area side slope). Apron C should have a median rock size of 9.0 inches, a minimum width of 11.3 feet, and a minimum thickness of 2.3 feet.

Filter Requirements. NUREG-1623 (Johnson, 2002), as detailed in section G.6, was used to determine if a bedding layer was required for the rock aprons. The results are presented in Table G.7 below.

Table G.7. Results of Filter Requirements for Rock Aprons

Location	Apron A: Non-Accumulating Slopes (Rounded)	Apron B: Cell 4A and 4B slopes(Angular)	Apron C: Cell 1 disposal area side slope (Angular)
Minimum D_{50} (inches)	3.4	10.6	9.0
Maximum D_{10} (inches)	1.0	3.3	2.8
Slope (%)	1	1	1
Interstitial Velocity (ft/s)	0.13	0.24	0.22
Filter Requirement	No	No	No

Based on the results in Table G.7, it is not required to place a bedding layer between the soil and rock protection for the rock aprons.

G.8 DISCHARGE CHANNEL AND SEDIMENTATION BASIN

The PMP event described in Section G.3 was used to determine the peak discharge to the channel to be located at the west end of the sedimentation basin. The peak discharge calculations were made using the Rational Method and the time of concentration was calculated for the longest flow path (see Figure G.1) across the mill site and sedimentation basin using the procedures described in section G.4. A runoff coefficient of 1.0 was used to represent PMP conditions (DOE, 1989). These characteristics represent high runoff quantities and peak flow velocities.

The PMP peak discharge calculated across the mill site and sedimentation basin is presented in Table G.8. This discharge represents the peak flow into the channel. Further details of the calculations can be found in Attachment G.1

Table G.8. Peak Discharge Flow to the Discharge Channel

Location	Slope Length (feet)	Time of Concentration (min)	Rainfall Intensity (in/hr)	Runoff Coefficient	Peak Discharge (cfs)
Mill site and sedimentation basin	4,600	26.3	16.4	1.0	2,440

The peak discharge value in Table G.8 above, was used to evaluate the peak flow velocities through the discharge channel excavated into bedrock. The channel dimensions are shown on Drawing REC-3 and include a 150-foot bottom width and 3:1 (H:V) side slopes. The Manning's n-value was estimated and adjusted based on the anticipated type of bedrock and the presumed roughness, along the channel, after excavation. Table G.9 includes peak flow velocities for Manning's n-values of 0.02 and 0.03.

Table G.9. Peak Discharge Channel Flow Velocities

Location	Channel Bottom Width (feet)	Channel Side Slopes (H:V)	Manning Coefficient, n	Flow Depth (ft)	Cross Sectional Area of Flow (ft^2)	Hydraulic Radius (ft)	Peak Velocity (fps)
Discharge channel	150	3:1	0.02	1.67	259	1.61	9.4
Discharge channel	150	3:1	0.03	2.12	332	2.03	7.3

Based on the available bedrock information near the channel location, the rock is expected to consist of a fine to medium-grained sandstone with varying degrees of cementation and weathering, or a claystone (Dames and Moore, 1978). The shear wave velocities from seismic refraction surveys indicate the bedrock will range from rippable to hard rock, requiring blasting (D'Appolonia, 1979). Because of this variability, an initial Manning's n-value of 0.015 was selected, for a channel in rock and then modifications of 0.005 and 0.015 were added for increasing irregularities in the final excavated rock surface. (USBR, 1987). Maximum suggested permissible peak channel velocities are 10 feet per second for channels excavated in "poor rock" (USACE, 1994).

G.9 REFERENCES

Abt, S., J. Ruff, and R. Wittler, 1991. Estimating Flow Through Riprap, Journal of Hydraulic Engineering, Vol. 117, No. 5, May.

Abt, S., and T. Johnson, 1991. Riprap Design for Overtopping Flow, Journal of Hydraulic Engineering, Vol. 117, No. 8, August.

Abt, S., T. Johnson, C. Thornton, and S. Trabant, 1998. Riprap Sizing at Toe of Embankment Slopes, Journal of Hydraulic Engineering, Vol. 124, No. 7, July.

Cedegren, H.R., 1989. Seepage, Drainage, and Flow Nets. Equation 5.3. 3rd Edition. John Wiley & Sons, Inc., New York.

Dames and Moore, 1978. Site Selection and Design Study - Tailing Retention and Mill Facilities White Mesa Uranium Project. January 17.

D'Appalonia, 1979. Tailings Management System, White Mesa Uranium Project, Blanding Utah. June.

Denison Mines (USA) Corporation (Denison), 2009. "Re: Cell 4B Lining System Design Report, Response to DRC Request for Additional Information – Round 3 Interrogatory, Cell 4B Design – Exhibit C: Probable Maximum Precipitation (PMP) Event Calculation", Letter to Dane Finerfrock, September 11.

Denison Mines (USA) Corporation (Denison), 2012. Responses to Interrogatories – Round 1 for Reclamation Plan, Revision 5.0, March 2012; Attachment B: Updated Probable Maximum Precipitation (PMP) Calculation. May 31.

Energy Fuels Resources (USA), Inc. (EFRI), 2012. Responses to Interrogatories – Round 1 for Reclamation Plan, Revision 5.0, March 2012. August 15.

Hansen, E. M., F.K. Schwarz, J.T. Riedel, 1984. "Hydrometeorological Report No. 49: Probable Maximum Precipitation Estimates, Colorado River and Great Basin Drainages," Hydrometeorological Branch Office of Hydrology, National Weather Service, U.S. Department of Commerce, National Oceanic and Atmosphere Administration, U.S. Department of the Army, Corps of Engineers, Silver Springs, MD.

Jensen, D. 1995. Final Report: Probable Maximum Precipitation Estimates for Short Duration, Small Area Storms in Utah, October.

Johnson, T.L., 2002. "Design of Erosion Protection for Long-Term Stabilization." U.S. Nuclear Regulatory Commission (NRC), *NUREG-1623*. September.

MWH Americas, Inc. (MWH), 2011. Updated Tailings Cover Design. Prepared for Denison Mines (USA) Corp. September.

Nelson, J., S. Abt, R. Volpe, D. van Zyl, N. Hinkle, and W. Staub, 1986. "Methodologies for Evaluation of Long-term Stabilization Designs of Uranium Mill Tailings Impoundments." *NUREG/CR-4620,* U.S. Nuclear Regulatory Commission, June.

Temple, D.M., K.M. Robinson, R.A. Ahring, and A.G. Davis, 1987. "Stability Design of Grass-Lined Open Channels." *USDA Handbook 667.*

U.S. Army Corps of Engineers, 1994. *Hydraulic Design of Flood Control Channels*, EM 1110-2-1601. p.2-16. June.

U.S. Department of Agriculture (USDA), 1994. Gradation Design of Sand and Gravel Filters, National Engineering Handbook, Part 633, Chapter 26, October.

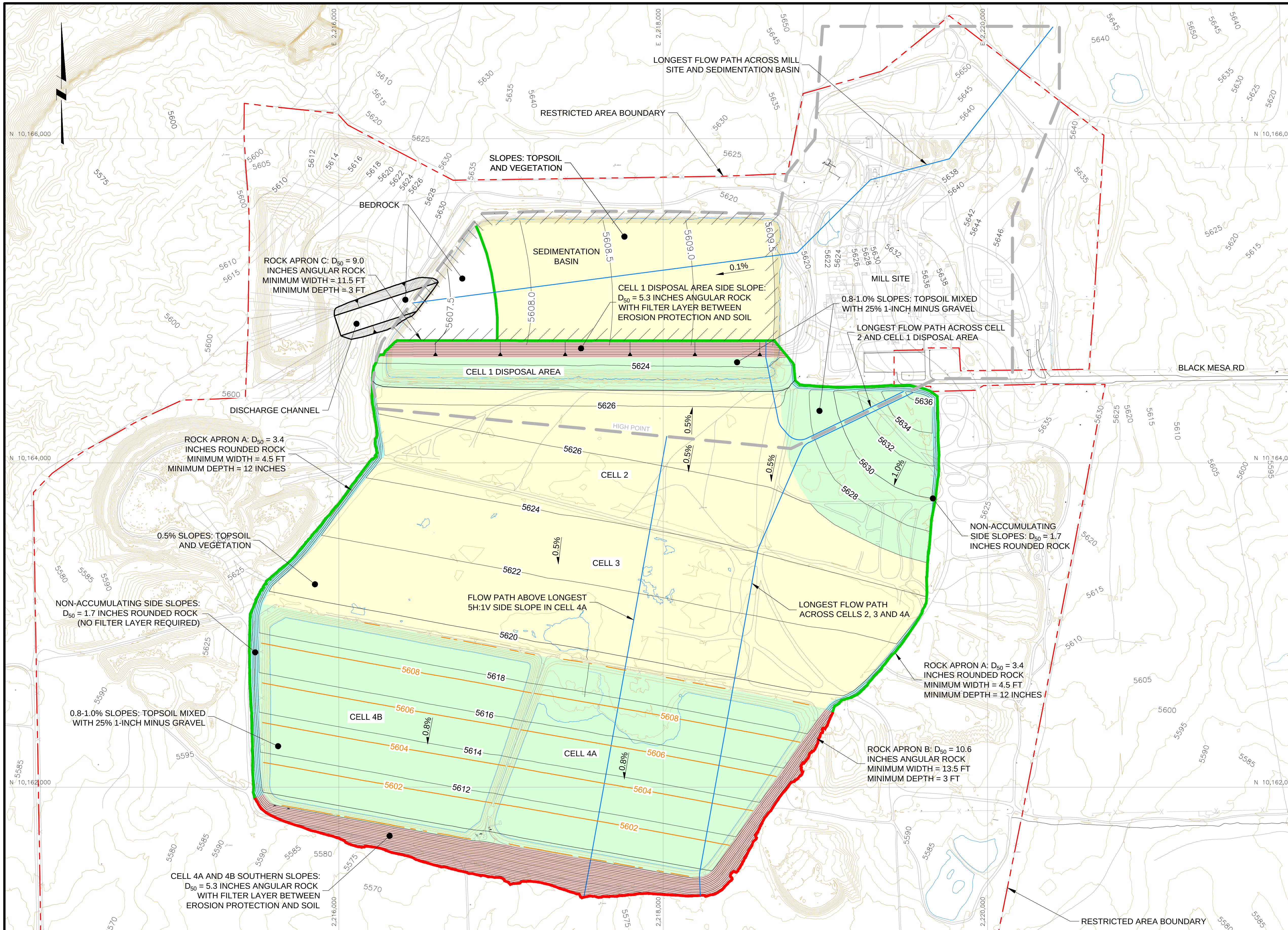
U.S. Department of Energy (DOE), 1989. Technical Approach Document, Revision II, UMTRA-DOE/AL 050425.0002, Uranium Mill Tailings Remedial Action Project, Albuquerque, New Mexico.

U.S. Department of the Interior, Bureau of Reclamation (USBR), 1987. *Design of Small Dams.* 3rd Edition. p.595.

U.S. Nuclear Regulatory Commission (NRC), 1990. "Final Staff Technical Position, Design of Erosion Protective Covers for Stabilization of Uranium Mill Tailings Sites," August.

Utah Department of Environmental Quality, Utah Division of Radiation Control (DRC). 2012. Denison Mines (USA) Corp's White Mesa Reclamation Plan, Rev. 5.0, Interrogatories - Round 1. March.

Utah Department of Environmental Quality, Division of Radiation Control (DRC), 2013. Review of August 15, 2012 (and May 31, 2012) Energy Fuels Resources (USA), Inc. Responses to Round 1 Interrogatories on Revision 5 Reclamation Plan Review, White Mesa Mill, Blanding, Utah, report dated September 2011. February 13.



LEGEND:

5605	EXISTING GROUND SURFACE ELEVATION, FEET (SEE REFERENCE)
5605	TOP ON INTERIM FILL ELEVATION, FEET
5605	MAXIMUM PERMITTED TAILINGS SURFACE CONTOUR AND ELEVATION, FEET
	EXISTING ROAD
	EXISTING WATER
	EXISTING TRAIL
X	EXISTING FENCE
	DRAINAGE AREA TO DISCHARGE CHANNEL, 147.3 ACRES
	FLOW PATH
	EXISTING STRUCTURE
	SEDIMENTATION BASIN

Energy Fuels Resources (USA) Inc.

PROJECT: WHITE MESA MILL TAILINGS RECLAMATION

TITLE: RECLAMATION COVER EROSION PROTECTION

MWH

SHEET: FIGURE G.1

FILE NAME: WMM EROS PRO

DATE: AUG 2015

L:\Design-Drafting\Clients-A-H\ENERGY FUELS\013-Sheet Set\2015-08-31 COVER DSGN FIGS\WMM EROS PRO

ATTACHMENT G.1

PMP CALCULATIONS
DENISON (2012)
DENISON (2009)

Client:	**Denison Mines**	**Job No.:**	**1009740**
Project:	**White Mesa Reclamation Plan**	**Date:**	**5/10/2012**
Detail:	**Updated Probable Maximum Precipitation (PMP) Calculation**	**Computed By:**	**MMD**

References:

Denison Mines (USA) Corporation (Denison), 2009. Re: Cell 4B Lining System Design Report, Response to DRC Request for Additional Information – Round 3 Interrogatory, Cell 4B Design – Exhibit C: Probable Maximum Precipitation (PMP) Event Calculation, Letter to Dane Finerfrock, September 11.

Hansen, E. M., Schwarz, F.K., Riedel, J.T., 1984. Hydrometeorological Report No. 49: Probable Maximum Precipitation Estimates, Colorado River and Great Basin Drainages, Hydrometeorological Branch Office of Hydrology, National Weather Service, U.S. Department of Commerce, National Oceanic and Atmosphere Administration, U.S. Department of the Army, Corps of Engineers, Silver Springs, MD.

Jensen, D. 1995. Final Report: Probable Maximum Precipitation Estimates for Short Duration, Small Area Storms in Utah, October.

Jensen, D., 2003. 2002 Update for Probable Maximum Precipitation, Utah 72 Hour Estimates to 5,000 sq. mi., March.

Utah Division of Radiation Control (DRC), 2012. Denison Mines (USA) Corp's White Mesa Reclamation Plan, Rev. 5.0, Interrogatories - Round 1, March.

Approach:

Update previous calculations (Denison, 2009) to incorporate Jensen (1995) and Jensen (2003) references as recommended by DRC (2012) Jensen (2003) is applicable for 72-hour durations for areas up to 5,000 square miles. Incorporation of this reference does not modify the previous calculations for one-hour or six-hour duration PMP values for the site.

Calculations:

Site Information

Parameter	Value	Units	Comments
Drainage Area	0.4	mi^2	Denison (2009) for Cells 2 through 4B
Latitude	N 37°31'		Denison (2009)
Longitude	W 109°30'		Denison (2009)
Minimum Elevation	5600	ft	Denison (2009)

Updated Local-Storm PMP Estimates

Parameter	Value	Units	Comments
One-hour point precipitation PMP value	8.6	in	Jensen (1995) references Figure 4.7 in Hansen (1984).
Elevation Reduction	97	%	Jensen (1995) recomments same elevation reduction as used in Hansen (1984).
One-Hour PMP (adjusted for elevation)	8.3	in	This is the same value presented in Denison (2009)
6-hr to 1-hr Depth Percentage	115	%	Table 15 in Jensen (1995)
Six-Hour PMP	9.6	in	One-hour PMP multiplied by 6-hr to 1-hr depth percentage
Areal Reduction	100	%	Table 15 in Jensen (1995) for 1 sq. mi. area

RESULTS

One-Hour Duration PMP	**8.3**	**in**
Six-Hour Duration PMP	**9.6**	**in**

Updated Local-Storm PMP Incremental Values

Duration (hr)	Percentage of 1-hr PMP	Depth (in)	Incremental Depth (in)
0.25	50	4.2	4.2
0.5	74	5.5	1.3
0.75	90	7.5	2.0
1	100	8.3	0.8
2	110	9.1	0.8
3	112	9.3	0.2
4	113.5	9.4	0.1
5	114.5	9.5	0.1
6	115	9.6	0.1

Six-Hour Duration PMP	
Hourly Increments	Depth (in)
1st	0.1
2nd	0.2
3rd	8.3
4th	0.8
5th	0.1
6th	0.1

One-Hour Duration PMP	
15-Min. Increments	Depth (in)
1st	4.2
2nd	2.0
3rd	1.3
4th	0.8

EXHIBIT C

PROBABLE MAXIMUM PRECIPITATION (PMP) EVENT CALCULATION PACKAGE

Geosyntec
consultants

COMPUTATION COVER SHEET

Client: **DMC** Project: **White Mesa Mill – Cell 4B** Project/ Proposal No.: Task No. **SC0349**

Title of Computations **PROBABLE MAXIMUM PRECIPITATION (PMP) EVENT COMPUTATION**

Computations by:	Signature	[signature]	9/4/09 Date
	Printed Name	Meghan Lithgow	
	Title	Senior Staff Engineer	
Assumptions and Procedures Checked by: (peer reviewer)	Signature	[signature]	9/9/09 Date
	Printed Name	Rebecca Flynn, PE	
	Title	Engineer	
Computations Checked by:	Signature	[signature]	9/9/09 Date
	Printed Name	Meghan Lithgow	
	Title	Senior Staff Engineer	
Computations backchecked by: (originator)	Signature	[signature]	9/9/09 Date
	Printed Name	Meghan Lithgow	
	Title	Senior Staff Engineer	
Approved by: (pm or designate)	Signature	[signature]	9/10/09 Date
	Printed Name	Gregory T. Corcoran, PE	
	Title	Principal	

Approval notes:

Revisions (number and initial all revisions)

No.	Sheet	Date	By	Checked by	Approval

Written by:	**M. Lithgow**	Date:	**09/04/09**	Reviewed by:	**G. Corcoran**	Date:	**9/10/09**
Client:	**DMC**	Project:	**White Mesa Mill-Cell 4B**	Project/ Proposal No.:	**SC0349**	Task No.:	**02**

PROBABLE MAXIMUM PRECIPITATION (PMP) EVENT COMPUTATION
WHITE MESA MILL – CELL 4B
BLANDING, UTAH

OBJECTIVE

The purpose of this calculation is to evaluate the local-storm Probable Maximum Precipitation (PMP) event for the White Mesa Mill Facility site located in Blanding, Utah. This calculation demonstrates that the probable maximum precipitation (PMP) event that the site will experience is 10 inches (0.83 ft) in 6 hours.

PMP COMPUTATION PROCEDURE

The Probable Maximum Precipitation (PMP) for the site was evaluated using "Hydrometeorological Report No. 49: Probable Maximum Precipitation Estimates, Colorado River and Great Basin Drainages" (Hansen, et. al., 1984). The use of this method is cited in a hydrology report that was prepared as part of an agreement between UMETCO and the Nuclear Regulatory Commission (NRC) during the permitting of Cell 4A (UMETCO, 1990).

PROBABLE MAXIMUM PRECIPITATION EVENT CALCULATIONS

Step 1: Calculate the Average 1-hr 1-mi^2 PMP for drainage using Figure 4.5

The average 1-hr 1-mi^2 PMP is 8.6-in (Attachment A, 1/7)

Step 2a: Reduce the 1-hr 1-mi^2 PMP event for elevation

If the lowest elevation within the drainage is above 5,000 feet (ft) above Mean Seal Level (MSL), decrease the PMP value from Step 1 by 5% for each 1,000 ft or proportionate fraction thereof above 5,000 ft to obtain the elevation adjusted drainage average 1-hr 1-mi^2 PMP.

The elevation of Cell 4B is 5,598 ft above MSL, which is conservatively the lowest elevation for the completed cells 2 through 4B; therefore, it is required to interpolate

Written by:	M. Lithgow	Date:	09/04/09	Reviewed by:	G. Corcoran	Date:	9/10/09
Client:	DMC	Project:	White Mesa Mill-Cell 4B	Project/ Proposal No.:	SC0349	Task No.:	02

between 95% and 100% using the following equation:

$$\frac{5\,\%}{1{,}000\ ft} = \frac{x\,\%}{598\ ft}$$; x = 3% reduction

100 % - 3 % = 97 %

Therefore, reduce the value obtained in Step 1 by 97%.

Step 2b: Multiply the number calculated in Step 1 by the number calculated in Step 2a.

8.6 inches x 0.97 = 8.3 inches

Step 3: Determine the average 6/1-hr ratio for drainage using Figure 4.7

The average 6/1-hr ratio for drainage is approximately 1.2. (Attachment A, 2/7)

Step 4: Calculate the durational variation for 6/1-hr ratio of Step 3 using Table 4.4

The durational value is determined using Table 4.4 is as follows: (Attachment A, 3/7)

Duration (hr)									
¼	½	¾	1	2	3	4	5	6	
74	89	95	100	110	115	118	119	120	%

Step 5: Multiply step 2b by Step 4 to calculate the 1-mi^2 PMP for indicated durations

For example, for the ¼ hour duration: 8.3 x 0.74 = 6.1

The following numbers are calculated as follows:

Duration (hr)									
¼	½	¾	1	2	3	4	5	6	
6.1	7.4	7.9	8.3	9.1	9.5	9.8	9.9	10.0	in.

Step 6: Determine the areal reduction using Figure 4.9 for the site:

Written by:	M. Lithgow	Date:	09/04/09	Reviewed by:	G. Corcoran	Date:	9/10/09
Client:	DMC	Project:	White Mesa Mill-Cell 4B	Project/ Proposal No.:	SC0349	Task No.:	02

First, determine the total watershed contributing to Cell 4B, including Cell 4B. The watershed areas of the upstream Cells 2, 3, and 4A are 87 acres (ac), 83 ac, and 40 ac, respectively and the proposed Cell 4B is 42 ac. Areas outside of these cells do not drain to Cell 4B and are therefore not part of the watershed area.

Total acreage is 87 ac + 83 ac + 42 ac + 42 ac = 254 acres.
Next, convert this number into square miles:

$$254\ acre\ x \frac{43{,}560\ ft^2}{1\ acre} x \frac{(1mi)^2}{(5{,}280\ ft)^2} = 0.40\ mi^2$$

Using Figure 4.9, the depth ratio of ≤1 mi^2 is 100 percent for each of the durations (Attachment A, 4/7).

<u>Step 7: Multiply the duration values in Step 5 by the areal reduction in Step 6 to calculate the areal reduced PMP.</u>

This step is neglected because the depth ratio is 100 percent; therefore, the values obtained in Step 5 are not reduced.

<u>Step 8: Calculate the incremental PMP using successive subtraction of the values in Step 7 for the hourly durations (1 hr through 6 hr) and 15-minute incremental durations (1/4 hr through 1 hr).</u>

The incremental PMP is calculated in two separate steps; the incremental PMP is calculated on the first line for the hourly increments (hours 1 through 6) and then calculated on the second line for the 15-minute increments during the first hour of the storm. To determine the incremental PMP, the following formula is used:

$PMP_{t\ to\ t+1} = PMP_{t+1} - PMP_t$, where t = time

In this example, the PMP between the first interval and second interval is determined by subtracting the PMP for interval 1 from the PMP for the second interval, as calculated in Step 5. The following equation illustrates the calculation of the incremental PMP between hours 0 and 1:

Written by:	M. Lithgow	Date:	09/04/09	Reviewed by:	G. Corcoran	Date:	9/10/09
Client:	DMC	Project:	White Mesa Mill-Cell 4B	Project/ Proposal No.:	SC0349	Task No.:	02

$$PMP_1 - PMP_0 = 8.3 \text{ in} - 0 \text{ in.} = 8.3 \text{ in.}$$

The next equation illustrates the calculation of the incremental PMP between hours 1 and 2:

$$PMP_2 - PMP_1 = 9.1 \text{ in} - 8.3 \text{ in.} = 0.8 \text{ in.}$$

This calculation is continued until the following table is completed as shown for each PMP interval.

Duration (hr)									
¼	½	¾	1	2	3	4	5	6	
			8.3	0.8	0.4	0.2	0.1	0.1	in.
6.1	1.2	0.5	0.4						in.

Step 9: Order the incremental PMP in a sequence dictated by hourly and 15-minute increments using Table 4.7 (Attachment 5/7) and Table 4.8 (Attachment 6/7), respectively.

The incremental PMP calculated in Step 8 must now be arranged in a specific order to model the runoff generated by the storm event. This order is dictated by Table 4.7 for the hourly PMP intervals and Table 4.8 for the 15-minute PMP intervals.

The final arrangement of the numbers determined in Step 8 is as follows:

Hourly increments:	0.1	0.4	8.3	0.8	0.2	0.1	in.
15-minute increments:	6.1	1.2	0.5	0.4			in.

The storm's 6 hour PMP runoff event is calculated by summing the incremental PMP for each hour of the storm.

0.1 in. + 0.4 in. + 8.3 in. + 0.8 in. + 0.2 in. + 0.1 in. = 9.9 inches **(10 inches).**

This step is repeated to calculate the runoff generated during the first hour of the storm.

6.1 in. + 1.3 in. + 0.5 in. + 0.4 in. = 8.3 inches

Because 9.9 > 8.3, the runoff generated from the 6 hour storm (9.9 inches) is used.

CONCLUSIONS AND RECOMMENDATIONS

Our calculations are summarized in a worksheet modeled after Table 6.3A in the Hydrometerological Report No. 49 and is provided as Attachment A, 7/7. Our analysis determined the Probable Maximum Precipitation (PMP) event generates 10 inches (0.83 ft) over 6 hours.

REFERENCES

UMETCO Minerals Corporation, 1990, "White Mesa Mill Drainage Report for Submittal to NRC."

Attachment A

Hansen, E. Marshall, Schwartz, Francis K., Riedel, John T., 1984. "Hydrometeorological Report No. 49: Probable Maximum Precipitation Estimates, Colorado River and Great Basin Drainages," Hydrometeorological Branch Office of Hydrology National Weather Service, U.S. Department of Commerce, National Oceanic and Atmosphere Administration, U.S. Department of Army Corps of Engineers, Silver Springs, Md.

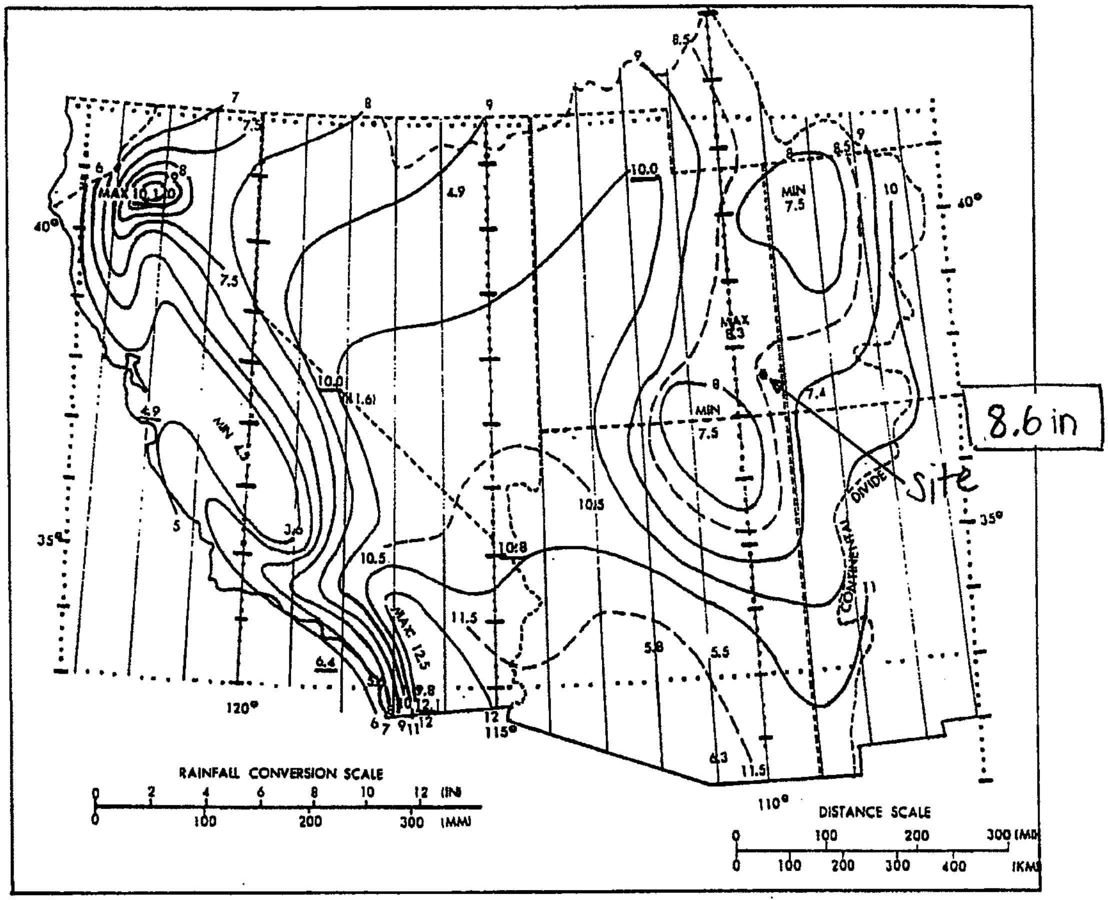


Figure 4.5--Local-storm PMP for 1 mi^2 (2.6 km^2) 1 hr. Directly applicable for locations between sea level and 5000 ft (1524 m). Elevation adjustment must be applied for locations above 5000 ft.

events. In contrast to figure 4.4, figure 4.5 maintains a maximum between these two locations. There is no known meteorological basis for a different solution. The analysis suggests that in the northern portion of the region maximum PMP occurs between the Sierra Nevada on the west and the Wasatch range on the east.

A discrete maximum (> 10 inches, 254 mm) occurs at the north end of the Sacramento Valley in northern California because the northward-flowing moist air is increasingly channeled and forced upslope. Support for this PMP center comes from the Newton, Kennett, and Red Bluff storms (fig. 4.1). Although the analysis in this region appears to be an extension of the broad maximum through the center of the Southwestern Region, it does not indicate the direction of moist inflow. The pattern has evolved primarily as a result of attempts to tie plotted maxima into a reasonable picture while considering inflow directions, terrain effects, and moisture potential.

Attachment A, 1/7

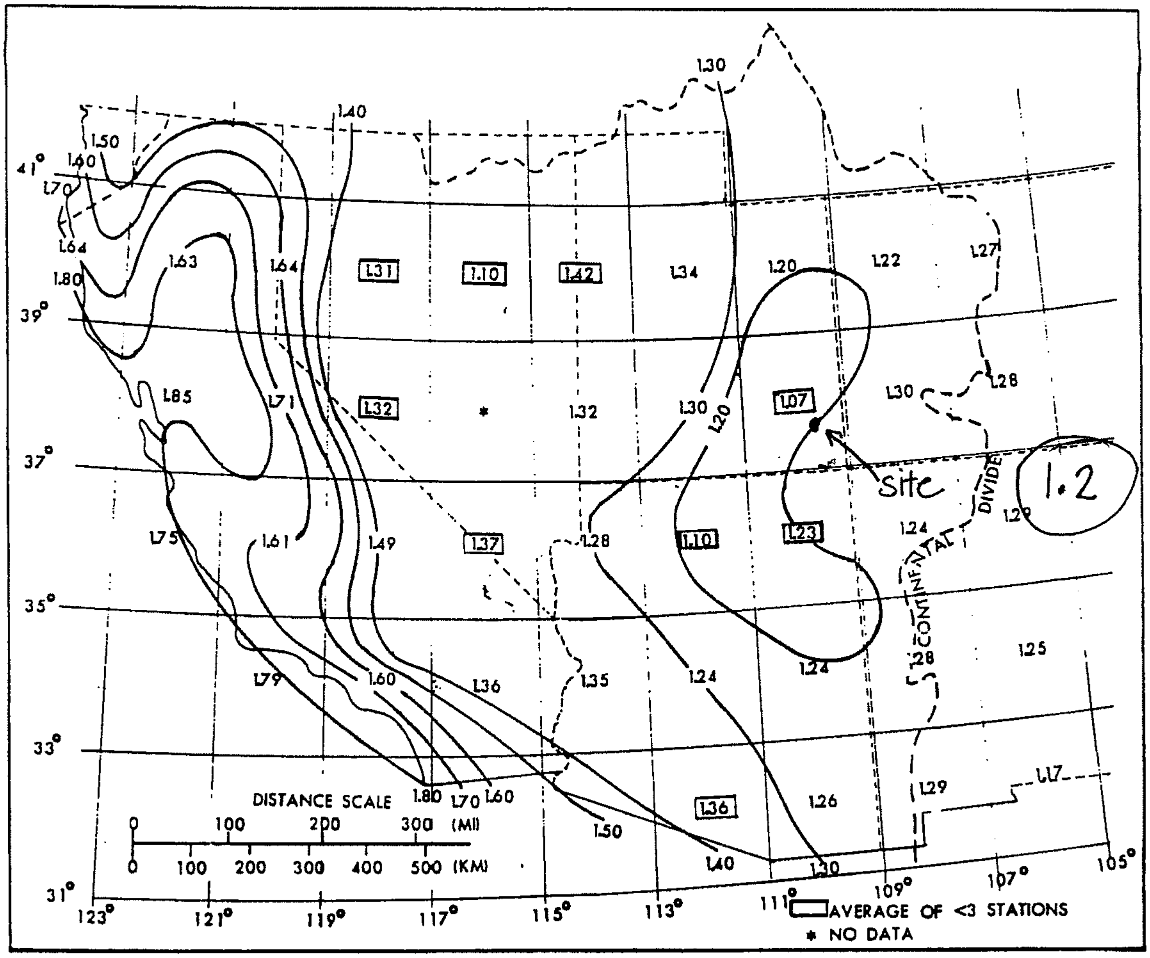


Figure 4.7.--Analysis of 6/1-hr ratios of averaged maximum station data (plotted at midpoints of a 2° latitude-longitude grid).

establish the basic depth-duration curve, then structure a variable set of depth-duration curves to cover the range of 6/1-hr ratios that are needed.

Three sets of data were considered for obtaining a base relation (see table 4.3 for depth-duration data).

a. An average of depth-duration relations from each of 17 greatest 3-hr rains from summer storms (1940-49) in Utah (U. S. Weather Bureau 1951b) and in unpublished tabulations for Nevada and Arizona (1940-63). The 3-hr amounts ranged from 1 to 3 inches (25 to 76 mm) in these events.

b. An average depth-duration relation from 14 of the most extreme short-duration storms listed in Storm Rainfall (U. S. Army, Corps of Engineers 1945-). These storms come from Eastern and Central States and have 3-hr amounts of 5 to 22 inches (127 to 559 mm).

Attachment A, 2/7

ratios than storms with high 3/1-hr ratios. The geographical distribution of 15-min to 1-hr ratios also were inversely correlated with magnitudes of the 6/1-hr ratios of figure 4.7. For example, Los Angeles and San Diego (high 6/1-hr ratios) have low 15-min to 1-hr ratios (approximately 0.60) whereas the 15-min to 1-hr ratios in Arizona and Utah (low 6/1-hr ratios) were generally higher (approximately 0.75).

Depth-duration relations for durations less than 1 hour were then smoothed to provide a family of curves consistent with the relations determined for 1 to 6 hours, as shown in figure 4.3. Adjustment was necessary to some of the curves to provide smoother relations through the common point at 1 hour.

We believe we were justified in reducing the number of the curves shown in figure 4.3 for durations less than 1 hour, letting one curve apply to a range of 6/1-hr ratios. The corresponding curves have been indicated by letter designators, A-D, on figure 4.3. As an example, for any 6-hr amount between 115% and 135% of 1-hr, 1-mi^2 (2.6-km^2) PMP, the associated values for durations less than 1 hour are obtained from the curve designated as "B".

Table 4.4 lists durational variations in percent of 1-hr PMP for selected 6/1-hr rain ratios. These values were interpolated from figure 4.3.

To determine 6-hr PMP for a basin, use figure 4.3 (or table 4.4) and the geographical distribution of 6/1-hr ratios given in figure 4.7.

Table 4.4.--Durational variation of 1-mi^2 (2.6-km^2) local-storm PMP in percent of 1-hr PMP (see figure 4.3)

6/1-hr ratio	Duration (hr) 1/4	1/2	3/4	1	2	3	4	5	6
1.1	86	93	97	100	107	109	110	110	110
☆ 1.2	74	89	95	100	110	115	118	119	120
1.3	74	89	95	100	114	121	125	128	130
1.4	63	83	93	100	118	126	132	137	140
1.5	63	83	93	100	121	132	140	145	150
1.6	43	70	87	100	124	138	147	154	160
1.8	43	70	87	100	130	149	161	171	180
2.0	43	70	87	100	137	161	175	188	200

4.5 Depth-Area Relation

We have thus far developed local-storm PMP for an area of 1 mi^2 (2.6 km^2). To apply PMP to a basin, we need to determine how 1-mi^2 (2.6-km^2) PMP should decrease with increasing area. We have adopted depth-area relations based on rainfalls in the Southwest and from consideration of a model thunderstorm.

Attachment A, 3/7

Attachment A, 4/7

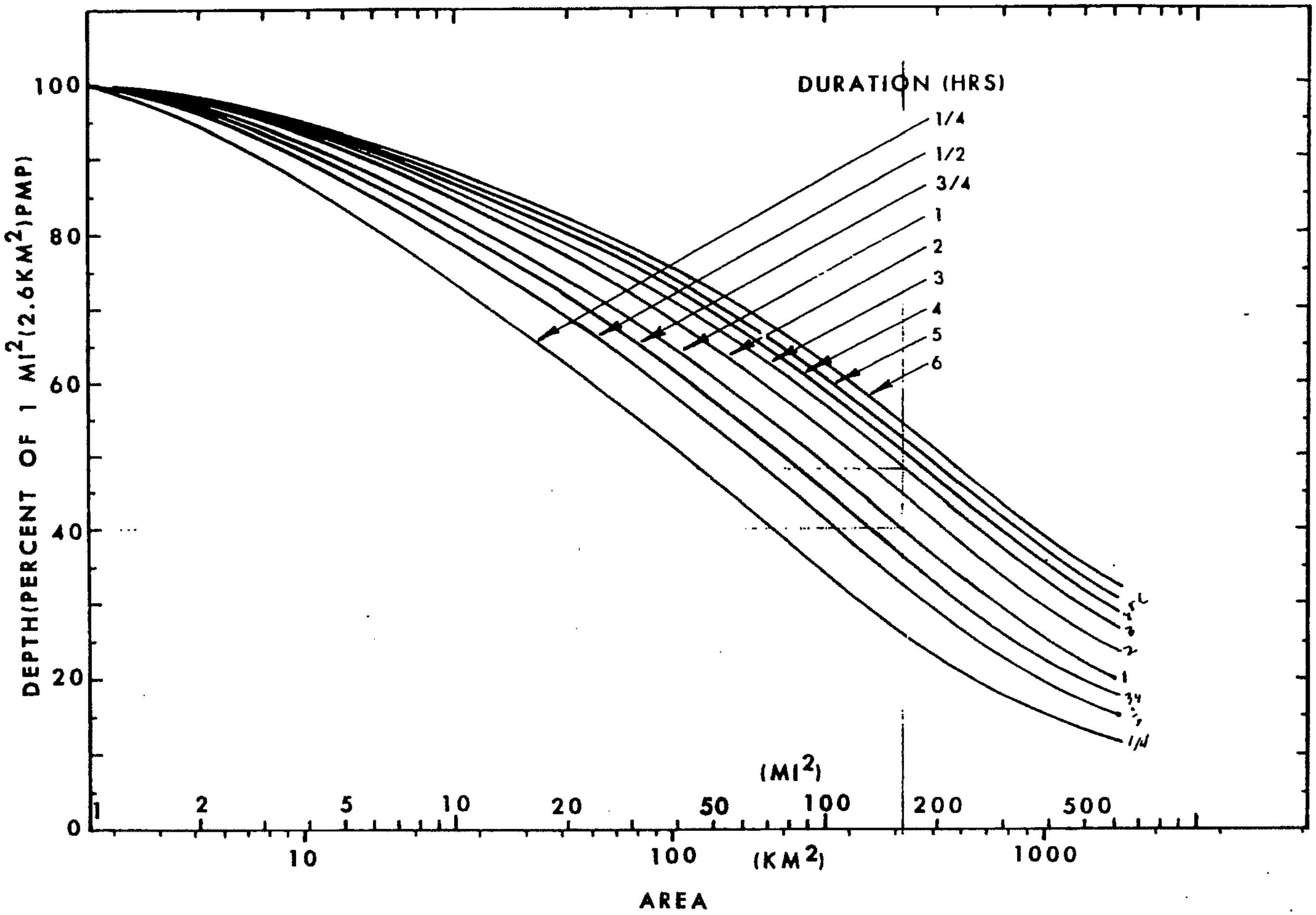


Figure 4.9.--Adopted depth-area relations for local-storm PMP.

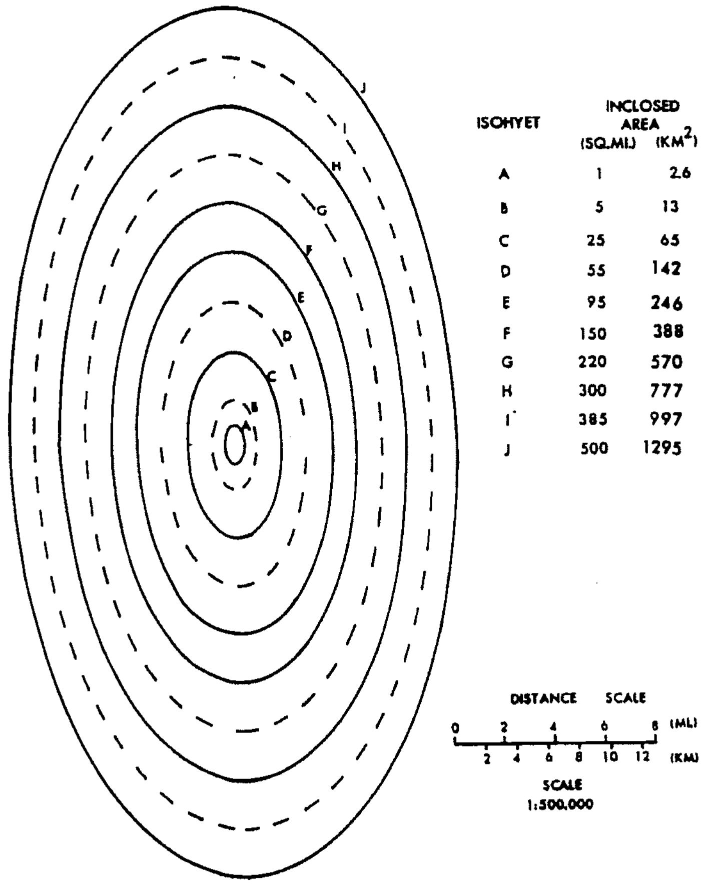


Figure 4.10.--Idealized local-storm isohyetal pattern.

storm period. The sequence of hourly incremental PMP for the Southwest 6-hr thunderstorm in accord with this study is presented in column 2 of table 4.7. A small variation from this sequence is given in Engineering Manual 1110-2-1411 (U. S. Army, Corps of Engineers 1965). The latter, listed in column 3 of table 4.7, places greater incremental amounts somewhat more toward the end of the 6-hr storm period. In application, the choice of either of these distributions is left to the user since one may prove to be more critical in a specific case than the other.

Table 4.7.--Time sequence for hourly incremental PMP in 6-hr storm

Increment		HMR No. 5[1]	EM1110-2-1411[2]
		Sequence Position	
Largest hourly amount	8.3	Third	Fourth
2nd largest	0.8	Fourth	Third
3rd largest	0.5	Second	Fifth
4th largest	0.2	Fifth	Second
5th largest	0.2	First	Last
least	0.1	Last	First

[1]U. S. Weather Bureau 1947.
[2]U. S. Corps of Engineers 1952.

Attachment A, 5/7

Also of importance is the sequence of the four 15-min incremental PMP values. We recommend a time distribution, table 4.8, giving the greatest intensity in the first 15-min interval (U.S. Weather Bureau 1947). This is based on data from a broad geographical region. Additional support for this time distribution is found in the reports of specific storms by Keppell (1963) and Osborn and Renard (1969).

Table 4.8.--Time sequence for 15-min incremental PMP within 1 hr.

Increment	Sequence Position
Largest 15-min amount	First
2nd largest	Second
3rd largest	Third
least	Last

4.8 Seasonal Distribution

The time of the year when local-storm PMP is most likely is of interest. Guidance was obtained from analysis of the distribution of maximum 1-hr thunderstorm events through the warm season at the recording stations in Utah, Arizona, and in southern California (south of 37°N and east of the Sierra Nevada ridgeline). The period of record used was for 1940-72 with an average record length for the stations considered of 27 years. The month with the one greatest thunderstorm rainfall for the period of record at each station was noted. The totals of these events for each month, by States, are shown in table 4.9.

Table 4.9.--Seasonal distribution of thunderstorm rainfalls.

(The maximum event at each of 108 stations, period of record 1940-72.)

	Month						
	M	J	J	A	S	O	No. of Cases
Utah	1	5	9	14	5		34
Arizona		4	16	19	4		43
S. Calif.*		14	10	7			31
No. of cases/mo.	1	23	35	40	9	0	

*South of 37°N and east of Sierra Nevada ridgeline.

Attachment A, 6/7

Table 6.3A -- Local-storm PMP computation, Colorado River, Great Basin and California drainages. For drainage average depth PMP.

Drainage: White Mesa Mill Facility, Cells 2 - 4B | Area 0.39 mi^2

Latitude: N 37° 31' | Longitude: W 109° 30' | Min. Elevation 5598 ft

1	Average 1-hr 1-mi^2 (2.6-km^2) PMP for drainage [fig. 4.5]	8.6 in.									
2a.	Reduction for Elevation. [No adjustment for elevations up to 5,000 feet: 5% decrease per 1,000 feet above 5,000 feet.	0.97 %									
b.	Multiply step 1 by step 2a.	8.3 in.									
3.	Average 6/1-hr ratio for drainage [fig 4.7]	1.2									
		Duration (hr)									
		1/4	1/2	3/4	1	2	3	4	5	6	
4	Durational variation for 6/1-hr ratio of step 3 [table 4.4]	74	89	95	100	110	115	118	119	120	%
5	1-mi^2 (2.6 km^2) PMP for indicated durations [step 2b x step 4]	6.1	7.4	7.9	8.3	9.1	9.5	9.8	9.9	10.0	
6	Areal reduction [fig. 4.9]	100	100	100	100	100	100	100	100	100	%
7	Areal reduced PMP [steps 5 x 6]	6.1	7.4	7.9	8.3	9.1	9.5	9.8	9.9	10.0	in.
8	Incremental PMP [successive subtraction in step 7]				8.3	0.8	0.4	0.2	0.1	0.1	in.
		6.1	1.2	0.5	0.4	} 15-min. increments					
9	Time sequence of incremental PMP to: Hourly increments [table 4.7]				0.1	0.4	8.3	0.8	0.2	0.1	in.
						Total depth of 6 hour storm				**9.9**	**in.**
	Four largest 15-min increments [table 4.8]				6.1	1.2	0.5	0.4	in		
					Total depth of 1st hour of storm					**8.3**	**in.**

ATTACHMENT G.2

SUPPORTING CALCULATIONS

Client:	**Energy Fuels Resources (USA) Inc.**	**Job No.:**	**1009740**
Project:	**White Mesa Reclamation Plan**	**Date:**	**5/31/2011**
Detail:	**Erosion Protection**	**Computed By:**	**RTS**

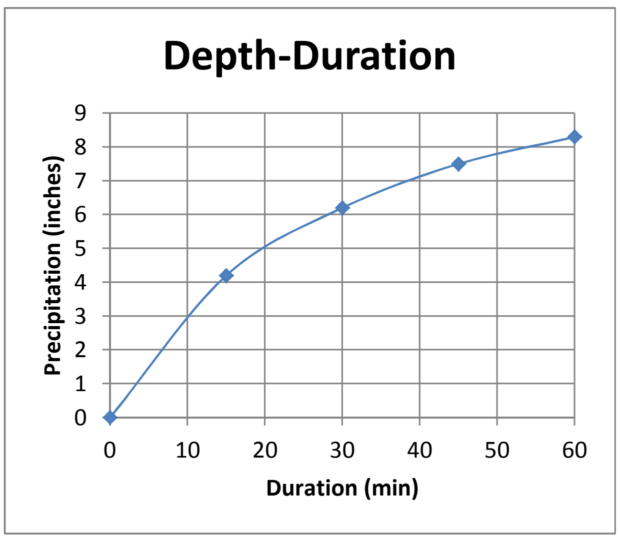
PMP Event

PMP calculation from "Re: Cell 4B Lining System Design Report, Response to DRC Request fo Additional Information - Round 3 Interrogatory, Cell 4B design", September 11,2009.

Procedure: Hydrometeorological Report No. 49: Probable Maximum Precipitation Estimates, Colorado river and Great Basin Drainages (Hansen et al., 1984), corrected for elevation and area.

Table 1. Estimated Precipitation Depths For Local-Storm PMP, White Mesa Mill, Utah Site

Hourly Increments	**First Hour**	**Second Hour**	**Third Hour**				**Fourth Hour**	**Fifth Hour**	**Sixth Hour**
PMP Depths (inches)	0.1	0.2	8.3				0.8	0.1	0.1
Third-Hour Component Depths (inches)			4.2	2.0	1.3	0.8			



Client:	**Energy Fuels Resources (USA) Inc.**	**Job No.:**	**1009740**
Project:	**White Mesa Reclamation Plan**	**Date:**	**8/22/2015**
Detail:	**Erosion Protection**	**Computed By:**	**TMS/MMD**

Time of Concentration

1-hour PMP (in) 8.3

Flow Path 1: flow path across longest 5H:1V side slope in Cell 4A

Description	Slope (feet/feet)	Slope Length (feet)	Time of Concentration (minutes)				% of 1-hour PMP	PD_{PMP} (in)	Intensity (in/hr)
			Kirpich	SCS	Brant and Oberman	Average			
Cell 2 at 0.5%	0.005	570	7.9	8.0	11.8	9.2	61.3	5.08	33.0
Cell 3 top	0.005	870	18.9	19.0	25.4	21.1	82.3	6.83	19.4
Cell 4A top	0.008	1200	30.7	30.7	38.4	33.3	91.2	7.57	13.7
Cell 4A side slope	0.2	230	31.7	31.7	41.0	34.8	92.0	7.6	13.2

Note: Flow accumulates as it flows from Cell 2 to Cell 4A. Design flow path is longest path across maximum 5H:1V side slope

Flow Path 2: longest flow path across cells across cells 2, 3, 4A and 4B

Description	Slope (feet/feet)	Slope Length (feet)	Time of Concentration (minutes)				% of 1-hour PMP	PD_{PMP} (in)	Intensity (in/hr)
			Kirpich	SCS	Brant and Oberman	Average			
Cell 2 at 1%	0.01	900	8.6	8.7	10.9	9.4	61.8	5.13	32.7
Cell 2 at 0.5%	0.005	550	16.4	16.4	22.6	18.5	79.3	6.58	21.4
Cell 3 top	0.005	830	27.0	27.0	36.0	30.0	89.4	7.42	14.8
Cell 4A top	0.008	1200	38.7	38.8	49.0	42.2	95.0	7.88	11.2
Cell 4A side slope	0.2	100	39.2	39.3	50.9	43.2	95.3	7.9	11.0

Note: Flow accumulates as it flows from Cell 2 to Cell 4A. Design flow path is longest path across Cell 2, 3, and 4A, and not the longest flow path across each individual cell

Cell 2 and Side slopes that only drain area of slope

Description	Slope (feet/feet)	Slope Length (feet)	Time of Concentration (minutes)				% of 1-hour PMP	PD_{PMP} (in)	Intensity (in/hr)
			Kirpich	SCS	Brant and Oberman	Average			
Cell 2 Top 1% Slope	0.01	830	8.1	8.1	10.6	9.0	60.4	5.0	33.6
Cell 2 Northern .5% Slope	0.005	250	12.3	12.3	19.6	14.8	73.8	6.1	24.9
Cell 1 Disposal 1% Slope	0.01	230	15.4	15.4	26.6	19.1	80.1	6.6	20.9
Cell 1 Northern Side Slope	0.2	90	15.8	15.8	28.4	20.0	81.1	6.7	20.2
Non-Accumulating Side Slopes	0.2	50	0.3	0.3	1.5	2.5	27.5	2.3	54.8

Note: These are the slopes on the sides of Cells 4A, 4B, 3, and 2

Flow Path 3: Flow Path Across Cell 1

Description	Slope (feet/feet)	Slope Length (feet)	Time of Concentration (minutes)				% of 1-hour PMP	PD_{PMP} (in)	Intensity (in/hr)
			Kirpich	SCS	Brant and Oberman	Average			
Cell 1 at .1%	0.001	2232	42.2	42.3	31.9	38.8	93.7	7.8	12.0

Source: Brant and Oberman(1975) as presented in UMTRA TAD (1989)
Formula: tc=C(L/Si^2)^(1/3).
Source:Kirpich (1940) as presented in NUREG 4620
Formula: tc=0.00013*L^0.77/S^0.385 with L in feet, tc in hours
Source: SCS as presented in NUREG 4620
Formula: tc=(11.9L^3/H)^0.385 with L in miles, H in feet, t in hours
% of one-hour PMP=RD/(0.0089*RD+0.0686) for tc<15 min based on Table 4.1 of TAD
Cell geometry based on Figure G.1

Client:	**Energy Fuels Resources (USA) Inc.**	**Job No.:**	**1009740**
Project:	**White Mesa Reclamation Plan**	**Date:**	**8/22/2015**
Detail:	**Erosion Protection**	**Computed By:**	**TMS/MMD**

Unit discharge of PMP

Flow Path 1: flow path across longest 5H:1V side slope in Cell 4A

Description	Total Drainage Length (ft)	C	Tc (min)	Intensity (in/hr)	unit discharge (cfs/ft)
Cell 2 at 0.5%	570	1	9.2	33.0	0.43
Cell 3 top	1440	1	21.1	19.4	0.64
Cell 4A top	2640	1	33.3	13.7	0.83
Cell 4A side slope	2870	1	34.8	13.2	0.87

Note: Flow accumulates as it flows from Cell 2 to Cell 4A

Flow Path 2: longest flow path across cells with 0.8% top slope across cells 4A and 4E

Description	Total Drainage Length (ft)	C	Tc (min)	Intensity (in/hr)	unit discharge (cfs/ft)
Cell 2 at 1%	900	1	9.4	32.7	0.68
Cell 2 at 0.5%	1450	1	18.5	21.4	0.71
Cell 3 top	2280	1	30.0	14.8	0.78
Cell 4A top	3480	1	42.2	11.2	0.90
Cell 4A side slope	3580	1	42.2	11.2	0.92

Note: Flow accumulates as it flows from Cell 2 to Cell 4A

Side Slope Flow Paths

Description	Total Drainage Length (ft)	C	Tc (min)	Intensity (in/hr)	unit discharge
Cell 2 Northern 1% Slope	830	1	9.0	33.6	0.64
Cell 2 Northern .5% Slope	1080	1	14.8	24.9	0.62
Cell 1 Disposal 1% Slope	1310	1	19.1	20.9	0.63
Cell 1 Disposal Side Slope	1400	1	20.0	20.2	0.65
Non-Accumulating Side Slopes	50	1	2.5	54.8	0.06
Cell 1 at .1%	2232	1	38.8	12.0	0.62

Client:	**Energy Fuels Resources (USA) Inc.**	**Job No.:**	**1009740**
Project:	**White Mesa Reclamation Plan**	**Date:**	**8/22/2015**
Detail:	**Erosion Protection**	**Computed By:**	**TMS/MMD**

Temple Method for Vegetated Slopes - Top Soil

Reference: Temple, D.M., Robinson, K.M., Ahring, R.M., and Davis, A.G., 1987. Stability Design of Grass-Lined Open Channels, USDA Handbook 667.
And as presented in UMTRA TAD Section 4.3.3 and NUREG 1623, Appendix A

Area	Cell 2 at 0.5%	Cell 3 top	
PMP Design flow (cfs/ft)	0.71	0.78	
Concentration Factor, F	3	3	
PMP Design flow (cfs/ft), q	**2.14**	**2.33**	
Slope, S (ft/ft)	0.005	0.005	
average dry density (pcf)	100	100	(estimated from laboratory testing)
average specific gravity	2.61	2.61	(estimated from laboratory testing)
void ratio, e	0.629	0.629	
unit weight water (pcf)	62.4	62.4	

Topsoil Description	topsoil	topsoil	
Plasticity Index, PI	<10	<10	(from laboratory testing)
base allowable tractive shear stress (psf) τab=	na	na	
void ratio correction factor, Ce=	na	na	
allowable tractive shear stress (psf), τa=	0.020	0.020	
Long-term, PMP precip			
Repr. stem length (ft) h(ave)			
good veg	2	2	pg 36 and 39 of Temple et al. (1987)
poor veg	1	1	
Repr. stem density (stems/sq ft), M(ave)			
good veg	200	200	Temple Table 3.1, grass mixture
poor veg	67	67	
Retardance curve index, Ci			
good veg	7.62	7.62	
poor veg	5.03	5.03	
Cover factor, Cf			
good veg	0.75	0.75	Temple Table 3.1, grass mixture
poor veg	0.375	0.375	assume min 30% coverage
allowable vegetated shear strength (psf), τva			
good veg	5.71	5.71	
poor veg	3.78	3.78	
Mannings n for soil roughness, ns=	0.0156	0.0156	
Mannings n for vegetal conditions, nr			
good veg	0.0916	0.0872	
poor veg	0.0503	0.0487	
Mannings n for vegetated slopes, nv			
good veg	0.0916	0.0872	
poor veg	0.0503	0.0487	
assumed depth of flow, d (ft)			
good veg	1.452	1.485	
poor veg	1.013	1.047	
calculated q (cfs/ft), with veg			
good veg	2.14	2.33	
poor veg	2.14	2.33	
qcalc - qdesign			
good veg	**0.00**	**0.00**	
poor veg	**0.00**	**0.00**	
Iterate with d until q calc equals q design			
velocity (ft/s), v			
good veg	1.47	1.57	
poor veg	2.11	2.23	
effective shear stress (psf), τe			
good veg	0.0033	0.0037	
poor veg	0.0190	0.0210	
effective veg shear stress (psf) τve			
good veg	0.4497	0.4597	
poor veg	0.2970	0.3056	
shear stress ratio, vegetated slope			
good veg	**12.7**	**12.4**	
poor veg	**12.7**	**12.4**	
shear stress ratio, soil on vegetated slope			
good veg	**6.1**	**5.4**	
poor veg	**1.1**	**1.0**	

Client:	**Energy Fuels Resources (USA) Inc.**	**Job No.:**	**1009740**
Project:	**White Mesa Reclamation Plan**	**Date:**	**8/22/2015**
Detail:	**Erosion Protection**	**Computed By:**	**TMS/MMD**

Temple Method for Vegetated Slopes - Top Soil Ammended with 25% Gravel

Reference: Temple, D.M., Robinson, K.M., Ahring, R.M., and Davis, A.G., 1987. Stability Design of Grass-Lined Open Channels, USDA Handbook 667.
And as presented in UMTRA TAD Section 4.3.3 and NUREG 1623, Appendix A

Area	Cell 1 at 1%	Cell 2 at 1%	Cell 4A top	
PMP Design flow (cfs/ft)	0.63	0.68	0.87	
Concentration Factor, F	3	3	3	
PMP Design flow (cfs/ft), q	**1.88**	**2.03**	**2.60**	
Slope, S (ft/ft)	0.01	0.01	0.008	
average dry density (pcf)	106	106	106	(estimated from laboratory testing)
average specific gravity	2.62	2.62	2.62	(estimated from laboratory testing)
void ratio, e	0.542	0.542	0.542	
unit weight water (pcf)	61.4	62.4	62.4	

Topsoil Description	Topsoil with 25% 1"-minus gravel	Topsoil with 25% 1"-minus gravel	Topsoil with 25% 1"-minus gravel	
d75 (inches)	0.2	0.2	0.2	from preliminary gradation specs
base allowable tractive shear stress (psf) τab=	na	na	na	
void ratio correction factor, Ce=	na	na	na	
allowable tractive shear stress (psf), τa=	0.080	0.080	0.080	
Long-term, PMP precip				
Repr. stem length (ft) h(ave)				
good veg	2	2	2	pg 36 and 39 of Temple et al. (1987)
poor veg	1	1	1	
Repr. stem density (stems/sq ft), M(ave)				
good veg	200	200	200	Temple Table 3.1, grass mixture
poor veg	67	67	67	
Retardance curve index, Ci				
good veg	7.62	7.62	7.62	
poor veg	5.03	5.03	5.03	
Cover factor, Cf				
good veg	0.75	0.75	0.75	Temple Table 3.1, grass mixture
poor veg	0.375	0.375	0.375	assume min 30% coverage
allowable vegetated shear strength (psf), τva				
good veg	5.71	5.71	5.71	
poor veg	3.78	3.78	3.78	
Mannings n for soil roughness, ns=	0.0196	0.0196	0.0196	
Mannings n for vegetal conditions, nr				
good veg	0.0986	0.0944	0.0821	
poor veg	0.0528	0.0513	0.0468	
Mannings n for vegetated slopes, nv				
good veg	0.0993	0.0952	0.0829	
poor veg	0.0541	0.0526	0.0482	
assumed depth of flow, d (ft)				
good veg	1.148	1.169	1.338	
poor veg	0.797	0.819	0.966	
calculated q (cfs/ft), with veg				
good veg	1.88	2.03	2.60	
poor veg	1.88	2.03	2.60	
qcalc - qdesign				
good veg	**0.00**	**0.00**	**0.00**	
poor veg	**0.00**	**0.00**	**0.00**	
Iterate with d until q calc equals q design				
velocity (ft/s), v				
good veg	1.64	1.73	1.95	
poor veg	2.36	2.47	2.69	
effective shear stress (psf), τe				
good veg	0.0068	0.0077	0.0093	
poor veg	0.0401	0.0442	0.0497	
effective veg shear stress (psf) τve				
good veg	0.6978	0.7219	0.6587	
poor veg	0.4494	0.4672	0.4328	
shear stress ratio, vegetated slope				
good veg	**8.2**	**7.9**	**8.7**	
poor veg	**8.4**	**8.1**	**8.7**	
shear stress ratio, soil on vegetated slope				
good veg	**11.7**	**10.4**	**8.6**	
poor veg	**2.0**	**1.8**	**1.6**	

Client:	Energy Fuels Resources (USA) Inc.	Job No.:	1009740
Project:	White Mesa Reclamation Plan	Date:	8/22/2015
Detail:	Erosion Protection	Computed By:	TMS/MMD

Abt and Johnson method (Abt and Johnson, 1991) applicable for slopes of 50% or less.

Angular-Shaped rock sizing equation: $D_{50} = 5.23S^{0.43}q_{design}^{0.56}$ $q_{design} = 1.35q_f$

For rounded rock, increase size by 40%.

Area	Cell 4A Flow Path 2 Southern Side Slope - Angular	Non-Accumulating Side Slopes - Rounded	Cell 2 Northern Side Slope - Angular
Side Slope (ft/ft)	0.2	0.2	0.2
angle α (rad)	0.197	0.197	0.197
PMP unit flow (cfs/ft)	0.87	0.06	0.65
Concentration Factor	3	3	3
Coef. Of Movement	1.35	1.35	1.35
design flow (cfs/ft)	3.51	0.25	2.63
Coef. Of Uniformity	NA	NA	NA
design flow over rock (cfs/ft)	3.51	0.25	2.63
D50 (inches)	5.29	1.70	4.49

Client:	Energy Fuels Resources (USA) Inc.	Job No.:	1009740
Project:	White Mesa Reclamation Plan	Date:	8/22/2015
Detail:	Erosion Protection	Computed By:	TMS/MMD

Preliminary Gradations

This spreadsheet calculates preliminary gradations of riprap based on D50
Source: NUREG 4620
Source: USDA, National Engineering Handbook, Part 633, Chapter 26, Gradation Design of Sand and Gravel Filters, October 1994.

Area Description	Cell 4A side slope	Comment
Minimum D50 (in)	4.49	Assuming Angular Rock, Safety Factor Method for Top Slope, Abt and Johnson (1991) method for side slopes
Rock thickness (in)	8.99	Based on constructability: 1.5 to 2*D50. May consider 12" as minimum thickness for rock
Maximum D50 (in)	5.99	Based on constructability: Thickness/1.5
Maximum D50 (in)	22.47	Prevent gap-grading: minimum D50*5
Maximum D50 (in)	5.99	Smaller of two above criteria
Maximum D100 (in)	8.99	Based on constructability: 1*Thickness
Maximum D100 (in)	29.96	Based on internal stability?: 5*maximum D50
Maximum D100 (in)	8.99	Smaller of two above criteria
Minimum D100 (in)	6.74	1.5*minimum D50
Minimum D15 (in)	0.56	Based on internal stability: Maximum D100/16
Maximum D15 (in)	2.81	Prevent gap-grading: Minimum D15*5
Minimum D60 (in)	6.29	Prevent gap-grading: D60/D10<=6
Maximum D60 (in)	8.39	Prevent gap-grading: D60/D10<=6
Minimum D10 (in)	1.05	Prevent gap-grading: D60/D10<=6
Maximum D10 (in)	1.40	Prevent gap-grading: D60/D10<=6

Client:	**Energy Fuels Resources (USA) Inc.**	**Job No.:**	**1009740**
Project:	**White Mesa Reclamation Plan**	**Date:**	**8/22/2015**
Detail:	**Erosion Protection**	**Computed By:**	**TMS/MMD**

Interstitial Velocities

Source: NUREG 1623, Section D
Abt, SR, JF Ruff, RJ Wittler (1991). Estimating Flow Through Riprap, Journal of Hydraulic Engineering, Vol. 117, No. 5, May.

Description	**Non-Accumulating Side Slopes - Rounded**	**Cell 1 Disposal Area Side Slope - Angular**	**Cell 4A Flow Path 2 Southern Side Slope - Angular**	
Minimum D50 (inches)	1.70	4.49	5.29	from Safety Factor Method, or Abt/Johnson Method, assuming rounded rock
Minimum D10 (inches)	0.40	1.05	1.23	from preliminary gradation specs
Maximum D10 (inches)	0.53	1.40	1.65	from preliminary gradation specs
Slope (ft/ft)	0.2	0.20	0.20	from preliminary design
Min Velocity (ft/s)	0.37	0.60	0.65	calculated from Abt et al. (1991) based on Min D10
Max Velocity (ft/s)	0.43	0.69	0.75	calculated from Abt et al. (1991) based on Max D10
Underlying filter required?	No	Recommended	Recommended	Per NUREG 1623, Appendix D, section 2.1.1

Client: Energy Fuels Resources (USA) Inc.
Project: White Mesa Reclamation Plan
Detail: Erosion Protection

Job No.: 1009740
Date: 7/9/2012
Computed By: TMS

USDA Filter Gradation Calulations - 2010 Material Testing

Step 1: Plot Gradation Curve of Base Soil

Stockpile ID	**E4 (Field ID 2)**		**E5 (Field ID 3)**		**E6 (Field ID 4)**		**E7 (Field ID 5)**		**E8 (Field ID 6)**		**W9 (Field ID 7)**		**W7 (Field ID 8)**		**W1 (Field ID 12)**		**W2 (Field ID 13)**	
Description	Sandy Clay Random Fill		Sandy Clay Random Fill		Clay Random Fill		Sandy Clay Random Fill		Sandy Clay Random Fill		Sandy Clay Random Fill		Sandy Clay Random Fill		Sandy Clay Random Fill		Sandy Clay Random Fill	
Sieve Sizes	Diameter (mm)	% Finer	Diameter (mm)	% Finer	Diameter (mm)	% Finer	Diameter (mm)	% Finer	Diameter (mm)	% Finer	Diameter (mm)	% Finer	Diameter (mm)	% Finer	Diameter (mm)	% Finer	Diameter (mm)	% Finer
1 1/2"	38.1	100	38.1	100	38.1	100	38.1	100	38.1	100	38.1	100	38.1	100	38.1	100	38.1	100
1"	25.4	100	25.4	100	25.4	100	25.4	100	25.4	100	25.4	100	25.4	100	25.4	100	25.4	100
3/4"	19.1	100	19.1	100	19.1	100	19.1	100	19.1	100	19.1	100	19.1	100	19.1	100	19.1	100
3/8"	9.8	100	9.8	100	9.8	100	9.8	100	9.8	100	9.8	100	9.8	100	9.8	100	9.8	100
Nº 4	4.75	99.9	4.75	100	4.75	99.9	4.75	100	4.75	100	4.75	100	4.75	100	4.75	100	4.75	99.8
Nº 10	2	99.8	2	99.9	2	99.9	2	100	2	100	2	100	2	99.3	2	100	2	99.7
Nº 20	0.85	98.9	0.85	99.2	0.85	99.2	0.85	100	0.85	99	0.85	99.3	0.85	98.8	0.85	99.5	0.85	97.4
Nº 40	0.425	97.7	0.425	97.9	0.425	96.9	0.425	99.7	0.425	97.4	0.425	98.3	0.425	98.1	0.425	98.8	0.425	94.7
Nº 60	0.25	95.1	0.25	93.1	0.25	92.6	0.25	98.8	0.25	91.9	0.25	96.1	0.25	94.4	0.25	97.8	0.25	88.2
Nº 100	0.15	90.8	0.15	80.9	0.15	88.8	0.15	96.7	0.15	74.7	0.15	92.3	0.15	79.4	0.15	95.2	0.15	76.6
Nº 200	0.075	58.8	0.075	64.5	0.075	82.2	0.075	69.8	0.075	53	0.075	62.6	0.075	56.2	0.075	59.4	0.075	58.3

D15 estimated as 0.025

All Steps below are from USDA Ch. 26 Example 26-2A

Step 4. Base Soil Category		2		2		2		2		2		2		2		2		2
D85	0.14		0.18		0.11		0.12		0.21		0.13		0.19		0.13		0.22	
Step 5. Filtering Criteria (Max D15) (mm)		0.70		0.70		0.70		0.70		0.70		0.70		0.70		0.70		0.70
Step 6. Min D15		0.08		0.07		0.05		0.06		0.08		0.07		0.08		0.08		0.08
Step 7. Ratio		9.15		10.03		12.79		10.86		8.24		9.74		8.74		9.24		9.07
Control Point 1 (D15max)		0.38		0.35		0.27		0.32		0.42		0.36		0.40		0.38		0.39
Control Point 2 (D15min)		0.08		0.07		0.05		0.06		0.08		0.07		0.08		0.08		0.08
Step 8. MaxD10		0.32		0.29		0.23		0.27		0.35		0.30		0.33		0.32		0.32
CP3 Max D60		1.91		1.74		1.37		1.61		2.12		1.80		2.00		1.89		1.93
CP4 Min D60		0.38		0.35		0.27		0.32		0.42		0.36		0.40		0.38		0.39
Step 9. CP5 D5min		0.08		0.08		0.08		0.08		0.08		0.08		0.08		0.08		0.08
CP6 D100 max		75.00		75.00		75.00		75.00		75.00		75.00		75.00		75.00		75.00
Step 10. CP7 D10		0.06		0.06		0.05		0.05		0.07		0.06		0.07		0.06		0.06
CP8 D90		20.00		20.00		20.00		20.00		20.00		20.00		20.00		20.00		20.00
For Plotting:	4.75	100.00																

Step 11. Connecting Control Points

	CP	**E4 (Field ID 2)**		**E5 (Field ID 3)**		**E6 (Field ID 4)**		**E7 (Field ID 5)**		**E8 (Field ID 6)**		**W9 (Field ID 7)**		**W7 (Field ID 8)**		**W1 (Field ID 12)**		**W2 (Field ID 13)**	
		D(mm)	% Finer	D(mm)	% Finer	D(mm)	% Finer	D(mm)	% Finer	D(mm)	% Finer	D(mm)	% Finer	D(mm)	% Finer	D(mm)	% Finer	D(mm)	% Finer
Fine Design Band (Upper)	4	0.382653	60	0.348837	60	0.273722628	60	0.32234957	60	0.424528	60	0.359425	60	0.400356	60	0.378787879	60	0.385935	60
	2	0.076531	15	0.069767	15	0.054744526	15	0.064469914	15	0.084906	15	0.071885	15	0.080071	15	0.075757576	15	0.077187	15
	5	0.075	5	0.075	5	0.075	5	0.075	5	0.075	5	0.075	5	0.075	5	0.075	5	0.075	5
	6	75	100	75	100	75	100	75	100	75	100	75	100	75	100	75	100	75	100
Course Design	3	1.913265	60	1.744186	60	1.368613139	60	1.611747851	60	2.122642	60	1.797125	60	2.001779	60	1.893939394	60	1.929674	60
	1	0.382653	15	0.348837	15	0.273722628	15	0.32234957	15	0.424528	15	0.359425	15	0.400356	15	0.378787879	15	0.385935	15
	7	0.063776	10	0.05814	10	0.045620438	10	0.053724928	10	0.070755	10	0.059904	10	0.066726	10	0.063131313	10	0.064322	10

Step 12. Determine Gradation from plot

Shaded boxes means these values were changed to meet the requirements from the references listed below.
References cited and listed in Appendix G

D50 base	0.06	0.06	0.05	0.05	0.07	0.06	0.07	0.06	0.06
D50 Fine Filter	0.31	0.29	0.23	0.27	0.35	0.30	0.33	0.31	0.32
D50 Course Filter	1.57	1.43	1.13	1.33	1.75	1.48	1.65	1.56	1.59

Nelson eqn 4.35	2.81	1.90	2.56	2.75	2.02	2.73	2.14	2.94	1.74
Cedergren eqn 5.3	24.67	24.67	24.67	24.67	24.67	24.67	24.67	24.67	24.67
Nelson eqn 4.36	2.81	1.90	2.56	2.75	2.02	2.73	2.14	2.94	1.74

Client: Energy Fuels Resources (USA) Inc
Project: White Mesa Reclamation Plan
Detail: Erosion Protection

Job No.: 1009740
Date: 7/9/2012
Computed By: TMS

USDA Filter Gradation Calulations - 2012 Material Testing

Step 1: Plot Gradation Curve of Base Soil

Field ID	**E3-A**		**E5-B**		**E8-B**		**W2-A**		**W2-B**		**W5-A**		**W5-B**		**W8-A**		**W8-B**		**W9-B**	
Description	Sandy Clay Random Fill		Sandy Clay Random Fill		Clay Random Fill		Sandy Clay Random Fill		Sandy Clay Random Fill		Sandy Clay Random Fill		Sandy Clay Random Fill		Sandy Clay Random Fill		Sandy Clay Random Fill		Sandy Clay Random Fill	
Sieve Sizes	Diameter (mm)	% Finer	Diameter (mm)	% Finer	Diameter (mm)	% Finer	Diameter (mm)	% Finer	Diameter (mm)	% Finer	Diameter (mm)	% Finer	Diameter (mm)	% Finer	Diameter (mm)	% Finer	Diameter (mm)	% Finer	Diameter (mm)	% Finer
2"	50.8	100	50.8	100	50.8	100	50.8	100	50.8	100	50.8	100	50.8	100	50.8	100	50.8	100	50.8	100
1"	25.4	100	25.4	100	25.4	81.93	25.4	93.18	25.4	100	25.4	100	25.4	82.21	25.4	85.17	25.4	75.41	25.4	100
3/4"	19.1	100	19.1	100	19.1	76.8	19.1	90.46	19.1	100	19.1	100	19.1	81.53	19.1	79.85	19.1	75.41	19.1	98.84
3/8"	9.8	100	9.8	99.31	9.8	66.01	9.8	79.02	9.8	100	9.8	99.64	9.8	75.03	9.8	71.12	9.8	69.81	9.8	97.64
Nº 4	4.75	99.56	4.75	98.46	4.75	60.03	4.75	69.56	4.75	99.89	4.75	99.08	4.75	70.97	4.75	65.34	4.75	68.41	4.75	94.13
Nº 10	2	97.56	2	97.21	2	56.18	2	59.53	2	99.72	2	97	2	66.88	2	59.49	2	66.04	2	89.65
Nº 20	0.85	95.84	0.85	96.11	0.85	54.66	0.85	53.25	0.85	99.46	0.85	95.03	0.85	64.04	0.85	55.59	0.85	63.76	0.85	86.42
Nº 40	0.425	94.66	0.425	95.19	0.425	52.56	0.425	49.39	0.425	98.73	0.425	93.04	0.425	59.3	0.425	48.97	0.425	58.56	0.425	84.16
Nº 60	0.25	92.35	0.25	93.34	0.25	47.28	0.25	43.49	0.25	96.47	0.25	88.27	0.25	45.76	0.25	33.93	0.25	47.26	0.25	80.58
Nº 100	0.15	86.48	0.15	89.93	0.15	39.4	0.15	34.43	0.15	94.12	0.15	83.32	0.15	38.09	0.15	20.12	0.15	39.94	0.15	75.53
Nº 200	0.075	76.74	0.075	82.68	0.075	28.78	0.075	25.11	0.075	61.5	0.075	50.38	0.075	26.77	0.075	13.78	0.075	28.17	0.075	50.1

Note: Areas with fiels ID's E1-A and W4-B were topsoil samples and thus were not included in this analysis

All Steps below are from USDA Ch. 26 Example 26-2A

	E3-A		E5-B		E8-B		W2-A		W2-B		W5-A		W5-B		W8-A		W8-B		W9-B	
Step 4. Base Soil Category		2		2		3		3		2		2		3		4		3		2
D85	0.14		0.10		29.72		14.66		0.13		0.18		29.38		25.20		35.31		0.58	
Step 5. Filtering Criteria (Max D15) (mm)		0.70		0.70		53.73		35.21		0.70		0.70		62.53		100.79		67.20		0.70
Step 6. Min D15		0.10		0.10		0.16		0.18		0.10		0.10		0.17		0.27		0.16		0.10
Step 7. Ratio		7.00		7.00		343.64		196.48		7.00		7.00		371.98		368.62		420.65		7.00
Control Point 1 (D15max)		0.50		0.49		0.78		0.90		0.50		0.50		0.84		1.37		0.80		0.50
Control Point 2 (D15min)		0.10		0.10		0.16		0.18		0.10		0.10		0.17		0.27		0.16		0.10
Step 8. MaxD10		0.42		0.41		0.65		0.75		0.42		0.42		0.70		1.14		0.67		0.42
CP3 Max D60		2.50		2.45		3.91		4.48		2.50		2.50		4.20		6.84		3.99		2.50
CP4 Min D60		0.50		0.49		0.78		0.90		0.50		0.50		0.84		1.37		0.80		0.50
Step 9. CP5 D5min		0.08		0.08		0.08		0.08		0.08		0.08		0.08		0.08		0.08		0.08
CP6 D100 max		75.00		75.00		75.00		75.00		75.00		75.00		75.00		75.00		75.00		75.00
Step 10. CP7 min D10		0.08		0.08		0.13		0.15		0.08		0.08		0.14		0.23		0.13		0.08
CP8 D90		20		20		20		20		20		20		20		20		20		20
For Plotting:	4.75	100																		

Step 11. Connecting Control Points

	CP	**E3-A** D(mm)	% Finer	**E5-B** D(mm)	% Finer	**E8-B** D(mm)	% Finer	**W2-A** D(mm)	% Finer	**W2-B** D(mm)	% Finer	**W5-A** D(mm)	% Finer	**W5-B** D(mm)	% Finer	**W8-A** D(mm)	% Finer	**W8-B** D(mm)	% Finer	**W9-B** D(mm)	% Finer
Fine Design Band (Upper)	4	0.5	60	0.49	60	0.782	60	0.896	60	0.5	60	0.5	60	0.840	60	1.367	60	0.799	60	0.5	60
	2	0.1	15	0.1	15	0.156	15	0.179	15	0.1	15	0.1	15	0.168	15	0.273	15	0.160	15	0.1	15
	5	0.075	5	0.075	5	0.075	5	0.075	5	0.075	5	0.075	5	0.075	5	0.075	5	0.075	5	0.075	5
Course Design Band (Lower)	6	75	100	75	100	75	100	75	100	75	100	75	100	75	100	75	100	75	100	75	100
	3	1.4	60	1.3	60	3.909	60	4.480	60	1.8	60	2.2	60	4.202	60	6.836	60	3.994	60	2.2	60
	1	0.5	15	0.49	15	0.782	15	0.896	15	0.5	15	0.5	15	0.840	15	1.367	15	0.799	15	0.5	15
	7	0.083	10	0.083	10	0.130	10	0.149	10	0.083	10	0.083	10	0.140	10	0.228	10	0.133	10	0.083	10

Step 12. Determine Gradation from plot

Shaded boxes means these values were changed to meet the requirements from the references listed below
References cited and listed in Appendix G

D50 base	0.05	0.05	0.34	0.49	0.06	0.07	0.30	0.49	0.29	0.07
D50 Fine Filter	0.41	0.40	0.64	0.74	0.41	0.41	0.69	1.12	0.66	0.41
D50 Course Filter	1.20	1.12	3.21	3.68	1.51	1.82	3.46	5.62	3.28	1.82

Nelson eqn 4.35	3.61	4.95	0.03	0.06	3.88	2.72	0.03	0.05	0.02	0.86
Cedergren eqn 5.3	24.56	24.69	9.45	7.48	24.78	24.48	11.34	11.44	11.23	24.34
Nelson eqn 4.36	3.61	4.95	0.03	0.06	3.88	2.72	0.03	0.05	0.02	0.86

Client:	**Energy Fuels Resources (USA) Inc.**	**Job No.:**	**1009740**
Project:	**White Mesa Reclamation Plan**	**Date:**	**8/22/2015**
Detail:	**Erosion Protection**	**Computed By:**	**TMS/MMD**

Apron Protection

Source: Abt, SR, Johnson, TL, Thornton, CI, and Trabant, SC, Riprap Sizing at Toe of Embankment Slopes, Journal of Hydraulic Engineering, Vol. 124, No. 7, July 1998.

Equation: D50=10.46*S^0.43*qd^0.56

	Apron C: Cell 2 Northern Side Slope	Apron B: Cell 4A Southern Side Slope	Apron A: Non-Accumulating Slopes	West
unit discharge (cfs/ft)	0.65	0.87	0.06	0.06
Cr	1	1	1	1
Cf	3	3	3	3
Cm	1.35	1.35	1.35	1.35
design discharge (cfs/ft)	2.63	3.51	0.25	0.25
Slope (ft/ft)	0.2	0.2	0.2	0.2
D50 **Angular** (in)	9.0	10.6	2.4	2.4
D50 **Rounded** (in)	12.6	14.8	3.4	3.4

Client:	**Energy Fuels Resources (USA) Inc.**	**Job No.:**	**1009740**
Project:	**White Mesa Reclamation Plan**	**Date:**	**8/22/2015**
Detail:	**Erosion Protection**	**Computed By:**	**TMS/MMD**

Interstitial Velocities - Apron

Source: NUREG 1623, Section D
Abt, SR, JF Ruff, RJ Wittler (1991). Estimating Flow Through Riprap, Journal of Hydraulic Engineering, Vol. 117, No. 5, May.

Description	**Non-Accumulating Side Slopes - Rounded**	**Cell 1 Disposal Area Side Slope - Angular**	**Cell 4A Flow Path 2 Southern Side Slope - Angular**	
Minimum D50 (inches)	3.18	8.99	10.58	from Safety Factor Method, or Abt/Johnson Method, assuming rounded rock
Minimum D10 (inches)	0.74	2.10	2.47	from preliminary gradation specs
Maximum D10 (inches)	0.99	2.80	3.29	from preliminary gradation specs
Slope (ft/ft)	0.01	0.01	0.01	from preliminary design
Min Velocity (ft/s)	0.11	0.19	0.21	calculated from Abt et al. (1991) based on Min D10
Max Velocity (ft/s)	0.13	0.22	0.24	calculated from Abt et al. (1991) based on Max D10
Underlying filter required?	No	No	No	Per NUREG 1623, Appendix D, section 2.1.1

Client:	**Energy Fuels Resources (USA) Inc.**	**Job No.:**	**1009740**
Project:	**White Mesa Reclaimation**	**Date:**	**8/22/2015**
Detail:	**Erosion Protection**	**Computed By:**	**TMS/MMD**

Modified Universal Soil Loss Equation (MUSLE)

Source : Clyde et al. (1978) as presented in NUREG 4620, section 5.1.2
A=R*K*LS*VM

	Topsoil	Rock Mulch	
Inputs for K factor			
Percent silt and very fine sand	43.6	32.7	from laboratory testing
Percent sand (0.10-2.0 mm)	39.2	29.4	from laboratory testing
Percent organic matter	1.5	1.5	
Soil structure Number	2	3	
Permeability	3	2	
Inputs for LS factor			
Slope length (ft)	1440	1200	from Figure G.1
slope steepness (%)	0.5	0.8	
m exponent	0.2	0.2	Table 5.2 of NUREG 4620

		Topsoil	Rock Mulch	
R	Rainfall Factor	30	30	From Table 5.1 of NUREG 4620 for eastern third of Utah
K	Soil Erodibility factor	0.28	0.12	From nomograph Fig. 5.1 of NUREG 4620
LS	Topographic factor	0.16	0.18	
VM	Dimensionless erosion control factor	0.4	0.4	From Table 5.3 of NUREG 4620 for seedings, 0-60 days
A	Soil Loss (tons/acre/year)	0.54	0.27	
A	Soil density (pcf)	100	106	from laboratory testing
A	Soil Loss (inches/1000 years)	3.0	1.4	

Client:	**Energy Fuels Resources (USA) Inc.**	**Job No.:**	1009740
Project:	**White Mesa Mill**	**Date:**	8/14/2012
Detail:	**Discharge Channel**	**Computed By:**	JMC

Peak Discharge of PMP precipitation

Description	Total Drainage Area (acres)	C	Tc (min)	Intensity (in/hr)	Q (cfs)
Sed-Channel	**148.40**	1	26.3	16.4	2440.1

Client:	**Energy Fuels Resources (USA) Inc.**	**Job No.:**	**1009740**
Project:	**White Mesa Mill**	**Date:**	**8/14/2012**
Detail:	**Discharge Channel**	**Computed By:**	**JMC**

Time of Concentration

1-hour PMP (in) 8.3

Description	Slope (feet/feet)	Path Length (feet)	Time of Concentration (minutes) Kirpich	SCS	Brant and Oberman	Average	% of 1-hour PMP	PD_{PMP} (in)	Intensity (in/hr)
Sed-Channel	**0.010**	**4600**	30.1	30.2	18.7	26.3	86.9	7.21	16.4

Source: Brant and Oberman(1975) as presented in UMTRA TAD (1989)
Formula: tc=C(L/Si^2)^(1/3).
Source:Kirpich (1940) as presented in NUREG 4620
Formula: tc=0.00013*L^0.77/S^0.385 with L in feet, tc in hours
Source: SCS as presented in NUREG 4620
Formula: tc=(11.9L^3/H)^0.385 with L in miles, H in feet, t in hours
% of one-hour PMP=RD/(0.0089*RD+0.0686) for tc<15 min based on Table 4.1 of TAD
Cell geometry and grading based on REC-1 Reclamation Plan Revisions, September, 2011

Client:	Energy Fuels Resources (USA) Inc.	**Job No.:**	1009740
Project:	White Mesa Mill	**Date:**	8/2/2012
Detail:	Discharge Channel	**Computed By:**	JMC

Peak Channel Velocity

Design flow:		2,440 cfs	
Trapezoid or triangular channels			
slope (ft/ft)	0.009	ft/ft	
Channel Side Slope 1 (ft/ft)	0.33	ft/ft	
Channel Side Slope 2 (ft/ft)	0.33	ft/ft	
bottom width	150	ft	
Q	2,440	cfs	
n native soils	0.020		bedrock channel with minor irregularities
Area of flow (A)	258.52	ft^2	
Wetted Perimeter Slope 1 (P1)	5.32	ft	
Wetted Perimeter Slope 2 (P2)	5.32	ft	
Hydraulic Radius (R)	1.61	ft	
Top Width (T)	160.1	ft	
Maximum depth of flow (d)	1.67	ft	
Q calc	2440.0	cfs	**ok**
average velocity (v)	**9.4**	**fps**	**8-10 fps ok**
unit discharge	**15.74**	**cfs/ft**	take as total Q divided by average flow width

Client:	Energy Fuels Resources (USA) Inc.	**Job No.:**	1009740
Project:	White Mesa Mill	**Date:**	8/14/2012
Detail:	Discharge Channel	**Computed By:**	JMC

Peak Channel Velocity

Design flow: 2,440 cfs

Trapezoid or triangular channels				
slope (ft/ft)	0.009	ft/ft		
Channel Side Slope 1 (ft/ft)	0.33	ft/ft		
Channel Side Slope 2 (ft/ft)	0.33	ft/ft		
bottom width	150	ft		
Q	2,440	cfs		
n native soils	0.030		bedrock channel with moderate irregularities	
Area of flow (A)	332.10	ft^2		
Wetted Perimeter Slope 1 (P1)	6.77	ft		
Wetted Perimeter Slope 2 (P2)	6.77	ft		
Hydraulic Radius (R)	2.03	ft		
Top Width (T)	162.9	ft		
Maximum depth of flow (d)	2.12	ft		
Q calc	2440.0	cfs	**ok**	
average velocity (v)	**7.3**	**fps**	**less than 8-10 fps**	**ok**
unit discharge	**15.60**	**cfs/ft**	take as total Q divided by average flow width	

Client:	Energy Fuels Resources (USA) Inc.	**Job No.:**	1009740
Project:	White Mesa Mill	**Date:**	8/2/2012
Detail:	Discharge Channel	**Computed By:**	JMC

Manning's N-value Determination

From US Department of the Interior, Bureau of Reclamation. Design of Small Dams. p. 595. 1987.

Basic N-value for channels in Rock	0.015	
Modifications of N-value	0.005	Minor degree of irregularity
	0.010	Moderate degree of irregularity
	0.020	Severe irregualrity

Based on seismic refraction data, test numbers 1-3, shear wave velocities ranged from 3100 to 7400 feet/sec (see test results from Nielsons, 1978, Appendix A D'Appolonia, 1979). The bedrock in the area c excavation is anticpated to range from soft and rippable to hard rock requiring blasting. The excavated rock surface will likely exhibit minor ro moderate irregularity.

Assume an N-value ranging from 0.020 0.030

From US Army Corps of Engineers. Hydraulic Design of Flood Control Channels, EM 1110-2-1601. p.2-16. June 1994.
From Table 2-5, Suggested Maximum Permissible Mean Channel Velocities

Poor Rock (usually sedimentary)	10.0	fps
Soft Sandstone	8.0	fps
Soft Shale	3.5	fps
Good Rock (usually igneous or hard metamorphic)	20.0	fps

The bedrock within the channel excavation is anticipated to consist of fine to medium-grained sandstone of varying cementation and weathering, or claystone. (see borings by Dames and Moore, 1978) Based on the presumed rock type and the referenced table above, permissible mean channel velocities may range up to 8 to 10 fps.

ATTACHMENT G

SUPPORTING DOCUMENTATION FOR INTERROGATORY 11/1:

REVISED APPENDIX D, VEGETATION AND BIOINTRUSION, TO THE UPDATED TAILINGS COVER DESIGN REPORT (APPENDIX D OF THE RECLAMATION PLAN, REVISION 5.0)

ATTACHMENT G.1

REVISED APPENDIX D, VEGETATION AND BIOINTRUSION, TO THE UPDATED TAILINGS COVER DESIGN REPORT (APPENDIX D OF THE RECLAMATION PLAN, REVISION 5.0)

APPENDIX D

VEGETATION AND BIOTINTRUSION EVALUATION

D.1 INTRODUCTION

This appendix provides an evaluation of vegetation that would be used as an integral part of an evapotranspiration (ET) cover proposed for reclamation of tailings cells at the White Mesa Mill (Mill) site. A critical component of an ET cover is the plant community that will be established on the cover and will function over the long term to provide protection from wind and water erosion and assist in removing water through the process of transpiration. In this appendix, issues related to the short-term establishment and long-term sustainability of vegetation proposed as part of the ET cover are addressed. These issues include: plant species selection, ecological characteristics of species (i.e., longevity, sustainability, compatibility, competition, rooting depth and root distribution), characteristics of the established plant community (i.e., percent plant cover and leaf area index [LAI]), and soil requirements for sustained plant growth. Information is also presented on weed control, vegetation performance goals and criteria, and post-closure vegetation monitoring. In addition, biointrusion from both plants and animals is addressed using information from an on-site survey conducted in June 2012 and literature applicable to site conditions. Finally there is discussion on climate change projections for the performance period and possible changes that may occur with plant community composition over time.

D.2 PROPOSED SPECIES FOR ET COVER RECLAMATION

The following 15 species (11 grasses, 2 forbs, and 2 shrubs) are proposed for the ET cover system at the Mill site. These species were selected for their adaptability to site conditions, compatibility, and long-term sustainability. Species were also selected based on the assumption that institutional controls will exclude grazing by domestic livestock. The proposed species are:

- Western wheatgrass, variety Arriba (*Pascopyrum smithii*)
- Bluebunch wheatgrass, variety Goldar (*Pseudoroegneria spicata*)
- Slender wheatgrass, variety San Luis (*Elymus trachycaulus*)
- Streambank wheatgrass, variety Sodar (*Elymus lanceolatus ssp. psammophilus*)
- Pubescent wheatgrass, variety Luna (*Thinopyrum intermedium ssp. barbulatum*)
- Indian ricegrass, variety Paloma (*Achnatherum hymenoides*)
- Sandberg bluegrass, variety Canbar (*Poa secunda*)
- Sheep fescue, variety Covar (*Festuca ovina*)
- Squirreltail, variety Toe Jam Creek (*Elymus elymoides*)
- Blue grama, variety Hachita (*Bouteloua gracilis*)
- Galleta, variety Viva (*Hilaria jamesii*)
- Common yarrow, no variety (*Achillea millefolium*)
- White sage, variety Summit (*Artemisia ludoviciana*)
- Fourwing saltbush, variety Wytana (*Atriplex canescens*)
- Rubber rabbitbrush, no variety (*Ericameria nauseosus*).

These species are described in more detail later in this appendix.

D.3 PROPOSED SEEDING RATES

Given a mixture of the species listed above, Table D.1 presents broadcast seeding rates for each species. Seeding rates were developed based on the objective of establishing a permanent cover of grasses, forbs, and shrubs in a mixture that would promote compatibility among species and minimize competitive exclusion or loss of species over time. The proposed seeding rate is based on number of seeds/ft^2 and then converted to pounds of pure live seed per acre (lbs PLS/acre), with further discussion presented below.

The number of seeds placed in a unit area of soil is called the seeding rate. The total seeding rate is the sum of the individual species seeding rates. Seeding rates are normally expressed as the number of seeds per square foot or pounds per acre. Many different seeding rates for the same species can be found in the literature. The primary reason for these differences is that some rates are for monocultures and other rates are for diverse mixtures. In addition, seeding rates vary depending on the method of seeding and site conditions related to edpaphic factors, topography and climate.

Seeding rates are developed on the basis of number of seeds per unit area (e.g. number of seeds per square foot). Once this number is determined, then it can be converted to weight per unit area (e.g. pounds per acre). Since each species produces seed that weighs a different amount, the development of seeding rates based purely on weight per unit area will produce erroneous rates that will tend to over emphasize small seeded species and under-emphasize large seeded species. For example, blue grama has approximately 700,000 seeds per pound, while Indian ricegrass has approximately 175,000 seeds per pound. If seeding rates were calculated simply on the basis of weight per unit area, without recognizing the fact that a pound of blue grama seed has four times the number of seeds per pound as Indian ricegrass, it would be very easy to over plant blue grama and under plant Indian ricegrass.

Table D.1. Species and Seeding Rates Proposed for ET Cover at the Mill Site

Scientific Name	Common Name	Varietal Name	Native/ Introduced	Seeding Rate (lbs PLS/acre)†	Seeding Rate (# seeds/ft^2)
Grasses					
Pascopyrum smithii	Western wheatgrass	Arriba	Native	3.0	7.9
Pseudoroegneria spicata	Bluebunch wheatgrass	Goldar	Native	3.0	9.6
Elymus trachycaulus	Slender wheatgrass	San Luis	Native	2.0	6.2
Elymus lanceolatus	Streambank wheatgrass	Sodar	Native	2.0	7.3
Elymus elymoides	Squirreltail	Toe Jam	Native	2.0	8.8
Thinopyrum intermedium	Pubescent wheatgrass	Luna	Introduced‡	1.0	1.8
Achnatherum hymenoides	Indian ricegrass	Paloma	Native	4.0	14.7
Poa secunda	Sandberg bluegrass	Canbar	Native	0.5	11.4
Festuca ovina	Sheep fescue	Covar	Introduced‡	1.0	11.5
Bouteloua gracilis	Blue grama	Hachita	Native	1.0	16.5
Hilaria jamesii	Galleta	Viva	Native	2.0	7.3
Forbs					

Scientific Name	Common Name	Varietal Name	Native/ Introduced	Seeding Rate (lbs PLS/acre)†	Seeding Rate (# seeds/ft^2)
Achillea millefolium, variety occidentalis	Common yarrow	VNS*	Native	0.5	32
Artemisia ludoviciana	White sage	VNS	Native	0.5	45
Shrubs					
Atriplex canescens	Fourwing saltbush	Wytana	Native	3.0	3.4
Ericameria nauseosus	Rubber rabbitbrush	VNS	Native	0.5	4.6
Total				26.5	188

†Seeding rate is for broadcast seed and presented as pounds of pure live seed per acre (lbs PLS/acre).
‡Introduced refers to species that have been 'introduced' from another geographic region, typically outside of North America. Also referred to as 'exotic' species. *VNS=Variety Not Specified but seed source would be designated from sites similar to the Mill site.

Seeding rate may be calculated from an expected field emergence for each species and the desired number of plants per unit area. For purposes of calculation, field emergence for small seeded grasses and forbs is assumed to be around 50 percent if germination is greater than 80 percent. Field emergence is assumed to be around 30 percent if germination is between 60 and 80 percent. The Natural Resource Conservation Service recommends a seeding rate of 20 to 30 pure live seeds per square foot as a minimum number of seeds when drill seeding single species in areas with an annual precipitation between 6 and 18 inches. Twenty pure live seeds per square foot, with an expected field emergence of 50 percent should produce an adequate number of plants on the seeded area to control erosion and suppress annual invasion. This seeding rate is primarily for favorable growing conditions, soils that are not extreme in texture, gentle slopes, north or east facing aspect, good moisture, adequate soil nutrients and single species vs. multiple species in a mixture. When conditions are less favorable when the seed is broadcast, or when multiple species are in a mixture the seeding rates are increased.

A Quality Assurance/Quality Control Plan for application rates and procedures for confirming that specified application rates are achieved is as follows. The first step begins with a seed order. Seed would be purchased as pounds of pure live seed. Each State has a seed certifying agency and certification programs may be adopted by seed growers. Certification of a container of seed assures the customer that the seed is correctly identified and genetically pure. The State agency responsible for seed certification sets minimum standards for mechanical purity and germination for each species of seed. When certified, a container of seed must be labeled as to origin, germination percentage, date of the germination test, percentage of pure seed (by weight), other crop and weed seeds, and inert material. The certification is the consumer's best guarantee that the seed being purchased meets minimum standards and the quality specified.

Once the seed is obtained, seed labels would be checked to determine the percent PLS and the date that the seed was tested for percent purity and percent germination. If the test date is greater than 6 months old, the seed would be tested again before being accepted. Seed will be applied using a broadcasting method. This procedure would use a centrifugal type broadcaster (or similar implement)), also called an end-gate seeder. These broadcasters operate with an electric motor and are usually mounted on the back of a small tractor and generally have an effective spreading width of about 20 feet or more. Prior to seeding, a known area will be covered with a tarp and seed will be distributed using the broadcaster and simulating conditions that would exist under actual seeding conditions. Seed will then be collected and weighed to determine actual seeding rate in terms of pounds per acre. This process will be repeated until the specified seeding rate is obtained. During the seeding process, the seeding rate will be verified at least once by comparing pounds of seed applied to the size of the area seeded. In addition, seed will be applied in two separate passes. One-half of the seed will be spread in one direction and the other half of seed will be spread in a perpendicular direction. This will ensure that seed distribution across the site is highly uniform and also provide the opportunity to adjust the seeding rate if the specified rate is not being achieved.

D.4 ECOLOGICAL CHARACTERISTICS OF PROPOSED SPECIES AND ESTABLISHED PLANT COMMUNITY

D.4.1 Ecological Characteristics of Plant Species of Tailings Cover System

Important ecological characteristics for each species proposed for reclamation are provided in the paragraphs that follow. Species information was obtained from a number of references that are cited below. The proposed species are adapted to the elevation (5,600 feet), precipitation (13 inches per year on average), and soil textural ranges (loam to sandy clay) that are well within the environmental conditions of the Mill site. Table D.2 presents a summary of the ecological characteristics discussed in the following paragraphs.

Western wheatgrass, variety Arriba (*Pascopyrum smithii*) – Western wheatgrass is a native, rhizomatous, long-lived perennial cool season grass. It grows well in a 10- to 14-inch mean annual precipitation zone and is adapted to a wide range of soil textural classes at elevation ranges up to 9,000 feet. Western wheatgrass has been an important species for restoring mining related disturbances, for erosion control and for critical area stabilization in semi-arid regions because of its ease of establishment and ability to grow successfully in pure or mixed stands of both warm and cool season species. Western wheatgrass is fire tolerant and regenerates readily following burning. The variety of Arriba is known for rapidly establishing seedlings and high seed production. The combination of its ability to spread vegetatively and reproduce by seed ensures long-term sustainability of this species.

Bluebunch wheatgrass, variety Goldar (*Pseudoroegneria spicata*) – Bluebunch wheatgrass is a native, cool season perennial bunch grass. Bluebunch wheatgrass grows on soils that vary in texture, depth and parent material. It is one of the most important and productive grasses found in sagebrush communities in the intermountain west. Bluebunch wheatgrass is fire tolerant and regenerates vegetatively following burning. This species is well adapted to a 12- to 14-inch mean annual precipitation range and is considered to be highly drought resistant. Bluebunch wheatgrass performs well in mixtures with other species and grows at elevations up to 10,000 feet.

Slender wheatgrass, variety San Luis (*Elymus trachycaulus*) – Slender wheatgrass is a native, cool season, perennial bunch grass that occasional produces rhizomes. It is a short-lived species (5 to 10 years) but it reseeds and spreads well by natural seeding, exceeding most other wheatgrasses in this characteristic. Slender wheatgrass can serve as an important pioneer species; its seedlings are vigorous and capable of establishing on harsh sites. In addition, it is able to establish and compete with weedy species. Slender wheatgrass is commonly seeded in mixtures with other grasses and forbs to restore disturbances and rehabilitate native communities. It is adapted to a wide variety of sites and is moderately drought tolerant. It performs best at sites with an annual precipitation of 15 inches or more, but can grow on sites with precipitation levels as low as 13 inches.

Table D.2. Summary of Ecological Characteristics of Plant Species Proposed for the ET Cover at the Mill Site

Species	Origin	Annual or Perennial	Method of Spread	Ease of Establishment[a]	Compatibility with Other Species[a]	Longevity[a]	Annual Precipitation Range (inches)	Elevation Range (feet)	Soil Texture[b]	Rooting Depth (cm)	Soil Stabilization[a]	Drought Tolerance[a]	Fire Tolerance[a]
Western wheatgrass	Native	Perennial	Vegetative	4	3	4	10-14	≤9,000	S,C,L	109[d]	4	4	4
Bluebunch wheatgrass	Native	Perennial	Seed	4	4	4	12-14	≤10,000	S,C,L	122[e]	4	4	4
Slender wheatgrass	Native	Perennial	Seed	4	4	2	13-18	≤10,000	S,C,L	109[d]	2	2	2
Streambank wheatgrass	Native	Perennial	Vegetative	4	4	4	11-18	≤10,000	S,C,L	165[f]	4	4	3
Pubescent wheatgrass	Introduced	Perennial	Vegetative	4	2	4	12-18	≤10,000	S,C,L	185[d]	4	4	3
Indian ricegrass	Native	Perennial	Seed	3	4	4	6-16	≤10,000	S,L	84[g]	2	4	2
Sandberg bluegrass	Native	Perennial	Seed	4	4	4	12-18	≤12,000	S,C,L	45[h]	2	3	4
Sheep fescue	Introduced	Perennial	Seed	4	2	4	10-14	≤11,000	S,C, L	56[e]	3	4	2
Squirreltail	Native	Perennial	Seed	3	4	3	8-15	≤11,000	S,C,L	30[c,i]	2	4	3
Blue grama	Native	Perennial	Vegetative	2	4	4	10-16	≤10,000	S,L	119[g]	4	4	4
Galleta	Native	Perennial	Vegetative	3	4	4	6-18	≤8,000	S,C,L	30[j]	4	4	4
Common yarrow	Native	Perennial	Vegetative	4	3	4	13-18	≤11,000	S,C,L	105[h]	4	3	2
White sage	Native	Perennial	Vegetative	4	4	4	12-18	≥5,000	S,C,L	20[c,i]	3	3	2
Fourwing saltbush	Native	Perennial	Seed	4	4	4	8-14	≤8,000	S,L	600[j]	4	4	1
Rubber rabbitbrush	Native	Perennial	Seed	4	4	4	7-18	≤9,000	S,C,L	150[k]	4	4	1

[a]Key to Ratings—4 = Excellent, 3 = Good, 2 = Fair, 1 = Poor
[b]Soil Texture Codes—S = Sand, C = Clay, L = Loam
[c]Depth represents minimum depth; no information in the literature on average or maximum depth could be found.
[d]Wyatt et al., 1980.
[e]Weaver and Clements, 1938.
[f]Coupland and Johnson, 1965.
[g]Foxx and Tierney, 1987.
[h]Spence, 1937.
[i]USDA, 2012.
[j]Gibbens and Lenz 2001
[k]Monsen et al., 2004.

Streambank wheatgrass, variety Sodar (*Elymus lanceolatus* ssp. *psammophilus*) – Streambank wheatgrass is considered to be part of the thickspike wheatgrass (*Elymus lanceolatus* ssp. *lanceolatus*) taxa. Variety Sodar is a native, perennial sod grass that is highly rhizomatous and adapted to the western intermountain area. It is highly drought tolerant and performs well in mean annual precipitation ranges between 11 and 18 inches. It grows on a wide range of soil textures, from sandy to clayey. Streambank wheatgrass is commonly used in mine land reclamation and is best known for its ability to control erosion and compete with annual weeds. Its highly rhizomatous nature ensures long-term sustainability of this species.

Pubescent wheatgrass, variety Luna (*Thinopyrum intermedium* ssp. *barbulatum*) – Pubescent wheatgrass is a long-lived sod forming perennial introduced from Eurasia. It is highly drought tolerant and grows where the mean annual precipitation is 12 inches or more. It is adapted to a wide range of soil textures, from sand to clay. Pubescent wheatgrass is a highly persistent species, should be seeded at low densities to avoid competition with native species.

Indian ricegrass, variety Paloma (*Achnatherum hymenoides*) – Indian ricegrass is a native, cool season, perennial bunchgrass with a highly fibrous root system. Indian ricegrass is one of the most common grasses on semi-arid lands in the west and is one of the most drought tolerant species used in mine land reclamation. It generally occurs on sandy soils, but is found on soils ranging from sandy to heavy clays. It grows from 2,000 to 10,000 feet in areas where the mean annual precipitation is 6 to 16 inches. Indian ricegrass is slow to establish, but highly persistent once it becomes established.

Sandberg bluegrass, variety Canbar (*Poa secunda*) – Sandberg bluegrass is a native, cool season perennial bunchgrass that is adapted to all soil textures and is highly resistant to fire damage. Sandberg bluegrass is one of the more common early-season bunchgrasses in the Intermountain area. It grows at elevations from 1,000 to 12,000 feet and can be successfully established in areas with a mean annual precipitation of 12 inches or more. Established plants are not overly competitive, and therefore highly compatible with other native species.

Sheep fescue, variety Covar (*Festuca ovina*) – Sheep fescue is a short, mat-forming introduced perennial that grows well on infertile soils in areas with a mean annual precipitation of 10 to 14 inches. It is long-lived and highly drought tolerant. Sheep fescue is a cool season species that greens up early in the spring. The proposed variety, Covar, was introduced from Turkey and is commonly used in mine land reclamation for long-term stabilization and erosion control. This variety was selected because plants are persistent, winter hardy, and drought tolerant.

Squirreltail, variety Toe Jam Creek (*Elymus elymoides*) – Squirreltail is a short-lived perennial that is selected for its ability to establish quickly and to effectively compete with undesirable annual grasses. It grows along an elevation range from 2,000 to 11,000 feet and on all soil textures in mean annual precipitations zones of 8 to 15 inches. Squirreltail is fairly tolerant of fire because of its small size.

Blue grama, variety Hachita (*Bouteloua gracilis*) – Blue grama is a low-growing perennial warm season bunchgrass. Blue grama produces an efficient, widely spreading root system that is mostly concentrated near the soil surface. Blue grama is adapted to a variety of soil types, but does best on well-drained soils and once established, is highly drought tolerant. This species is commonly found with cool-season species and is highly compatible with other native perennials.

Galleta, variety Viva (*Hilaria jamesii*) – Galleta is a strongly rhizomatous perennial warm season grass with a dense, fibrous root system. Galleta grows on sits receiving 6 to 18 inches of annual precipitation with soils ranging from coarse to fine. Plants have a low requirement for soil fertility and are drought and fire tolerant.

Common yarrow (*Achillea millefolium, var. occidentalis*) – Yarrow is a common native forb species that is rhizomatous and found growing from valley bottoms to timberline. It is commonly used in mine land reclamation, establishes easily from seed and is highly persistent. It grows on a variety of soil textures and found in a mean annual precipitation range between 13 and 18 inches. If seed is not available for *Achillea millefolium* var. *occidentalis*, then the introduced *Achillea millefolium* would be used, which has the same growth characteristics as the native form.

White sage, variety Summit (*Artemisia ludoviciana*) – White sage is considered to be a pioneer rhizomatous forb species that establishes quickly on disturbed sites and is highly compatible with perennial grasses. It does best on well-drained soils, but can be found growing on a wide range of soil textures. It is adapted to sites above 5,000 feet in elevation and to sites with a mean annual precipitation above 12 inches.

Fourwing saltbush, variety Wytana (*Atriplex canescens*) – Fourwing saltbush can be deciduous or evergreen, depending on climate. Its much-branched stems are stout and mature plants range from 1 to 8 feet in height, depending on ecotype, the soil, and climate. Fourwing saltbush is one of the most widely distributed and important native shrubs on rangelands in the western United States. Fourwing saltbush is highly palatable browse and is utilized primarily in the winter at which time it is high in carotene and digestible protein. Fourwing saltbush provides excellent season long browse for deer. It is a good browse plant for antelope and elk in fall and winter. It is also a food source and excellent cover for upland birds. Fourwing saltbush has excellent drought tolerance. Fourwing saltbush is adapted to most soils but is best suited to loamy to sandy to gravely soils. It is not especially tolerant of fire, but may re-sprout to some degree if fire intensity is not too severe. Fourwing saltbush occurs most commonly in salt-desert scrub communities in the desert areas of western North America in areas that receive 8 to 14 inches of annual precipitation. It can be found from sea level in Texas to over 8,000 feet in Wyoming.

Rubber rabbitbrush (*Ericameria nauseosus*) – Rubber rabbitbrush is a native, perennial, warm-season shrub that grows to 1 to 8 feet tall. Rubber rabbitbrush is an important browse species for wildlife during the winter months. Rubber rabbitbrush occurs as a dominant to minor component in many plant communities, ranging from arid rangelands to montane openings. It thrives in poor conditions, and can tolerate coarse, alkaline soils. Dense stands are often found on degraded rangelands, along roadsides, and in abandoned agricultural fields. The species is useful in soil stabilization and restoration of disturbed sites. The root system establishes quickly and plants produce large quantities of leaf litter. Rubber rabbitbrush is adapted to cold, dry environments receiving 7 to 18 inches of annual precipitation at elevations ranging from 450 to 8,000 feet. Depending on the ecotype, rubber rabbitbrush can be found on loamy, sandy, gravelly or heavy clay soils that are slightly acidic, slight to strongly basic, or saline.

D.4.2 Longevity and Sustainability

All of the species proposed for reclamation of the tailings cells are long-lived, except for slender wheatgrass (*Elymus trachycaulus*) and squirreltail (*Elymus elymoides*). Slender wheatgrass is a perennial bunchgrass that is short-lived (5 to 10 years) but has the ability to reseed and spread vegetatively with rhizomes. Squirreltail is also a short-lived perennial but has the ability to establish quickly and is highly effective in competing with undesirable annual grasses. Both of these species are included in the proposed seed mixture because of their ability to provide quick cover for erosion protection and to effectively compete with annual and biennial species that cannot be relied upon to provide consistent and sustainable plant cover. The use of these species will facilitate the establishment of the remaining long-lived perennials that have been documented to be highly adapted to the elevation, climate, and soil conditions found at the Mill site (Monsen et al., 2004; Alderson and Sharp, 1994; Wasser, 1982; Thornburg, 1982).

The perennial grasses, forbs, and shrubs in the proposed seed mixture include species that develop individual plants that are long lived (30 years or more) and are able to reproduce either by seed or vegetative plant parts like rhizomes and tillers. The use of these species in reclamation of the tailings cells will ensure a permanent or sustainable plant cover because of the highly adapted nature of these species to site conditions, their tolerance to environmental stresses such as drought, fire, and herbivory, and their ability to effectively reproduce over time.

The use of a mixture of species for the ET cover also contributes to longevity and sustainability. The establishment of a diverse community has many advantages over a monoculture for sustained plant growth. The use of a variety of species ensures that diverse microsites that may exist over a seeded site are properly matched with species that are adapted to those specific environmental conditions. In addition, a mixture of species reverses the loss of plant diversity and enhances natural recovery processes following impacts from insects, disease organisms, and adverse or changes in climatic conditions. Finally, mixtures provide improved ground cover and surface stability, along with reducing weed invasion by fully utilizing plant resources such as water, nutrients, sunlight and space. Weeds in this context are typically annual or biennial plants considered to be undesirable, especially growing where they are not wanted.

D.4.3 Compatibility

Reclamation research and its application have been ongoing in the U.S. since the early 1900s. First with the reseeding of millions of acres following the dust bowl of the 1930s. Then, improvements of large tracts of arid and semi-arid rangelands between the 1960s and 1980s following more than a half a century of rangeland exploitation through overgrazing. In 1985 the U.S. Department of Agriculture Conservation Reserve Program was implemented which resulted in the conversion of more than 40 million acres of marginal farm land to permanent grasslands through an extensive seeding program. Finally, there have been tens of thousands of acres of mined lands reclaimed across the U.S. with the implementation of federal and state rules and regulations governing mine land reclamation. Over this time period, there have been thousands of reclamation publications in the form of books, scientific journal articles, symposium proceedings, and government publications. Many publications have reported on the performance of individual species and mixtures of species under semi-arid conditions similar to southeastern Utah (e.g., Plummer et al., 1968; Monsen et al., 2004). All of this work has led to a knowledge base about species compatibility. Species that are seeded together in mixtures must be compatible as young, developing plants or certain individuals will succeed and others will fail. The species proposed for the ET cover at the Mill site are all compatible with each other and seeding rates will be used to prevent overseeding species that may be aggressive [e.g., pubescent wheatgrass (*Thinopyrum intermedium*)] and could potentially dominate the site (Monsen et al., 2004). These species are commonly seeded together and many studies have shown excellent interspecies compatibility (e.g., DePuit et al., 1978; DePuit, 1982; Redente et al., 1984; Sydnor and Redente, 2000; Newman and Redente, 2001). Finally, to increase compatibility and to reduce competition among seeded species, sites would be broadcast seeded as opposed to drill seeded. According to Monsen et al. (2004), drill seeding causes species in a mixture to be placed in potentially competitive situations, while broadcasted seeds are not placed in as close contact with each other as with drilling and therefore are less likely to be negatively impacted from competition.

D.4.4 Competition

There are two ways to view competition. In the context of establishing an ET cover on the tailings cells, the use of seeded species to compete with weeds is a desirable attribute. However, competition among seeded species with the potential loss of any of these species is undesirable. Therefore, as stated earlier, the proposed seed mixtures is comprised of species that can coexist and also fully utilize plant resources to minimize weed species establishment and excluding seeded species. The establishment of weeds, especially invasives (i.e., non-native species whose introduction causes economic and environmental harm) is unacceptable because of the potential loss of seeded perennial species and the subsequent reduction in species diversity, plant cover, and overall sustainability. Once established, the proposed seed mixture will produce a grass-forb-shrub community of highly adapted and productive species that will effectively compete with undesirable species.

D.4.5 Plant Cover

Monitoring of an alternative cover at the Monticello, Utah, Uranium Mill Tailings Disposal Site showed that the plant cover performed well over a seven year period. Plant cover ranged from 5.5 percent during the first growing season to nearly 46 percent in the seventh growing season (Waugh et al., 2008). Using results from the 2007 vegetation monitoring report (DOE, 2008) the following contributions to relative cover were reported showing that 6 of the 16 species seeded provided 70 percent or more of the cover when cover differences between reclamation zones is averaged: big sagebrush—5 percent to 10 percent; rubber rabbitbrush—5.3 percent to 17 percent; western wheatgrass—38.6 percent; cicer milkvetch—11 percent; thickspike wheatgrass—7.2 percent; and globemallow—0.1 to 0.2 percent.

Approximately 40 percent of the species proposed for the Mill site were seeded at Monticello and of the six best-performing species, three of these species are in the White Mesa mixture (i.e. *Pascopyrum smithii, Elymus lanceolatus,* and *Ericameria nauseosus*). Highly competitive species used at Monticello that are not proposed for White Mesa include three introduced species (i.e. smooth brome, crested wheatgrass, and alfalfa) that were not considered acceptable for the Mill site. Based on these results and the similarity in environmental conditions between Monticello and White Mesa, a plant cover estimate of 40 percent was determined to be a reasonable estimate for a long-term average, while a percent plant cover of 30 percent was assigned as a reduced performance scenario. The percent vegetative cover at White Mesa is expected to be slightly less than what would be found at Monticello because the average annual precipitation at White Mesa is approximately 13 inches compared to 15 inches at Monticello and the average annual maximum/minimum air temperatures are 64/37°F for White Mesa and 59/33°F for Monticello. The slightly greater precipitation and lower temperatures at Monticello are due to its slightly higher elevation of 7,000 feet compared to 5,600 feet at White Mesa.

A map of current vegetation at the Mill site does not exist. The most recent mapping of vegetation at the Mill site was conducted by Dames and Moore in 1977 (Dames and Moore 1978) as part of the Environmental Report for the White Mesa Uranium Project. In 1977, the major mapping units for the project site were: big sagebrush (232 acres), controlled big sagebrush (567 acres), and reseeded grassland (369 acres). In June 2012 the area surrounding the Mill site was surveyed for plant community composition and cover in response to Interrogatory 11/1: Vegetation and Biointrusion Evaluation and Revegetation Plan of DRC (2012). There are two principal plant community types in the vicinity of the Mill site. These plant communities are Big Sagebrush shrubland and Juniper woodland. The Dames and Moore Environmental Report (1978) classified the Juniper woodland as a Pinyon-Juniper community type, but the primary tree species is Utah juniper (*Juniperus osteosperma*) and the presence of pinyon pine (*Pinus edulis*) is so infrequent that the community may be more appropriately classified as a Juniper woodland. In addition to these two principal plant community types, there are a number of disturbed areas that are in different stages of successional development and reflect past disturbances such as sagebrush removal (chaining and plowing) and seeding and intense grazing as evidenced by a complete lack of any understory species in some areas. The vegetation survey conducted in 2012 provides information of species that exist on the Mill site and their relative importance in terms of plant cover. All areas surveyed in 2012 show that big sagebrush (*Artemisia tridentata*) is the dominant species and subdominants are either broom snakeweed (*Gutierrezia sarothroae*) or galleta (*Hilaria jamesii*). If the area were re-mapped, most of the site would map as Big Sagebrush association. It appears that areas that were reseeded to crested wheatgrass and areas where controlled measures were applied to remove big sagebrush have returned to big sagebrush following seeding and/or control measures implemented sometime prior to 1978.

The Big Sagebrush shrubland is dominated by big sagebrush (*Artemisia tridentata*) with interspersed shrubs of broom snakeweed (*Gutierrezia sarothroae*) pale desert-thorn (*Lycium pallidum* var. *pallidum*), and rubber rabbitbrush (*Ericameria nauseosa*). The understory is mostly grasses with an infrequent occurrence of forbs. The grasses include galleta (*Hilaria jamesii*), squirreltail (*Elymus elymoides*), Indian ricegrass (*Achnatherum hymenoides*), and cheatgrass (*Bromus tectorum*). Forb species include scarlet globemallow (*Sphaeralcea coccinea*), lesser rushy milkvetch (*Astragalus convallarius*), and Russian thistle (*Salsola kali*).

The Juniper woodland occurs on shallow soils along the canyon rim to the east and west of the site. It is highly unlikely that this community type would expand its range into the deep, very fine sandy loam soil that occurs on the Mill site, which is the primary soil type supporting the Big Sagebrush shrubland. The vegetation sampling that was conducted in 2012 focused on the Big Sagebrush community and did not include the Juniper woodland because of the unlikely probability that this community type would ever establish on the Mill site or tailings cell cover system. A reconnaissance level survey was conducted in the Juniper community to observe both plant and animal species that occupy these areas.

D.4.6 2012 Plant Survey

The big sagebrush community type within the White Mesa Control Area to the north, south, and west of the restricted area of the mill and tailings facilities was surveyed using randomly placed transects and estimating cover by species using a point intercept sampling method (see Figure D.1). Along each 100 m long transect, live plant cover by species was determined by lowering a pin at 1 meter intervals and recording the plant species or ground cover (litter and bareground) that intersected the point. A total of 10 transects were sampled in each of the areas to the north, south and west of the mill and tailings cells. Table D.3 presents a summary of the vegetation survey conducted in the areas surrounding the mill and tailings cells. Tables D.4 through D.33 present plant cover data by transect for each of the three areas sampled in 2012.

Table D.3. Average Plant and Ground Cover from June 2012 Sampling in Areas Surrounding the Mill Site

Site and Plant Species	% Cover
North of Mill	
o Big sagebrush (*Artemisia tridentata*)	19.1
o Broom snakeweed (*Gutierrezia sarothroae*)	3.9
o Rubber rabbitbrush (*Ericameria nauseosa*).	0.2
o Palm desert-thorn (*Lycium pallidum* var. *pallidum*)	0.1
o Galleta (*Hilaria jaamesii*)	3.6
o Squirreltail (*Elymus elymoides*)	0.1
o Indian ricegrass (*Achnatherum hymenoides*)	0.1
o Cheatgrass (*Bromus tectorum*)	9.5
o Scarlet globemallow (*Sphaeralcea coccinea*)	0.1
o Lesser rushy milkvetch (*Astragalus convallarius*)	0.1
o Russian thistle (*Salsola kali*)	0.6
Total Live Cover	37.4
Total Litter Cover	9.7
Total Bareground	53.1
South of Mill	
o Big sagebrush (*Artemisia tridentata*)	18.3
o Broom snakeweed (*Gutierrezia sarothroae*)	3.0
o Galleta (*Hilaria jaamesii*)	8.5
o Squirreltail (*Elymus elymoides*)	0.3
o Indian ricegrass (*Achnatherum hymenoides*)	0.1
o Cheatgrass (*Bromus tectorum*)	6.7
o Scarlet globemallow (*Sphaeralcea coccinea*)	0.1
o Russian thistle (*Salsola kali*)	1.4
Total Live Cover	38.4
Total Litter Cover	13.4
Total Bareground	48.2
West of Mill	
o Big sagebrush (*Artemisia tridentata*)	20.5
o Broom snakeweed (*Gutierrezia sarothroae*)	4.4
o Pale desert-thorn (*Lycium pallidum* var. *pallidum*)	0.1
o Galleta (*Hilaria jaamesii*)	6.6
o Squirreltail (*Elymus elymoides*)	0.1
o Indian ricegrass (*Achnatherum hymenoides*)	0.1
o Cheatgrass (*Bromus tectorum*)	5.3
o Scarlet globemallow (*Sphaeralcea coccinea*)	0.1
o Russian thistle (*Salsola kali*)	0.8
Total Live Cover	37.9
Total Litter Cover	16.1
Total Bareground	46.0

Results from the 2012 sampling of the Big Sagebrush community surrounding the Mill site showed a mean live plant cover of 37.8 percent after averaging live plant cover estimated in areas north, south and west of the Mill site (Table D.3). This plant cover included an average of 23.1 percent cover for shrubs, 13.7 percent cover for grasses, and 1.0 percent cover for forbs. In addition, the average percent litter was 13.1 percent and bareground averaged 49.1 percent. These cover estimates are somewhat greater than the cover values reported in Dames and Moore Environmental Report (1978). In the Environmental Report, the average live plant cover in the Big Sagebrush community was 33.3 percent. This cover included an average of 19.4 percent for shrubs and 13.8 percent for grasses. Litter was estimated at 16.9 percent and bareground was 49.9 percent. Annual precipitation in 1977 was 23.6 cm compared to a long-term average of 29.7 cm (Dames and Moore 1978). In addition, monthly precipitation during the period May-September 1978 totaled 3.8 cm compared to a long-term average of 12.5 cm for the same period. Considering the fact that the areas sampled are currently grazed, it is highly likely that a cover of 40 percent can be achieved and maintained on the tailings cell cover system for conditions that exclude grazing by livestock. The formation of desert pavement and potential impact on plant cover has been raised as an issue for discussion. Desert pavements are armored surfaces composed of angular or rounded rock fragments, usually 2 to 3 cm thick, set on or in a matrix of finer material (Cooke and Warren, 1973). These surfaces form on arid soils through deflation of fine material by wind or water erosion due to a lack of protection by surface vegetation (Cooke and Warren, 1973). Desert pavements are not common in semi-arid regions and do not occur where either wind or water erosion are controlled by plant cover (Hendricks, 1991), as would be the case for the White Mesa cover system. In addition, there is no evidence of desert pavement formation either on the Mill site or areas surrounding the site (which was confirmed during the 2012 plant survey). Even with the use of a topsoil layer amended with gravel, there is no supporting evidence to indicate a potential for desert pavement formation or an associated decrease in plant cover over the long term.

Table D.4. Plant cover data collected in 2012 north of the Mill site on Transect #1

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	20
Broom snakeweed (*Gutierrezia sarothroae*)	7
Galleta (*Hilaria jaamesii*)	6
Cheatgrass (*Bromus tectorum*)	13
Russian thistle (*Salsola kali*)	1
Litter	8
Bareground	45
Total Live Cover	47

Table D.5. Plant cover data collected in 2012 north of the Mill Site on Transect #2

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	28
Broom snakeweed (*Gutierrezia sarothroae*)	9
Rubber rabbitbrush (*Ericameria nauseosa*).	1
Galleta (*Hilaria jaamesii*)	2
Cheatgrass (*Bromus tectorum*)	8
Scarlet globemallow (*Sphaeralcea coccinea*)	1
Russian thistle (*Salsola kali*)	1
Litter	11
Bareground	39
Total Live Cover	50

Table D.6. Plant cover data collected in 2012 north of the Mill site on Transect #3

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	13
Rubber rabbitbrush (*Ericameria nauseosa*).	1
Galleta (*Hilaria jaamesii*)	6
Cheatgrass (*Bromus tectorum*)	9
Litter	7
Bareground	63
Total Live Cover	30

Table D.7. Plant cover data collected in 2012 north of the Mill site on Transect #4

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	27
Galleta (*Hilaria jaamesii*)	3
Cheatgrass (*Bromus tectorum*)	13
Russian thistle (*Salsola kali*)	2
Litter	8
Bareground	47
Total Live Cover	45

Table D.8. Plant cover data collected in 2012 north of the Mill site on Transect #5

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	31
Broom snakeweed (*Gutierrezia sarothroae*)	8
Indian ricegrass (*Achnatherum hymenoides*)	1
Lesser rushy milkvetch (*Astragalus convallarius*)	1
Russian thistle (*Salsola kali*)	1
Litter	9
Bareground	49
Total Live Cover	42

Table D.9. Plant cover data collected in 2012 north of the Mill site on Transect #6

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	6
Broom snakeweed (*Gutierrezia sarothroae*)	6
Squirreltail (*Elymus elymoides*)	1
Cheatgrass (*Bromus tectorum*)	9
Russian thistle (*Salsola kali*)	1
Litter	6
Bareground	71
Total Live Cover	23

Table D.10. Plant cover data collected in 2012 north of the Mill site on Transect #7

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	8
Broom snakeweed (*Gutierrezia sarothroae*)	6
Galleta (*Hilaria jaamesii*)	4
Cheatgrass (*Bromus tectorum*)	7
Litter	12
Bareground	63
Total Live Cover	25

Table D.11. Plant cover data collected in 2012 north of the Mill site on Transect #8

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	29
Galleta (*Hilaria jaamesii*)	11
Cheatgrass (*Bromus tectorum*)	14
Litter	14
Bareground	32
Total Live Cover	54

Table D.12. Plant cover data collected in 2012 north of the Mill site on Transect #9

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	4
Broom snakeweed (*Gutierrezia sarothroae*)	2
Indian ricegrass (*Achnatherum hymenoides*)	1
Galleta (*Hilaria jaamesii*)	4
Cheatgrass (*Bromus tectorum*)	6
Litter	9
Bareground	74
Total Live Cover	17

Table D.13. Plant cover data collected in 2012 north of the Mill site on Transect #10

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	24
Palm desert-thorn (*Lycium pallidum* var. *pallidum*)	1
Cheatgrass (*Bromus tectorum*)	16
Litter	13
Bareground	46
Total Live Cover	41

Table D.14. Plant cover data collected in 2012 south of the Mill site on Transect #1

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	12
Broom snakeweed (*Gutierrezia sarothroae*)	4
Galleta (*Hilaria jaamesii*)	7
Cheatgrass (*Bromus tectorum*)	12
Russian thistle (*Salsola kali*)	3
Litter	14
Bareground	48
Total Live Cover	38

Table D.15. Plant cover data collected in 2012 south of the Mill site on Transect #2

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	15
Broom snakeweed (*Gutierrezia sarothroae*)	
Galleta (*Hilaria jaamesii*)	17
Cheatgrass (*Bromus tectorum*)	7
Russian thistle (*Salsola kali*)	2
Litter	19
Bareground	40
Total Live Cover	41

Table D.16. Plant cover data collected in 2012 south of the Mill site on Transect #3

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	14
Rubber rabbitbrush (*Ericameria nauseosa*).	7
Galleta (*Hilaria jaamesii*)	8
Scarlet globemallow (*Sphaeralcea coccinea*)	1
Cheatgrass (*Bromus tectorum*)	6
Russian thistle (*Salsola kali*)	2
Litter	16
Bareground	46
Total Live Cover	38

Table D.17. Plant cover data collected in 2012 south of the Mill site on Transect #4

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	28
Galleta (*Hilaria jaamesii*)	4
Indian ricegrass (*Achnatherum hymenoides*)	1
Cheatgrass (*Bromus tectorum*)	1
Russian thistle (*Salsola kali*)	1
Litter	17
Bareground	48
Total Live Cover	35

Table D.18. Plant cover data collected in 2012 south of the Mill site on Transect #5

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	6
Galleta (*Hilaria jaamesii*)	6
Squirreltail (*Elymus elymoides*)	3
Cheatgrass (*Bromus tectorum*)	11
Litter	14
Bareground	60
Total Live Cover	26

Table D.19. Plant cover data collected in 2012 south of the Mill site on Transect #6

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	26
Broom snakeweed (*Gutierrezia sarothroae*)	8
Galleta (*Hilaria jaamesii*)	8
Cheatgrass (*Bromus tectorum*)	5
Litter	8
Bareground	45
Total Live Cover	47

Table D.20. Plant cover data collected in 2012 south of the Mill site on Transect #7

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	23
Cheatgrass (*Bromus tectorum*)	6
Russian thistle (*Salsola kali*)	3
Litter	12
Bareground	56
Total Live Cover	32

Table D.21. Plant cover data collected in 2012 south of the Mill site on Transect #8

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	13
Galleta (*Hilaria jaamesii*)	13
Cheatgrass (*Bromus tectorum*)	11
Russian thistle (*Salsola kali*)	3
Litter	16
Bareground	44
Total Live Cover	40

Table D.22. Plant cover data collected in 2012 south of the Mill site on Transect #9

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	18
Broom snakeweed (*Gutierrezia sarothroae*)	8
Galleta (*Hilaria jaamesii*)	9
Cheatgrass (*Bromus tectorum*)	2
Litter	14
Bareground	49
Total Live Cover	37

Table D.23. Plant cover data collected in 2012 south of the Mill site on Transect #10

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	29
Broom snakeweed (*Gutierrezia sarothroae*)	2
Galleta (*Hilaria jaamesii*)	13
Cheatgrass (*Bromus tectorum*)	6
Litter	4
Bareground	46
Total Live Cover	50

Table D.24. Plant cover data collected in 2012 west of the Mill site on Transect #1

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	26
Broom snakeweed (*Gutierrezia sarothroae*)	6
Galleta (*Hilaria jaamesii*)	4
Cheatgrass (*Bromus tectorum*)	7
Litter	13
Bareground	44
Total Live Cover	43

Table D.25. Plant cover data collected in 2012 west of the Mill site on Transect #2

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	26
Galleta (*Hilaria jaamesii*)	9
Cheatgrass (*Bromus tectorum*)	1
Litter	18
Bareground	46
Total Live Cover	36

Table D.26. Plant cover data collected in 2012 west of the Mill site on Transect #3

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	9
Cheatgrass (*Bromus tectorum*)	11
Litter	23
Bareground	57
Total Live Cover	20

Table D.27 Plant cover data collected in 2012 west of the Mill site on Transect #4

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	33
Broom snakeweed (*Gutierrezia sarothroae*)	13
Galleta (*Hilaria jaamesii*)	7
Scarlet globemallow (*Sphaeralcea coccinea*)	1
Cheatgrass (*Bromus tectorum*)	4
Russian thistle (*Salsola kali*)	4
Litter	9
Bareground	39
Total Live Cover	62

Table D.28. Plant cover data collected in 2012 west of the Mill site on Transect #5

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	29
Galleta (*Hilaria jaamesii*)	6
Squirreltail (*Elymus elymoides*)	1
Cheatgrass (*Bromus tectorum*)	5
Russian thistle (*Salsola kali*)	2
Litter	14
Bareground	43
Total Live Cover	43

Table D.29. Plant cover data collected in 2012 west of the Mill site on Transect #6

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	12
Broom snakeweed (*Gutierrezia sarothroae*)	9
Indian ricegrass (*Achnatherum hymenoides*)	1
Cheatgrass (*Bromus tectorum*)	7
Russian thistle (*Salsola kali*)	2
Litter	17
Bareground	52
Total Live Cover	31

Table D.30. Plant cover data collected in 2012 west of the Mill site on Transect #7

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	14
Broom snakeweed (*Gutierrezia sarothroae*)	4
Galleta (*Hilaria jaamesii*)	14
Palm desert-thorn (*Lycium pallidum* var. *pallidum*)	1
Cheatgrass (*Bromus tectorum*)	6
Litter	14
Bareground	37
Total Live Cover	39

Table D.31. Plant cover data collected in 2012 west of the Mill site on Transect #8

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	22
Broom snakeweed (*Gutierrezia sarothroae*)	7
Cheatgrass (*Bromus tectorum*)	6
Litter	20
Bareground	45
Total Live Cover	35

Table D.32. Plant cover data collected in 2012 west of the Mill site on Transect #9

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	14
Broom snakeweed (*Gutierrezia sarothroae*)	2
Galleta (*Hilaria jaamesii*)	11
Cheatgrass (*Bromus tectorum*)	3
Litter	19
Bareground	51
Total Live Cover	30

Table D.33. Plant cover data collected in 2012 west of the Mill site on Transect #10

Species and Other Cover Categories	Percent Cover
Big sagebrush (*Artemisia tridentata*)	19
Broom snakeweed (*Gutierrezia sarothroae*)	3
Galleta (*Hilaria jaamesii*)	15
Cheatgrass (*Bromus tectorum*)	3
Litter	14
Bareground	46
Total Live Cover	40

D.4.7 Leaf Area Index

Monthly leaf area index (LAI) values were estimated for the proposed ET cover at the Mill site. Three primary publications were used to estimate monthly LAI for the ET cover, including: Groeneveld (1997), Scurlock et al. (2001), and Fang et al. (2008). Table D.34 presents a compilation of LAI values based on North American data sets that were focused on semi-arid herbaceous plant communities. Scurlock et al. (2001) presented mean LAI values for 15 biomes/land cover classes that included desert, grassland, and shrubland. Leaf Area Index data was a compilation of data from the literature and represented various data collection methods. Mean LAI values reported were 1.3 (S.D. 0.85) for desert, 2.6 (S.D. 3.0) for grassland, and 2.1 (S.D. 1.6) for shrubland. Fang et al. (2008) presented LAI data for various biomes using MODIS (Moderate Resolution Imaging Spectroradiometer). These authors reported monthly LAIs for grasslands and shrublands with peak values for shrubland reported at 1.5 and 1.0 for grasslands. Finally, Groeneveld (1997) conducted field measurements of LAI in Owens Valley, CA in 1983. He reported LAI values for individual grass and shrub species and reported the following values in November for big sagebrush and in July for the remaining species: big sagebrush LAI's ranged from 0.65 to 1.8; fourwing saltbush (*Atriplex canescens*) LAI's ranged from 1.2 to 4.7; shadscale saltbush (*Atriplex confertifolia*) LAI's ranged from 1.6 to 2.6; greasewood (*Sarcobatus vermiculatus*) LAI's ranged from 1.0 to 3.3; alkali sacaton (*Sporobolus airoides*) LAI's ranged from 0.38 to 4.0; and saltgrass (*Distichlis spicata*) LAI's ranged from 0.67 to 3.9. All of the data presented in these three papers was used to estimate an average monthly LAI for the revegetated cover system assuming a well-established plant community. A maximum LAI of 2.6 was selected for peak biomass in the month of September which matches the mean grassland LAI reported by Scurlock al. (2001) and well below values reported by Groeneveld (1997). Leaf Area Index values for the remaining months was then extrapolated from the peak month using monthly values presented by Fang et al. (2008). It is important to note that the proposed species for the ET cover include both cool- and warm-season species. This combination of species will maximize the length of the growing season and transpiration from early spring to late fall. Cool-season species are more productive and use more water during the cooler times of the growing season, while warm-season species are more productive and use more water during the warmest period of the year.

Table D.34. Leaf Area Index for the ET Cover at Mill Site

Month											
Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
0	0	0.3	0.7	0.6	0.6	1.8	2.4	2.6	0.8	0.1	0

D.4.8 Project Root Biomass for Infiltration Modeling

We have chosen to use root biomass data from a seeded site in Cheyenne, Wyoming that was seeded in the 1950s with root biomass data collected about 35 years after seeding (Redente et al. 1989). Data were collected as g/m^2 and will not be converted (Table D.35). Infiltration model uses a normalized root density function, so root measurement units are irrelevant. The climatic conditions between Blanding, Utah and Cheyenne, Wyoming are similar with Blanding receiving 34 cm of precipitation and Cheyenne receiving 36 cm. Potential evapotranspiration (PET) at Blanding is 122 cm and 115 cm in Cheyenne. Finally, the precipitation to PET ratio is 0.28 for Blanding and 0.31 for Cheyenne. Table D.35 presents both anticipated root biomass and reduced biomass that is calculated based on a 75 percent reduction in biomass that has been reported in long-term drought studies (Weaver and Albertson 1936).

Table D.35. Projected root biomass data for anticipated and reduced performance for use in infiltration modelling

Depth (cm)	Root Biomass (g/m^2) Anticipated Performance	Root Biomass (g/m^2) Reduced Performance†
0-5	160	64
5-10	140	49
10-20	76	23
20-60	125	32
60-100‡	52	2

†Based on an increasing percent reduction from 60% to 80% with depth, as extended drought or reduced precipitation with potential climate change would result in less deep infiltration and therefore greater negative effect on deeper roots compared to shallower roots. ‡Maximum rooting depth under the reduced performance scenario would be 68 cm.

D.5 BIOINTRUSION

D.5.1 Plant Intrusion

Table D.36 presents percent of root mass by depth for grass and shrub species that exist or may occur on the Mill site during the performance period. It is extremely important to recognize that the rooting depths for the shrubs do not reflect the rooting depths that are expected in the cover system but represent rooting depths reported in the literature with an effort to identify the maximum rooting depths reported. Detailed rooting depth studies are rare and the majority of studies do not report root mass by depth. The shrub values reported in Table D.36 represent extrapolations from the literature using the maximum rooting depths reported and following the general findings in the literature that the majority of root growth typically is in the upper 30 cm for grasses and the upper 60 cm for shrubs growing in semiarid regions. The final note of importance that relates to the cover system is that root growth is strongly influenced by the soil which the root is growing and therefore root data from the literature must be carefully scrutinized as it is applied to specific site conditions (Munshower 1995). The shrub root data shown in Table D.36 should therefore not be interpreted to represent the expected rooting depths in the cover system since rooting depth will be controlled by the highly compacted radon attenuation layer within the cover system.

Soil texture appears to be the most important soil property determining the growth-limiting bulk density of a soil because of the effect of texture on soil pore size and mechanical resistance. A soil with a large amount of fine particles (silt and clay) will have smaller pore diameters and a higher penetration resistance at a lower bulk density than a soil with a large amount of coarse particles (sand size). Zisa et al. (1980) reported a silt loam soil had 19 percent macropore space and a measured penetration resistance of 2.5 bars at a bulk density of 1.4 g/cm^3. A coarser sandy loam soil had 28.9 percent macropore space and a penetration resistance of 1.2 bars at the same bulk density.

Roots grow in soil through large soil pores and by moving soil particles aside when the roots penetrate pores that are smaller than the root tips. When a soil is compacted to a growth-limiting level, most soil pore diameters are substantially smaller than the diameters of growing roots. In this situation, root growth is essentially halted because the roots cannot exert enough pressure to overcome the mechanical resistance and move soil particles. Other pertinent studies that relate root growth and bulk density include articles by Siegel Issem et al. 2005, Mimore and Woollard 1969, and Heilman 1981.

Most, if not all, of the root growth studies cited above that relate root growth to soil compaction and soil bulk density are field studies in native soils that have been in place for centuries or longer. These soils have therefore gone through countless wetting and drying cycles and freeze-thaw cycles and still maintain certain bulk densities that impede root growth.

Table D.36. Percent of root mass by depth for grasses and shrub species that exist or may occur at the Mill site during the performance period of 200 years.

Species	0-30 cm	30-60 cm	60-90 cm	90-120 cm	120-150 cm
Western wheatgrass[a]	65	14	12	9	0
Blue grama[a]	94	4	1	1	0

Species	0-20 cm	20-40 cm	40-60 cm	60-80 cm	80-100 cm	100-200 cm	200-300 cm	300-400 cm	400-500 cm	500-600 cm
Big sagebrush[a]	35	19	17	10	7	8	4	--[f]	--	--
Fourwing saltbush[b]	18	22	15	14	10	8	6	4	2	1
Shadscale[c]	15	20	18	14	12	8	6	4	2	1
Blackbrush[d]	35	50	15	--	--	--	--	--	--	--
Mormon tea[e]	20	35	17	13	10	4	1	--	--	--

[a]Tabler 1964; [b]Gibbens and Lenz 2001; [c]Kearney et al 1960; [d]West 1983; Manning et al. 1990; [e] Gibbens and Lenz 2001;[f]beyond maximum rooting depth reported in the literature

It is important to note that shrub rooting depths reported in the literature do not reflect expected rooting depths in the cover system because of the presence of a highly compacted radon attenuation layer.

D.5.2 Animal Intrusion

The Dames and Moore Environmental Report (1978) included animal surveys for sites surrounding the Mill site. The Environmental Report recorded the presence or possible presence of a number of burrowing species in the Big Sagebrush community, including burrowing owl (*Bubo virginianus*), pocket mouse (*Perognathus* sp.), kangaroo mouse (*Microdipodops* sp.), vole (*Microtus* sp.), desert cottontail (*Sylvilagus audubonii*), coyote (*Canis latrans*), red fox (*Vulpes vulpes*), striped skunk (*Mephitis mephitis*), badger (*Taxidea taxus*), longtail weasel (*Mustela frenata*), and Gunnison prairie dog (*Cynomys gunnisoni*). Additional burrowing animals reported to occur in the Juniper community included pinyon mouse (*Peromyscus truei*) and deer mouse (*Peromyscus maniculatus*). The northern pocket gopher (*Thomomys talpoides*) was not observed in either community type and no mention of the species is made in the 1978 report.

D.5.3 2012 Burrowing Animal Survey

In June 2012 the area surrounding the Mill site was surveyed for burrowing animals in response to Interrogatory 11/1. A total of 100 km of transects were walked in Big Sagebrush and Juniper communities surrounding the Mill Site to determine either the presence of burrowing animals or future colonization based on existing habitat characteristics (see Figure D.2).

Transects were arranged in a systematic manner (at each location in Figure D.2) with a 50 m spacing between transects and transect lengths running between 100 and 400 m, depending upon physiographic features on the landscape. The primary focus of the survey was on three species that would potentially represent the deepest potential for burrows on the tailings cells during the performance period. These species included the badger, Gunnison prairie dog, and northern pocket gopher. Observations were made along each transect for animal sightings, animal presence in the form of tracks, scat or active burrows, burrow densities, and habitat characteristics.

During the animal survey one badger sighting was made and multiple active prairie dog colonies were observed to the north of the mill complex. There appears to be suitable habitat for the northern pocket gopher in the sagebrush communities surrounding the Mill site, but there is no indication that a population of northern pocket gophers occurs in the vicinity of the Mill site. There were no evidence of pocket gophers during surveys associated with the Environmental Report (Dames and Moore, 1978) and no evidence of pocket gophers 34 years later.

An attempt was made to estimate burrow densities for badgers but it was not always possible to confirm a badger burrow. No badger feeding areas (i.e. dug-out prey burrows) were observed along transects that were traversed. The reported burrow density for badgers may or may not be low, depending upon how active badgers are in the area. One of the seminal studies on badger ecology was conducted by Messick and Hornocker (1981) in southwestern Idaho. The authors reported badger densities of 159/50 km^2. This converts to approximately three per 100 hectares. Our survey reported the highest burrow densities at one per 80 to 100 hectares. If each burrow represented more than one individual badger, the densities potentially would be greater. Regardless, the reported burrow densities from the 2012 survey are believed to be a realistic estimate of badger presence at the Mill site.

Within the prairie dog colonies that were located in the area of the Mill site, the greatest burrow density was estimated at 148 burrows per hectare. Over the entire Mill site the prairie dog burrow density ranges from 0 to 148 burrows per hectare. Lupis et al. (2007) reported densities of active burrows in southeastern Utah in the range of 41 to 131/hectare or an average of 75 active burrows per hectare. The burrow densities reported from out 2012 survey are well within the range of a much larger study conducted by Lupis et al. (2007).

Lupis et al. (2007) provide a list of species in grasslands and shrublands in Utah considered primary and secondary habitat for the Gunnison's prairie dog as follows:

> "Perennial and annual Grasslands; or herbaceous dry meadows, including mostly forbs and grasses occurring at 640-2,740 m (2,200-9,000 ft) elevation. Principal perennial grass species include: bluebunch wheatgrass, sandburg bluegrass (Poa secunda), crested wheatgrass (Agropyron cristatum), basin wildrye (Elymus cinereus), galleta (Pleuraphis jamesii), needlegrass (Achnatherum hymenoides), sand dropseed (Sporobolus cryptandrus), blue grama (Bouteloua gracilis), Thurbers needlegrass (Achnatherum thurberianum), western wheatgrass (Pascopyum smithii), squirreltail (Sitanion hystrix), timothy (Phleum spp.), poa (Poa spp.), spike (Trisetum spicatum), Indian ricegrass (Oryzopsis hymenoides), and some sedges (Cyperaceae spp.). Principle annual grass species is cheatgrass (Bromus tectorum). Principal forb species include: yarrow (Achillea millefolium), dandelion (Taraxacum officinale), Richardson's geranium (Geranium richardsonii), penstemon (Penstemon spp.), mulesears (Wyethia amplexicaulis), golden aster (Chrysopsis villosa), arrowleaf balsamroot (Balsamorhiza sagittata), hawkbit (Agoseris pumila), larkspur (Delphinium spp.), and scarlet gilia (Gilia pulchella). Primary associated shrub species include: sagebrush (Artemesia spp.), shadscale (Atriplex confertifolia), greasewood (Sarcobatus spp.), creosote (Larrea tridentate), rabbit brush (Crysothamnus spp.), cinquefoil (Potentilla simplex), snowberry (Symphoricarpos albus), and elderberry (Sambucus spp.). Primary associated tree species is juniper (Juniperus spp.)."
>
> "Shrublands at 670-3,150 m (2,200-10,300 ft) elevation principally dominated by greasewood (Sarcobatus vermiculatus), shadscale, graymolly (Kochia vestita), mat-atriplex (Atriplex corrugata), Castle Valley clover (Atriplex cuneata), winterfat, budsage (Artemisia spinescens), four-wing saltbush (Atriplex canescens), halogeton (Halogeton glomeratus), Mormon tea (Ephedra spp.), horsebrush (Tetradymia canescens), snakeweed and rabbitbrush; or low elevation perennial grassland co-dominate with shrubland. Principal grassland species include: galleta, Indian ricegrass, three-awn grass (Aristida glauca) and sand dropseed. Primary associated forb species include: desert trumpet (Eriogonum inflatum). Primary associated shrub species include: sagebrush, and black brush (Coleogyne ramosissima); other associated species include seepweed (Suaeda torreyana)."

Based on the report by Lupis et al. (2007) we agree that the habitat that will be created at the Mill site following revegetation will include species consistent with prairie dog occupation.

Table D.37 presents an updated assessment of maximum burrow depths for animal species that may occur on the Mill site. Based on a review of literature for burrow depths, the species that have the potential for the deepest burrows are badger (228 cm), northern pocket gopher (150 cm), and Gunnison prairie dog (427 cm). As discussed above, both the badger and Gunnison prairie dog were observed during the 2012 animal survey, while there is no evidence that the northern pocket gopher occurs in the vicinity of the Mill site from both the 1978 and 2012 surveys.

The proposed cover system is a monolithic evapotranspiration (ET) cover that consists of the following layers from top to bottom: 15 cm of a topsoil-gravel erosion protection layer over 107 cm of a water storage, biointrusion and radon attenuation layer over 75 cm of a highly compacted radon attenuation layer over 75 cm of a grading and radon attenuation layer. The proposed cover system does not contain a biobarrier (e.g. cobble layer) to minimize potential intrusion by burrowing animals. The proposed cover system is designed to minimize burrowing animal intrusion through the use of thick layers of soil cover in combination with a highly compacted layer placed at a depth that is below the expected burrowing depths among species that may inhabit the site. The thickness of the cover (total of 272 cm), the use of a highly compacted radon attenuation layer located at a depth between 122 and 197 cm, and a final 75 cm layer below the compacted zone will all contribute to minimizing any biointrusion through the cover. Considering the animal species that may inhabit the tailings cells and the thickness and physical nature of the cover, it is not anticipated that burrowing will extend below 122 cm or into the very top portion of the highly compacted zone. Burrowing into the highly compacted radon attenuation layer that begins at a depth of 122 cm will be restricted because of the high density of this material (95 percent Standard Proctor).

Table D.37. Range of maximum burrow depths for wildlife that inhabit or may inhabit the Mill site during the required performance period of at least 200 years

Species	Maximum Depth (cm)	Source
Pocket mouse	52 to 62 35-153	Kenagy 1973; Scheriber 1978
Pinyon mouse	34	Reynolds and Wakkinen 1987
Deer mouse	13-50	Reynolds and Laundre 1988; Kritzman 1974
Kangaroo rat	24-61 20-69	Reynolds and Wakkinen 1987; Anderson and Allred 1964
Vole	15-55	Reynolds and Wakkinen 1987
Desert cottontail	Abandoned burrows and surface nest	Wilson and Reeder 2005; Chapman and Willner 1978
Long-tailed weasel	Abandoned burrows and surface nest	Feldhammer et al. 2003
Striped Skunk	90	Jackson 1961
Badger	150 to 228	Lindsey 1976; Anderson and Johns 1977
Gunnison prairie dog	30 to 427 69 to 185 68 to 82	Verdolin et al. 2008; Sheets et al 1971; Whitehead 1927
Red fox	100 to 130	Feldhammer et al. 2003; Saunders 1988
Coyote	Most common behavior is to use burrows of other animals like the badger	http://carnivora.com/topic/932884/1/
Burrowing owl	Abandoned burrows	Haug et al. 1993
Northern Pocket Gopher	10 to 30 150	Winsor and Whicker 1980; Gettinger 1975; Felthauser and McInroy 1983

D.6 SOIL REQUIREMENTS FOR SUSTAINABLE PLANT GROWTH

There are two key components to establishing an ET cover with a sustainable plant community. The first is to select long-lived species that are adapted to the environmental conditions of the site. The second is to provide a cover soil that will function as an effective plant growth medium over the long term by supplying plants with adequate amounts of water, nutrients and rooting volume.

There are a number of soil characteristics that are particularly important to achieve long-term sustainability in semi-arid environments and include the following: pH, electrical conductivity (EC), sodium levels, percent organic matter, texture, bulk density, cation exchange capacity, macronutrient concentrations, available water holding capacity, and soil microorganisms. Table D.38 presents levels for most of these soil properties that are considered necessary for long-term sustained plant growth. In addition, the table includes soil property levels from soil samples of potential cover soil collected from stock piles at the Mill site in May 2009.

The soil properties of the potential cover soil that are acceptable for sustaining long-term plant growth include: pH, EC, sodium adsorption ratio (SAR), percent clay content, and extractable phosphorus. Those soil properties that appear to be deficient and would need improvement include: percent organic matter, total nitrogen, and extractable potassium.

Cation exchange capacity was not measured in the potential cover soil, but it is believed that the cover soil will have an acceptable level for sustained plant growth based on the percent clay content and a recommendation that an organic matter amendment be added to the soil during the reclamation process. Bulk density of the emplaced cover material will be specified in the cover design and will be controlled during the construction process to be within the sustainability range shown in Table D.38.

Table D-38. Soil Properties and Their Range of Values Important for Sustainable Plant Growth, Along with Analytical Results of Soil Available for ET Cover Construction at the Mill Site

Soil Property	Level for Sustainability	Reference	Levels for On-Site Soil
pH (units)	6.6 to 8.4	Munshower (1994)	7.7 to 8.1
EC (mmhos/cm)	≤4.0	Munshower (1994)	<1.5
Sodium adsorption ratio	≤12	Munshower (1994)	<0.5
Organic matter (%)	1.0 to 3.0	Smith et al. (1987)	0 to 0.4
Texture (%)	> 50% silt and clay	Brady (1974)	> 50% silt and clay
Bulk density (g/cm^3)	1.2 to 1.8	Brady (1974)	1.59 to 1.99†
Water holding capacity (cm H_2O/cm soil)	0.08 to 0.16	Brady (1974)	0.084-0.14†
Cation exchange capacity (meq/100g)	5 to 30	Munshower (1994)	Not measured
Total nitrogen (%)	0.05 to 0.5	Harding (1954)	0.02 to 0.05
Extractable phosphorus (mg/kg)	6 to 11	Ludwick and Rogers (1976)	10 to 57
Extractable potassium (mg/kg)	60 to 120	Ludwick and Rogers (1976)	11 to 36

†Calculated values

In order for the potential cover soil to function as a normal soil and provide long-term sustainable support for the vegetation component of the ET cover, it will be amended to improve organic matter content, nitrogen and potassium levels. An organic matter amendment will also improve available water holding capacity and cation exchange capacity. The proposed organic amendment is composted biosolids. Composted biosolids have been successfully used in mined land reclamation over the past 40 years. This amendment would also provide a source of soil microorganisms that will function to cycle nutrients over time and ensure sustainable plant growth. Composted biosolids would be applied at a rate of 10 tons/acre and incorporated into the upper six inches of the water storage layer of the cover system. Composted biosolids are also a source of nitrogen, phosphorous and potassium and will serve to improve organic matter content and soil fertility. The following discussion provides the rationale for selecting composted biosolids as the amendment of choice for the cover soil.

<u>Type of Amendment, Application Rates, and Costs</u> – There are three possible soil amendments that would be a source of organic matter and nutrients for sustained plant growth. These amendments include composted biosolids, a combination of manure and hay, or a commercial organic fertilizer such as Biosol®. Biosol® is a highly effective organic amendment but would be cost prohibitive if the objective is to achieve 1 percent organic matter content in the soil. It would require the addition of at least 10 tons/acre to meet this organic matter target and the cost would be approximately $12,300/acre, which includes a product cost of $12,000/acre, transportation cost of $100/acre, and an application cost of $200/acre. Composted biosolids would be equally effective as Biosol®, but much less expensive. Composting of biosolids is a proven method for pathogen reduction and results in a product that is easy to handle, store, and use. The end product is usually a Class A, humus-like material without detectable levels of pathogens that can be applied as a soil amendment. Composted biosolids provide large quantities of organic matter and nutrients (such as nitrogen and phosphorus) to the soil, improves soil texture, and elevates soil exchange capacity. If composted biosolids were obtained from Farmington, NM (which appears at this time to be the closest source), the cost for a 10 ton/acre application rate would be $1,530/acre, which includes $260/acre for product cost, $1,070/acre for transportation, and $200/acre for application. The use of manure and hay would be the least effective amendment because both products have the potential of adding unwanted weed seed to the cover vegetation and manure is relatively high in nitrogen and if not properly off set with hay, there is a potential of having excessive nitrogen introduced into the cover system that would also lead to a proliferation of unwanted weeds.

<u>Method of Application</u> – Composted biosolids are produced by mixing biosolids (treated sewage sludge) and wood waste material. Composted biosolids are easy to apply and would be broadcast over the soil surface using a commercial manure spreader and the amendment would then be incorporated with a chisel plow or disc plow.

<u>Limitations of Soil Amendments</u> – Composted biosolids have few limitations as a soil amendment. Composted biosolids are often low in readily available nitrogen, but have high organic nitrogen levels that can be slowly released for plant use over time. The EPA has established rules for the land application of biosolids that address concerns about possible pathogen transmittal, nitrate pollution, and trace metal contamination (EPA, 1993 and 1995). In order to be land applied, a particular biosolid must have undergone a pathogen reduction process, must contain less than a specified amount of bacterial pathogens, and must meet limits for heavy metal concentration.

Considerable research has been conducted over the past 40 years on the interactions between biosolids, soil properties, plant growth and environmental quality. Amendment of disturbed soils with composted biosolids has been shown to increase soil organic matter, cation exchange capacity, soil nutrient levels, microbial biomass and activity, water holding capacity, and aggregate stability, and also to reduce soil bulk density and metal availability for plant uptake. The potential for successful reclamation with composted biosolids is tremendous and most of the highly beneficial properties of composted biosolids as a soil amendment come from its high organic matter content (Sopper, 1993). The use of composted biosolids is extremely important where topsoil is inadequate in amount or quality (Sopper, 1993; Munshower, 1994).

The application of composted biosolids on disturbed land generally has had a very beneficial effect on the establishment and growth of grasses and forbs (Sopper, 1993; Haering et al., 2000). It facilitates rapid establishment and vigorous growth of herbaceous plants. Sites treated with composted biosolids generally have a greater percent cover, greater aboveground production, and better developed root systems compared to non-amended sites or sites treated with just inorganic fertilizers (Sopper, 1993; Haering et al., 2000). The use of composted biosolids also aids in the establishment and growth of shrubs. Annual height and diameter growth is improved with composted biosolids and overall woody plant survival is increased if competition from herbaceous plants is not an issue (Sopper, 1993; Haering et al., 2000).

Field studies at the Climax Molybdenum Mine near Leadville, Colorado conducted by Carlson et al. (2006) examined the effect of composted biosolids on tailings reclamation over a seven-year period. The findings of this study were that composted biosolids are an effective means of establishing soil microbe and vegetation communities on tailings. The authors concluded that: over seven years and in extreme growing conditions, biosolid amendments reduced soil toxicity [by immobilizing heavy metals], neutralized acidity, and introduced constituents [e.g. nutrients and soil microbes] necessary to sustain vegetation communities on tailings capped with overburden material.

In a very long-term study conducted by Paschke et al. (2005) the effect of biosolids amendments were assessed on disturbances in a sagebrush community in northwestern Colorado. The authors reported that 24 years after biosolids were applied on fertile and infertile soil material that: "… biosolids amendments have long-lasting effects on soil fertility and plant community composition…"

The greatest limitation for the use of composted biosolids at the Mill site will be availability of the product. Availability varies over time depending upon supply and demand. Since the Mill site is in a remote location, sources of composted biosolids in the quantities needed for tailing cell reclamation are limited and advanced planning will be required to secure the quantities needed when the cover system is being constructed.

D.7 WEED MANAGEMENT

Weed management would be conducted on the Mill site by identifying the presence of any noxious weeds during annual vegetation surveys and developing a weed control plan that is specific to the species that are present (Table D.39). Noxious weed control is species dependent and both method and timing will vary from species to species.

Each survey will identify noxious weed populations and locate these populations on a map using a set of symbols to identify species, size of the infestation, and density of the population. The effectiveness of control methods will also be documented in each annual survey. In addition, immediately adjacent off-site properties will be visually surveyed to a distance of 100 feet. Inspections will be conducted by personnel familiar with the identification of noxious weeds in the area and based on Utah's Noxious Weed List.

The selected control methods will be based on the type, size, and location of the mapped noxious weeds. The treated area(s) will be monitored and re-inspected annually for new weed introductions and to evaluate the success of the control methods. Prevention is the highest priority weed management practice on non-infested lands; therefore protecting weed-free plant communities is the most economical and efficient land management practice. Prevention is best accomplished by ensuring that new weed species seed or vegetative reproductive plant parts of weeds are not introduced into new areas, and by early detection of any new weed species before they begin to spread.

Control methods may include chemical or mechanical approaches. The optimum method or methods for weed management will vary depending on a number of site-specific variables such as associated vegetation, weed type, stage of growth, and severity of the weed infestation.

Table D.39. Noxious Weed Species

Scientific Name	Common Name
Utah State—Listed Noxious Weeds	
Acroptilon repens	Russian knapweed
Cardaria spp.	Whitetop (all species)
Carduus nutans	Musk thistle
Centaurea diffusa	Diffuse knapweed
Centaurea solstitialis	Yellow star thistle
Centaurea stoebe ssp. micranthos	Spotted knapweed
Centaurea virgate ssp. Squarrosa	Squarrose knapweed
Cirsium arvense	Canada thistle
Convolvulus spp.	Bindweed (all species)
Cynodon dactylon	Bermuda grass
Elymus repens	Quackgrass
Euphorbia esula	Leafy spurge
Isatis tinctoria	Dyer's woad
Lepidium latifolium	Broadleaf pepperweed
Lythrum salicaria	Purple loosestrife
Onopordum acanthium	Scotch thistle
Sorghum almum	Perennial sorghum (all species)
Taeniatherum caput-medusae	Medusahead
San Juan County—Listed Noxious Weeds	
Aegilops cylindrical	Jointed goatgrass
Alhagi maurorum	Camelthorn
Asclepias subverticillata	Western whorled milkweed
Solanum elaeegnifolium	Silverleaf nightshade
Solanum rostratum	Buffalobur

<u>Chemical Control</u>
Chemical control consists mostly of selective and non-selective herbicides. Considerations for chemical controls include: herbicide selection, timing of application, target weed, desirable plant species being grown or that will be planted, number of applications per year and number of years a particular species will need to be treated for desired control. Also important are the health and safety factors involved, and the need to consider undesirable impacts. The use of herbicides will be in compliance with all Federal and State laws on proper use, storage, and disposal. The chemical application will be done by a licensed contractor in accordance with all applicable laws and regulations and all label instructions will be strictly followed. Applications of herbicides would

not be permitted when the instructions on the herbicide label indicate conditions that are not optimal.

Mechanical Control
Mechanical control is the physical removal of weeds from the soil and includes tilling, mowing, and pulling undesirable plant species. Tillage is most effective prior to seeding and establishment of desirable vegetation. The tillage method of weed control can be effective in eliminating noxious perennial weeds when repeated at short intervals (every 1-2 weeks) throughout the growing season. Tillage has the drawback of indiscriminately impacting all vegetation interspersed with weeds in established areas and can eliminate competitive, desirable vegetation leaving behind a prime seedbed for weeds to reinvade. Mowing can be an effective method for controlling the spread of an infestation and preventing the formation and dispersal of seeds. Mowing is most effective on weeds which spread solely or primarily by seed. In order to achieve this, it must be repeated at least twice during the growing season prior to, or shortly after bloom. Also, even the most intense mowing treatment will not kill hardy perennial weeds. Additional considerations will be made when selecting control treatments when specific situations arise regarding type, size, and location of weed infestations. Examples of this are perennial versus biennial, broadleaf versus grasses, noxious weeds interspersed with desirable vegetation, large monoculture patches, or small patches requiring spot treatment.

Treatment windows schedules, based on the control methods chosen and the noxious weeds present, will be established for each treatment area. The best time to treat perennial noxious weeds is in the spring or fall during their active growth phase. Different species will have different optimum treatment times even with the same type of control. Perennial weeds usually grow vegetatively in the spring, flower and seed in late spring and early summer, enter dormancy during the summer and actively grow again in the fall. The treatment windows selected will depend on the species present and control methods selected.

The final preparatory step is to determine the priority for areas to be treated. Prioritization ensures that the most important areas are dealt with at the most effective times. Important areas of concern include areas that may transport weed seeds. These areas include ditches, roadsides, and land equipment storage sites. Large monoculture patches are of concern wherever they occur and would always be high priority. Also, small patches of weeds would be treated to prevent expansion of weed populations.

Once the treatment plan is implemented, detailed records will be kept, and success or failure of treatment will be recorded so as to eliminate unsuccessful treatments.

D.8 REVEGETATION ACCEPTANCE GOALS/CRITERIA AND MONITORING

The following Revegetation Acceptance Goals/Criteria have been adapted from the Monticello Site and would be used at the Mill site to determine reclamation success.

Criterion 1 Species Composition

a. The vegetative cover (the percentage of ground surface covered by live plants) shall be composed of a minimum of five perennial grass species (at least four listed as native), one perennial forb and two shrub species listed in Table D.1.

Criterion 2 Vegetative Cover

a. Attain a minimum vegetative cover percentages of 40 percent.

b. Individual grass and forb species listed in Table D.1 that are used to achieve the cover criteria shall have a minimum relative cover (the cover of a plant species expressed as a percentage of total vegetative cover) of 4 percent and a maximum relative cover of 40 percent.

c. Individual species not listed in Table D.1 may be accepted as part of the cover criteria if it is demonstrated that the species is native or adapted to the area and is a desirable component of the reclaimed project site.

d. Species not listed in Table D.1, including annual weeds or other undesirable species shall not count toward the minimum vegetative cover requirement. Every attempt should be made to minimize establishment of all non-noxious weeds.

e. Reclaimed areas shall be free of state- and county-listed noxious weeds (Table D.40).

f. The vegetative cover shall be self-regenerating and permanent. Self-regeneration shall be demonstrated by evidence of reproduction, such as tillers and seed production.

Criterion 3 Shrub Density

a. A minimum shrub density of 500 stems per acre

b. Shrubs shall be healthy and have survived at least two complete growing seasons before being evaluated against success criteria

Monitoring

Plant cover would be measured annually on the tailing cells for a minimum of ten years or until the revegetation goals stated above are achieved. Cover would be measured by the point method, using a vegetation sighting scope mounted on an adjustable tripod with a level (or similar instrument). Cover would be measured for each species encountered, as well as litter, rock, and bareground. Cover measurements would be made along a minimum of ten randomly placed transects on each tailing cell that are 100 feet long. A total of 100 points would be sited at one-foot intervals along each transect to collect cover data in the categories of live vegetation, litter, rock, and bareground. Sample adequacy would be determined for each tailing cell using the following formula that identifies the minimum number of samples that are necessary to estimate the population mean at a 90 percent level of confidence. Total live vegetation cover would be used to calculate sample adequacy.

$$n = \frac{t^2 s^2}{(.10x)^2}$$

Where: n = minimum number of samples required to meet sample

adequacy requirements
s^2 = variance
t^2 = 1.64 for 90% confidence
x = sample mean

Shrub density would be measured in belt transects placed on either side of the cover transects. All shrubs would be counted within a three-foot wide strip or belt transect along each side of the transect used for point cover measurements, resulting in a belt transect that is six-feet wide and 100 feet long.

In addition to the above cover sampling, annual observations would be made of overall plant community health and sustainability. Overall health would be based on plant vigor, presence of annual weeds, and signs of plant deficiencies or toxicities. Plant community sustainability would be based on observations of reproduction, including both vegetative reproduction, such as tillering, and seed production.

If revegetated areas are not making satisfactory progress in meeting revegetation goals outlined above, then remedial actions will be implemented as needed. These actions may include fertilization/soil amendments, reseeding, weed control, and/or erosion control depending upon the cause of the problem that may exist and the best remediation approach to ensure plant community success. Potential revegetation problems that are most likely to occur based on typical revegetation projects in the semiarid west and on experiences at the Monticello Site fall into two categories. The first is poor initial plant establishment following revegetation practices and the second is poor plant growth during post-revegetation management. Poor initial plant establishment can be caused by a number of factors including unfavorable soil conditions related to texture or soil chemistry, improper seedbed preparation, improper seeding techniques, improper species selection, poor seed quality, planting in the wrong season, seed predation, and inadequate precipitation. If revegetation at the Mill site results in unacceptable initial plant establishment, the cause of this response will be investigated, the identified cause will be corrected, and the necessary revegetation practices will be applied until successful plant establishment has occurred. The most likely cause of poor initial plant establishment at the Mill site would be low precipitation and additional seedings would be required in a subsequent year(s) until precipitation improves and an adequate stand of vegetation is achieved. Additional mulching to control erosion and improve soil moisture conditions for seed germination and initial seedling growth would be part of the remedial process. Poor plant growth during post-revegetation management has been an issue at the Monticello Site as it relates to shrub establishment. The primary species that has been an issue is big sagebrush and the cause of the problem has been seedling damage associated with vole herbivory.

D.9 SUSTAINABILITY OF THE COVER DESIGN

D.9.1 CLIMATE CHANGE

Climate, more than any other factor, controls the broadscale distributions of plant species and vegetation. At finer scales, other factors such as local environmental conditions including soil nutrient status, pH, water-holding capacity and the physical elements of aspect or slope influence the potential presence or absence of a species. However, intra- and inter-specific interactions, such as competition for resources (light, water, nutrients), ultimately determine whether an individual plant is actually found at any particular location (Sykes 2009). Rapid climate change associated with increasing greenhouse gas emissions (IPCC 2007) influences current and future vegetation patterns. Other human-influenced factors are, however, also involved. Sala et al. (1997) identified five different drivers of change that can be expected to affect global biodiversity over the next 100 years. Globally, land use change was considered the most important driver of change, followed by climate change, airborne nitrogen deposition, biotic interactions (invasive species) and direct CO_2 fertilizing or water use efficiency effects.

Predicted changes in climate that may occur in the southwestern U.S. include increased atmospheric concentrations of CO_2, increased surface temperatures, changes in the amount, seasonality, and distribution of precipitation, more frequent climatic extremes, and a greater variability in climate patterns. Recent temperature increases have made the current drought in the region more severe than the natural droughts of the last several centuries. This drought has caused substantial die-off of pinyon pine trees in approximately 4,600 square miles of pinyon-juniper woodland in the Four Corners region (Breshears et al. 2005). Williams et al. (2010) examined correlations between climate and the radial growth of trees across North America. They show that conifer trees in the southwest are particularly sensitive to temperature and aridity relative to other regions. They used climate-tree growth relations calculated for the past 100 years, combined with Intergovernmental Panel on Climate Change (IPCC) climate model estimates for the 21st century to predict the likely fate of important southwest tree species such as pinyon pine. They concluded that woodlands and forests will experience substantially reduced growth rates and increase mortality at many southwest sites as the century progresses.

The specific physiological effects of increasing GHG emissions (particularly CO_2) on vegetation include increased net photosynthesis, reduced photorespiration, changes in dark respiration, and reduced stomatal conductance which decreases transpiration and increases water use efficiency (Patterson and Flint 1990). Ambient temperature affects plants directly and indirectly at each stage of their life cycle (Morison and Lawlor 1999). Water (i.e. soil moisture) is usually the abiotic factor most limiting to vegetation, especially in arid and semi-arid regions. Carbon dioxide, temperature, and soil moisture effects on plant physiology are exhibited at the whole-plant level in terms of growth and resource acquisition. In addition to the individual effects of increasing temperatures, CO_2 is the additional interactive effect on photosynthetic productivity and ecosystem-level process (Long and Hutchin 1991).

Plants are finely tuned to the seasonality of their environment, and shifts in the timing of plant activity (i.e. phenology) provide some of the most compelling evidence that species and ecosystems are being influenced by global environmental change (Cleland et al. 2007). Changes in the phenology of plants have been noted in recent decades in regions around the world (Bradley et al. 1999; Fitter and Fitter 2002; Walther et al. 2002; Parmesan and Yohe 2003). Phenology of plant species is important both at the individual and population levels. Specific timing is crucial to optimal seed set for individuals and populations; and variation among species in their phenology is an important mechanism for maintaining species coexistence in diverse plant communities by reducing competition for pollinators and other resources. Global climate change could significantly alter plant phenology because temperature influences the timing of development, both alone and through interactions with other cues, such as photoperiod.

Shifts in the relative competitive ability of plants that experience changes in CO_2, surface temperatures, or soil moisture may result in changes to their spatial distribution (Long and Hutchin 1991; Neilson and Marks 1994). Increases in temperature may enhance the competitive ability of C_4 plants (such as grasses) relative to C_3 plants (shrubs and trees) (Owensby et al. 1999), especially where soil moisture (Neilson 1993) or temperature (Esser 1992) is limiting.

There are numerous uncertainties and complexities associated with the use of all regional climate models with regard to their ability to reliably forecast longer-term future climate conditions in the North American South West (NASW) and at the Mill site. Therefore, attempts to extend the results from climate model predictions forecasting climate conditions through the end of the 21st century to timeframes of 200 to 1,000 years will likely result in further compounding of these uncertainties and result in unreliable predictions. We identified this concern in earlier discussions presented on the topic of climate change.

We have reviewed references cited in the Division's Rd 1 Interrogatories for White Mesa Revised ICTM Report on estimating the range of future climates (CNRWA 2005; NRC 2003; NRC 1997). The Center for Nuclear Waste Regulatory Analyses (CNRWA 2005) conducted an analysis of factors contributing to uncertainty in estimating future climates at Yucca Mountain. Their report concludes the following:

> "In summary, research performed within the last five years suggests that the timing of climate changes over the next 100,000 years may be difficult to infer from the patterns of climate change over the last 500,000 years due to the unusually low eccentricity of Earth's orbit and, possibly, the influence of anthropogenic greenhouses gases. After 100,000 years, the Earth's orbital climate forcing will be stronger, and the influence of greenhouse gases may have diminished so that the Pleistocene climate history may offer a better analog in terms of timing of climate changes. In terms of the characteristics of future climates (i.e., mean annual precipitation and temperature, seasonal weather patterns, and storm intensities), the characteristics inferred from paleoclimate reconstructions and present day analog records may represent the range of climate conditions that will occur in the future, even if the timing of these climates cannot be reliably estimated. The greatest uncertainty in future climate conditions relates to anthropogenic effects that may result in climates in southern Nevada that do not have analogs with present or Pleistocene climates, such as prolonged El Niño conditions. The nature, likelihood, and duration of such nonrepresentative climate conditions cannot be reliably assessed based on current research. Over longer time periods, the range of conditions inferred from the Pleistocene paleoclimate record reasonably bounds future climate during the period of geologic stability."

We agree with NRC's preferred approach of using paleoclimate data to estimate the likely range of future conditions. In fact, in our previous discussion of climate change in Attachment G (EFRI, 2012), we discussed the paleoclimate approach presented by Waugh and Petersen (1994) for the Monticello site.

Waugh and Petersen (1994) summarize future climate change as follows:

> "Global mean temperature may increase by 1.8 to 5.2°C in the next century, in response to an industrial age buildup of carbon dioxide (CO_2), methane, and other gases (Houghton et al. 1992). Model projections of the magnitude of warming vary, depending on whether factors such as CO_2 fertilization, feedback from stratospheric ozone depletion, and the radiative effects of sulfate aerosols are taken into account. Model projections of precipitation responses to greenhouse warming also are inconsistent (Houghton et al. 1990; Crowley and North 1991; Washington and Meehl 1984; Wilson and Mitchell 1987; Schlesinger and Mitchell 1987). Some regions may be effectively wetter and others drier, depending on the balance of the greater potential evaporation and the greater water-holding capacity of a warmer atmosphere. Greenhouse warming may eventually be overwhelmed as the earth plunges into another ice age. Models of cyclic astronomical

forcing of climate agree that, without anthropogenic disturbances, a long-term cooling trend that started about 6,000 years ago will continue, climaxing with a major glaciation in about 60,000 years (Imbrie and Imbrie 1980; Berger et al. 1991). In contrast, aperiodicity in the timing of past ice ages is evident in oxygen isotope records (Winograd et al. 1992). Other paleorecords suggest that certain feedback mechanisms have caused rapid and unpredictable transitions into ice ages (Berger and Labeyrie 1987; Phillips et al. 1990)."

Waugh and Petersen (1994) concluded from their investigation that despite uncertainty about drivers of future climate change, climate extremes in the next 1,000 years likely will not exceed those associated with the last glacial and interglacial periods. Therefore, paleo-records of full glacial and Altithermal climates in the Four Corners region provide reasonable ranges of possible future climate and should be incorporated in assessments of the long-term performance of tailings disposal facilities. For Monticello, Utah, full glacial and Altithermal climate reconstructions provide working levels of 2 to 10^{o} C mean annual temperature and 38 to 80 cm mean annual precipitation. If we assume that a similar range of temperature and precipitation could also occur at the Mill site, then during the next glacial phase anticipated to occur approximately 60,000 years into the future the climate would be a colder and wetter compared to current conditions, and if conditions post-glaciation result in a warm period the climate would be warmer and wetter than current conditions.

Table D.41 presents a list of possible climate scenarios for the Mill site, their likelihood of occurrence and the resulting plant community type that would develop during the required performance period. From the review of climate change literature applicable to the southwest U.S. and an analysis of the impact of various climate change scenarios, it is our conclusion that the most likely plant community type that will be maintained throughout the 200- to 1,000-year performance period is a community dominated initially by cool season grasses, with a long-term transition to dominance by warm season grasses and shrubs as atmospheric CO_2 and temperature continues to increase and precipitation ether increases or decreases.

D.7.2 Plant Community Succession and Potential for Species Colonization

Plant succession is the ecological process of directional vegetation change over time, usually beginning with relatively-short lived herbaceous plants and culminating in plant communities dominated by long-lived, generally woody species. Succession occurs on all sites. The rate of succession can be relatively rapid, especially in regions of higher rainfall, or it can be very slow, as in some desert and arctic regions, but this process of vegetation change is constantly taking place.

Two common aspects of succession are 1) an increase in vegetation structure and 2) an increase in the relative amounts of woody plants. Both of these aspects have profound implications to the function of cover systems. Vegetation structure refers to the shape of the vegetation, e.g., height, coverage, and stratification. Structure increases as succession proceeds, both above- and belowground. Aboveground, the height of the vegetation increases (e.g., grasses may be replaced by shrubs), coverage of the soil surface increases, and layering (strata) of vegetation occurs, with different species occupying different vertical layers. Similar processes occur belowground. Root systems become deeper as shallow-rooted species are replaced by deeper-rooted species, root biomass increases in lower soil depths as the number and types of species increase, and the density of the root system increases in the various layers.

Table D.40. Possible Climate Scenarios for the Mill Site, Likelihood of Occurrence and Projected Change in Plant Species Composition Compared to the Initial Grass/forb Community Established on the Soil Cover

Possible Climate Scenarios	Likelihood of Occurence[9]	Projected Plant Community Type in 1,000 Years with Seeded Grass/Forb as the Initial Community
Warmer and Dryer than Present[1]	Highly Likely	Grass/forb community with an increase in warm season species.
Warmer and Wetter than Present[2]	Highly Likely	Will depend on distribution of additional precipitation. If more precipitation in winter months, then the plant community would experience an increase in woody plants; if more precipitation in the summer months, then the plant community would continue as a grass/forb type.
Warmer than Present with Similar Total Precipitation[3]	Unlikely	Grass/forb community with an increase in warm season species.
Cooler and Wetter than Present[4]	Highly Unlikely	Shift to more woody plants because of more snow in winter months.
Cooler and Dryer than Present[5]	Highly Unlikely	Shift to more woody plants because of more snow in winter months.
Cooler than Present with Similar Precipitation[6]	Highly Unlikely	Shift to more woody plants because of more snow in winter months.
Dryer than Present with Similar Temperature[7]	Unlikely	Grass/forb community with an increase in warm season species because of less overall moisture and increase in atmospheric CO_2.
Wetter than Present with Similar Temperature[8]	Unlikely	Shift to more woody plants because of more winter precipitation.

[1]Results in less total precipitation but shift to less snow and more rain in winter months.
[2]Results in more total precipitation with shift to less snow and more rain in winter months or more rain in summer months.
[3]Results in no change in total precipitation but shift to less snow and more rain in winter months.
[4]Results in more total precipitation with shift to more snow in winter months.
[5]Results in less total precipitation but shift to more snow in winter months
[6]Results in no change in total precipitation but shift to more snow in winter months.
[7]Results in less total precipitation.
[8]Results in more total precipitation.
[9]Likelihood of occurrence based on majority of climate model estimates analyzed by Cayan et al. 2010 and Seager and Vecchi 2010, with a focus on the southwest U.S.

As the vegetation shifts from dominance by herbaceous plants (e.g., grasses), which have relatively shallow root systems but with very dense root mass in the upper profile, to dominance by woody species (e.g., shrubs), which have deeper roots systems with proportionately more roots in deeper layers, the hydrological dynamics of the system change. Early successional plant communities tend to extract most of the water they transpire from the upper soil profile. Late successional communities have greater ability to extract water from depth. This can be both a positive and a negative in the functional efficiency of covers. Because of successional changes in the vegetation, the plant-soil-water characteristics of a cover are likely to become very different over time. Conditions 200 years or more after construction are not likely to be similar to those soon after construction was completed. In some ways, conditions will be more favorable, e.g., evapotranspiration will likely be higher thus reducing the amount of deep infiltration and stability of the vegetation may be greater. In other ways, conditions will be less favorable, e.g., deeper root systems increase the concern for biointrusion. Because succession is a process that is near-universal ecologically, these changes have been accounted for in the cover design.

As stated earlier, the proposed cover system is a monolithic ET cover that consists of the following layers from top to bottom: 15 cm of a topsoil-gravel erosion protection layer over 107 cm of a water storage, biointrusion and radon attenuation layer over up to 110 to 136 cm of a highly compacted radon attenuation layer over 76 cm of a grading and radon attenuation layer. The proposed cover system does not contain a biobarrier (e.g. cobble layer) to minimize potential intrusion by plant roots during the required performance period. The proposed cover system is designed to minimize plant root intrusion through the use of thick layers of soil cover in combination with a highly compacted layer placed deep within the cover. The climax community for the Mill site is believed to be Big Sagebrush based on the current community type at the site and the relatively deep fine loamy soils that are present. If climate trends towards a warmer and dryer climate for the White Mesa area over the next 200 to 1,000 years, it is unlikely that sagebrush will remain on site and a community dominated by warm season species and more arid shrub species (e.g. shadscale saltbush, blackbrush and Mormon tea) may occur.

As discussed above, the process of succession and the effect of climate change will bring about changes in species composition in the tailings cover system. Our best forecast for the percentage of potential species colonization would be for a small percent of non-seeded species establishing during the first 50 years. The seeded community will be highly sustainable and big sagebrush would be the primary invader into the cover system. It is estimated that the established community will consist of 60 to 70 percent seeded species and 30 to 40 percent non-seeded species at end of the first 100 years. These non-seeded species will include big sagebrush and broom snakeweed, and a few grass and forb species common in the area. During the next 100 years the plant community will begin to transition to warm season species and big sagebrush will begin to diminish. By the end of the second 100 years it is estimated that the plant community will consist of 30 to 40 percent seeded and 60 to 70 percent non-seeded species and many of the non-seeded species will be warm season grasses and more arid shrub species. This trend will most likely continue through the remainder of the performance period with only 10 to 20 percent of the original seeded species still present and these would include blue grama and galleta. The remainder of the community would consist of more warm season grasses and shrubs that will have migrated north and higher in elevation with the warming climate.

REFERENCES

Alderson, J. and W.C. Sharp. 1994. Grass Varieties in the United States. U.S. Department of Agriculture, Agriculture Handbook No. 170. Washington, D.C.

Anderson, D.C. and D.W. Johns. 1977. Predation by badger on yellow-bellied marmot in Colorado. Southwest. Naturalist. 22:283-284.

Anderson, O.A. and D.M. Allred. 1964. Kangaroo rat burrows at the Nevada Test Site. Great Basin Naturalist 24:93-101.

Berger, A., H. Gallee, and J.L. Melice. 1991. The Earth's future climate at the astronomical timescale. Pp. 148-165. In: Future Climate Change and Radioactive Waste Disposal: Proceedings of International Workshop. G. M. Goodess and J. P. Paulutifof (eds). NSS/R257. U.K. Nirex Radioactive Waste Disposal, Ltd. Harwell, UK.

Berger, W.H. and L. D. Labeyrie. 1987. Abrupt Climatic Change: Evidence and Implications. Reidel, Dordrecht, The Neatherlands.

Bradley, N.L., Leopold, A.C., Ross, J. and W. Huffaker. 1999. Phenological changes reflect climate change in Wisconsin. Proceedings of the National Academy of Sciences 96:9701–9704.

Brady, N. C. 1974. The Nature and Property of Soils. 8th ed. MacMillian Press. New York, NY.

Breshears, D.D., N.S. Cobb, P.M. Rich, K.P. Price, C.D. Allen, R.G. Balice, W.H. Romme, J.H. Hastens, M.L. Floyd, J. Belnap, J.J. Anderson, O.B. Myers, and C.W. Meyer. 2005. Regional vegetation die-off in response to global-change drought. Proceedings of the National Academy of Sciences 102:15144-15148.

Carlson, K., A. Radil, and B. Romig. 2006. Biosolid applications at the Climax Mine: revegetation and soil results. In Proceedings High Altitude Revegetation Workshop No. 17. Colorado Water Resources Research Institute Information Series No. 101. Fort Collins, CO.

Carnivora. 2012. http://carnivora.com/topic/932884/1/. Site accessed in July 2012.

Cayan, D., T. Das, D. Pierce, T. Parnett, M. Tyree, and A. Gershunov. 2010. Future dryness in the southwest U.S. and the hydrology o the early 21st century drought. Proceedings of the National Academy of Sciences 107:21271-21276.

Chapman, J. and G. Willner. 1978. Sylvilagus audubonii. Mammalian Species No. 106. 4 pp.

Cleland E., I. Chuine, A. Menzel, H. Mooney, and M. Schwartz. 2007. Shifting plant phenology in response to global change. Trends in Ecology and Evolution 22:357-365.

Center for Nuclear Waste Regulatory Analysis (CNRWA) 2005. Analysis of Factors Contributing to Uncertainty in Estimating Future Climates at Yucca Mountain. San Antonio, Texas. Revised November 2005.

Cooke, R.V. and A. Warren. 1973. Geomorphology in Deserts. University of California Press. Berkeley, CA.

Coupland, R.T. and R.E. Johnson. 1965. Rooting characteristics of native grassland species in Saskatchewan. J. of Ecology 53:475-507.

Crowley, T.J. and G.R. North. 1991. Paleoclimatology. Oxford Monographs on Geology and Geophysics No. 16. Oxford University Press. NY.

Dames and Moore. 1978. Environmental Report—White Mesa Uranium Project, San Juan County, Utah. Prepared for Energy Fuels Nuclear, Inc.

DePuit, E. J. 1982. Cool-season perennial grass establishment on Northern Great Plains mined lands: status of current technology. Pages B1-B24 In Proceedings: Symposium on surface Coal Mining and Reclamation in the Northern Great Plains. Montana Agricultural Experiment Station Research Report 194. Bozeman, MT.

DePuit, E. J., J. G. Coenenberg, and W. H. Willmuth. 1978. Research on Revegetation of Surface Mined Lands at Coalstrip Montana: Progress Report 1975—1977 Res. Rep. 127. Montana

Agricultural Experiments Station, Bozeman, MT.

DOE (U.S. Department of Energy). 2008. 2007 Revegetation Monitoring of the Monticello, Utah, Repository Cover, U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado, March.

Energy Fuels Resources (USA) Inc. (EFRI), 2012. Responses to Interrogatories – Round 1 for Reclamation Plan, Revision 5.0, March 2012. August 15.

Esser, G. 1992. Implications of climate change for production and decomposition in grasslands and coniferous forests. Ecological Applications 2:47-54.

Fang, H., S. Liang, J.R. Townshend and R. Dickenson. 2008. Spatially and temporally continuous LAI data sets based on integrated filtering method: Examples from North America. Remote Sensing of Environment 112:75-93.

Feldhammer, G., B. Thompson, and J. Chapman. 2003. Wild Mammals of North America: biology, management, and conservation. John Hopkins University Press. Baltimore, MD.

Felthauser, M. and D. McInroy. 1983. Mapping pocket gopher burrow systems with expanding polyurethane foam. Journal Wildlife Management 47:555-558.

Fitter, A. H. and R. S. Fitter. 2002. Rapid changes in flowering time in British plants. Science 296:1689–1691.

Foxx, T. S. and G. D. Tierney. 1987. Rooting patterns in the pinyon-juniper woodland. pp. 69-79 In Everett, R. L. (ed.). Proceedings—Pinyon-Juniper Conference. USDA Forest Service. Intermountain Forest and Range Experiment Station. General Technical Report INT-215.

Gettinger, R. D. 1975. Metabolism and thermoregulation of a fossorial rodent, the northern pocket gopher (Thomomys talpoides). Physiol. Zool. 48:311-322.

Gibbens, R. P. and J. M. Lenz. 2001. Root systems of some Chihuahuan Desert plants. Journal of Arid Environments 49:221-263.Groeneveld, David. 1997. Vertical point quadrat sampling and an extinction factor to calculate leaf area index. J. of Arid Environments. 36:475-485.

Groeneveld, D., 1997. Vertical point quadrat sampling and an extinction factor to calculate leaf area index. J. of Arid Environments. 36:475-485.

Haering, K., W. Daniels, and S. Feagley. 2000. Reclaiming mined lands with biosolids, manures, and papermill sludge. pp. 615-644. In Barnhisel, R., R. Darmody and W. Daniels (eds.) Reclamation of Drastically Disturbed Lands. American Society of Agronomy. Madison, WI.

Harding, R. B. 1954. Surface accumulation of nitrates and other soluble salts in California orange orchards. Soil Science Society of America Proceedings. 18:369-372.

Haug, E., D. Millsap, and M. Martell. 1993. Burrowing owl. In Poule, A. and F. Gill (eds.) Birds of North America. The Academy of Natural Sciences. Philadelphia, PA.

Heilman, P. 1981. Root penetration of Douglas-fir seedlings into compacted soil. Forest Science 27:660-666.

Hendricks, David M. 1991. Genesis and classification of arid region soils. Pages 33-79 In Skujins, J. (ed.) Semiarid Lands and Deserts. Marcel Dekker, Inc. New York, NY.

Houghton, J. T., B. A. Callander, and S. K. Varney. 1992. Climate Change 1992: The Supplementary Report to the IPCC Scientific Assessment. Cambridge University Press. Cambridge, UK.

Imbrie, J. and J. Z. Imbrie. 1980. Modeling the climatic response to orbital variation. Science 207:143-153.

Houghton, J.T., G.J. Jenkins, and J.J. Ephraums (eds.). 1990. Climate Change: The IPCC Scientific Assessment. Cambridge University Press. Cambridge, UK.

Intergovernmental Panel on Climate Change (IPCC). 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

Jackson, H.H.T. 1961. Mammals of Wisconsin. University of Wisconsin Press. Madison, WI.

Kearney, T.H., Peebles, R.H., Howell, J.T and E. McClintock. 1960. Arizona flora. 2nd ed. University of California Press. Berkeley, CA. 1085p.

Kenagy, G. J. 1973. Daily and seasonal patterns of activity and energetics in a heteromyid rodent community. Ecology 54:1201-1219.

Kritzman, E. B. 1974. Ecological relationships of Peromyscus maniculatus and Perognathus parvus in eastern Washington. Journal of Mammalogy 55:172-188.

Lindsey, F. 1976. Characteristics of the Natal Den of the Badger. Northwest Science 50:178-180.

Long, S. P. and P.R. Hutchin. 1991. Primary production in grasslands and coniferous forests with climate change: an overview. Ecological Applications 1:139-156.

Ludwick, A.E., and J.R. Rogers. 1976. Soil test explanation. 502 Service in Action. Colorado State University Agricultural Extension Service. Fort Collins, CO.

Lupis, S.G., K.D. Bunnell, T. A. Black, and T.A. Messmer. 2007. Utah Gunnison's Prairie Dog and White-Tailed Prairie Dog Conservation Plan: Draft #5. Utah Department of Natural Resources. Salt Lake City UT.

Manning, S. J. and D. P. Groeneveld. 1990. Shrub rooting characteristics and water acquisition on xeric sites in western Great Basin. Pp. 238-244 In McArthur, D. E., E. M. Romney, S. Smith, and P. Tueller (eds) Proceedings—Symposium of Cheatgrass Invasion, Shrub Die-Off and Other Aspects of Shrub Biology and Management. Gen Tech Rept INT-276. U.S. Department of Agriculture, Forest Service, Intermountain Research Station. Ogden, UT.

Messick, J.P. and M.G. Hornocker. 1981. Ecology of the badger in southwestern Idaho. *Wildl. Monogr.* 76. 17 p.

Mimore, D., D. Smith, and F. Woollard. 1969. Effects of high soil density on seedling root growth of seven northwestern tree species. USDA Forest Service Research Note PNW-112. Pacific Northwest Forest and Range Experiment Station, Portland, OR.

Monsen, S.B., R. Stevens and N.L. Shaw. 2004. Restoring Western Ranges and Wildlands. U.S. Department of Agriculture. Forest Service. General Technical Report RMRS-GTR-136-vol 1-3. Rocky Mountain Research Station. Fort Collins, CO.

Morison, J. I. L., and D.W. Lawlor. 1999. Interactions between increasing CO2 concentration and temperature on plant growth. Plant, Cell & Environment 22:659-682.

Munshower, F. 1994. Practical Handbook of Disturbed Land Revegetation. CRC Press. Boca Raton, FL.

Munshower, F. 1995. Forbs, Shrubs and Trees for Revegetation of Disturbed Lands in the Northern Great Plains and Adjacent Areas. 2nd Edition. Montana State University Reclamation Research Unit Publication No. 9505. Bozeman, MT.

Neilson, R.P. 1993. Transient ecotone response to climatic change: some conceptual and modelling approaches. Ecological Applications 3:385-395.

Neilson, R.P. and D. Marks. 1994. A global perspective of regional vegetation and hydrologic sensitivities from climatic change. Journal of Vegetation Science 5:715-730.

Newman, G.J., and E.F. Redente. 2001. Long-term plant community development as influenced by revegetation techniques. J. Range Manage. 54:717-724.

Owensby, C.E., Ham, J.M., Knapp, A.K. and Auen, L.M. 1999. Biomass production and species composition change in a tallgrass prairie ecosystem after long-term exposure to elevated atmospheric CO2. Global Change Biology 5:497-506.

Parmesan, C. and G. Yohe. 2003. A globally coherent fingerprint of climate change impacts across natural systems. Nature 421:37–42.

Paschke, M.W., K. Topper, R.B. Brobst and E.F. Redente. 2005. Long-term effects of biosolids on revegetation of disturbed sagebrush steppe in Northwestern Colorado. Restoration Ecology 13:545-551.

Patterson, D.T. and E.P. Flint. 1990. Implications of increasing carbon dioxide and climate change for plant communities and competition in natural and managed ecosystems. pp 83-110 In B.A. Kimball, N.J. Rosenberg, L.H. Allen, Jr., G.H. Heichel, C.W. Stuber, D.E. Kissel, S. Ernst, (eds.). Impact of carbon dioxide, trace gases, and climate change on global agriculture. ASA Spec. Publ. No. 53. Am. Soc. Agron., Crop Sci. Soc. Am., and Soil Sci. Soc. Am.

Phillips, F.M., A.C. Campbell, R. Roberts, and C.V. Kruger. 1990. Abrupt interglacial/glacial transition in the 1.4 Ma water balance record from Searles Lake, CA. PP. 28 In: CANQUA/AMQUA 1990: Program and Abstracts, First Joint Meeting, Canadian Quaternary Association and American Quaternary Association. University of Waterloo, Waterloo, Ontario, Canada.

Plummer, A.P., D.R. Christensen, and S.B. Monsen. 1968. Restoring Big-Game Range in Utah.

Utah Division of Fish and Game. Publication No. 68-3. Utah Division of Fish and Game, Ephraim, UT.

Redente, E.F., M.E. Biondini, and J.C. Moore. 1989. Productivity dynamics of a crested wheatgrass (Agropyron cristatum) and native shortgrass ecosystem in southern Wyoming. J. Range Manage. 42:113-118.

Redente, E. F., T. B. Doerr, C. E. Grygiel, and M. E. Biondini. 1984. Vegetation establishment and succession on disturbed soils in northwest Colorado. Reclamation and Revegetation Research 3:153-166.

Reynolds, T. and J. Laundre, 1988. Vertical Distribution of Soil Removed by Four Species of Burrowing Rodents in Disturbed and Undisturbed Soils. Health Physics 54:445–450.

Reynolds, T. and W. Wakkinen, 1987. Burrow Characteristics of Four Species of Rodents in Undisturbed Soils in Southeastern Idaho. American Midland Naturalist 118:245–260.

Sala, O., W. Lauenroth, and R. Golluscio. 1997. Plant functional types in temperate semi-arid regions. pp. 217-233 In Smith, T., H. Shugart, and F. Woodward (eds.). Plant Functional Types: Their Relevance to Ecosystem Properties and Global Change. Cambridge University Press. Cambridge, England.

Saunders, D. A. 1988. Adirondack Mammals. State University of New York, College of Environmental Science and Forestry. 216pp

Schlesinger, M. E. and J. F. B. Mitchell. 1987. Climate model simulations of the equilibrium climatic response to increased carbon dioxide. Reviews of Geophysics 25:760-798.

Schreiber, R. K. 1978. Bioenergetics of the Great Basin Pocket Mouse, Prognathus parvus. Acta Theriol. 32:469-487.

Scurlock, J. M. O., G. P. Asner, and S. T. Gower. 2001. Worldwide Historical Estimates of Leaf Area Index, 1932-2000. Oakridge National Laboratory. ORNL/TM-2001/268.

Seager, R. and G. Vecchi. 2010. Greenhouse warming and the 21st century hydroclimate of southwestern North America. Proceedings of the National Academy of Sciences 107:21277-21282.

Siegel Issem, C., J. Burger, R. Power, F. Ponder, and S. Patterson. 2005. Seedling root growth as a function of soil density and water content. Soil Science Society of America Journal 69:215-226.

Sheets, R. G., R. L. Linder and R. B. Dahlgren. 1971. Burrow systems of prairie dogs in South Dakota. J. Mammal. 52:451-453.

Sopper, W. E. 1993. Municipal Sludge Use in Land Reclamation. Lewis Publishers. Boca Raton, FL.

Smith, P.L., E.F. Redente, and E. Hooper. 1987. Soil organic matter, p. 185-214. In R. Dean Williams and Gerald E. Schuman, eds. Reclaiming Mine Soils and Overburden in the Western United States, Analytic Parameters and Procedures. Soil Conservation Society of America. Ankeny, Iowa.

Spence, L. E. 1937. Root studies of important range plants of the Boise River watershed. J. of Forestry 35:747-754.

Sydnor, R.S. and E.F. Redente. 2000. Long-term plant community development on topsoil treatments overlying a phytotoxic growth medium. J. Environmental Quality 29:1778-1786.

Sykes, M. T. 2009. Climate Change Impacts: Vegetation. In Encyclopedia of Life Sciences (ELS). John Wiley & Sons, Ltd.

Tabler, R. D. 1964. The root system of Artemisia tridentata at 9,500 feet in Wyoming. Ecology 45:633-636.

Thornburg, A.A. 1982. Plant Materials for Use on Surface-Mined Lands in Arid and Semiarid Regions. USDA. Soil Conservation Service. SCS-TP-157. EPA-600/7-79-134. U.S. Government Printing Office. Washington, D.C.

USDA. 2012. http://plants.USDA.gov. Accessed on July 24, 2012.

U.S. Environmental Protection Agency. 1993. Standards for the use or disposal of sewage sludge. Fed. Reg. 58(32):9248-9415.

U.S. Environmental Protection Agency. 1995. Part 503 Implementation Guidance. EPA 833-R-95-001. EPA, Washington, D.C.

U.S. NRC 1997. "Issue Resolution Status Report on Methods to Evaluate Climate Change and Associated Effects at Yucca Mountain." Washington, DC: NRC. 1997.

U.S. NRC. 2003. NUREG–1804. "Yucca Mountain Review Plan." Final Report. Rev. 2. Washington, DC: NRC. 2003.

Utah Department of Environmental Quality, Division of Radiation Control (DRC), 2012. Dension Mines (USA) Corp's White Mesa Reclamation Plan, Rev. 5.0; Interrogatories – Round 1. March.

Verdolin, J., K. Lewis and C. Slobodchidoff. 2008. Morphology of burrow systems: A comparison of Gunnison's (Cynomy gunnisoni), White-tailed (C. leucurus), black-tailed (C. ludovicianus), and Utah (C. parvidens) Prairie Dogs. The Southwestern Naturalist 53:201-207.

Walther G., E. Post, P. Convey, A, Menzel, C. Parmesan, T. Beebee, J. Fromentin, O. Hoegh-Guldberg, and F. Bairlein. 2002. Ecological responses to recent climate change. Nature 416:389–395.

Washington, W. M. and G. A. Meehl. 1984. Seasonal cycle experiment on the climate sensitivity due to a doubling of CO_2 with an atmospheric general circulation model coupled to a simple mixed-layer ocean model. Journal of Geophysical Research 89:9475-9503.

Wasser, C.H. 1982. Ecology and Culture of Selected Species Useful in Revegetating Disturbed Lands in the West. U.S. Department of Interior. Fish and Wildlife Service. FWS/OBS-82/56. U.S. Government Printing Office. Washington, D.C.

Waugh, W. J., M. K. Kastens, L. R. L. Sheader, C. H. Benson, W. H. Albright, and P. S. Mushovic. 2008. Monitoring the performance of an alternative landfill cover at the Monticello, Utah, Uranium Mill Tailings Disposal Site. Proceedings of the Waste Management 2008 Symposium. Phoenix, AZ.

Waugh, W. J. and K. Petersen. 1994. Paleoclimatic data application: long-term performance of uranium mill tailings repositories. pp. 163-185 In Climate Change in the Four Corners and Adjacent Regions: Implications for Environmental Restoration and Land Use Planning. U.S. Department of Energy, Washington, D.C.

Weaver, J.E. and F.W. Albertson. 1936. Effects of the great drought on the prairies of Iowa, Nebraska, and Kansas. Ecology 17:567-639.

Weaver, J.E. and F.E. Clements. 1938. Plant Ecology. 2nd Edition. McGraw-Hill. New York, NY.

West, N.E. 1983. Colorado Plateau—Mohavian Blackbrush Semi-Desert. Pp. 399-411 In: West N. E. (ed) Temperate Deserts and Semi-Deserts. Elsevier Scientific Publication Co., Amsterdam, Netherlands.

Whitehead, L. C. 1927. Notes on prairie dogs. J. Mammal. 8:58.

Williams, A., J. Michaelsen, S. Leavitt, and C. Still. 2010. Using tree rings to predict the response of tree growth to climate change in the continental United States during the Twenty-First Century. Earth Interactions 14:1–20.

Wilson, C.A. and J.F.B. Mitchell. 1987. A doubled CO2 climate sensitivity experiment with a global climate model including a simple ocean. Journal of Geophysical Research 92:13315-13343.

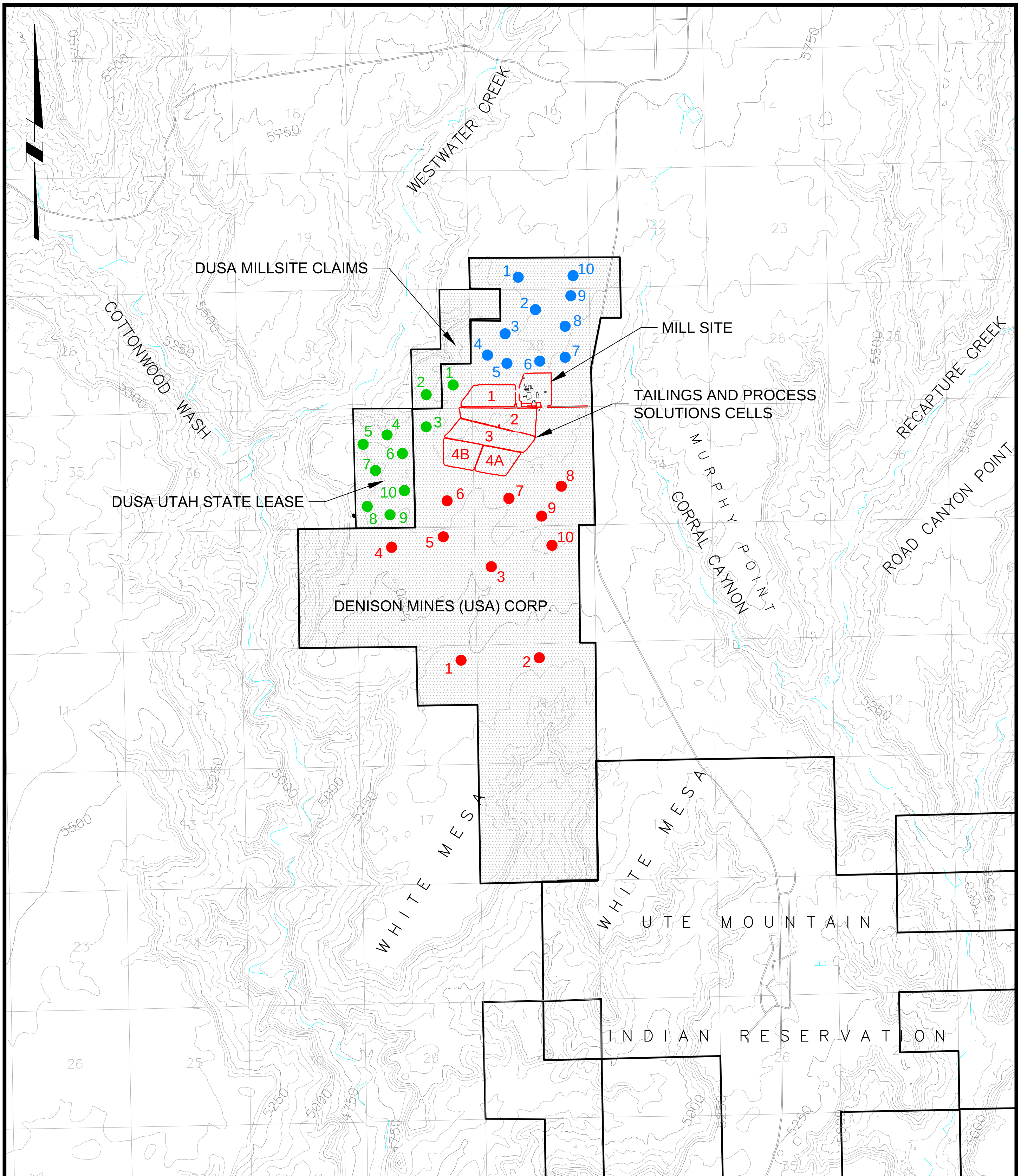
Wilson, D. and D. Reeder. 2005. Mammal Species of the World: At Taxonomic and Geographic Reference (3rd Edition). John Hopkins University Press. Baltimore, MD.

Winograd, I.J., T.B. Coplen, J.M. Landwehr, A.C. Riggs, K.R. Ludwig, B.J. Szabo, P.T. Kolesar, and K.M. Revesz. 1992. Continuous 500,000-year climate record from vein calcite in Devils Hole, Nevada. Science 258:255-260.

Winsor, T.F., and F.W. Whicker. 1980. Pocket gophers and redistribution of plutonium in soil. Health Phys. 39:257-262.

Wyatt, J. W., D. J. Dollhopf, and W. M. Schafer. 1980. Root distribution in 1 to 48 year old stripmine spoils in southeastern Montana. J. Range Management 33:101-104.

Zisa, R., H. Halverson, and B. Stout. 1980. Establishment and early growth of conifers on compact soils in urban areas. USDA Forest Service Research Paper NE-451. Northeastern Forest Experiment Station, Broomall, PA.



SCALE

6000' 0 6000'

LEGEND

- TRANSECT LOCATION TO NORTH OF MILL COMPLEX
- TRANSECT LOCATION TO SOUTH OF MILL COMPLEX
- TRANSECT LOCATION TO WEST OF MILL COMPLEX

Energy Fuels Resources (USA) Inc.

PROJECT

WHITE MESA MILL RECLAMATION

TITLE

LOCATION OF 2012 PLANT COVER SURVEY TRANSECTS

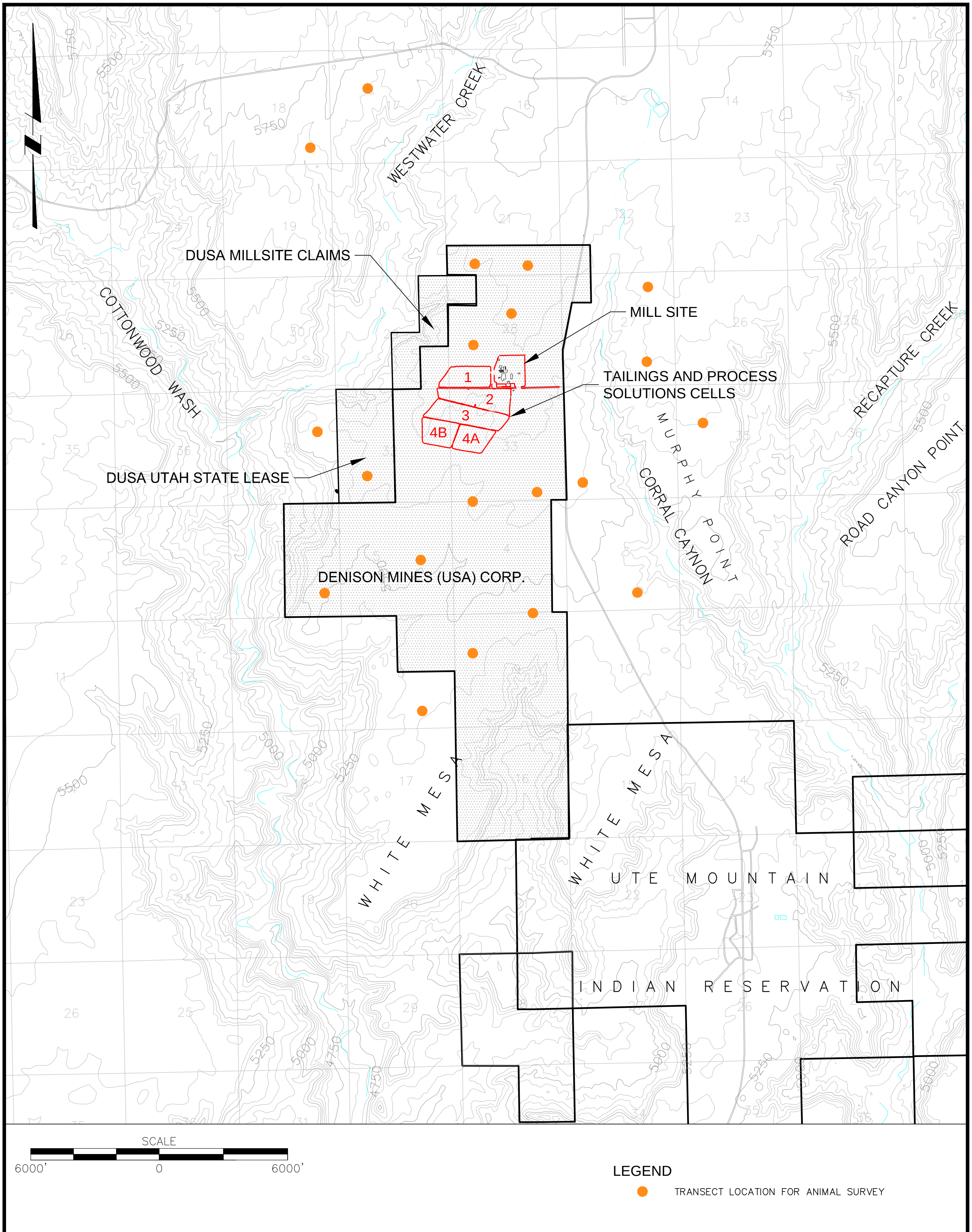
MWH

DATE AUG 2015

FIGURE D.1

FILE NAME 1009740 TRANS

L:\Design-Drafting\Clients-A-H\DENISON MINES\013-Sheet Set\2015-03-26 COVR DSN REP\1009740 TRANS



L:\Design-Drafting\Clients-A-H\DENISON MINES\013-Sheet Set\2015-03-26 COVR DSN REP\1009740 TRANS

Energy Fuels Resources (USA) Inc.

PROJECT

WHITE MESA MILL RECLAMATION

TITLE

LOCATION OF 2012 ANIMAL COVER SURVEY TRANSECTS

MWH

DATE AUG 2015

FIGURE D.2

FILE NAME 1009740 TRANS

ATTACHMENT G.2

REVISED APPENDIX J, REVEGETATION PLAN, TO THE UPDATED TAILINGS COVER DESIGN REPORT (APPENDIX D OF THE RECLAMATION PLAN, REVISION 5.0)

APPENDIX J

REVEGETATION PLAN

J.1 INTRODUCTION

Revegetation of the tailing cells at the White Mesa Mill Site will be completed following construction of the cover system. The revegetation process will establish a grass-forb-shrub community consisting primarily of native, long-lived perennial grasses, forbs, and shrubs that are highly adapted to the climatic and edaphic conditions of the site. Revegetation methods will follow state-of-the-art techniques for soil amendments, seedbed preparation, seeding and mulching. In addition, quality assurance and quality control procedures will be followed to ensure that revegetation methods are implemented correctly and the results of the process meet expectations.

J.2 PLANT SPECIES AND SEEDING RATES

The following 15 species (11 grasses, 2 forbs, and 2 shrubs) are proposed for the ET cover system at the White Mesa Mill site. These species were selected for their adaptability to site conditions, compatibility, and long-term sustainability. Species were also selected based on the assumption that institutional controls will exclude grazing by domestic livestock. The proposed species are:

- Western wheatgrass, variety Arriba (*Pascopyrum smithii*)
- Bluebunch wheatgrass, variety Goldar (*Pseudoroegneria spicata*)
- Slender wheatgrass, variety San Luis (*Elymus trachycaulus*)
- Streambank wheatgrass, variety Sodar (*Elymus lanceolatus ssp. psammophilus*)
- Pubescent wheatgrass, variety Luna (*Thinopyrum intermedium ssp. barbulatum*)
- Indian ricegrass, variety Paloma (*Achnatherum hymenoides*)
- Sandberg bluegrass, variety Canbar (*Poa secunda*)
- Sheep fescue, variety Covar (*Festuca ovina*)
- Squirreltail, variety Toe Jam Creek (*Elymus elymoides*)
- Blue grama, variety Hachita (*Bouteloua gracilis*)
- Galleta, variety Viva (*Hilaria jamesii*)
- Common yarrow, no variety (*Achillea millefolium*)
- White sage, variety Summit (*Artemisia ludoviciana*)
- Fourwing saltbush, variety Wytana (*Atriplex canescens*)
- Rubber rabbitbrush (*Ericameria nauseosus*).

The ecological characteristics of these species are described in detail in Appendix D.

Table J.1 presents broadcast seeding rates for each species. Seeding rates were developed based on the objective of establishing a permanent cover of grasses, forbs, and shrubs in a mixture that would promote compatibility among species and minimize competitive exclusion or loss of species over time. Seeding rates were developed on the basis of number of seeds per unit area (e.g. number of seeds per square foot) and then converted to weight per unit area (e.g. pounds per acre).

Table J.1. Species and seeding rates proposed for ET cover at the White Mesa Mill Site

Scientific Name	Common Name	Varietal Name	Native/ Introduced	Seeding Rate (lbs PLS/acre)†	Seeding Rate (# seeds/ft^2)
Grasses					
Pascopyrum smithii	Western wheatgrass	Arriba	Native	3.0	7.9
Pseudoroegneria spicata	Bluebunch wheatgrass	Goldar	Native	3.0	9.6
Elymus trachycaulus	Slender wheatgrass	San Luis	Native	2.0	6.2
Elymus lanceolatus	Streambank wheatgrass	Sodar	Native	2.0	7.3
Elymus elymoides	Squirreltail	Toe Jam	Native	2.0	8.8
Thinopyrum intermedium	Pubescent wheatgrass	Luna	Introduced‡	1.0	1.8
Achnatherum hymenoides	Indian ricegrass	Paloma	Native	4.0	14.7
Poa secunda	Sandberg bluegrass	Canbar	Native	0.5	11.4
Festuca ovina	Sheep fescue	Covar	Introduced‡	1.0	11.5
Bouteloua gracilis	Blue grama	Hachita	Native	1.0	16.5
Hilaria jamesii	Galleta	Viva	Native	2.0	7.3
Forbs					
Achillea millefolium, variety occidentalis	Common yarrow	VNS*	Native	0.5	32
Artemisia ludoviciana	White sage	VNS	Native	0.5	45
Shrubs					
Atriplex canescens	Fourwing saltbush	Wytana	Native	3.0	3.4
Ericameria nauseosus	Rubber rabbitbrush	VNS	Native	0.5	4.6
Total				26.5	188

†Seeding rate is for broadcast seed and presented as pounds of pure live seed per acre (lbs PLS/acre). ‡Introduced refers to species that have been 'introduced' from another geographic region, typically outside of North America. Also referred to as 'exotic' species. * VNS=Variety Not Specified but seed source would be designated from sites similar to the Mill Site.

Seeding rates are calculated from an expected field emergence for each species and the desired number of plants per unit area. For purposes of calculation, field emergence for small seeded grasses and forbs is assumed to be around 50 percent if germination is greater than 80 percent. Field emergence is assumed to be around 30 percent if germination is between 60 and 80 percent. The Natural Resource Conservation Service recommends a seeding rate of 20 to 30 pure live seeds per square foot as a minimum number of seeds when drill seeding single species in areas with an annual precipitation between 6 and 18 inches. Twenty pure live seeds per square foot, with an expected field emergence of 50 percent should produce an adequate number of plants on the seeded area to control erosion and suppress annual invasion. This seeding rate is primarily for favorable growing conditions, soils that are not extreme in texture, gentle slopes, north or east facing aspect, good moisture, adequate soil nutrients and single species vs. multiple species in a mixture. When conditions are less favorable when the seed is broadcast, or when multiple species are in a mixture the seeding rates are increased.

A Quality Assurance/Quality Control Plan for application rates and procedures for confirming that specified application rates are achieved is as follows. The first step begins with a seed order. Seed would be purchased as pounds of pure live seed. Each State has a seed certifying agency and certification programs may be adopted by seed growers. Certification of a container of seed assures the customer that the seed is correctly identified and genetically pure. The State agency responsible for seed certification sets minimum standards for mechanical purity and germination for each species of seed. When certified, a container of seed must be labeled as to origin, germination percentage, date of the germination test, percentage of pure seed (by weight), other crop and weed seeds, and inert material. The certification is the consumer's best guarantee that the seed being purchased meets minimum standards and the quality specified.

Once the seed is obtained, seed labels would be checked to determine the percent PLS and the date that the seed was tested for percent purity and percent germination. If the test date is greater than 6 months old, the seed would be tested again before being accepted. Seed will be applied using a broadcasting method as described below.

J.3 SOIL FERTILIZATION AND ORGANIC MATTER AMENDMENT

The physical and chemical characteristics of the soil that will be used for the cover system are presented in Appendix D. Based on this analysis, there are three soil properties that appear to be deficient for sustained plant growth and will need to be treated prior to seeding and to ensure that the soil provides adequate carbon and plant essential nutrients for initial plant establishment and long-term sustainability. The soil properties that will need treatment include percent organic matter, total nitrogen, and plant available potassium (Appendix D). The upper 15 cm of the water storage layer will be treated with an organic matter amendment to alleviate the existing deficiencies. This treatment will be applied after the water storage layer is in place and before placement of the topsoil-gravel erosion protection layer. Further chemical analysis will be conducted prior to placement of the water storage layer to verify the chemical properties of this material and to finalize the proposed treatment. In order for the potential cover soil to function as a normal soil and provide long-term sustainable support for the vegetation component of the ET cover, it will be amended to improve organic matter content, nitrogen and potassium levels. An organic matter amendment will also improve available water holding capacity and cation exchange capacity. The proposed organic amendment is composted biosolids. Composted biosolids have been successfully used in mined land reclamation over the past 40 years. This amendment would also provide a source of soil microorganisms that will function to cycle nutrients over time and ensure sustainable plant growth. Composted biosolids would be applied at a rate of 10 tons/acre and incorporated into the upper six inches of the water storage layer of the cover system. Composted biosolids are also a source of nitrogen, phosphorous and potassium and will serve to improve organic matter content and soil fertility.

The topsoil-gravel erosion control layer will not be amended for organic matter or nutrients to avoid the stimulation of undesirable weedy species. The addition of nutrients, especially nitrogen, during revegetation is known to stimulate the growth of annual weeds at the potential detriment of seeded perennial species. Withholding nutrient additions from the topsoil-gravel cover will allow the seeded species to establish without the unwanted competition from undesirable weedy species.

J.4 SEEDBED PREPARATION

Following placement of the topsoil-gravel erosion protection layer, the area will be harrowed to reduce any compaction that may have occurred during placement of the cover and to create an uneven surface for optimum seedbed conditions. Since seeding will be conducted with a broadcast method it is critical for the soil surface to be loose and uneven, but also have a firmness below the soil surface to allow proper seeding depth and to promote optimum seed-soil contact for germination and initial plant establishment.

J.5 SEEDING

Seed will be applied using a broadcasting method as soon as practicable following seedbed preparation. This procedure will use a centrifugal type broadcaster (or similar implement), also called an end-gate seeder. These broadcasters operate with an electric motor and are usually mounted on the back of a small tractor and generally have an effective spreading width of about 20 feet or more. Prior to seeding, a known area will be covered with a tarp and seed will be distributed using the broadcaster and simulating conditions that would exist under actual seeding conditions. Seed will then be collected and weighed to determine actual seeding rate in terms of pounds per acre. This process will be repeated until the specified seeding rate is obtained. During the seeding process, the seeding rate will be verified at least once by comparing pounds of seed applied to the size of the area seeded. In addition, seed will be applied in two separate passes. One-half of the seed will be spread in one direction and the other half of seed will be spread in a perpendicular direction. This will ensure that seed distribution across the site is highly uniform and also provide the opportunity to adjust the seeding rate if the specified rate is not being achieved. Seeding will not occur if wind speeds exceed 10 mph.

Immediately following seeding, the area will be lightly harrowed to provide seed coverage and to maximize seed-soil contact. This step in the revegetation process will ensure that the seed is placed at an optimum seeding depth and in good soil contact for proper germination conditions.

Seeding will take place as soon as practical after the cover system is in place. Successful seeding in southeastern Utah can occur either in late fall (e.g. October) as a dormant seeding, with germination and establishment occurring the following spring or can be conducted in June, prior to the summer monsoon season. The timing for seeding will be dependent upon the construction schedule for the cover system.

J.6 MULCHING

A mulch will be applied immediately following seeding to conserve soil moisture for seed germination and initial plant establishment. Mulching will also provide additional soil erosion protection from both wind and water until a plant cover is established. A weed-free, wood-fiber mulch will be applied to the seeded area at a rate of 1.5 tons/acre. Wood fiber mulch will consist of specially prepared wood fibers and will not be produced from recycled material such as sawdust, paper, cardboard, or residue from pulp and paper plants. The fibers will be dyed an appropriate color, non-toxic, water-soluble dye to facilitate visual metering during application. Wood fiber mulch will be supplied in packages and each package will be marked by the manufacturer to show the air-dry weight.

The wood fiber mulch will be applied by means of hydraulic equipment that utilizes water as the carrying agent. The mulch will be applied in a uniform manner at a minimum rate of 1.0 ton/acre. A continuous agitator action, that keeps the mulching material and approved additives in uniform suspension, will be maintained throughout the distribution cycle. The pump pressure will be capable of maintaining a continuous non-fluctuating stream of slurry. The slurry distribution lines will be large enough to prevent stoppage and the discharge line will be equipped with a set of hydraulic spray nozzles that will provide an even distribution of the mulch slurry to the seedbed. Mulching will not be done in the presence of free surface water resulting from rains, melting snow, or other causes.

A tackifier will be used with the wood fiber mulch to improve adhesion. The tackifier will be a biodegradable organic formulation processed specifically for the adhesive binding of mulch. In addition, the tackifier will uniformly disperse when mixed with water and will not be detrimental to the homogeneous properties of the mulch slurry. Tackifier may be added either during the manufacturing of the mulch or incorporated during mulch application. Tackifier will have characteristics of hydrating and dispersing in circulating water to form a homogeneous slurry and remain in such a state in the hydraulic mulching unit when mixed with the wood fiber mulch. When applied, the tackifier will form a loose chain-like protective film, but not a plant inhibiting membrane, which will allow moisture to percolate into the underlying soil, while helping bind seeds to the soil surface during germination and initial seedling growth, after which the tackifier will break down through natural processes.

ATTACHMENT H

SUPPORTING DOCUMENTATION FOR INTERROGATORY 12/1:

REVISED APPENDIX C, RADON EMANATION MODELING, TO THE UPDATED TAILINGS COVER DESIGN REPORT (APPENDIX D OF THE RECLAMATION PLAN, REVISION 5.0)

APPENDIX C

RADON EMANATION MODELING

C.1 BACKGROUND

This appendix presents the results of modeling the emanation of radon-222 from the top surface of the proposed cover over the White Mesa tailing impoundments to achieve the State of Utah's long-term radon emanation standard for uranium mill tailings (Utah Administrative Code, Rule 313-24). These results comprise an update of radon emanation modeling presented in Attachment F of the 2009 Reclamation Plan (Denison, 2009) and Appendix H of the Infiltration and Contaminant Transport Modeling Report (Denison, 2010), as well as an update to Appendix C of the 2011 Updated Tailings Cover Design report (MWH, 2011). This appendix provides a summary of additional analyses of radon attenuation through the proposed evapotranspiration (ET) cover, and incorporates the revised cover grading design, results of cover material testing conducted in 2010 and 2012 (summarized in Attachment B of EFRI, 2012), and results of tailings testing conducted in 2013 (presented in MWH, 2015).

The final version of this appendix will be provided as Appendix C to the next version of the Updated Tailings Cover Design report. The Updated Tailings Cover Design report will be submitted as an attachment to the next version of the Reclamation Plan.

The monolithic ET cover system evaluated in this appendix consists of the following layers from top to bottom:

- 0.5 ft (15 cm) Erosion Protection Layer (gravel-admixture or topsoil)
- 3.5 ft (107 cm) Water Storage/Biointrusion/Frost Protection/Radon Attenuation Layer (loam to sandy clay)
- 3.0 to 4.0 ft (91 to 122 cm) Radon Attenuation Layer (highly compacted loam to sandy clay)
- 2.5 ft (76 cm) Radon Attenuation and Grading Layer (loam to sandy clay)

The loam to sandy clay soil used to construct the ET cover, referred to in previous reports (Titan 1996, Knight Piesold 1999) as random/platform fill, is stockpiled at the site.

C.2 DESCRIPTION OF MODEL AND INPUT VALUES

The thickness of the reclamation cover necessary to limit radon emanation from the disposal areas was analyzed using the NRC RADON model (NRC, 1989). The model utilizes the one-dimensional radon diffusion equation, which uses the physical and radiological characteristics of the tailings and overlying materials to calculate the rate of radon emanation from the tailings through the cover. The model was used to calculate the cover thickness required to limit the radon emanation rate through the top of the cover to 20 picocuries per square meter per second (pCi/m^2-s), following the guidance presented in U.S. Nuclear Regulatory Commission (NRC) publications NUREG/CR-3533 and Regulatory Guide 3.64 (NRC 1984, 1989). The rate of emanation standard is applied to the average emanation over the entire surface of the disposal area.

The input parameters used in the model are based on engineering experience with similar projects, recent laboratory testing results for samples of random fill (summarized in Attachment B of EFRI, 2012) and tailings (MWH, 2015), in addition to available data from previous work by others, including Chen and Associates (1978, 1979, 1987), Rogers and Associates Engineering Corporation (1988), Western Colorado Testing (1999a, 1999b), IUC (2000), and Titan (1996).

The available data from testing performed by others was summarized in Appendix A of the Updated Tailings Cover Design report (MWH, 2011). Appendix A will be revised for the next version of the Updated Tailings Cover Design report to include data from recent random fill and tailings testing. The input parameters and values used in the model are outlined below.

C.2.1 Thickness of Tailings

The thickness of tailings currently deposited in Cells 2 and 3 is approximately 30 ft (914 cm), while the anticipated tailings thickness deposited in Cells 4A and 4B will be approximately 42 ft (1,280 cm). As documented in NRC Regulatory Guide 3.64, a tailings thickness greater than 100 to 200 cm is effectively equivalent to an infinitely thick radon source. Therefore, a thickness of 500 cm may be used in RADON to represent an equivalent infinitely thick tailings source of radon.

C.2.2 Radium Activity Concentration

The radium-226 activity concentration values for the tailings in the impoundments are estimated based on material inventory data provided by Energy Fuels Resources (USA), Inc. (EFRI). A summary of the material inventories for Cells 2 and 3 and the projected inventory for Cells 4A and 4B is provided in Attachment C.1. The radium-226 and thorium-230 activity concentrations are listed for each material in the inventories. These values were used to calculate a weighted average for radium-226 and thorium-230 activity concentrations for the tailings using the volume of material placed in Cells 2 and 3. In addition, these values were used to project radium-226 and thorium-230 activity concentrations for the materials to be placed in Cells 4A and 4B. Calculations for radium-226 from decay of thorium-230 were also made. These calculations are also provided in Attachment C.1. The results for Cell 3 and Cells 4A and 4B indicate the highest radium-226 values are a result of original radium-226 and radium-226 from thorium-230 decay at approximately 1000 years. The results are summarized below and in Table C.1.

Table C.1. Radium Activity Concentrations

Tailings Cell	Weighted Average Radium-226 Activity Concentration (pCi/g)	Weighted Average Thorium-230 Activity Concentration (pCi/g)	Total Radium-226 Activity Concentration (original radium-226 and radium-226 from thorium-230 decay) (pCi/g)
Cell 2	923	923	923
Cell 3	606	1048	758
Cells 4A and 4B	617	695	642

Random Fill and Erosion Protection. The radium activity of the random fill and erosion protection layer is assumed to be zero, based on guidance in Regulatory Guide 3.64 (NRC, 1989) which states that radium activity in the cover soils may be neglected for cover design purposes provided the cover soils are obtained from background materials that are not associated with ore formations or other radium-enriched materials.

C.2.3 Radon Emanation Coefficient

The radon emanation coefficient used in the model for the tailings is 0.20 based on laboratory data (Rogers & Associates, 1988) and the recommendation in NUREG-1620 (NRC, 2003) to use a value of 0.20 for tailings if there is limited site-specific data.

The radon emanation coefficient used in the model for the cover layers is 0.35. This is the conservative default value used in the RADON model.

C.2.4 Specific Gravity, Density and Porosity

The densities and porosities of the tailings and cover materials used in the model are based on laboratory testing results. The values are summarized in Table C.2 and discussed in more detail below.

Table C.2. Density and Porosity Values

Material	Specific Gravity	Degree of Compaction (%)	Placed Density (pcf)	Placed Density (g/cc)	Porosity
Erosion Protection (topsoil)	2.61	85% SP	100	1.6	0.38
Erosion Protection (rock mulch)*	2.62	85% SP	106	1.7	0.35
Random fill (low compaction water storage, rooting zone)	2.63	85% SP	100	1.6	0.39
Random Fill (high compaction)	2.63	95% SP	112	1.8	0.32
Random Fill (in place, low compaction, platform fill)	2.63	80% SP	94	1.5	0.43
Tailings	2.80	---	96	1.5	0.45

SP = standard proctor compaction
* Estimated by applying a 25% rock correction to the topsoil

The specific gravity of the tailings was estimated as 2.80 based as the weighted average specific gravity from laboratory tests using estimated percentages of sand, sand-slime, and slime tailings of 10, 65, and 25 percent, respectively (MWH, 2015). The dry density of the tailings was estimated as 96 pcf, based on laboratory tests (Chen and Associates, 1987 and Western Colorado Testing, 1999b) and assuming the upper bound long-term density of the tailings should be no greater than 90 percent of the average laboratory measured maximum dry density for the tailings. The referenced reports are provided as part of Appendix A.1 of MWH (2011). The porosity of the tailings was calculated using the estimated specific gravity and dry density based on the following equation:

$$n = 1 - \left(\frac{\gamma_d}{G_s \gamma_w}\right) \qquad \text{(Eq. C.1)}$$

where

n = porosity,
γ_d = dry density of soil,
G_s = specific gravity of soil, and
γ_w = unit weight of water.

The specific gravity and dry density values used in the model for the random fill layers were estimated by laboratory tests (ATT, 2010 and UWM, 2012). The referenced reports will be provided as part of Appendix A.2 of the next version of the of the Updated Tailings Cover Design report. These reports were presented in Attachment B of EFRI (2012). The estimation for the values used in the model is provided in Attachment C.2. The porosity values for the layers were calculated using equation C.1. The proposed cover system has three layers of random fill placed at different levels of compaction. The lower layer of random fill consists of a minimum thickness of 2.5 feet of random fill that is assumed to be dumped and minimally compacted by construction equipment to approximately 80 percent standard Proctor. The middle layer (3.0 – 4.0 feet) of random fill will be compacted to 95 percent of standard Proctor. In Cell 2 and parts of Cell 3, the lower layer of random fill is already placed and is approximately 3 feet. It is assumed the upper 6 inches of this fill will be part of the middle random fill layer and can be compacted by additional passes of compactors to reach 95 percent of standard Proctor compaction. The uppermost 3.5 feet of random fill will be placed at 85 percent of standard Proctor compaction in order to optimize water storage and rooting characteristics for plant growth.

The 0.5 foot erosion protection layer is assumed to be topsoil or rock mulch consisting of topsoil material mixed with 25 percent gravel by weight. The specific gravity and density of the topsoil was estimated to be 2.61 and 100 pcf, respectively, based on laboratory testing results for topsoil (UWM, 2012) The specific gravity and density of the rock mulch was estimated to be 2.62 and 106 pcf, respectively, based on laboratory testing results for topsoil (UWM, 2012) and applying a rock correction based on 25 percent gravel by weight.

C.2.5 Long-term Moisture Content

The long-term moisture content value for the tailings is assumed to be 6 percent. This is a conservative assumption, per NRC Regulatory Guide 3.64 (NRC, 1989), which represents the lower bound for moisture in western soils and is typically used as a default value for the long-term water content of tailings. Use of 15 bar water contents to estimate a long-term water content is one of the methods recommended in NRC (2003) for radon emanation modeling.

MWH collected representative samples from the on-site random fill and topsoil stockpiles for use in estimating the long-term moisture contents for the random fill and erosion protection cover layers. The laboratory results for the 15 bar water contents for these samples were used to estimate long-term water contents for the random fill and erosion protection layers.

The long-term water content of the topsoil was estimated as 5.2 percent based on the measured 15 bar gravimetric water content for a topsoil sample (E1-A) which represents the average index properties for the topsoil stockpiles (UWM, 2012). The long-term water content of the rock mulch was estimated as 4 percent based on the addition of 25 percent gravel by weight to the topsoil.

Based on the cover material gradations, the cover soils were bracketed into three groups, finer grained soils, uniform graded soils, and broadly graded soils. A weighted average procedure that accounts for the size of soil type based on the stockpile volumes was incorporated to determine the average long-term gravimetric water content for the random fill using the measured 15 bar water contents. The estimation of the long-term water content value for the cover material is provided in Attachment C.2.

The average long-term moisture contents are summarized in Table C.3.

Table C.3. Estimated Long-Term Moisture Contents

Material	Gravimetric Water Content (%)
Erosion Protection (topsoil)	5.2
Erosion Protection (rock mulch)	4.0
Random fill	6.7
Tailings	6.0

C.2.6 Diffusion Coefficient

The radon diffusion coefficient used in the RADON model can either be calculated based on an empirical relationship dependent upon porosity and the degree of saturation or input directly in the model using values measured from laboratory testing. Although laboratory test data was available for the tailings and the cover material (Rogers & Associates 1988), tests were performed at porosities and water contents different than those estimated to represent long-term conditions. Therefore, the empirical relationship presented in Rogers and Nielson (1991) was used, resulting in the calculated values summarized in Table C.4 below.

Table C.4. Estimated Radon Diffusion Coefficients

Material	Diffusion Coefficient (cm^2/s)
Erosion Protection (rock mulch)	0.0254
Random Fill (low compaction water storage, rooting zone)	0.0225
Random Fill (high compaction)	0.0160
Random Fill (in place, low compaction, platform fill)	0.0260
Tailings	0.0288

C.3 MODEL RESULTS

The radon emanation modeling results show that the designed cover systems presented in Table C.5 will reduce the rate of radon emanation to values below the limit of 20 picocuries per square meter per second (pCi/m^2-s) averaged over the entire area of the tailings impoundments, which is the regulatory criterion (Utah Administrative Code, Rule 313-24). The RADON model output is provided in Attachment C.3.

Table C.5. Summary of Results

Cover Layer	Cover Thickness (ft)		
	Cell 2	Cell 3	Cells 4A/4B
Erosion Protection (rock mulch or topsoil)	0.5	0.5	0.5
Random Fill (low compaction water storage, rooting zone)	3.5	3.5	3.5
Random Fill (high compaction)	4.0	3.5	3.0
Random Fill (in place, low compaction, platform fill)	2.5	2.5	2.5
Total Cover Thickness	**10.5**	**10.0**	**9.5**

C.4 IMPACTS OF INCREASED THICKNESS OF RANDOM FILL

Radon modeling as discussed above assumed that the lower layer of random fill was placed at 80 percent of standard Proctor compaction, and had a thickness of 2.5 feet (assuming top 6 inches can be compacted to 95 percent of standard Proctor density prior to placement of additional fill). However, there are some areas within Cells 2 and 3 which show thicknesses of existing random fill greater than 3.0 feet. Additional modeling was performed to determine the minimum thickness of highly compacted random fill required in order to meet regulatory criterion to limit the radon emanation rate through the top of the cover to 20 pCi/m^2-s. This modeling indicates that for every extra foot of low-compaction random fill (80 percent standard Proctor compaction), the highly compacted random fill layer (95 percent standard Proctor compaction) can be reduced in thickness by approximately 0.75 feet. This trend is shown in Figure C.1. The RADON model output is provided in Attachment C.4.

C.5 REFERENCES

Advanced Terra Testing (ATT), 2010. Denison White Mesa Project, Job No. 2521-53, Laboratory Testing for Borrow Stockpiles. October.

Chen and Associates, Inc., 1978. Earth Lined Tailings Cells, White Mesa Uranium Project, Blanding, Utah, Report prepared for Energy Fuels Nuclear, Inc., July 18.

Chen and Associates, Inc., 1979. Soil Property Study, Proposed Tailings Retention Cells, White Mesa Uranium Project, Blanding, Utah, Report prepared for Energy Fuels Nuclear, Inc. January 23.

Chen and Associates, Inc., 1987. Physical Soil Data, White Mesa Project, Blanding Utah, Report prepared for Energy Fuels Nuclear, Inc.

Denison Mines USA Corporation (Denison), 2009. Reclamation Plan, White Mesa Mill, Blanding Utah, Revision 4.0, November.

Denison Mines USA Corporation (Denison), 2010. Revised Infiltration and Contaminant Transport Modeling Report, White Mesa Mill, Blanding, Utah, March.

Energy Fuels Resources (USA), Inc. (EFRI), 2012. Responses to Interrogatories – Round 1 for Reclamation Plan, Revision 5.0, March 2012. August 15.

International Uranium Corporation (IUC), 2000. Reclamation Plan, White Mesa Mill, Blanding, Utah, Source Material License No. SUA-1358, Docket No. 40-8681, Revision 3.0. July.

Knight Piesold, 1999. Radon Emanation Calculations (Revised). Technical Memorandum from Roman Popielak and Pete Duryea to File 1626B. April 15.

MWH Americas, Inc. (MWH), 2011. Updated Tailings Cover Design. Prepared for Denison Mines (USA) Corp. September.

MWH Americas, Inc. (MWH), 2015. White Mesa Mill Tailings Data Analysis Report. Prepared for Energy Fuels Resources (USA) Inc. April.

Rogers & Associates Engineering Corporation, 1988. Two separate letters prepared by Renee Y. Bowser for C.O. Sealy of Umetco Minerals Corporation. March 4 and May 9.

Rogers, V.C., and K.K. Nielson. 1991. Correlations for Predicting Air Permeabilities and Rn- 222 Diffusion Coefficients of Soils, Health Physics (61) 2.

TITAN Environmental Corporation (Titan), 1996. Tailings Cover Design, White Mesa Mill, Blanding Utah, Report prepared for Energy Fuels Nuclear, Inc. September.

University of Wisconsin-Madison (UWM), Wisconsin Geotechnics Laboratory, 2012. Compaction and Hydraulic Properties of Soils from Banding, Utah. Geotechnics Report NO. 12-41 by C.H. Benson and X. Wang. July 24.

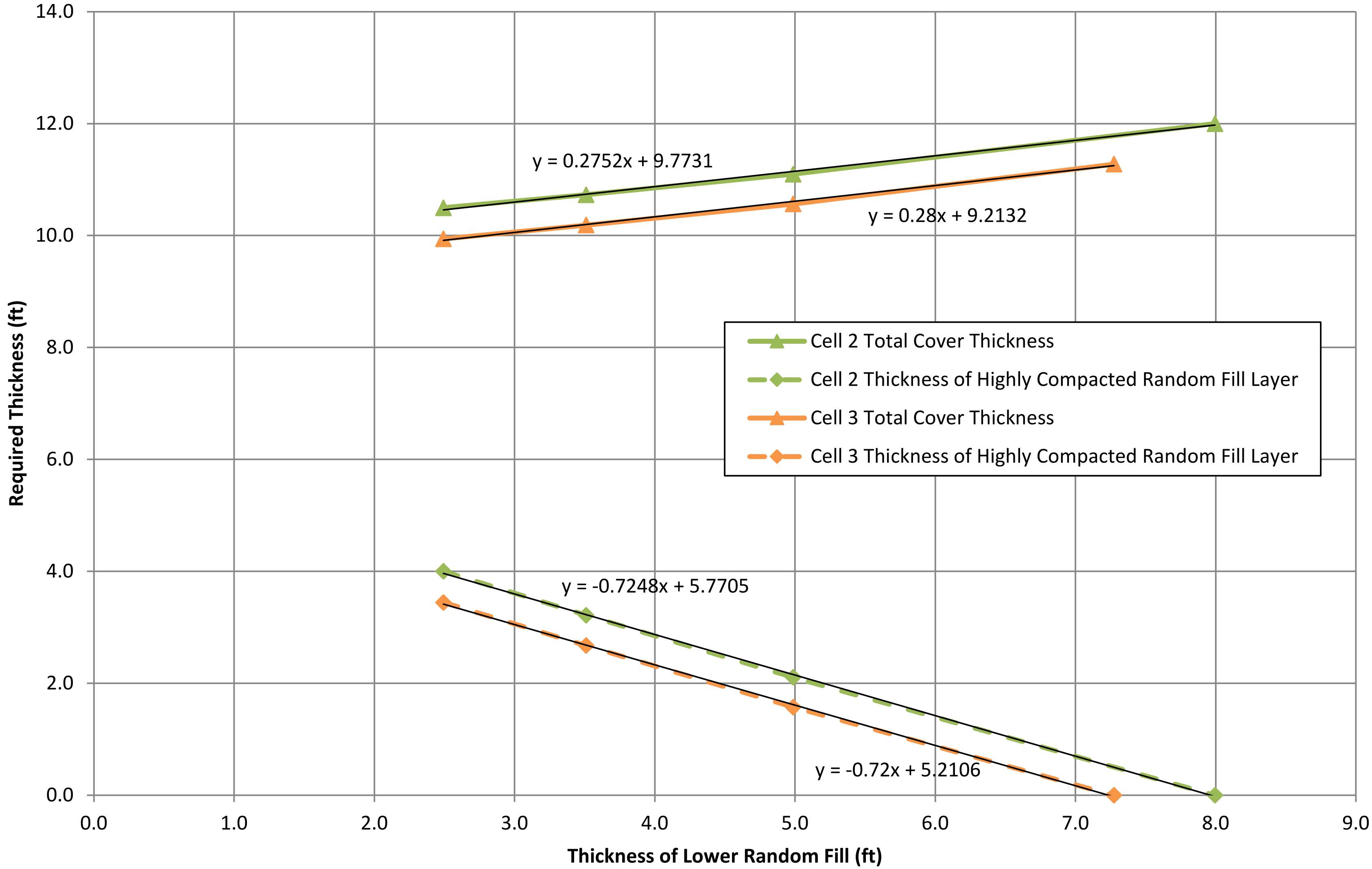
U.S. Nuclear Regulatory Commission (NRC), 1984. Radon Attenuation Handbook for Uranium Mill Tailings Cover Design, NUREG/CR-3533.

U.S. Nuclear Regulatory Commission (NRC), 1989. Calculation of Radon Flux Attenuation by Earthen Uranium Mill Tailings Covers, Regulatory Guide 3.64.

U.S. Nuclear Regulatory Commission (NRC), 2003. Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act of 1978. Final Report. NUREG-1620, Rev. 1. June.

Western Colorado Testing, Inc., 1999a. Soil Sample Testing Results for On-Site Random Fill and Clay Stockpiles, prepared for International Uranium (USA) Corporation. May.

Western Colorado Testing, Inc., 1999b. Report of Soil Sample Testing of Tailings Collected from Cell 2 and Cell 3, Prepared for International Uranium (USA) Corporation. May 4.



Energy Fuels Resources (USA) Inc.

PROJECT White Mesa Mill Reclamation		MWH
TITLE RADON EMANATION INCREASED THICKNESS OF LOWER RANDOM FILL VS TOTAL COVER THICKNESS	DATE AUG 2015	FIGURE C.1
	FILENAME Summary of Radon Runs_8-2015pptx	

ATTACHMENT C.1

RADIUM-226 ESTIMATION TABLES

Energy Fuels Resources (USA) Inc.
White Mesa Mill Site, Summary of Processed Ores and Alternate Feeds

Material Category/Location	Origin/ Description	Dates	Total Mass Ores Processed (tons)	$\%U_3O_8$	Ra-226 Activity Conc.[a] (pCi/g)	Th-230 Activity Conc.[b] (pCi/g)	Reference/Comments
Processed Ores							
Natural Ores	Arizona Strip Ores	1980 - 2000	1,000,000	0.55	1546.6	1546.6	Total quantity for both ores from Denison (2009, 2011), ore grades and quantity breakdown from Roberts (2012b)
	Colorado Plateau Ores	1980 - 2000	2,840,536	0.25	703.0	703.0	Total quantity for both ores from Denison (2009, 2011), ore grades and quantity breakdown from Roberts (2012b)
Pandora		2008-2011	231,191	0.218	613.0	613.0	Data provided from D. Turk (2012a)
Daneros		2010-2011	71,287	0.269	756.4	756.4	Data provided from D. Turk (2012a)
Beaver		2010-2011	90,280	0.174	489.3	489.3	Data provided from D. Turk (2012a)
Arizona 1		2010-2011	41,863	0.608	1709.7	1709.7	Data provided from D. Turk (2012a)
Sunday		2008-2011	20,251	0.178	500.5	500.5	Data provided from D. Turk (2012a)
West Sunday		2008-2010	79,744	0.157	441.5	441.5	Data provided from D. Turk (2012a)
Topaz		2008-2010	16,869	0.128	359.9	359.9	Data provided from D. Turk (2012a)
St. Jude		2008-2010	29,572	0.167	469.6	469.6	Data provided from D. Turk (2012a)
Tony M		2008-2009	189,876	0.131	368.4	368.4	Data provided from D. Turk (2012a)
Dawn Mining		2009-2010	2,875	0.456	1282.3	1282.3	Data provided from D. Turk (2012a)
Carnation		2009-2010	5,584	0.166	466.8	466.8	Data provided from D. Turk (2012a)
Purchased Ore		2010-2011	18,008	0.146	410.6	410.6	Data provided from D. Turk (2012a)
Humbug Cressler		2011	118	0.044	123.7	123.7	Data provided from D. Turk (2012a)
Alternate Feeds							
Linde	Soil	1996-1999, 2002-2003, 2007	258,992		33	133	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).
Ashland 1	Soil	1996-1999, 2002-2003	317,831		91.3	1849	Date range est. from Denison (2011) and Roberts (2012c). Quantities and activities est. from Roberts (2012a,2012c).
Heritage	Monazite sands	1996-1999, 2002-2003, 2007	7,374		19.4	10.6	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).
Cabot	Tantalum residues	1996-1999	16,828		772	118	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).
Ashland 2	Soil	1996-1999	43,981		91.3	1849	Date range est. from Denison (2011) and Roberts (2012c). Quantities and activities est. from Roberts (2012a,2012c).
Cameco	KF product	1996-1999	1,966		0.6	5.3	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).
Allied Signal/Honeywell	Calcium Fluoride	1996-1997	2,343		989	23800	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).
Cameco	Phosph. regen. product	1996-1999	557		2.70	2.10	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).
Cameco	Calcined product	1996-1999	2,197		1040	9170	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).
Allied Signal	KOH solution recovery	1996-1999	1,526		989	0.00	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Harold (2012a) and Turk (2012b).
Rhone-Poulenc	Uranyl nitrate hexahydrate	1996-1997	17		156	2550	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Harold (2012a) and Turk (2012b).
Cameco	UF4 with filter ash	1996-1999	10		156	2550	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).
Nev. Test Site	Cotter Concentrate	1996-1997	420		3590	585000	Date range est. from Denison (2011) and Roberts (2012c). Quantities and activities est. from Roberts (2012a,2012c).
Molycorp		2002-2003, 2007	11,689		38.6	268.0	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).
Cabot	Tantalum residues	2011	8,700		772	118	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).
Cameco	UF4	2009-2010	462		156	2550	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).
Allied Signal/Honeywell	Calcium Fluoride	2011	1,969		989	23800	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).
FMRI (Fansteel)		2011	1,369		236	4.9	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).

Notes:
[a]Values for ores estimated using method in NRC Reg. Guide 3.64 (1989) of multiplying the ore grade by 2812 pCi/g.
[b]Values for thorium estimated as Ra-226 values.

References:

Denison Mines USA Corporation (Denison), 2009. Reclamation Plan, White Mesa Mill, Blanding Utah, Revision 4.0, November.
Denison Mines USA Corporation (Denison), 2011. Reclamation Plan, White Mesa Mill, Blanding Utah, Revision 5.0, September.
Roberts, H., 2012a. Electronic communication including files "InvThNov00.xls and Inventory Umass in tails.xls" from Harold Roberts, Denison Mines (USA) Corp., to Melanie Davis, MWH Americas, Inc., July 20.
Roberts, H., 2012b. Personal communication from Harold Roberts, Denison Mines (USA) Corp., to Melanie Davis, MWH Americas, Inc., June 21.
Roberts, H., 2012c. Electronic communication including file "Alternate Feed Tons.pdf" and personal communication from Harold Roberts, Denison Mines (USA) Corp., to Melanie Davis, MWH Americas, Inc., July 24.
Turk, D., 2012a. Electronic communication including file "Ore Numbers.pdf" from David Turk, Denison Mines (USA) Corp., to Melanie Davis, MWH Americas, Inc., June 8.
Turk, D., 2012b. Electronic communication including file "DAC s Calculations 2012_rev6-29-12" from David Turk, Denison Mines (USA) Corp., to Melanie Davis, MWH Americas, Inc., June 29.

Energy Fuels Resources (USA) Inc.
Estimation of Cell 2 Ra-226 and Th-230 Activity Concentrations for Tailings

Material Category/Location	Origin/ Description	Dates	Total Mass Ores Processed (tons)	Total Mass Ore Processed for Cell 2[a] (tons)	%U_3O_8	Ra-226 Activity Conc.[b] (pCi/g)	Th-230 Activity Conc.[c] (pCi/g)	Reference/Comments
Processed Ores								
Natural Ores	Arizona Strip Ores	1980 - 2000	1,000,000	598,875	0.55	1547	1547	Total quantity for both ores from Denison (2009, 2011), ore grades and quantity breakdown from Roberts (2012b)
	Colorado Plateau Ores	1980 - 2000	2,840,536	1,701,125	0.25	703	703	Total quantity for both ores from Denison (2009, 2011), ore grades and quantity breakdown from Roberts (2012b
			Total Tons	2,300,000	**Weighted Ave.**	**923**	**923**	

Notes:
[c]Estimated from total tons of tailings to Cell 2 from Denison (2009), Attachment E. Estimated mass is for ore processed. Material placed in Cell 2 are only those listed in the table (Roberts, 2012c).
[b]Values for ores estimated using method in NRC Reg. Guide 3.64 (1989) of multiplying the ore grade by 2812 pCi/g.
[c]Values for thorium estimated as Ra-226 values.

References:

Denison Mines USA Corporation (Denison), 2009. Reclamation Plan, White Mesa Mill, Blanding Utah, Revision 4.0, November.
Denison Mines USA Corporation (Denison), 2011. Reclamation Plan, White Mesa Mill, Blanding Utah, Revision 5.0, September.
Roberts, H., 2012b. Personal communication from Harold Roberts, Denison Mines (USA) Corp., to Melanie Davis, MWH Americas, Inc., June 21.
Roberts, H., 2012c. Electronic communication including file "Alternate Feed Tons.pdf" and personal communication from Harold Roberts, Denison Mines (USA) Corp., to Melanie Davis, MWH Americas, Inc., July 24.

Energy Fuels Resources (USA) Inc.
Estimation of Cell 3 Ra-226 and Th-230 Activity Concentrations for Tailings

Material Category/Location	Origin/ Description	Dates	Total Mass Ores Processed (tons)	Total Mass Ore Processed for Cell 3[a] (tons)	%U_3O_8	Ra-226 Activity Conc.[a] (pCi/g)		Th-230 Activity Conc.[b] (pCi/g)		Reference/Comments
Processed Ores										
Natural Ores	Arizona Strip Ores	1980 - 2000	1,000,000	401,125	0.55	1546.6	253.15	1546.6	253.15	Total quantity for both ores from Denison (2009, 2011), ore grades and quantity breakdown from Roberts (2012b)
	Colorado Plateau Ores	1980 - 2000	2,840,536	1,139,411	0.25	703.0	326.85	703.0	326.85	Total quantity for both ores from Denison (2009, 2011), ore grades and quantity breakdown from Roberts (2012b)
Pandora		2008	80,046	80,046	0.218	613.0	20.02	613.02	20.02	Data provided from D. Turk (2012a)
Sunday		2008	12,066	12,066	0.178	500.5	2.46	500.54	2.46	Data provided from D. Turk (2012a)
West Sunday		2008	53,613	53,613	0.157	441.5	9.66	441.48	9.66	Data provided from D. Turk (2012a)
Topaz		2008	8,746	8,746	0.128	359.9	1.28	359.94	1.28	Data provided from D. Turk (2012a)
St. Jude		2008	15,140	15,140	0.167	469.6	2.90	469.60	2.90	Data provided from D. Turk (2012a)
Tony M		2008	74,802	74,802	0.131	368.4	11.24	368.37	11.24	Data provided from D. Turk (2012a)
Alternate Feeds										
Linde	Soil	1996-1999, 2002-2003, 2007	258,992	258,992		33	3.49	133	14.06	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).
Ashland 1	Soil	1996-1999, 2002-2003	317,831	317,831		91.3	11.84	1849	239.80	Date range est. from Denison (2011) and Roberts (2012c). Quantities and activities est. from Roberts (2012a,2012c).
Heritage	Monazite sands	1996-1999, 2002-2003, 2007	7,374	7,374		19.4	0.06	10.6	0.03	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).
Cabot	Tantalum residues	1996-1999	16,828	16,828		772	5.30	118	0.81	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).
Ashland 2	Soil	1996-1999	43,981	43,981		91.3	1.64	1849	33.18	Date range est. from Denison (2011) and Roberts (2012c). Quantities and activities est. from Roberts (2012a,2012c).
Cameco	KF product	1996-1999	1,966	1,966		0.6	0.00	5.3	0.00	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).
Allied Signal/Honeywell	Calcium Fluoride	1996-1997	2,343	2,343		989	0.95	23800	22.75	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).
Cameco	Phosph. regen. product	1996-1999	557	557		2.70	0.00	2.10	0.00	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).
Cameco	Calcined product	1996-1999	2,197	2,197		1040	0.93	9170	8.22	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).
Allied Signal	KOH solution recovery	1996-1999	1,526	1,526		989	0.62	0.00	0.00	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Harold (2012a) and Turk (2012b).
Rhone-Poulenc	Uranyl nitrate hexahydrate	1996-1997	17	17		156	0.00	2550	0.02	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Harold (2012a) and Turk (2012b).
Cameco	UF4 with filter ash	1996-1999	10	10		156	0.00	2550	0.01	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).
Nev. Test Site	Cotter Concentrate	1996-1997	420	420		3590	0.62	585000	100.26	Date range est. from Denison (2011) and Roberts (2012c). Quantities and activities est. from Roberts (2012a,2012c).
Molycorp		2002-2003, 2007	11,689	11,689		38.6	0.18	268.0	1.28	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).
			Total Tons	2,450,679	**Weighted Ave.**	**606**		**1048**		

Notes:
[c]Estimated from total tons of tailings to Cell 2 and capacity of Cell 3 from Denison (2009), Attachment E. Material placed before 2009 was placed in Cells 2 and 3 (Roberts, 2012c).
[b]Values for ores estimated using method in NRC Reg. Guide 3.64 (1989) of multiplying the ore grade by 2812 pCi/g.
[c]Values for thorium estimated as Ra-226 values.

References:

Denison Mines USA Corporation (Denison), 2009. Reclamation Plan, White Mesa Mill, Blanding Utah, Revision 4.0, November.

Denison Mines USA Corporation (Denison), 2011. Reclamation Plan, White Mesa Mill, Blanding Utah, Revision 5.0, September.

Roberts, H., 2012a. Electronic communication including files "InvThNov00.xls and Inventory Umass in tails.xls" from Harold Roberts, Denison Mines (USA) Corp., to Melanie Davis, MWH Americas, Inc., July 20.

Roberts, H., 2012b. Personal communication from Harold Roberts, Denison Mines (USA) Corp., to Melanie Davis, MWH Americas, Inc., June 21.

Roberts, H., 2012c. Electronic communication including file "Alternate Feed Tons.pdf" and personal communication from Harold Roberts, Denison Mines (USA) Corp., to Melanie Davis, MWH Americas, Inc., July 24.

Turk, D., 2012a. Electronic communication including file "Ore Numbers.pdf" from David Turk, Denison Mines (USA) Corp., to Melanie Davis, MWH Americas, Inc., June 8.

Turk, D., 2012b. Electronic communication including file "DAC s Calculations 2012_rev6-29-12" from David Turk, Denison Mines (USA) Corp., to Melanie Davis, MWH Americas, Inc., June 29.

Energy Fuels Resources (USA) Inc.
Estimation of Cell 4A and 4B Ra-226 and Th-230 Activity Concentrations for Tailings

Material Category/Location	Origin/ Description	Dates	Total Mass Ore/Alt. Feed Processed[a] (tons)	$\%U_3O_8$	Ra-226 Activity Conc.[b] (pCi/g)	Th-230 Activity Conc.[c] (pCi/g)	Reference/Comments
Processed Ores							
Pandora		2009-2011	151,145	0.218	613.0	613.0	Data provided from D. Turk (2012a)
Daneros		2010-2011	71,287	0.269	756.4	756.4	Data provided from D. Turk (2012a)
Beaver		2010-2011	90,280	0.174	489.3	489.3	Data provided from D. Turk (2012a)
Arizona 1		2010-2011	41,863	0.608	1709.7	1709.7	Data provided from D. Turk (2012a)
Sunday		2009-2011	8,185	0.178	500.5	500.5	Data provided from D. Turk (2012a)
West Sunday		2009-2010	26,131	0.157	441.5	441.5	Data provided from D. Turk (2012a)
Topaz		2009-2010	8,123	0.128	359.9	359.9	Data provided from D. Turk (2012a)
St. Jude		2009-2010	14,432	0.167	469.6	469.6	Data provided from D. Turk (2012a)
Tony M		2009	115,074	0.131	368.4	368.4	Data provided from D. Turk (2012a)
Dawn Mining		2009-2010	2,875	0.456	1282.3	1282.3	Data provided from D. Turk (2012a)
Carnation		2009-2010	5,584	0.166	466.8	466.8	Data provided from D. Turk (2012a)
Purchased Ore		2010-2011	18,008	0.146	410.6	410.6	Data provided from D. Turk (2012a)
Humbug Cressler		2011	118	0.044	123.7	123.7	Data provided from D. Turk (2012a)
Alternate Feeds							
Cabot	Tantalum residues	2011	8,700		772	118	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).
Cameco	UF4	2009-2010	462		156	2550	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).
Allied Signal/Honeywell	Calcium Fluoride	2011	1,969		989	23800	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).
FMRI (Fansteel)		2011	1,369		236	4.9	Date range est. from Denison (2011) and Roberts (2012c). Quantities est. from Roberts (2012a,2012c). Activities est. from Turk (2012b).
				Weighted Ave.	**617**	**695**	

Notes:
[c]Current tailings in Cell 4A and future tailings to Cell 4A and 4B are projected to be from ores and alternative feeds similar to those processed after 2008 (Roberts, 2012c).
[b]Values for ores estimated using method in NRC Reg. Guide 3.64 (1989) of multiplying the ore grade by 2812 pCi/g.
[c]Values for thorium estimated as Ra-226 values.

References:

Denison Mines USA Corporation (Denison), 2009. Reclamation Plan, White Mesa Mill, Blanding Utah, Revision 4.0, November.
Denison Mines USA Corporation (Denison), 2011. Reclamation Plan, White Mesa Mill, Blanding Utah, Revision 5.0, September.
Roberts, H., 2012a. Electronic communication including files "InvThNov00.xls and Inventory Umass in tails.xls" from Harold Roberts, Denison Mines (USA) Corp., to Melanie Davis, MWH Americas, Inc., July 20.
Roberts, H., 2012b. Personal communication from Harold Roberts, Denison Mines (USA) Corp., to Melanie Davis, MWH Americas, Inc., June 21.
Roberts, H., 2012c. Electronic communication including file "Alternate Feed Tons.pdf" and personal communication from Harold Roberts, Denison Mines (USA) Corp., to Melanie Davis, MWH Americas, Inc., July 24.
Turk, D., 2012a. Electronic communication including file "Ore Numbers.pdf" from David Turk, Denison Mines (USA) Corp., to Melanie Davis, MWH Americas, Inc., June 8.
Turk, D., 2012b. Electronic communication including file "DAC s Calculations 2012_rev6-29-12" from David Turk, Denison Mines (USA) Corp., to Melanie Davis, MWH Americas, Inc., June 29.

Energy Fuels Resources (USA) Inc. White Mesa Mill
Tailings Cell 2
Calculation of Ra-226 Concentrations Due to Future Decay of Th-230

The RA-226 concentration at various times in the future depends on both the decay of the Ra-226 currently present and the ingrowth from Th-230. The Ra-226 decays with a half-life of 1602 years. The ingrowth is also a function of the Ra-226 half-life (1602 years) and the Th-230 half-life (77,000 years).

A (Ra-226) at a time t (years) = [A (Ra-226) at t=0][exp(-0.693t/1602 years)]

A (Ra-226 from decay of Th-230 at time t (years)) = [A (Th-230)][1-exp(-0.693t/1602 years)][exp(-0.693t/77,000 years)]

Residual Ra-226 at time t

Time (years)	exp (-0.693t/1602)	Initial Ra-226 Concentration (pCi/g) Cell 2	Ra-226 Concentration at time t (pCi/g) Cell 2
0	1.000	923	923
100	0.958	923	884
200	0.917	923	847
500	0.805	923	743
1000	0.649	923	599

Ra-226 Concentration from Ingrowth Due to Decay of Th-230

Time (years)	exp (-0.693t/1602)	Initial Th-230 Concentration (pCi/g) S.I.	Ra-226 Concentration at time t (pCi/g) S.I.	exp (-0.693t/77000)
0	1.000	923	0	1.000
100	0.958	923	39	0.999
200	0.917	923	76	0.998
500	0.805	923	179	0.996
1000	0.649	923	321	0.991

Total Ra-226 Concentration at Time t (original Ra-226 and Ra-226 from Th-230 decay)

Time (years)	Total Ra-226 Concentration (pCi/g) avg. S.I.
0	923
100	923
200	**923**
500	922
1000	920

Energy Fuels Resources (USA) Inc. White Mesa Mill
Tailings Cell 3
Calculation of Ra-226 Concentrations Due to Future Decay of Th-230

The RA-226 concentration at various times in the future depends on both the decay of the Ra-226 currently present and the ingrowth from Th-230. The Ra-226 decays with a half-life of 1602 years. The ingrowth is also a function of the Ra-226 half-life (1602 years) and the Th-230 half-life (77,000 years).

A (Ra-226) at a time t (years) = [A (Ra-226) at t=0][exp(-0.693t/1602 years)]

A (Ra-226 from decay of Th-230 at time t (years)) = [A (Th-230)][1-exp(-0.693t/1602 years)][exp(-0.693t/77,000 years)]

Residual Ra-226 at time t

Time (years)	exp (-0.693t/1602)	Initial Ra-226 Concentration (pCi/g) Cell 3	Ra-226 Concentration at time t (pCi/g) Cell 3
0	1.000	606	606
100	0.958	606	580
200	0.917	606	556
500	0.805	606	488
1000	0.649	606	393

Ra-226 Concentration from Ingrowth Due to Decay of Th-230

Time (years)	exp (-0.693t/1602)	Initial Th-230 Concentration (pCi/g) S.I.	Ra-226 Concentration at time t (pCi/g) S.I.	exp (-0.693t/77000)
0	1.000	1048	0	1.000
100	0.958	1048	44	0.999
200	0.917	1048	87	0.998
500	0.805	1048	203	0.996
1000	0.649	1048	365	0.991

Total Ra-226 Concentration at Time t (original Ra-226 and Ra-226 from Th-230 decay)

Time (years)	Total Ra-226 Concentration (pCi/g) avg. S.I.
0	606
100	625
200	642
500	691
1000	**758**

Energy Fuels Resources (USA) Inc. White Mesa Mill
Tailings Cells 4A/B
Calculation of Ra-226 Concentrations Due to Future Decay of Th-230

The RA-226 concentration at various times in the future depends on both the decay of the Ra-226 currently present and the ingrowth from Th-230. The Ra-226 decays with a half-life of 1602 years. The ingrowth is also a function of the Ra-226 half-life (1602 years) and the Th-230 half-life (77,000 years).

A (Ra-226) at a time t (years) = [A (Ra-226) at t=0][exp(-0.693t/1602 years)]

A (Ra-226 from decay of Th-230 at time t (years)) = [A (Th-230)][1-exp(-0.693t/1602 years)][exp(-0.693t/77,000 years)]

Residual Ra-226 at time t

Time (years)	exp (-0.693t/1602)	Initial Ra-226 Concentration (pCi/g) Cell 4A/B	Ra-226 Concentration at time t (pCi/g) Cell 4A/B
0	1.000	617	617
100	0.958	617	591
200	0.917	617	566
500	0.805	617	497
1000	0.649	617	400

Ra-226 Concentration from Ingrowth Due to Decay of Th-230

Time (years)	exp (-0.693t/1602)	Initial Th-230 Concentration (pCi/g) S.I.	Ra-226 Concentration at time t (pCi/g) S.I.	exp (-0.693t/77000)
0	1.000	695	0	1.000
100	0.958	695	29	0.999
200	0.917	695	57	0.998
500	0.805	695	135	0.996
1000	0.649	695	242	0.991

Total Ra-226 Concentration at Time t (original Ra-226 and Ra-226 from Th-230 decay)

Time (years)	Total Ra-226 Concentration (pCi/g) avg. S.I.
0	617
100	620
200	623
500	632
1000	**642**

ATTACHMENT C.2

COVER MATERIAL PARAMETERS ESTIMATION TABLE

ENERGY FUELS RESOURCES (USA) INC. WHITE MESA MILL

Summary of Laboratory Testing Results for Borrow Stockpiles

Borrow Stockpile ID	Estimated Stockpile Volume[1] (cy)	Field Investigation Date	Material Description	USCS	Sample ID	Sample Depth (ft)	Gravimetric Water Content (%)	Atterberg Limits[2] LL/PL/PI (%)	PI	Specific Gravity	% Gravel	%Sand	%Silt	% Clay	% Fines	Max. Density (pcf)	Opt. Moist. Cont. (%)	Ksat (cm/s)	15bar Grav. Water Content (%)	Soil Group[4]
E1	15,900	Apr-2012	Topsoil (Sandy Silty Clay)	CL-ML	E1-A	0 - 3	--	23/18/5	5	2.61	0	41	43	16	59	118	11	1.3×10^{-4}	5.2	Topsoil
E2	92,000	Oct-2010	Silty Sand/Clayey Sand	SM	A	5	4.5	NP	NP	--	0.5	77.1	13.5	8.9	22					B
				SC	B	12	5.7	23.3/11.2/12.1	12.1	2.64	13.1	50.3	22.6	14.0	37					U
E3	16,800	Apr-2012	Clay with Sand	CH	E3-A	0 - 3	--	54/24/30	30	2.53	0	23	29	48	77	105	19	9.5×10^{-5}	13.6	F
E4	66,600	Oct-2010	Sandy Clay	CL	A	5	8.6	30.3/14.4/15.9	15.9	--	0.0	41.2	39.1	19.7	59					U
E5	68,800	Oct-2010	Sandy Clay	CL	A	6	9.0	33.2/14.3/18.9	18.9	--	0.0	35.5	38.1	26.4	65					F
		Apr-2012	Clay with Sand	CH	E5-B	0 - 3	--	51/24/27	27	2.56	2	15	36	47	83					F
E6	100,700	Oct-2010	Clay	CL	A	5	14.4	40.2/15.8/24.4	24.4	2.74	0.1	17.7	49.5	32.7	82					F
E7	74,900	Oct-2010	Sandy Clay	CL	A	6	5.7	26.2/16.3/9.9	9.9	--	0.0	30.2	56.1	13.7	70					U
E8	227,300	Oct-2010	Sandy Clay	CL	A	2	7.4	23.0/12.0/11.0	11.0	--	0.0	47.0	36.9	16.1	53					U
		Apr-2012	Gravel with Clay and Sand	GW-GC	E8-B	0 - 4	--	27/16/11	11	2.63	40.0	31.0	18.0	11.0	29	125	11		6.0	B
W1	85,700	Oct-2010	Sandy Clay	CL	A	5	8.8	32.1/14.5/17.6	17.6	--	0.0	40.6	37.6	21.8	59					U
W2	584,500	Oct-2010	Sandy Clay	CL	A	surface	8.5	28.1/13.1/15.0	15.0	--	0.2	41.5	42.5	15.8	58					U
		Apr-2012	Clayey Sand with Gravel	SC	W2-A	0 - 3	--	24/14/10	10	2.62	30	45	15.0	10.0	25				6.9	B
		Apr-2012	Silty Clayey Sand with Gravel	SC-SM	W2-B	0 - 5	--	18/13/5	5	2.63	41	45	9.0	5.0	14	128	9	1.5×10^{-3}	3.5	B
W3	84,800	Oct-2010	Topsoil (Sandy Silty Clay)	CL-ML	A	surface	4.3	20.9/16.2/4.7	4.7	--	0.2	44.2	39.2	16.4	56					Topsoil
W4	90,000	Oct-2010	Topsoil (Sandy Silt)	ML	A	5	5.3	21.9/18.0/3.9	3.9	--	0.0	32.6	54.3	13.1	67					Topsoil
		Apr-2012	Topsoil (Sandy Silty Clay)	CL-ML	W4-B	0 - 4	--	26/19/7	7	2.60	0	38	44	18	62					Topsoil
W5	2,001,160	Apr-2012	Sandy Clay	CL	W5-A	0 - 4	--	27/18/9	9	2.61	1	49	32	18	50				7.0	U
			Clayey Sand with Gravel	SC	W5-B	0 - 4	--	24/15/9	9	2.63	29	44	19	8	27	122	10	1.1×10^{-3}	3.6	B
W6	93,400	Oct-2010	Topsoil (Sandy Silty Clay)	CL-ML	A	surface	3.3	23.1/16.5/6.6	6.6	--	0.0	34.3	51.8	13.9	66					Topsoil
W7	39,500	Oct-2010	Sandy Clay	CL	A	5	8.7	28.0/10.6/17.3	17.3	2.67	0.0	43.8	43.1	13.1	56					U
W8	178,411	Apr-2012	Silty Sand with Gravel	SM	W8-A	0 - 3	--	NP	NP	2.64	35	51	9	5	14	117	13	1.2×10^{-3}	5.0	B
			Silty Sand with Gravel	SM	W8-B	0 - 4	--	NP	NP	2.66	32	40	18	10	28				6.4	B
W9	60,250	Oct-2010	Sandy Clay	CL	A	surface	4.4	25.9/12.3/13.5	13.5	--	0.0	37.4	45.2	17.4	63					U
		Apr-2012	Sandy Clay	CL	W9-B	0 - 4	--	28/16/12	12	2.63	6	44	35	15	50	115	14	4.1×10^{-4}	7.7	U

Estimation of Cover Material Properties Used in Model

Soil Group[4]	Volume (cy)	Total Vol (cy)	Percent of Total Volume	Ave. Max. Dry Density (pcf)	Ave. Specific Gravity	Ave. 15bar Grav. Water Content (%)
Group B	1,728,308	3,596,621	48.1%	123	2.64	5.2
Group U	1,682,013	3,596,621	46.8%	115	2.64	7.3
Group F	186,300	3,596,621	5.2%	105	2.61	13.6
			Weighted Ave.	**118**	**2.63**	**6.7**

Notes:

1. Volumes estimated using 2009 topography and assuming a relatively flat bottom surface, except for stockpiles W5, W8 and W9. The volumes for stockpiles W8 and W9 were estimated by comparing the 2011 versus 2009 topography. The volume for stockpile W5 was estimated using a combination of both methods.
2. LL = Liquid Limt, PL = Plastic Limit, PI = Plasticity Index (PI = LL-PL)
3. Gravel = 4.75 mm to 75 mm, Sand = 0.075 mm to 4.75 mm, Fines: Silt = 0 .075 mm to 0.002 mm, Clay = less than 0.002 mm
4. Group B (broadly graded), Group U (uniformly graded), and Group F (fine textured) based on evaluation of gradations and Benson (2012). See Attachment B of EFRI (2012) for gradations and laboratory reports.

References:

Benson, C., 2012. Electronic communication from Craig Benson, University of Wisconsin-Madison, to Melanie Davis, MWH Americas, Inc., regarding evaluation of gradations performed for potential cover soils for White Mesa, May 20.

Energy Fuels Resouces (USA) Inc. (EFRI), 2012. Response to Interrogatories - Round 1 for Reclamation Plan, revision 5.0., March 2012. August 15.

ATTACHMENT C.3

RADON MODEL OUTPUT

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: Cell2ts

DESCRIPTION: Cell 2 Cover (topsoil on surface)

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS		2.65

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	5	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.001	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 Tailings

THICKNESS	500	cm
POROSITY	.45	
MEASURED MASS DENSITY	1.5	g cm^-3
MEASURED RADIUM ACTIVITY	923	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.2	
CALCULATED SOURCE TERM CONCENTRATION	1.292D-03	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6	%
MOISTURE SATURATION FRACTION	.200	
MEASURED DIFFUSION COEFFICIENT	.0288	cm^2 s^-1

LAYER 2 Random Fill

THICKNESS	76	cm
POROSITY	.43	
MEASURED MASS DENSITY	1.5	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.234	
MEASURED DIFFUSION COEFFICIENT	.026	cm^2 s^-1

LAYER 3 Compacted Random Fill

THICKNESS	122	cm
POROSITY	.32	
MEASURED MASS DENSITY	1.8	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.377	
MEASURED DIFFUSION COEFFICIENT	.016	cm^2 s^-1

LAYER 4 ET Cover

THICKNESS	107	cm
POROSITY	.39	
MEASURED MASS DENSITY	1.6	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.275	
MEASURED DIFFUSION COEFFICIENT	.0225	cm^2 s^-1

LAYER 5 Topsoil

THICKNESS	15	cm
POROSITY	.38	
MEASURED MASS DENSITY	1.6	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5.2	%
MOISTURE SATURATION FRACTION	.219	
MEASURED DIFFUSION COEFFICIENT	.0254	cm^2 s^-1

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
5	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-03

LAYER	DX	D	P	Q	XMS	RHO
1	5.000D+02	2.880D-02	4.500D-01	1.292D-03	2.000D-01	1.500
2	7.600D+01	2.600D-02	4.300D-01	0.000D+00	2.337D-01	1.500
3	1.220D+02	1.600D-02	3.200D-01	0.000D+00	3.769D-01	1.800
4	1.070D+02	2.250D-02	3.900D-01	0.000D+00	2.749D-01	1.600
5	1.500D+01	2.540D-02	3.800D-01	0.000D+00	2.189D-01	1.600

BARE SOURCE FLUX FROM LAYER 1: 6.713D+02 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.000D+02	2.884D+02	3.461D+05
2	7.600D+01	1.094D+02	2.058D+05
3	1.220D+02	3.505D+01	3.071D+04
4	1.070D+02	2.018D+01	2.963D+03
5	1.500D+01	2.000D+01	0.000D+00

```
                    -----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

         RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS
ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: Cell2rm

DESCRIPTION: Cell 2 Cover (rock mulch on surface)


              CONSTANTS

RADON DECAY CONSTANT                          .0000021      s^-1
RADON WATER/AIR PARTITION COEFFICIENT         .26
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS               2.65


              GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS                  5
NO LIMIT ON RADON FLUX
LAYER THICKNESS NOT OPTIMIZED
DEFAULT SURFACE RADON CONCENTRATION           0             pCi l^-1
SURFACE FLUX PRECISION                        .001          pCi m^-2 s^-1


              LAYER INPUT PARAMETERS

LAYER 1       Tailings


THICKNESS                                     500           cm
POROSITY                                      .45
MEASURED MASS DENSITY                         1.5           g cm^-3
MEASURED RADIUM ACTIVITY                      923           pCi/g^-1
MEASURED EMANATION COEFFICIENT                .2
CALCULATED SOURCE TERM CONCENTRATION          1.292D-03     pCi cm^-3 s^-1
WEIGHT % MOISTURE                             6             %
MOISTURE SATURATION FRACTION                  .200
MEASURED DIFFUSION COEFFICIENT                .0288         cm^2 s^-1


LAYER 2       Random Fill


THICKNESS                                     76            cm
POROSITY                                      .43
MEASURED MASS DENSITY                         1.5           g cm^-3
MEASURED RADIUM ACTIVITY                      0             pCi/g^-1
MEASURED EMANATION COEFFICIENT                .35
CALCULATED SOURCE TERM CONCENTRATION          0.000D+00     pCi cm^-3 s^-1
WEIGHT % MOISTURE                             6.7           %
MOISTURE SATURATION FRACTION                  .234
MEASURED DIFFUSION COEFFICIENT                .026          cm^2 s^-1
```

LAYER 3 Compacted Random Fill

THICKNESS	122	cm
POROSITY	.32	
MEASURED MASS DENSITY	1.8	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.377	
MEASURED DIFFUSION COEFFICIENT	.016	cm^2 s^-1

LAYER 4 ET Cover

THICKNESS	107	cm
POROSITY	.39	
MEASURED MASS DENSITY	1.6	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.275	
MEASURED DIFFUSION COEFFICIENT	.0225	cm^2 s^-1

LAYER 5 Rock Mulch

THICKNESS	15	cm
POROSITY	.35	
MEASURED MASS DENSITY	1.7	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	4	%
MOISTURE SATURATION FRACTION	.194	
MEASURED DIFFUSION COEFFICIENT	.0256	cm^2 s^-1

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
5	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-03

LAYER	DX	D	P	Q	XMS	RHO
1	5.000D+02	2.880D-02	4.500D-01	1.292D-03	2.000D-01	1.500
2	7.600D+01	2.600D-02	4.300D-01	0.000D+00	2.337D-01	1.500
3	1.220D+02	1.600D-02	3.200D-01	0.000D+00	3.769D-01	1.800
4	1.070D+02	2.250D-02	3.900D-01	0.000D+00	2.749D-01	1.600
5	1.500D+01	2.560D-02	3.500D-01	0.000D+00	1.943D-01	1.700

BARE SOURCE FLUX FROM LAYER 1: 6.713D+02 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.000D+02	2.884D+02	3.461D+05
2	7.600D+01	1.094D+02	2.058D+05
3	1.220D+02	3.501D+01	3.077D+04
4	1.070D+02	2.007D+01	3.107D+03
5	1.500D+01	1.988D+01	0.000D+00

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: Cell3ts

DESCRIPTION: Cell 3 Cover (topsoil on surface)

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS		2.65

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	5	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.001	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 Tailings

THICKNESS	500	cm
POROSITY	.45	
MEASURED MASS DENSITY	1.5	g cm^-3
MEASURED RADIUM ACTIVITY	758	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.2	
CALCULATED SOURCE TERM CONCENTRATION	1.061D-03	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6	%
MOISTURE SATURATION FRACTION	.200	
MEASURED DIFFUSION COEFFICIENT	.0288	cm^2 s^-1

LAYER 2 Random Fill

THICKNESS	76	cm
POROSITY	.43	
MEASURED MASS DENSITY	1.5	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.234	
MEASURED DIFFUSION COEFFICIENT	.026	cm^2 s^-1

LAYER 3 Compacted Random Fill

THICKNESS	107	cm
POROSITY	.32	
MEASURED MASS DENSITY	1.8	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.377	
MEASURED DIFFUSION COEFFICIENT	.016	cm^2 s^-1

LAYER 4 ET Cover

THICKNESS	107	cm
POROSITY	.39	
MEASURED MASS DENSITY	1.6	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.275	
MEASURED DIFFUSION COEFFICIENT	.0225	cm^2 s^-1

LAYER 5 Topsoil

THICKNESS	15	cm
POROSITY	.38	
MEASURED MASS DENSITY	1.6	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5.2	%
MOISTURE SATURATION FRACTION	.219	
MEASURED DIFFUSION COEFFICIENT	.0254	cm^2 s^-1

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
5	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-03

LAYER	DX	D	P	Q	XMS	RHO
1	5.000D+02	2.880D-02	4.500D-01	1.061D-03	2.000D-01	1.500
2	7.600D+01	2.600D-02	4.300D-01	0.000D+00	2.337D-01	1.500
3	1.070D+02	1.600D-02	3.200D-01	0.000D+00	3.769D-01	1.800
4	1.070D+02	2.250D-02	3.900D-01	0.000D+00	2.749D-01	1.600
5	1.500D+01	2.540D-02	3.800D-01	0.000D+00	2.189D-01	1.600

BARE SOURCE FLUX FROM LAYER 1: 5.513D+02 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.000D+02	2.374D+02	2.838D+05
2	7.600D+01	9.084D+01	1.681D+05
3	1.070D+02	3.427D+01	3.003D+04
4	1.070D+02	1.974D+01	2.898D+03
5	1.500D+01	1.956D+01	0.000D+00

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: Cell3rm

DESCRIPTION: Cell 3 Cover (rock mulch on surface)

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	5	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.001	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 Tailings

THICKNESS	500	cm
POROSITY	.45	
MEASURED MASS DENSITY	1.5	g cm^-3
MEASURED RADIUM ACTIVITY	758	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.2	
CALCULATED SOURCE TERM CONCENTRATION	1.061D-03	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6	%
MOISTURE SATURATION FRACTION	.200	
MEASURED DIFFUSION COEFFICIENT	.0288	cm^2 s^-1

LAYER 2 Random Fill

THICKNESS	76	cm
POROSITY	.43	
MEASURED MASS DENSITY	1.5	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.234	
MEASURED DIFFUSION COEFFICIENT	.026	cm^2 s^-1

LAYER 3 Compacted Random Fill

THICKNESS	107	cm
POROSITY	.32	
MEASURED MASS DENSITY	1.8	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.377	
MEASURED DIFFUSION COEFFICIENT	.016	cm^2 s^-1

LAYER 4 ET Cover

THICKNESS	107	cm
POROSITY	.39	
MEASURED MASS DENSITY	1.6	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.275	
MEASURED DIFFUSION COEFFICIENT	.0225	cm^2 s^-1

LAYER 5 Rock Mulch

THICKNESS	15	cm
POROSITY	.35	
MEASURED MASS DENSITY	1.7	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	4	%
MOISTURE SATURATION FRACTION	.194	
MEASURED DIFFUSION COEFFICIENT	.0256	cm^2 s^-1

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
5	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-03

LAYER	DX	D	P	Q	XMS	RHO
1	5.000D+02	2.880D-02	4.500D-01	1.061D-03	2.000D-01	1.500
2	7.600D+01	2.600D-02	4.300D-01	0.000D+00	2.337D-01	1.500
3	1.070D+02	1.600D-02	3.200D-01	0.000D+00	3.769D-01	1.800
4	1.070D+02	2.250D-02	3.900D-01	0.000D+00	2.749D-01	1.600
5	1.500D+01	2.560D-02	3.500D-01	0.000D+00	1.943D-01	1.700

BARE SOURCE FLUX FROM LAYER 1: 5.513D+02 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.000D+02	2.374D+02	2.838D+05
2	7.600D+01	9.083D+01	1.681D+05
3	1.070D+02	3.424D+01	3.009D+04
4	1.070D+02	1.962D+01	3.038D+03
5	1.500D+01	1.945D+01	0.000D+00

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: Cells4AB

DESCRIPTION: Cells 4A and 4B Cover

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	5	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.001	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 Tailings

THICKNESS	500	cm
POROSITY	.45	
MEASURED MASS DENSITY	1.5	g cm^-3
MEASURED RADIUM ACTIVITY	642	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.2	
CALCULATED SOURCE TERM CONCENTRATION	8.988D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6	%
MOISTURE SATURATION FRACTION	.200	
MEASURED DIFFUSION COEFFICIENT	.0288	cm^2 s^-1

LAYER 2 Random Fill

THICKNESS	76	cm
POROSITY	.43	
MEASURED MASS DENSITY	1.5	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.234	
MEASURED DIFFUSION COEFFICIENT	.026	cm^2 s^-1

LAYER 3 Compacted Random Fill

THICKNESS	91	cm
POROSITY	.32	
MEASURED MASS DENSITY	1.8	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.377	
MEASURED DIFFUSION COEFFICIENT	.016	cm^2 s^-1

LAYER 4 ET Cover

THICKNESS	107	cm
POROSITY	.39	
MEASURED MASS DENSITY	1.6	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.275	
MEASURED DIFFUSION COEFFICIENT	.0225	cm^2 s^-1

LAYER 5 Rock Mulch

THICKNESS	15	cm
POROSITY	.35	
MEASURED MASS DENSITY	1.7	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	4	%
MOISTURE SATURATION FRACTION	.194	

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
5	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-03

LAYER	DX	D	P	Q	XMS	RHO
1	5.000D+02	2.880D-02	4.500D-01	8.988D-04	2.000D-01	1.500
2	7.600D+01	2.600D-02	4.300D-01	0.000D+00	2.337D-01	1.500
3	9.100D+01	1.600D-02	3.200D-01	0.000D+00	3.769D-01	1.800
4	1.070D+02	2.250D-02	3.900D-01	0.000D+00	2.749D-01	1.600
5	1.500D+01	2.560D-02	3.500D-01	0.000D+00	1.943D-01	1.700

BARE SOURCE FLUX FROM LAYER 1: 4.669D+02 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.000D+02	2.017D+02	2.398D+05
2	7.600D+01	7.817D+01	1.412D+05
3	9.100D+01	3.498D+01	3.074D+04
4	1.070D+02	2.005D+01	3.104D+03
5	1.500D+01	1.987D+01	0.000D+00

ATTACHMENT C.4

RADON MODEL OUTPUT FOR VARIABLE THICKNESS OF RANDOM FILL

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: Cell2pt1

DESCRIPTION: Cell 2 Evaluation of Impact of Increased Random Fill Thickness – Point 1

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	5	
DEFAULT RADON FLUX LIMIT	20	pCi m^-2 s^-1
NO. OF THE LAYER TO BE OPTIMIZED	3	
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.001	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 Tailings

THICKNESS	500	cm
POROSITY	.45	
MEASURED MASS DENSITY	1.5	g cm^-3
MEASURED RADIUM ACTIVITY	923	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.2	
CALCULATED SOURCE TERM CONCENTRATION	1.292D-03	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6	%
MOISTURE SATURATION FRACTION	.200	
MEASURED DIFFUSION COEFFICIENT	.0288	cm^2 s^-1

LAYER 2 Random Fill

THICKNESS	76	cm
POROSITY	.43	
MEASURED MASS DENSITY	1.5	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	

CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.234	
MEASURED DIFFUSION COEFFICIENT	.026	cm^2 s^-1

LAYER 3 Compacted Random Fill

THICKNESS	1	cm
POROSITY	.32	
MEASURED MASS DENSITY	1.8	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.377	
MEASURED DIFFUSION COEFFICIENT	.016	cm^2 s^-1

LAYER 4 ET Cover

THICKNESS	107	cm
POROSITY	.39	
MEASURED MASS DENSITY	1.6	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.275	
MEASURED DIFFUSION COEFFICIENT	.0225	cm^2 s^-1

LAYER 5 Topsoil

THICKNESS	15	cm
POROSITY	.38	
MEASURED MASS DENSITY	1.6	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5.2	%
MOISTURE SATURATION FRACTION	.219	
MEASURED DIFFUSION COEFFICIENT	.0254	cm^2 s^-1

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
5	-1.000D+00	0.000D+00	3	2.000D+01	1.000D-03

LAYER	DX	D	P	Q	XMS	RHO
1	5.000D+02	2.880D-02	4.500D-01	1.292D-03	2.000D-01	1.500
2	7.600D+01	2.600D-02	4.300D-01	0.000D+00	2.337D-01	1.500
3	1.000D+00	1.600D-02	3.200D-01	0.000D+00	3.769D-01	1.800
4	1.070D+02	2.250D-02	3.900D-01	0.000D+00	2.749D-01	1.600
5	1.500D+01	2.540D-02	3.800D-01	0.000D+00	2.189D-01	1.600

BARE SOURCE FLUX FROM LAYER 1: 6.713D+02 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.000D+02	2.884D+02	3.461D+05
2	7.600D+01	1.094D+02	2.058D+05
3	1.219D+02	3.507D+01	3.073D+04
4	1.070D+02	2.020D+01	2.966D+03
5	1.500D+01	2.000D+01	0.000D+00

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: Cell2pt2

DESCRIPTION: Cell 2 Evaluation of Impact of Increased Random Fill Thickness – Point 2

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS		2.65

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	5	
DEFAULT RADON FLUX LIMIT	20	pCi m^-2 s^-1
NO. OF THE LAYER TO BE OPTIMIZED	3	
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.001	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 Tailings

THICKNESS	500	cm
POROSITY	.45	
MEASURED MASS DENSITY	1.5	g cm^-3
MEASURED RADIUM ACTIVITY	923	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.2	
CALCULATED SOURCE TERM CONCENTRATION	1.292D-03	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6	%
MOISTURE SATURATION FRACTION	.200	
MEASURED DIFFUSION COEFFICIENT	.0288	cm^2 s^-1

LAYER 2 Random Fill

THICKNESS	107	cm
POROSITY	.43	
MEASURED MASS DENSITY	1.5	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	

CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.234	
MEASURED DIFFUSION COEFFICIENT	.026	cm^2 s^-1

LAYER 3 Compacted Random Fill

THICKNESS	1	cm
POROSITY	.32	
MEASURED MASS DENSITY	1.8	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.377	
MEASURED DIFFUSION COEFFICIENT	.016	cm^2 s^-1

LAYER 4 ET Cover

THICKNESS	107	cm
POROSITY	.39	
MEASURED MASS DENSITY	1.6	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.275	
MEASURED DIFFUSION COEFFICIENT	.0225	cm^2 s^-1

LAYER 5 Topsoil

THICKNESS	15	cm
POROSITY	.38	
MEASURED MASS DENSITY	1.6	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5.2	%
MOISTURE SATURATION FRACTION	.219	
MEASURED DIFFUSION COEFFICIENT	.0254	cm^2 s^-1

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
5	-1.000D+00	0.000D+00	3	2.000D+01	1.000D-03

LAYER	DX	D	P	Q	XMS	RHO
1	5.000D+02	2.880D-02	4.500D-01	1.292D-03	2.000D-01	1.500
2	1.070D+02	2.600D-02	4.300D-01	0.000D+00	2.337D-01	1.500
3	1.000D+00	1.600D-02	3.200D-01	0.000D+00	3.769D-01	1.800
4	1.070D+02	2.250D-02	3.900D-01	0.000D+00	2.749D-01	1.600
5	1.500D+01	2.540D-02	3.800D-01	0.000D+00	2.189D-01	1.600

BARE SOURCE FLUX FROM LAYER 1: 6.713D+02 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.000D+02	3.002D+02	3.355D+05
2	1.070D+02	8.457D+01	1.545D+05
3	9.819D+01	3.508D+01	3.075D+04
4	1.070D+02	2.021D+01	2.967D+03
5	1.500D+01	2.000D+01	0.000D+00

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: Cell2pt3

DESCRIPTION: Cell 2 Evaluation of Impact of Increased Random Fill Thickness – Point 3

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS		2.65

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	5	
DEFAULT RADON FLUX LIMIT	20	pCi m^-2 s^-1
NO. OF THE LAYER TO BE OPTIMIZED	3	
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.001	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 Tailings

THICKNESS	500	cm
POROSITY	.45	
MEASURED MASS DENSITY	1.5	g cm^-3
MEASURED RADIUM ACTIVITY	923	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.2	
CALCULATED SOURCE TERM CONCENTRATION	1.292D-03	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6	%
MOISTURE SATURATION FRACTION	.200	
MEASURED DIFFUSION COEFFICIENT	.0288	cm^2 s^-1

LAYER 2 Random Fill

THICKNESS	152	cm
POROSITY	.43	
MEASURED MASS DENSITY	1.5	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	

CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.234	
MEASURED DIFFUSION COEFFICIENT	.026	cm^2 s^-1

LAYER 3 Compacted Random Fill

THICKNESS	1	cm
POROSITY	.32	
MEASURED MASS DENSITY	1.8	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.377	
MEASURED DIFFUSION COEFFICIENT	.016	cm^2 s^-1

LAYER 4 ET Cover

THICKNESS	107	cm
POROSITY	.39	
MEASURED MASS DENSITY	1.6	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.275	
MEASURED DIFFUSION COEFFICIENT	.0225	cm^2 s^-1

LAYER 5 Topsoil

THICKNESS	15	cm
POROSITY	.38	
MEASURED MASS DENSITY	1.6	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5.2	%
MOISTURE SATURATION FRACTION	.219	
MEASURED DIFFUSION COEFFICIENT	.0254	cm^2 s^-1

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
5	-1.000D+00	0.000D+00	3	2.000D+01	1.000D-03

LAYER	DX	D	P	Q	XMS	RHO
1	5.000D+02	2.880D-02	4.500D-01	1.292D-03	2.000D-01	1.500
2	1.520D+02	2.600D-02	4.300D-01	0.000D+00	2.337D-01	1.500
3	1.000D+00	1.600D-02	3.200D-01	0.000D+00	3.769D-01	1.800
4	1.070D+02	2.250D-02	3.900D-01	0.000D+00	2.749D-01	1.600
5	1.500D+01	2.540D-02	3.800D-01	0.000D+00	2.189D-01	1.600

BARE SOURCE FLUX FROM LAYER 1: 6.713D+02 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.000D+02	3.089D+02	3.276D+05
2	1.520D+02	5.950D+01	1.003D+05
3	6.418D+01	3.509D+01	3.075D+04
4	1.070D+02	2.021D+01	2.967D+03
5	1.500D+01	2.000D+01	0.000D+00

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: Cell2pt4

DESCRIPTION: Cell 2 Evaluation of Impact of Increased Random Fill Thickness – Point 4

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	4	
RADON FLUX LIMIT	20	pCi m^-2 s^-1
NO. OF THE LAYER TO BE OPTIMIZED	2	
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.001	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 Tailings

THICKNESS	500	cm
POROSITY	.45	
MEASURED MASS DENSITY	1.5	g cm^-3
MEASURED RADIUM ACTIVITY	923	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.2	
CALCULATED SOURCE TERM CONCENTRATION	1.292D-03	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6	%
MOISTURE SATURATION FRACTION	.200	
MEASURED DIFFUSION COEFFICIENT	.0288	cm^2 s^-1

LAYER 2 Random Fill

THICKNESS	1	cm
POROSITY	.43	
MEASURED MASS DENSITY	1.5	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	

CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.234	
MEASURED DIFFUSION COEFFICIENT	.026	cm^2 s^-1

LAYER 3 ET Cover

THICKNESS	107	cm
POROSITY	.39	
MEASURED MASS DENSITY	1.6	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.275	
MEASURED DIFFUSION COEFFICIENT	.0225	cm^2 s^-1

LAYER 4 Topsoil

THICKNESS	15	cm
POROSITY	.38	
MEASURED MASS DENSITY	1.6	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5.2	%
MOISTURE SATURATION FRACTION	.219	
MEASURED DIFFUSION COEFFICIENT	.0254	cm^2 s^-1

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
4	-1.000D+00	0.000D+00	2	2.000D+01	1.000D-03

LAYER	DX	D	P	Q	XMS	RHO
1	5.000D+02	2.880D-02	4.500D-01	1.292D-03	2.000D-01	1.500
2	1.000D+00	2.600D-02	4.300D-01	0.000D+00	2.337D-01	1.500
3	1.070D+02	2.250D-02	3.900D-01	0.000D+00	2.749D-01	1.600
4	1.500D+01	2.540D-02	3.800D-01	0.000D+00	2.189D-01	1.600

BARE SOURCE FLUX FROM LAYER 1: 6.713D+02 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.000D+02	3.145D+02	3.225D+05
2	2.437D+02	3.502D+01	3.520D+04
3	1.070D+02	2.017D+01	2.961D+03
4	1.500D+01	1.998D+01	0.000D+00

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: Cell3pt1

DESCRIPTION: Cell 3 Evaluation of Impact of Increased Random Fill Thickness – Point 1

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	5	
RADON FLUX LIMIT	20	pCi m^-2 s^-1
NO. OF THE LAYER TO BE OPTIMIZED	3	
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.001	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 Tailings

THICKNESS	500	cm
POROSITY	.45	
MEASURED MASS DENSITY	1.5	g cm^-3
MEASURED RADIUM ACTIVITY	758	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.2	
CALCULATED SOURCE TERM CONCENTRATION	1.061D-03	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6	%
MOISTURE SATURATION FRACTION	.200	
MEASURED DIFFUSION COEFFICIENT	.0288	cm^2 s^-1

LAYER 2 Random Fill

THICKNESS	76	cm
POROSITY	.43	
MEASURED MASS DENSITY	1.5	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	

CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.234	
MEASURED DIFFUSION COEFFICIENT	.026	cm^2 s^-1

LAYER 3 Compacted Random Fill

THICKNESS	1	cm
POROSITY	.32	
MEASURED MASS DENSITY	1.8	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.377	
MEASURED DIFFUSION COEFFICIENT	.016	cm^2 s^-1

LAYER 4 ET Cover

THICKNESS	107	cm
POROSITY	.39	
MEASURED MASS DENSITY	1.6	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.275	
MEASURED DIFFUSION COEFFICIENT	.0225	cm^2 s^-1

LAYER 5 Topsoil

THICKNESS	15	cm
POROSITY	.38	
MEASURED MASS DENSITY	1.6	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5.2	%
MOISTURE SATURATION FRACTION	.219	
MEASURED DIFFUSION COEFFICIENT	.0254	cm^2 s^-1

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
5	-1.000D+00	0.000D+00	3	2.000D+01	1.000D-03

LAYER	DX	D	P	Q	XMS	RHO
1	5.000D+02	2.880D-02	4.500D-01	1.061D-03	2.000D-01	1.500
2	7.600D+01	2.600D-02	4.300D-01	0.000D+00	2.337D-01	1.500
3	1.000D+00	1.600D-02	3.200D-01	0.000D+00	3.769D-01	1.800
4	1.070D+02	2.250D-02	3.900D-01	0.000D+00	2.749D-01	1.600
5	1.500D+01	2.540D-02	3.800D-01	0.000D+00	2.189D-01	1.600

BARE SOURCE FLUX FROM LAYER 1: 5.513D+02 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.000D+02	2.375D+02	2.837D+05
2	7.600D+01	9.099D+01	1.679D+05
3	1.050D+02	3.508D+01	3.074D+04
4	1.070D+02	2.020D+01	2.966D+03
5	1.500D+01	2.000D+01	0.000D+00

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: Cell3pt2

DESCRIPTION: Cell 3 Evaluation of Impact of Increased Random Fill Thickness – Point 2

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS		2.65

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	5	
RADON FLUX LIMIT	20	pCi m^-2 s^-1
NO. OF THE LAYER TO BE OPTIMIZED	3	
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.001	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 Tailings

THICKNESS	500	cm
POROSITY	.45	
MEASURED MASS DENSITY	1.5	g cm^-3
MEASURED RADIUM ACTIVITY	758	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.2	
CALCULATED SOURCE TERM CONCENTRATION	1.061D-03	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6	%
MOISTURE SATURATION FRACTION	.200	
MEASURED DIFFUSION COEFFICIENT	.0288	cm^2 s^-1

LAYER 2 Random Fill

THICKNESS	107	cm
POROSITY	.43	
MEASURED MASS DENSITY	1.5	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	

CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.234	
MEASURED DIFFUSION COEFFICIENT	.026	cm^2 s^-1

LAYER 3 Compacted Random Fill

THICKNESS	1	cm
POROSITY	.32	
MEASURED MASS DENSITY	1.8	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.377	
MEASURED DIFFUSION COEFFICIENT	.016	cm^2 s^-1

LAYER 4 ET Cover

THICKNESS	107	cm
POROSITY	.39	
MEASURED MASS DENSITY	1.6	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.275	
MEASURED DIFFUSION COEFFICIENT	.0225	cm^2 s^-1

LAYER 5 Topsoil

THICKNESS	15	cm
POROSITY	.38	
MEASURED MASS DENSITY	1.6	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5.2	%
MOISTURE SATURATION FRACTION	.219	
MEASURED DIFFUSION COEFFICIENT	.0254	cm^2 s^-1

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
5	-1.000D+00	0.000D+00	3	2.000D+01	1.000D-03

LAYER	DX	D	P	Q	XMS	RHO
1	5.000D+02	2.880D-02	4.500D-01	1.061D-03	2.000D-01	1.500
2	1.070D+02	2.600D-02	4.300D-01	0.000D+00	2.337D-01	1.500
3	1.000D+00	1.600D-02	3.200D-01	0.000D+00	3.769D-01	1.800
4	1.070D+02	2.250D-02	3.900D-01	0.000D+00	2.749D-01	1.600
5	1.500D+01	2.540D-02	3.800D-01	0.000D+00	2.189D-01	1.600

BARE SOURCE FLUX FROM LAYER 1: 5.513D+02 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.000D+02	2.471D+02	2.750D+05
2	1.070D+02	7.089D+01	1.255D+05
3	8.150D+01	3.507D+01	3.073D+04
4	1.070D+02	2.020D+01	2.966D+03
5	1.500D+01	2.000D+01	0.000D+00

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: Cell3pt3

DESCRIPTION: Cell 3 Evaluation of Impact of Increased Random Fill Thickness – Point 3

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	5	
RADON FLUX LIMIT	20	pCi m^-2 s^-1
NO. OF THE LAYER TO BE OPTIMIZED	3	
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.001	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 Tailings

THICKNESS	500	cm
POROSITY	.45	
MEASURED MASS DENSITY	1.5	g cm^-3
MEASURED RADIUM ACTIVITY	758	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.2	
CALCULATED SOURCE TERM CONCENTRATION	1.061D-03	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6	%
MOISTURE SATURATION FRACTION	.200	
MEASURED DIFFUSION COEFFICIENT	.0288	cm^2 s^-1

LAYER 2 Random Fill

THICKNESS	152	cm
POROSITY	.43	
MEASURED MASS DENSITY	1.5	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	

CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.234	
MEASURED DIFFUSION COEFFICIENT	.026	cm^2 s^-1

LAYER 3 Compacted Random Fill

THICKNESS	1	cm
POROSITY	.32	
MEASURED MASS DENSITY	1.8	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.377	
MEASURED DIFFUSION COEFFICIENT	.016	cm^2 s^-1

LAYER 4 ET Cover

THICKNESS	107	cm
POROSITY	.39	
MEASURED MASS DENSITY	1.6	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.275	
MEASURED DIFFUSION COEFFICIENT	.0225	cm^2 s^-1

LAYER 5 Topsoil

THICKNESS	15	cm
POROSITY	.38	
MEASURED MASS DENSITY	1.6	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5.2	%
MOISTURE SATURATION FRACTION	.219	
MEASURED DIFFUSION COEFFICIENT	.0254	cm^2 s^-1

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
5	-1.000D+00	0.000D+00	3	2.000D+01	1.000D-03

LAYER	DX	D	P	Q	XMS	RHO
1	5.000D+02	2.880D-02	4.500D-01	1.061D-03	2.000D-01	1.500
2	1.520D+02	2.600D-02	4.300D-01	0.000D+00	2.337D-01	1.500
3	1.000D+00	1.600D-02	3.200D-01	0.000D+00	3.769D-01	1.800
4	1.070D+02	2.250D-02	3.900D-01	0.000D+00	2.749D-01	1.600
5	1.500D+01	2.540D-02	3.800D-01	0.000D+00	2.189D-01	1.600

BARE SOURCE FLUX FROM LAYER 1: 5.513D+02 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.000D+02	2.543D+02	2.685D+05
2	1.520D+02	5.094D+01	8.036D+04
3	4.798D+01	3.509D+01	3.075D+04
4	1.070D+02	2.021D+01	2.967D+03
5	1.500D+01	2.000D+01	0.000D+00

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: Cell3pt4

DESCRIPTION: Cell 3 Evaluation of Impact of Increased Random Fill Thickness – Point 4

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	4	
RADON FLUX LIMIT	20	pCi m^-2 s^-1
NO. OF THE LAYER TO BE OPTIMIZED	2	
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.001	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 Tailings

THICKNESS	500	cm
POROSITY	.45	
MEASURED MASS DENSITY	1.5	g cm^-3
MEASURED RADIUM ACTIVITY	758	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.2	
CALCULATED SOURCE TERM CONCENTRATION	1.061D-03	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6	%
MOISTURE SATURATION FRACTION	.200	
MEASURED DIFFUSION COEFFICIENT	.0288	cm^2 s^-1

LAYER 2 Random Fill

THICKNESS	1	cm
POROSITY	.43	
MEASURED MASS DENSITY	1.5	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	

CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.234	
MEASURED DIFFUSION COEFFICIENT	.026	cm^2 s^-1

LAYER 3 ET Cover

THICKNESS	107	cm
POROSITY	.39	
MEASURED MASS DENSITY	1.6	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6.7	%
MOISTURE SATURATION FRACTION	.275	
MEASURED DIFFUSION COEFFICIENT	.0225	cm^2 s^-1

LAYER 4 Topsoil

THICKNESS	15	cm
POROSITY	.38	
MEASURED MASS DENSITY	1.6	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5.2	%
MOISTURE SATURATION FRACTION	.219	
MEASURED DIFFUSION COEFFICIENT	.0254	cm^2 s^-1

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
4	-1.000D+00	0.000D+00	2	2.000D+01	1.000D-03

LAYER	DX	D	P	Q	XMS	RHO
1	5.000D+02	2.880D-02	4.500D-01	1.061D-03	2.000D-01	1.500
2	1.000D+00	2.600D-02	4.300D-01	0.000D+00	2.337D-01	1.500
3	1.070D+02	2.250D-02	3.900D-01	0.000D+00	2.749D-01	1.600
4	1.500D+01	2.540D-02	3.800D-01	0.000D+00	2.189D-01	1.600

BARE SOURCE FLUX FROM LAYER 1: 5.513D+02 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.000D+02	2.583D+02	2.649D+05
2	2.217D+02	3.506D+01	3.523D+04
3	1.070D+02	2.019D+01	2.964D+03
4	1.500D+01	2.000D+01	0.000D+00

ATTACHMENT I

SUPPORTING DOCUMENTATION FOR INTERROGATORY 16/1:

REVISED RADIATION PROTECTION MANUAL

Responsible Authority

Radiation Safety Officer

The Radiation Safety Officer (RSO) shall meet the requirements as specified in section 2.4, Technical Qualifications of Health Physics Staff in NRC Regulatory Guide 8.31. Along with meeting the requirements outline in Regulatory Guide 8.31, the RSO must also be submitted and approved by the State of Utah as an acceptable responsible authority for reclamation activities.

The RSO will be responsible for following and complying with all rules and specifications that are outlined in the Reclamation Plan along with all standards pertaining to the health and safety of the employees and environment. The RSO must also maintain accurate documentation of all decontamination and disposal activities. The RSO will have the responsibility of overseeing all aspects of this procedure and all total releases of any materials from the facility. These records will be maintained on site for review.

1.0 RADIATION MONITORING – PERSONNEL

This section contains the following procedures for personnel radiation monitoring including: (1) airborne particulates (2) alpha surveys (3) beta/gamma surveys and (4) urinalysis surveys.

1.1 AIRBORNE PARTICULATES

Sampling for personnel exposure to airborne particulate radionuclides, other than for radon progeny, will be done utilizing two distinct sampling protocols: (1) personnel breathing zone samplers, and (2) ambient air high volume samplers. Specific standard operating procedures for these two collection methods are described in Section 1.1.2 and 1.1.3 below.

1.1.1 Frequency

For work where there is the potential to cause airborne radiation doses to site personnel, the frequency and type of air sampling to be conducted is determined from measured air concentrations:

0.01 DAC – 0.1 DAC	Quarterly or monthly area air sampling and/or bioassay measurements
> 0.1 DAC	Continuous sampling is appropriate if concentrations are likely to exceed 0.10 DAC averaged over 40 hours or longer.

The RSO will determine the exact frequency of area air sampling, breathing zone sampling and/or bioassay measurements and determine how many workers in a group of workers performing similar jobs are to be equipped with breathing zone air samplers. Higher airborne concentrations warrant more frequent use of area air samplers, bioassay measurements, and breathing zone air samplers. Area air samplers may be used where documentation exists showing the sample is equivalent to a breathing zone sample. Breathing zone samples taken within one foot of the worker's head are considered representative without further documentation. Breathing zone air samplers are preferred under work conditions of higher airborne concentrations. Table 1.1.1-1 below, from Regulatory Guide 8.25, provides additional guidance for the RSO in designing and implementing air sampling programs for specific jobs.

Table 1.1.1-1
Air Sampling Recommendations Based on Estimated Intakes and Airborne Concentrations

Worker's Estimated Annual Intake as a Fraction of ALI	Estimated Airborne Concentrations as a Fraction of DAC	Air Sampling Recommendations
< 0.1	< 0.01	Air sampling is generally not necessary. However, monthly or quarterly grab samples or some other measurement may be appropriate to confirm that airborne levels are indeed low.
	> 0.01	Some air sampling is appropriate. Intermittent or grab samples are appropriate near the lower end of the range. Continuous sampling is appropriate if concentrations are likely to exceed 0.1 DAC averaged over 40 hours or longer.
> 0.1	< 0.3	Monitoring of intake by air sampling or bioassay is required by 10 CFR 20.1502(b).
	> 0.3	A demonstration that the air samples are representative of the breathing zone is appropriate if (1) intakes of record will be based on air sampling and (2) concentrations are likely to exceed 0.3 DAC averaged over 40 hours (i.e., intake more than 12 DAC-hours in a week).
Any annual intake	> 1	Air samples should be analyzed before work resumes the next day when potential intakes may exceed 40 DAC-hours in 1 week. When work is done in shifts, results should be available before the next shift ends. (Credit may be taken for protection factors if a respiratory protection program is in place.)
	> 5	Continuous air monitoring should be provided if there is a potential for intakes to exceed 40 DAC-hours in 1 day. (Credit may be taken for protection factors if a respiratory protection program is in place.)

1.1.2 Breathing Zone Sampling

1.1.2.1 General

Breathing zone samplers (SKC pumps and accessory kits, or equivalent) are used to determine airborne exposure to uranium while individuals are performing specific jobs. The units consist of a portable low volume pump that attaches to the individuals belt, tygon tubing and filter holder that is attached to the individual's lapel or shirt collar. The unit monitors airborne uranium in a person's breathing zone. Pumps must be recharged after 6 to 8 hours of use.

1.1.2.2 Applicability

Breathing zone samples are required:

- for all calciner activities,
- at least quarterly during routine tasks on representative individuals performing these tasks,
- when radiation work permits are issued in which airborne concentrations may exceed 25% of 10 CFR Part 20 limits, or
- at the discretion of the RSO.

1.1.2.3 Procedure

The procedure for collecting a breathing zone sample is as follows:

1. Secure the breathing zone sampler, which has been charged and loaded with a filter paper from the radiation department.

2. Secure the pump to the worker's belt and the filter holder to the shirt collar or lapel. Try to secure pump tubing to minimize restriction of motion.

3. Turn pump on (record the time pump was turned on) and continue monitoring until the work being monitored is completed and the worker no longer is in the exposure area. Record the time at which the job is complete.

4. Return the pump and accessories to the RSO, who will remove the filter paper for analysis. Be sure to indicate accurately the total time taken by the work being monitored.

5. Analysis of filter samples will be performed using a sensitive alpha detector. The procedure is as follows: (a) count a background sample for ten minutes; (b) divide the background count by ten to obtain the background count rate in cpm; (c) Place the breathing zone sample in the instrument and count the sample again for ten minutes;

(d) divide the sample count by ten to obtain the count rate in cpm; (e) subtract the background count rate from the sample count rate; and, (f) record all data on the Breathing Zone sampling analysis form (a copy of which is attached).

6. Record the total hours of exposure that are being assigned to the employee on the Employee Exposure form, which is maintained in personnel folders. Be sure to consider protection factors permitted by respirator use if the employee was also wearing respiratory protection during the job.

7. The number of DAC hours assigned is calculated using the following formula:

$$\text{DAC hours of exposure} = \frac{\text{Measured air concentration}}{(\text{DAC})(\text{PF})} \times \text{Total hours of exposure}$$

where: DAC = Derived Air Concentration (for uranium; 10 CFR Part 20, Appendix B)

PF = protection factor for respirator use. If no respiratory protection was used PF =1.

The measured air concentration must be in μCi/cc.

1.1.2.4 Calibration

Prior to use, calibration of the breathing zone samplers will be done using a calibration method as described in Section 3.2.

1.1.2.5 Equipment – Breathing Zone Sampler

The equipment used for breathing zone samples consists of:

1. Personal sampling pumps
2. Gelman 37 mm Delrin filter holders, or equivalent
3. Gelman 37 mm type A/E glass fiber filters, or equivalent
4. Kurz Model 543 air mass flow meter, or equivalent

1.1.2.6 Data Record

Data maintained on file includes:

1. Time on and off for each sample pump.
2. Sampling location(s).
3. Individual's name, identification number, etc.
4. Date and sample number.

5. Sample count rate.

1.1.2.7 Calculations

The airborne concentration in µCi/cc is equal to the sample count rate minus the background count rate in cpm divided by the instrument alpha efficiency, the sample flow rate in cc/minute, the sample time in minutes and a conversion factor converting dpm to µCi.

The calculation is:

Equation Number 1:

$$\text{Airborne concentration} = \frac{\text{(Count Rate)}}{\text{(Time)(eff)(Conversion factor)(Flow Rate)}}$$

$$\text{i.e. } \frac{\text{uCi}}{\text{cc}} = \frac{\text{(cpm-Bkg) 1 uCi} \quad (1) \quad (1)}{(\text{eff})(2.22\text{x}10^{6}\text{dpm})(\text{cc/min})(\text{min})}$$

where: eff = cpm/dpm for counting instruments
cpm = counts/min
dpm = disintegrations/min
Conversion factor 1 µCi = $2.22\text{x}10^{6}$ dpm
Flow Rate = cc/min
Collection time = min

Once the airborne concentration has been calculated it is possible to calculate personnel exposure in microcuries (µCi). Personnel exposure is determined for an individual who is working in an area at a known air concentration (µCi /cc) for a given amount of time (hours) breathing the area air at an assumed rate. The breathing rate for a standard person (Handbook of Radiological Health) is 1.20 cubic meters per hour (m^3/hr).

The calculation for personnel exposure is:

Equation Number 2:

Exposure µCi = (µCi /cc)(1.20m^3/hr)(hours of exposure)(conversion rate)

Where: µCi /cc = air concentration from Equation 1

1.20 m^3/hr = breathing rate for standard man (ICRP)
hours of exposure = hours
conversion factor = 10^6cc/m^3

It is also possible to determine the percent or fraction of the Derived Air Concentration (DAC) for a particular radionuclide using the information obtained from the exposure calculation and dividing this value by the regulatory limit DAC listed in 10 CFR Part 20.

% DAC = Exposure in μCi / μCi limit 10 CFR Part 20

For the natural uranium (U-Nat) the DAC limits from 10 CFR Part 20 for insoluble Class Y compounds are as follows:

- Weekly 1.0×10^{-3} μCi /week
- Quarterly 1.25×10^{-2} μCi /Qt
- Yearly 5.0×10^{-2} μCi /yr

1.1.2.8 ALARA/Quality Control

The RSO reviews each monitored result and initiates action if levels exceed 25% of 10 CFR 20 limits. At a minimum, ten percent (10%) of the air samples collected in a given quarter will be recounted using the same instrument or using a different instrument and these results will be compared to the original sample results. Deviations exceeding 30% of the original sample results will be reviewed by the RSO and the samples will be recounted again until the sample results are determined to be consistent. Additional QA samples consisting of spiked air samples, duplicate samples and blank samples will be submitted to the radiation department for counting. This will be based on ten percent (10%) of the number of samples collected during a quarter. The sample results will be compared to the spiked values, duplicate values, or blank (background) values of the prepared sample. Deviations exceeding 30% of the determined spiked, duplicate or blank value will be recounted. If no resolution of the deviation exceeding 30% is made the QA samples preparation will be repeated. Periodic reviews by the RSO and the ALARA audit committee will be made and documented to ensure quality maintenance and ALARA control.

1.1.3 Airborne High Volume Sampling

Grab air sampling involves passing a representative sample of air through a filter paper disc via an air pump for the purpose of determining the concentration of uranium in breathing air at that location. Although the process is only measuring airborne concentrations at a specific place and at a specific time, the results can often be used to represent average concentration in a general area. A high volume sample pump will be used for this purpose. Samples will be analyzed as per standard gross alpha analysis procedures using a sensitive alpha detector.

1.1.3.1 Frequency and Locations

The following principles used for the collection of area grab samples must be considered when collecting a sample in order to obtain a representative air concentration that workers may be exposed to during their assigned work tasks.

1. The locations selected for sampling should be representative of exposures to employees working in the area.

2. For special air sampling, the sampling period should represent the conditions during the entire period of exposure. This may involve sampling during the entire exposure period.

3. For routine sampling, the sampling period must be sufficient to ensure a minimum flow rate of 40 liters per minute (lpm) for at least 60 minutes.

4. Sample filters will be analyzed for gross alpha using a sensitive alpha detector.

5. Grab sampling procedures may be supplemented by use of Breathing Zone Samples for special jobs or non-routine situations.

1.1.3.2 Sampling Equipment

Monitoring equipment will be capable of obtaining an air sample flow rate of at least 40 liters per minute for one hour or longer. Equipment utilized will be and Eberline RAS-1, or a Scientific Industries Model H25004, or equivalent. Filter media will be of appropriate micron pore diameter. Equipment is calibrated prior to each usage as per Section 3.3 of this manual.

1.1.3.3 Sampling Procedure

Steps for collection of area airborne grab samples are as follows:

1. A high volume pump will be used for sample collection.

2. Check sample pump calibration.

3. Locate sampler at designated site. Insert a clean filter, using tweezers, into the filter holder on the sampler. Do not contaminate the filter. Log start time and conditions at the site.

4. Collect a sample for a minimum of 60 minutes at a flow rate of 40 lpm.

5. After sampling is completed, carefully remove the filter, using tweezers, from the filter holder and place it in a clean envelope, or in the plastic casing furnished with the filter.

6. Log all sample data on the log sheet.
   A. Sample location and number (also on the envelope).
   B. Time on, time off and date.
   C. Mill operating conditions at the site.
   D. Sampler's initials.

7. Analyze for gross alpha

1.1.3.4 Calculations

Perform calculations as described in Section 1.1.2.7.

1.1.3.5 Records

Logs of all samples taken are filed in the RSO's files. Data are used to calculate radiation exposures as described in Section 4.0.

Whenever grab sampling results indicate that concentrations in work locations exceed 25% of the applicable value in 10 CFR Part 20, Appendix B, time weighted exposures of employees who have worked at these locations shall be computed. Calculations will reveal an individual's exposure in DAC hours. This value shall be assigned to the worker and logged onto the worker's "Employee Exposure to Airborne Radionuclides" form. This form is in Section 4. Whenever special air sampling programs (as required for cleanup, maintenance, decontamination incidents, etc.) reveal that an employee has been exposed to airborne radioactive material, the calculated value shall also be entered on the individual's exposure form.

1.1.3.6 Quality Assurance

Calibration checks on each air sampler, prior to field use, ensure accurate airflow volumes. Use of tweezers and new filter storage containers minimizes contamination potential. Field logging of data during sampling and logging of identifying data on sampled filter containers minimizes sample transposition. Quality control samples will be analyzed as described in Section 1.1.2.8

Review of data by the RSO and by the ALARA Audit committee further assures quality maintenance.

1.2 ALPHA SURVEYS

1.2.1 Restricted Area

The Restricted Area is defined as:

1. The property area within the chain link fence surrounding the mill property and the area enclosed to the north and east of the facility by the posted Restricted Area fence.

2. The active tailings and liquid waste disposal areas.

All personnel who enter the Restricted Area will monitor themselves each time they leave the Restricted Area and at the end of their shift. The Radiation Safety Department will review the monitoring information. All personnel exiting the Restricted Area must initial a record of their monitoring activity.

1.2.2 Instrumentation

The instrumentation utilized for personnel alpha scanning is listed in Appendix 1 at the end of this manual. Personnel alpha survey instruments are located at the exits from the Restricted Area.

1.2.3 Monitoring Procedures

The monitoring procedure includes the following steps:

1. The alarm rate meter is adjusted within the range of 750 to 1,000 dpm/100 cm^2 to ensure a margin of 250 dpm/100 cm^2 due to the low efficiency of this instrumentation.

2. An individual monitors himself by slowly passing the detector over their hands, clothing and shoes, including the shoe bottoms, at a distance from the surface of approximately ¼ inch. An area that is suspected of possessing any contamination (i.e. hands, boots, visible spotting/stain on clothing etc.) should be carefully monitored by placing the detector directly on the surface and note the measurement.

3. Should an alarm be set off indicating the presence of contamination, the individual should:
   a. Resurvey themselves to verify the contamination.
   b. If contamination is present the individual must wash the affected area and again resurvey themselves to ensure the contamination has been removed.

4. If the decontamination efforts by the individual are not successful, then the Radiation Safety personnel will be contacted to assess the situation. Further decontamination may be required.

5. If an individual's clothing cannot be successfully decontaminated, they must obtain clothing from the warehouse to use and must launder the personal clothing in the laundry room.

6. Individual surveys are to be logged and initialed.

7. Access to and from the Mill's Restricted Area by all Mill workers, contractors and delivery personnel, other than Radiation, Safety and Environmental Staff, Senior Laboratory personnel, Mill Management and Mill Supervisory personnel and others as may be designated by the RSO, will be limited to one or more access points as may be designated by the RSO from time to time.

8. A Radiation Technician will be positioned at each access point designated by the RSO under paragraph 7 above during peak transition times, such as during breaks and at the ends of shifts, to observe that each worker, contractor or delivery person is performing a proper scan.

1.2.4 Training

All employees will be trained on the proper scanning procedures and techniques.

1.2.5 Records

Log sheets will be collected daily and filed by the Radiation staff. Records will be retained at the Mill. Contamination incidents will result in a written record, which is maintained on file.

1.2.6 Limits/ALARA

Contamination limits for personnel scans are set at 1,000 dpm/100 cm^2. Records will be reviewed by the RSO to maintain levels noted as low as reasonable achievable.

1.2.7 Quality Assurance

A random check of an individual's scanning technique provides quality assurance of the monitoring procedures. Daily function checks using calibrated sources assures instrumentation performance. Periodic review by the RSO and the ALARA audit committee document and ensure quality control and ALARA maintenance.

1.3 PERSONNEL BETA-GAMMA MONITORING

Site employees working within the Restricted Area will be required to wear a personal monitoring device (such as a TLD, LUXEL badge or other NVLAP approved device which has been approved by the RSO and the SERP) during their work period. The personal monitoring devices are normally issued to each employee quarterly; however, during pregnancy or if the radiological potential for exposure to an individual is anticipated to be elevated and requires quick assessment the badges may be issued monthly.

1.3.1 Monitoring Procedures

The monitoring procedures consist of:

1. Personnel issued personal monitoring devices will wear the device on the trunk (torso) of the body. The personal monitoring device records beta/gamma radiation as well as other forms of penetrating radiation such as x-rays. A personal monitoring device is an exposure record of an individual's personal exposure to radiation while on the job. Therefore, personal monitoring devices are to remain at the Mill and stored on the assigned dosimeter storage boards. All exposure records obtained by a personal monitoring device which are not consistent with the exposure rates of work tasks or work location measurements made throughout the Mill will be evaluated by the RSO. This evaluation will result in an investigation by the RSO and a written explanation of the findings. These written records will be maintained at the Mill.

2. Personal monitoring devices will be issued at a minimum quarterly and will be exchanged by the Radiation Safety Department. Missing or lost badges will be reported to management.

3. Female employees that become pregnant and continue to work during the course of their pregnancy will be placed on a monthly personal monitoring device exchange during this period. NRC Regulation Guide 8.13 provides guidelines to be followed during pregnancy and is made part of this procedure.

1.3.2 Records

The Radiation Safety Department will maintain all occupational exposure records in the departmental files:

1. Occupational exposure records are a part of an individual's health record and, as such, will be considered private information.

2. An individual may examine his/her exposure record upon request.

3. An employee terminating his/her employment with the Company may request a copy of his/her occupational exposure records.

4. The Radiation Safety Department on the signature of the employee will request prior occupational exposure records.

5. Occupational exposure records will be made available to authorized company or regulatory personnel.

1.3.3 Quality Assurance

Periodic reviews by the RSO and the ALARA audit committee document and ensure quality control and maintenance of conditions ALARA.

1.4 URINALYSIS SURVEYS

1.4.1 Frequency

Urinalyses will be performed on those employees that are a) exposed to potential airborne yellowcake or involved in maintenance tasks during which yellowcake dust may be produced, or b) routinely exposed to airborne uranium dust. Baseline urinalyses will be performed prior to initial work assignments.

Urine samples are collected on a routine basis from employees as required in Regulatory Guide 8.22. Samples will be collected from all employees monthly. Bi-weekly samples will be collected if individual exposures are expected to exceed 25% of the DAC value. Non-routine urinalyses will usually be performed on employees who have been working on assignments that require a Radiation Work Permit, and always on any individual that may have been exposed to airborne uranium or ore dust concentrations that exceed the 25% of the DAC level.

1.4.2 Specimen Collection

Clean, disposable sample cups with lids will be provided to each employee that will be required to submit a urine specimen. The containers will be picked up at the administration building before the individual enters the Restricted Area.

The container, filled with specimen, will be returned to the bioassay laboratory prior to reporting to work. The name of the employee and the date of collection will be indicated on the specimen cup.

A valid sample must be collected at least 40 hours, but not more than 96 hours, after the most recent occupancy of the employee's work area (after two days, but not more than four days off).

The specimen should be collected prior to reporting to the individual's work location. To prevent contamination, the hands should be carefully washed prior to voiding.

Under unusual circumstances where specimens cannot be collected in this manner, the worker will shower immediately prior to voiding.

1.4.3 Sample Preparation

Equipment required:

- 15 ml disposable centrifuge tubes with lids
- 10 ml pipette
- 1 mL pipette
- 200 µL pipette
- 5 µl pipette
- 10 µl pipette
- Disposable tips for the above pipettes
- 1,000 ppm uranium solution
- Spiking solution – 0.03 or 0.02 g/l of uranium in de-ionized water

After the specimens are received, they will be stored in a refrigerator until they are prepared for analysis.

Sample preparation will be done in an area decontaminated to less than 25 dpm alpha (removable) per 100 cm^2 prior to preparation of samples. All of the equipment that is used in sample preparation will be clean and maintained in such condition.

A log will be prepared and the following information will be kept for each urinalysis performed:

Sample identification number
Name of employee submitting the specimen
Date of sample collection
Date the sample was sent to the laboratory
Date the results were received
Results of the urinalysis in µg/1
Indication of any spike used in µg/1

The centrifuge tubes will be marked with a sample identification number. 10 milliliters of urine will then be pipetted into the centrifuge tube using the pipette device. Or 1 milliliters of urine will then be pipette into the centrifuge tube using the pipette device (To prevent contamination, a new tip must be used for each specimen.) After each step of the procedure, the proper entry must be made in the logbook.

The samples that are to be spiked for quality assurance purposes will then be prepared. The spikes will be introduced into the sample with 5 µl or 10 µl pipettes. A new tip must be used with each spike. With the standard spike solution (0.03 g/l of U), a 5 µl spike will result in a 15 µg/l concentration for the 10 ml sample; the 10 µl spike will give 30 µg/l). The proper entry must be made in the logbook for each sample spiked.

After preparation has been completed, the QA samples are securely packaged as soon as practicable and sent to the contract laboratory for analysis.

The samples that are to be analyzed in-house will be placed in the chemistry laboratory's refrigerator until the analysis can be completed. A copy of the in-house analytical procedure is described in Section 1.4.7.6. Once the on-site laboratory is no longer functional, all samples will be submitted to a certified laboratory.

1.4.4 Quality Assurance

To assure reliability and reproducibility of results, at least 25% of the samples that are submitted for analysis will be used for quality assurance purposes. These samples will consist of spikes, duplicates, and blanks (samples collected from individuals known to have no lung or systemic uranium burden).

Spiked samples will be prepared as stated under sample preparation of this procedure.

Duplicates will be identical samples of the same specimen and/or spikes of identical concentrations.

To assure reliability of the in-house analytical procedure, 10% of the samples will be sent to a contractor laboratory for analysis. These samples will contain quality assurance items designed to provide intra-laboratory comparisons.

1.4.5 Analysis

After the samples are collected as outlined in Guide 8.22, they are identified to the lab by collection date and number. Urinalysis results must be completed and reported to the Radiation Safety Department within seven days of the sample collection.

1.4.5.1 Equipment List

1. Specimen collection cups with disposable lids (VWR No. 15708-711 or equivalent)
2. Screw cap, disposable, graduated 15 ml centrifuge tubes (Corning No. 25310 or equivalent)
3. Micro-pipettes 1 each 5, 5 each 10 μL (Oxford Model 7000 or equivalent)
4. Adjustable Finnpipette each 1,000 μL, 200 μL and 5 mL
5. Disposable micro-pipette tips for micro-pipettes (Oxford No. 910A or equivalent)
6. Fume Hood
7. Ultrasonic Cleaner
8. PE-SCIEX ELAN DRC II AXIAL FIELD TECHNOLOGY ICP-MS (or equivalent)
9. Polyscience Water Circulator (or equivalent)
10. Perkin-Elmer AS-10 Auto Sampler (or equivalent)

11. Thermo Scientific Vortex mixtures (or equivalent)

1.4.5.2 Reagent List

1. 1% to 2% Nitric Acid
2. Concentrated Nitric Acid
3. 1,000 µg/ml Uranium Stock Solution, certified vendor prepared
4. Dilutions of the above stock solution, replaced bi-annually. Used for QA/QC.
5. Appropriate Cleaning Solution for Ultrasonic Cleaner
6. 1,000 µg/ml Uranium Stock Solution, purchased from certified vendor to use as calibration standard at different dilutions

Ensure that all reagents used are within their expiration dates listed on each reagent package, if applicable.

1.4.5.3 Premise

A portion of urine is diluted with 2% Nitric acid solution, mixed thoroughly and analyzed.

1.4.5.4 Safety Precautions

1 Follow laboratory guidelines when working with acids.

2. Utilize all appropriate PPE.

1.4.5.5 Sample Preparation Procedure

1. Compare sample numbering with bioassay result sheet to insure order and eliminate discrepancies.

2. To 15 ml centrifuge tube add 1 mL urine sample, 200 µL internal standard of 1,000 ppb and 2% Nitric acid to make up volume to 10 mL.

3. Maintaining sample order of left to right, front to back, lowest sample number to highest sample number in the set.

4. Use vortex to mix it thoroughly.

5. Analyze using procedure on the ICP-MS described in section 1.4.5.6.

1.4.5.6 ICP-MS Procedures

Special considerations: Because of the high salt content of the samples, it is necessary to clean the skimmer and sampler cones after each use.

1. Turn the argon on at the tank and set the delivery pressure at 80 pounds per square inch (psi).

2. Turn on the exhaust fan and the water supply to the ICP-MS. The water supply has to have a delivery pressure of 70 psi. It may be necessary to change the filters on the water supply in order to achieve sufficient water supply pressure. The ICP-MS will not operate below this pressure.

3. Turn on the computer, monitor and printer.

4. On the windows desktop, double-click the ELAN icon.

5. Check the condition of the sample introduction system.

6. Check that the sample tubing and drain tubing leading from the peristaltic pump to the spray chamber are properly set up and in good working condition. It is recommended to use new tubes every day.

7. Place the capillary tubing into a container of 2% Nitric acid solution.

8. Open the instrument window, and then click the Front Panel Tab.

9. On the front panel tab click vacuum start.

10. When the instrument is ready, click Plasma Start.

11. After the plasma ignites, allow the instrument to warm up for 45 minutes.

12. To begin sample analysis, click the sample tab, build the sample analysis list and click on analyze sample.

13. After the last sample, aspirate the blank long enough to clean the lines.

14. Allow the pump to run long enough without aqueous uptake to void all lines.

15. Turn the flame off and relax lines off of pump.

16. After 5 to 10 minutes, turn off the water supply, exhaust fan and argon.

All bioassay samples need to be analyzed three (3) working days from receipt in the laboratory. Samples are extremely susceptible to contamination. Precautions should be taken to minimize traffic and fugitive dust while samples are digesting.

1.4.6 Reporting and Corrective Actions

As soon as the analytical results are received, they are entered in the logbook and the entries are checked for correctness and completeness.

The lab report is returned to the Radiation Safety Department with results reported as micrograms/liter of uranium. The information must be placed in the individual employee's exposure file and maintained as directed by the DRC.

The Radiation Safety Department is notified immediately of any sample with a concentration greater than 35 micrograms/liter of uranium. Corrective actions will be taken when the urinary uranium concentration falls within the limits listed in Table 1 (attached).

The Radiation Safety Department should compute the error on the control spiked samples and advise the lab if the results are more than ± 30% of the known values. If any of the results obtained for the quality assurance control samples are in error by a ± 30%, the analysis must be repeated.

1.5 IN-VIVO MONITORING

In-vivo body counting for lung burdens of U-natural and U-235 will not be routinely conducted. Monitoring will be conducted at the discretion of the RSO, samples may be sent for a follow-up analysis for specific radionuclides in consultation with DUSA management should potential exposure to an individual warrant.

2.0 RADIATION MONITORING – AREA

2.1 HIGH VOLUME AIRBORNE AREA AIR SAMPLING

Area air sampling involves passing a representative sample of air through a filter paper disc via an air pump for the purpose of determining the concentration of uranium in breathing air at that location. Although the process is only measuring airborne concentrations at a specific place and at a specific time, the results can often be used to represent average concentration in a general area. A high volume sampler or similar high volume pump will be used for this purpose. Samples will be analyzed as per standard gross alpha analysis procedures using a sensitive alpha detector.

2.1.1 Equipment

Monitoring equipment will be capable of obtaining an air sample flow rate of 40 lpm or greater for one hour or longer. A variety of equipment may be used for area air sampling, however normally the equipment used is an Eberline RAS-1, Scientific Industries Model H25004, or equivalent. Equipment is calibrated prior to each usage as per Section 3.6 of this manual.

2.1.2 Frequency/Locations

Area dust monitoring frequency is monthly for the locations shown in Table 2.1.2-1.

Table 2.1.2-1
Airborne Radiation Sample Locations

Code	Location/Description
BA1	Ore Scalehouse
BA2	Ore Storage
BA6	Sample Plant
BA7	SAG Mill Area
BA7A	SAG Mill Control Room
BA8	Leach Tank Area
BA9	Washing Circuit CCD Thickness
BA10	Solvent Extraction Building/Stripping Section
BA11	Solvent Extraction Building/Control Room
BA12	Yellowcake Precipitation & West Storage Area
BA12A	North Yellowcake Dryer Enclosure
BA12B	South Yellowcake Dryer Enclosure
BA13	Yellowcake Drying & Packaging Area
BA13A	Yellowcake Packaging Enclosure
BA14	Packaged Yellowcake Storage Room
BA15	Metallurgical Laboratory Sample Preparation Room

Code	Location/Description
BA16	Lunch Room Area (New Training Room)
BA17	Change Room
BA18	Administrative Building
BA19	Warehouse
BA20	Maintenance Shop
BA21	Boiler
BA22	Vanadium Panel
BA22A	Vanadium Dryer
BA23	Filter Belt/Rotary Dryer
BA24	Tails
BA25	Central Control Room
BA26	Shifter's Office
BA27	Operator's Lunch Room
BA29	Filter Press
BA30	Truck Shop
BA31	Women's Locker Room
BA32	Oxidation
BA33A	AF South Pad
BA33B	AF North Pad

Areas BA-10 and BA-12 were soluble uranium exposure areas. These areas were areas where the uranium compounds that were produced are soluble in lung fluids and are comparatively quickly eliminated from the body. All the other areas are insoluble exposure areas. Insoluble uranium areas were areas where the uranium compounds are not readily soluble in lung fluids and are retained by the body to a higher degree. Temperature of drying operations has a significant impact on solubility of uranium compounds. High drying temperatures produce insoluble uranium compounds. Area uranium dust monitoring, during production periods, is weekly in the designated yellowcake production areas. Monitoring increases to weekly in other monitored areas with the observance of levels exceeding 25% of 10 CFR 20 limits and reverts to monthly upon a continued observance of levels below 25% of 10 CFR 20 limits as determined by the RSO. The RSO may also perform any additional samplings at his or her discretion.

As areas are decommission and the ability to sample those areas is removed, the RSO will document this in the files and those areas will be removed from further monitoring.

2.1.3 Sampling Procedures

1. A RAS-1 or similar high volume pump shall be used for area grab sampling. Insure the pump has been recently calibrated within the past month.

2. The locations selected for area air samples should be representative of exposures to employees working in the area.

3. For routine sampling, the sampling period should be for a minimum collection duration of 60 minutes at a flow of 40 lpm or greater.

4. Insert a clean filter into the filter holder on the sampler. Note start time of pump and record unusual mill operating conditions if they exist.

    A. Stop sample collection and note time. Normally, an automatic timer is connected to the sampler and a 1 hour sample collection time is used.

6. Remove the filter from the sampler and place in a clean glassine envelope or the package supplied by the manufacturer for delivery to the Radiation Department.

7. Count the sample by gross alpha counting techniques and enter the result and sampling information into the record.

2.1.4 Calculations

Perform calculations as specified in Section 4.0.

2.1.5 Records

Logs of all samples taken are filed in the Radiation Safety Officer's files. Data is utilized to calculate radiation exposures as specified in Section 4.0.

2.1.6 Quality Assurance

Calibration checks on each air sampler are made at least monthly to ensure accurate airflow volumes are being collected. Usage of tweezers and new filter storage containers minimizes contamination potential. Field logging of data during sampling and logging of identifying data on sampled filter containers minimizes sample transposition. Samples may periodically be submitted for chemical analysis and a comparison of these results to the radiometric measurements will be made.

Review of data by the RSO and by the ALARA audit committee further assures quality maintenance.

2.2 RADON PROGENY

2.2.1 Definitions

Working Level:

A. The exposure to 1.3E + 05 MEV of alpha energy or the potential alpha energy in one liter of standard air containing 100 pCi each of RaA (Polonium-218), RaB (Lead-214), RaC (Bismuth-214), and RaC prime (Polonium-214). (Exposure level, not a dose rate)

Kusnetz Method: Method of radon progeny measurement and calculation based upon a 10 liter sample and at least 40 minutes decay time before counting.

2.2.2 Equipment

The equipment utilized consists of the following, or appropriate equivalents:

- Portable personal sampler
- Gelman 25 mm filter holder with end cap, or equivalent
- Gelman Type A/E 25 mm diameter glass fiber filters, or equivalent
- Counter-Scaler – Eberline MS-3 with SPA-1 probe, or equivalent

2.2.3 Frequency/Location

Radon progeny samples are obtained monthly for only those locations occupied by personnel where exposures may have the potential of exceeding 25% of 10 CFR 20 limits.

2.2.4 Procedures

The procedures to be utilized are as follows:

1. Assemble filter trains.

2. Ensure pump batteries are fully charged.

3. Calibrate pump (see Section 3.5).

4. Attached filter trains at sample locations; disconnect end plug.

5. Collect sample in the breathing zone of the employee.

6. Collect sample for five minutes at 4.0 lpm.

7. Log sample site, time started, time stopped, and filter pump number prior to leaving each site on the field log notebook.

8. Samples are counted between 40 minutes and 90 minutes after collection using sensitive alpha detector.

9. Check the calibration and function check information to ensure the detector is calibrated and operating.

10. If the calibration check correlates, proceed with sample analysis.

11. Radon progeny samples are normally counted for three minutes; however any sample count time may be selected for counting.

12. Run background detector count prior to running sampled filters.

13. After counting, calculate working levels.

Equation:

$$\frac{(\text{CPM - Bkg})}{(\alpha\ \text{eff})\ (20\ \text{liters})\ (\text{Time Factor})} = \text{WL}$$

Where:

CPM - sample count per minute
Bkg - counter-detector background count per minute
α Efficiency - The efficiency of the counting system (See Section 3.2.3.3)
Time Factor - Values determined from Kusnetz method (See attached Table 2.2.4-1)
WL - Working Levels

TABLE 2.2.4-1
Time Factors

Min.	Factor	Min.	Factor
40	150	71	89
41	148	72	87
42	146	73	85
43	144	74	84
44	142	75	83
45	140	76	82
46	138	77	81
47	136	78	78
48	134	79	76
49	132	80	75
50	130	81	74
51	128	82	73
52	126	83	71
53	124	84	69
54	122	85	68
55	120	86	66
56	118	87	65
57	116	88	63
58	114	89	61
59	112	90	60
60	110		
61	108		
62	106		
63	104		
64	102		
65	100		
66	98		
67	96		
68	94		
69	92		
70	90		

2.2.5 Exposure Calculations

The personnel exposure calculations are a job-weighted average of those areas and concentrations that an individual is exposed to. The procedure is:

1. Determine areas and durations (hrs.) each individual worked during the period (month and quarter).

2. Determine monitored concentrations (WL) for each area so noted.

3. The multiplication of the hours worked in each area by the area concentration (WL) noted is added to the result for each area involved in the period.

4. The result is the Working Level Hours exposed (WLH) for the period.

5. The working level hours (WLH) divided by 173 (30 CFR 57.5-40 note); or hours per month gives the working level months (WLM) exposure. (The limit is 4 working level months exposure per year.)

6. If calculated per quarter, the working level hours summed for the quarter are divided by 519 (173 X 3) to obtain the working level quarter exposure.

See Section 4.0 for details on how to perform exposure calculations and maintain the exposure records.

2.2.6 Records

Data records, which are filed in the Radiation Safety files, include:

1. Sample location
2. Date and time of sample
3. Time on and off of sample pump
4. Counts per minute of sample
5. Elapsed time after sampling
6. Background detector count
7. Appropriate Kusnetz time factor
8. Working level
9. Sampler identification

Employee exposure records include:

1. Month monitored
2. Areas and duration worked
3. Employee identification
4. Concentrations (WL) observed
5. Calculated WLMs

2.2.7 Quality Assurance

Calibration checks each month assure proper calibration of the counting equipment. Documented semi-annual calibrations of the counting equipment using certified alpha calibration and pulse meter sources ensure proper calibration of the equipment over the anticipated ranges. The air sampling system has documented calibration prior to each use, ensuring sampling the appropriate air volumes. Duplicate counts of select data may be counted to assure instrument precision. Field documentation is maintained for each sample during monitoring. This methodology provides assurance in data quality.

Review of data by the RSO and the ALARA audit committee further assures quality maintenance.

2.3 ALPHA SURVEYS

2.3.1 Equipment

Equipment to be utilized in area alpha surveys is shown in Appendix 1. Pre-use function checks will be performed on all radiation survey equipment as specified in Section 3.1.2.3.2.

2.3.2 Frequency/Locations

Fixed and removable alpha surveys are made at those general locations on the Table 2.3.2-1, "Alpha Area Survey Locations." Surveys are completed weekly in those areas designated by the RSO as authorized lunchroom/break areas are monitored. Designated eating areas are listed in Table 2.3.2-2.

As areas are decommission and the ability to sample those areas is removed, the RSO will document this in the files and those areas will be removed from further monitoring.

Table 2.3.2-1
White Mesa Mill
Alpha Area Survey Locations

Scale House Table
Warehouse Office Desks
Maintenance Office Desks
Change Room Lunch Tables
Maintenance Lunchroom Tables
Mill Office Lunchroom Tables
Metallurgical Laboratory Desks
Chemical Laboratory Desks
Administrative Break Room Counter
Administrative Office Desks

Table 2.3.2-2
White Mesa Mill
Designated Eating Area Locations

Maintenance Supervisor Break Room
Main Lunch/Training Room
Administrative Break/Conference Rooms
Administrative Office Desks

2.3.3 Procedures

2.3.3.1 *Respirators*

Respirators are monitored utilizing a removable alpha smear that is read using alpha scaler meter such as a Ludlum Model 2200 or other equivalent radiological instruments. Readings exceeding 100 dpm/100 cm^2 result in re-cleaning or discarding of the respirator. Respirator cleaning and monitoring is a function of the Radiation Safety staff assigned to this duty. The meter's performance is checked prior to each use period.

2.3.3.2 *Fixed Alpha Surveys*

Alpha surveys for fixed alpha contamination are performed using a variety of alpha detecting instruments, as listed in Appendix 1. Each instrument is checked using a calibrated alpha source for proper function and operation prior to use, as described in Section 3.1.2.3.2.

Adjustments to the surface area being measured must be made to convert from the particular detector's surface area to the commonly used surface area of 100 cm^2. Therefore when converting a measurement to the commonly used unit of dpm/100 cm^2, a multiplying area factor must be applied to the measurement. For the Ludlum instrument with a 43-1 detector of 75 cm^2 surface, multiply the value by 1.33 (i.e. 100 cm^2 divided by 75 cm^2).

The procedures are:

1. Turn the meter on and check the meter battery condition.

2. Check alpha detector mylar surface for pinholes, etc. Replace if necessary and repeat calibration.

3. As specified in Section 3.1.2.3.2, perform a function calibration check using calibrated alpha source.

4. If check is acceptable, proceed with monitoring.

5. At each designated site, monitor designated surfaces, table tops, etc., holding within ¼ inch of the surface.

6. Record data, location, cpm/cm^2 monitored on data sheet.

7. At the conclusion of the survey, transpose results to the file log, correcting to dpm/100 cm^2, using correction for detector's surface area and cpm/dpm conversion factor.

2.3.3.3 *Removable Alpha Surveys*

The Ludlum Model 2200 scaler with 43-17 detector, or a variety of other sensitive alpha detection instruments such as Model 2929 or equivalent, counts wipe samples collected during removable alpha surveys. Glass fiber filters, sized to fit the detector sample slot, are utilized as the wipe medium. A template having a 100 cm^2 surface area maybe used to standardize the surface area wiped.

The procedure is:

1. Perform function check calibration of the scaler/detector. Ensure that this measurement is within ± 10% of the value obtained from the calibration laboratory.

2. If so proceed with the survey and counting.

3. Obtain clean filters and clean envelopes for filter storage.

4. At a location to be surveyed, remove the filter from the envelope and wipe the surface covering approximately 100 cm^2. This is easily accomplished by making an "S" shaped smear for approximately 10 inches using normal swipes (approximately 2.5 cm diameter).

5. Record on envelope the date and location of the sample.

6. Upon returning to counting lab, place an unused filter in the counting unit for at least 1 minute and obtain a background count rate.

7. Repeat procedure for each used filter, extracting filter from envelope, immediately prior to counting, using tweezers and placing in the detector slot with the wiped surface facing the detector, and count for at least 1 minute.

8. Convert results from cpm/filter to dpm/filter (100 cm^2 wiped) after subtracting the blank background count.

9. Record on the alpha survey form the following information:

   A. Sample location and conditions
   B. Sample date
   C. Sampler identification
   D. Wipe count dpm/100 cm^2

10. Discard the filters and envelopes

2.3.4 Action Limits

2.3.4.1 *Respirators*

Levels greater than 100 dpm/100 cm^2 squared require re-cleaning or discarding of a respirator.

2.3.4.2 *Fixed Alpha Surveys*

Levels greater than 1,000 dpm/100 cm^2 squared require remedial action by management. ALARA criterion ensures that the RSO takes action where necessary to maintain levels as low as reasonably achievable.

2.3.4.3 2.3.4.3 *Removable Alpha Surveys*

Levels greater than 1,000 dpm/100 cm^2 squared require remedial action and decontamination. ALARA criteria ensure that the RSO takes action where necessary to maintain levels as low as reasonably achievable.

2.3.5 Records

Records of fixed and removable alpha surveys are maintained in the Radiation Safety office files. Records include:

1. Sample location/conditions
2. Sample date
3. Sampler identification
4. Fixed alpha determination – dpm/100 cm^2
5. Removable alpha determination – dpm/100 cm^2
6. Remedial action taken, where necessary

2.3.6 Quality Assurance

Calibration function checks of detector performance and visual observation of detector surfaces prior to each survey ensures counting reliability and consistency. Usage of clean containers and tweezers minimizes contamination of wipe samples. A Field log of sample I.D.'s on sample containers minimizes transposition of samples. Data review by the RSO and by the Audit Committee further assures quality maintenance.

2.4 BETA-GAMMA SURVEYS

2.4.1 Equipment

Beta/Gamma surveying instruments used for beta-gamma surveys are listed in Appendix 1 and the sources used are listed in Appendix 2.

Some instruments read directly in mrem/hour while others read in cpm (with a conversion to mrem/hour). The model 44-6 detector has a removable beta shield allowing discrimination between beta and gamma contributions. Each instrument has a manufactures user's manual which describes the function, use and capability of each instrument. These manuals must be understood before surveying proceeds. Calibration of Beta/Gamma and functional checks are performed using calibrated Cs-137 or SrY 90 sources

2.4.2 Frequency/Locations

The sites noted on Table 2.4.2-1 may be monitored on a monthly basis by of the Radiation Safety staff. During reclamation periods, only areas routinely occupied by personnel are monitored as designated by the RSO. As areas are decommission and the ability to sample those areas is removed, the RSO will document this in the files and those areas will be removed from further monitoring.

Table 2.4.2-1
Beta-gamma Survey Locations

Identification Number	Description of Possible Source of Area of Exposure	Distance from Source in cm
WM-1	Mill Feed Hopper & Transfer Chute	1
WM-2	SAG Mill Intake-Feed Chute	1
WM-3	Screens-Area Floor Between Screen	1
WM-4	Leach Operator's Desk	1
WM-5	Leach Tank Vent #3	1
WM-6	Leach Tank #3 – Wall	1
WM-7	CCD Thickeners	1
WM-8	Pumphouse Tailings Discharge	1
WM-9	Oxidant Makeup Room-Sump Pump	1
WM-10	Shift Foreman's Office-Work Desk	1
WM-11	SX Operator's Area	1
WM-12	Precipitation Tanks #1 Tank; Wall	1
WM-13	Precipitation Section "Lab Bench"	1

Identification Number	Description of Possible Source of Area of Exposure	Distance from Source in cm
WM-14	Precipitation Vent	1
WM-15	Yellowcake Thickener #1; Wall	1
WM-16	Centrifuge Discharge-Chute Wall	1
WM-17	Yellowcake Thickener #2; Wall	1
WM-18	Yellowcake Packaging Room	1
WM-19	Yellowcake Dryer	1
WM-20	Yellowcake Dust Collector	1
WM-21	SX Uranium Mixer #1 Extractor	1
WM-22	SX Uranium Mixer #1 Stripping	1
WM-23	SX Vanadium Mixer #1 Stripping	1
WM-24	Vanadium Dryer	1
WM-25	Mill Laboratory Fume Hood	1
WM-26	Chemical Laboratory Work Area	1
WM-27	Metallurgical Laboratory Work Area	1
WM-28	Lunchroom Eating Area	1
WM-29	Lunchroom Wash Area	1
WM-30	Maintenance Shop – Work Area	1
WM-31	Maintenance Shop – Rubber Coating	1
WM-32	Tailings Impoundment Discharge	1
WM-33	Tailings Impoundment Dike 1	1
WM-34	Tailings Impoundment Dike 2	1
WM-35	Tailings Impoundment Dike 3	1
WM-36	Scalehouse	1
WM-37	Tailings Impoundment Dike 4	1

2.4.3 Procedures

The monitoring procedures are:

1. Check meter battery condition.

2. Check detector using a check source.

3. If the calibration function check indicates that the instrument is operating within calibration specifications, proceed with monitoring.

4. Survey each designated location on Table 2.4.2-1 and record in the field log:

   A. Site location/condition
   B. Date
   C. Instrument used
   D. Sampler's initials
   E. Meter reading (beta + gamma)
   F. Meter reading (gamma)

5. Upon returning to the office, record the mrem/hr reading into a permanent file which is maintained for beta-gamma exposure evaluation.

2.4.4 Action Levels

The ALARA concept is utilized in action levels. Responses include operative cleaning of the area or isolation of the source. The Radiation Safety Department will ensure levels ALARA.

2.4.5 Records

Records maintained in the Radiation Safety office files include:

1. Date monitored
2. Site location/condition
3. Instrument used
4. Sampler's initials
5. Beta/Gamma level, mrem/hr
6. Remedial action taken, if necessary

2.4.6 Quality Assurance

Quality of data is maintained with routine calibration and individual function checks of meter performance. Personnel utilizing equipment are trained in its usage. Records of the operational checks and calibrations are maintained in the files. The RSO routinely reviews the data and the ALARA audit committee periodically analyzes the performance of the management of the monitoring and administrative programs.

2.5 EXTERNAL GAMMA MONITORING

External gamma area monitoring is conducted at various locations around the Mill site in order to provide Radiation Safety Staff with area-specific gamma measurements. The procedures applicable to such monitoring are set out in Section 4.3 of the Mill's Environmental Protection Manual.

2.5.1 Locations and Frequency of Monitoring

External gamma measurements are taken over a quarterly interval for the twelve months of the year at all BHV locations and selected areas around the mill site (see Attachment #1 for those locations).

2.5.2 Quality Assurance

Quality assurance for external gamma measurements consists of:

2.5.2.1.1 Monitoring the container locations to ensure the TLDs have not been lost;

2.5.2.1.2 Ensuring that all containers are present when receiving or shipping to Landauer; and

2.5.2.1.3 Reviewing Landauer data for consistency and data transportation.

2.5.3 Analytical Requirements

Values reported are in millirems per week average for the monitor period (supplied by Landauer) along with a counting error term. The counting error term is calculated by:

[(sample 2 sigma) – (control mrem/week)] / (#weeks)

2.5.4 STANDARD OPERATING PROCEDURES

2.5.4.1 Equipment

External gamma is monitored at the ambient air sampling sites and other selected areas around the mill site, using the OSL badges from Landauer, Inc., or the equivalent.

2.5.4.2 Monitoring Methodology

2.5.4.2.1 The containers, each containing five TLD chips, are mounted approximately one meter above ground plane at each site with one container per site.

2.5.4.2.2 The containers loaded with TLDs are received the first of each quarter from Landauer and exchanged with those in the field.

2.5.4.2.3 A background TLD is stored in the Administration Vault as a transportation control.

2.5.4.2.4 The TLDs are returned to Landauer for processing.

2.5.4.3 Record Keeping

Data maintained in record form for external gamma is:

2.5.4.3.1 Sample period;

2.5.4.3.2 Sample location; and

External gamma levels for total radiation.

2.6 EQUIPMENT RELEASE SURVEYS

2.6.1 Policy

Materials leaving a Restricted Area going to unrestricted areas for usage must meet requirements of NRC guidance for "Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use" (dated April 1993).

All material originating within the restricted area will be considered contaminated until checked by the Radiation Safety Department. All managers who desire to ship or release material from the facility will inform the RSO of their desires. The RSO has the authority to deny release of materials exceeding NRC guidance for "Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use" (dated April 1993). No equipment or materials will be released without documented release by the RSO or his designee.

2.6.2 Limits

The release limits for unrestricted use of equipment and materials is contained in the NRC guidance listed above in Section 2.6.1 and are summarized as follows:

Limits for Alpha emissions for U-Nat and its daughter products are:

Average	5,000 dpm/100 cm^2
Maximum	15,000 dpm/100 cm^2
Removable	1,000 dpm/100 cm^2

Limits for Beta-gamma emissions (measured at a distance of one centimeter) for Beta/Gamma emitting radioisotopes are:

Average	0.2 mrem/hr or 5,000 dpm/100 cm^2
Maximum	1.0 mrem/hr or 15,000 dpm/100 cm^2

2.6.3 Equipment

Radiological survey instruments are listed in Appendix 1.

2.6.4 Procedures

Upon notification that materials are requested for release, the Radiation Safety Department shall inspect and survey the material. Surveys include fixed and removable alpha surveys and beta-gamma surveys. See sections 2.3 Alpha Surveys and 2.4 Beta-Gamma Surveys for a detailed breakdown on the surveying aspects and equipment used for each survey. An equipment inspection and release form, see attached, is to be prepared and signed by the RSO or his designee. Any material released from the mill will be accompanied with the appropriate release form. If contamination exceeds levels found in NRC guidance "Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use", (dated April 1993), then decontamination must proceed at the direction of the RSO. If the material cannot be decontaminated, then it will not be released.

2.6.5 Records

Documented records for each released item are filed in the Radiation Safety Department files. These files shall include a completed Release Form, see attached, and a photograph of the material that is being released.

2.6.6 Quality Assurance

The RSO and the ALARA Audit Committee periodically review the policy and documented release forms to ensure policy and regulatory compliance.

2.7 Field Gamma Surveys

The field gamma surveys will be conducted in accordance with the currently approved Reclamation Plan, Section 6 of the Technical Specifications.

3.0 EQUIPMENT/CALIBRATION

All radiation detection instruments used at the Mill are sent to a qualified independent laboratory for calibration every six months. If necessary, Radiation Safety Staff can use the procedures outlined below to verify calibration.

3.1 Counters/Detectors

3.1.1 General

All radiation detectors require determination of detector optimal voltage performance or plateau operating point. The graph of voltage applied to a detector versus detector response is referred to as a plateau curve. The plateau curve typically has two rapidly sloping sections and a stable, flat region. The optimal operating point is typically located at the beginning of the flat, or flatter, section of the graph. The plateau curve is specific for a particular detector and its accompanying readout, or measuring meter, and may vary over time depending upon electronic component condition.

The equipment used to determine detector plateau curves includes:

1. Appropriate radiation sources
2. Electrostatic voltmeter
3. Radiation detecting instrument
4. Graph paper
5. Manufacturer's technical manual

The procedure is:

1. Ensure instrument batteries are fresh or fully charged, if applicable.

2. Turn the instrument on.

3. Adjust the instrument voltage control starting at voltage of 600 using electrostatic voltmeter to monitor voltage setting.

4. Expose detector to a radiation source applicable to the type of detector and in the appropriate setting.

5. Record voltage and instrument response for each adjustment of voltage applied; increments of 50 volts are adequate.

6. Repeat steps 4 and 5 until instrument response rapidly increases versus voltage level. At this point, the detector is approaching potential differentials across the electrode that may damage the detector.

7. Graph instrument response versus voltage applied.

8. Set equipment high voltage control to the optimum operating point. Record on graph voltage selected.

9. Retain graph with calibration records.

3.1.2 Function Checks

Calibration function checks are required prior to use of radiation detection instruments used at the Mill for the purpose of verifying that the instruments are operating at the same efficiency as when they were calibrated by the calibration laboratory (i.e., within +/-10%). Function checks are also used for verifying repeatability, reliability, and comparability of an instrument's measurements from one period to another. By performing function checks for extended time periods, or on a larger sample size, these goals are met.

Function checks involve two basic elements:

(1) The calibration laboratory efficiency is compared to the instrument's efficiency on the date of the function check; and

(2) The function check is verified with a check source having similar isotopic composition as the one that was used by the calibration laboratory to calibrate the instrument.

Function checks are made for all types of radiation survey instruments. The basic principle in performing a function check is measuring the radiation field using a survey instrument against a known amount of radiation from a calibrated source. These measurements are made for the specific type of radiation occurring. For example, when performing a beta/gamma survey, the instrument function check is performed using a beta/gamma check source, such as a (SrY)-90. When performing an alpha survey, use an alpha check source, such as Th-230 or Pu-239 for performing the function check.

Function checks are documented on the Calibration Check Forms (see Attachment A for copies of forms to be used) for each specific instrument. They will be maintained in the instrument's' calibration and maintenance file.

A number of radiation detection instruments are used at the Mill. An Instrument Users Manual for each instrument is maintained in the calibration files, together with calibration documentation. The Users Manuals are to be considered the primary reference for operating a particular instrument. This Standard Operating Procedure (SOP) is not intended to replace the Users Manual, but rather to supplement the Manual by providing steps to be performed for function checks. Before operating an instrument, personnel should read the Users Manual and become familiar with the instrument's operation, capabilities, and special features. Personnel will also receive on the job training on each instrument.

3.1.3 Alpha Monitors

Alpha particles travel very short distances in the air due to their high ionization ability – typically ¼ to ½ inch. Due to this limitation, alpha monitoring must be done at a distance of ¼ inch or less between the detector face and the source. Alpha monitoring, to be consistent, requires ensuring a consistent distance be utilized between the detector face and the source. Alpha detectors read out in counts per minute (cpm). A correlation relationship, known as the efficiency factor, between the meter response and the actual disintegration rate of the source is used to determine actual calibration of the meter.

Radioactivity is measured in curies (Ci), which, by definition, is 3.7×10^{10} disintegrations per second (dps), or 2.2×10^{12} disintegrations per minute (dpm). Another measurement unit is the Becquerel, or one dps. Alpha radiation is usually monitored as dpm, per surface area measured.

Radiation survey equipment used at the Mill for alpha surveys is listed in Appendices 1 and 2.

3.1.3.1 *Calibration and Function Check Frequency*

The frequency of calibration is specified in individual instrument user manuals and manufacturer's specifications.

The following frequencies are observed for calibration and function checks of radiation detection instruments:

	Type	Calibration Frequency	Function Checks
1.	Employee scans	6 months	7 days/week
2.	Radon progeny	6 months	each use
3.	Respirator checks	6 months	each use
4.	Area fixed scans	6 months	Daily or each use
5.	Area wipe scans	6 months	Daily or each use

3.1.3.2 *Function Check Procedures – Alpha Counters and Scaler Instruments*

The following steps will be used for function checks for alpha counters and alpha scaler instruments.

1. Turn the instrument on and place a calibrated alpha check source in the detector holder on or the face of the detector.

2. Count the source for 1 minute and record this value in cpm.

3. Repeat step 2 four more times.

4. Average the five readings and divide the average in cpm by the known activity on the alpha source. This is the efficiency of the instrument and detector.

5. Compare this efficiency with the efficiency obtained from the calibration lab. If the efficiency comparison is within ±10% deviation the instrument needs is calibrated if not the instrument needs to be recalibrated.

6. If this efficiency comparison is within ±10% deviation the instrument is in calibration.

7. Proceed with monitoring activities.

3.1.3.4 *Calibration Procedures*

All radiation detection instruments used at the Mill are sent to a qualified offsite laboratory every six months for calibration. However, if additional onsite calibration is required the calibration procedures are:

1. Set the detector high voltage at the prior determined operating point using an electrostatic voltmeter.

2. For counter/scalers (radon progeny/wipes), close the detector, without source present, obtain a reading for a set time. This is a background reading.

3. Place a calibrated source for the type of radiation being measured in the source holder and obtain reading.

4. Observe the cpm for both the background and the source.

5. Subtract the cpm value of background from the cpm value of the source to obtain the net cpm.

6. Divide the net cpm value by the known dpm of the source. This is the percentage efficiency of the instrument system for this energy source.

7. By dividing 100 by this efficiency, an efficiency factor is obtained.

8. Dpm equals the cpm divided by the efficiency of the instrument detector system:

Note: *1 curie = 2.22 E + 12 dpm*
1 microcurie = 2.22 E + 6 dpm
1 picocurie = 2.22 dpm

3.1.4 Beta-gamma Monitors

Equipment utilized for beta-gamma monitoring is listed in Appendices 1 and 2.

3.1.4.1 *Function Check Procedure*

The following steps will be used for function checks on beta/gamma instruments:

1. Turn the instrument on and place the calibrated beta/gamma (SrY-90) check source on the face of the detector.

2. Let the reading stabilize to a constant value.

3. Record this value in cpm.

4. Divide this value by the known activity on the check source. This is the efficiency of the instrument and detector.

5. Compare this efficiency to the efficiency obtained from the calibration laboratory. If the efficiency comparison is within ±10% deviation the instrument needs is calibrated if not the instrument needs to be recalibrated.

6. If this efficiency comparison is within ±10% deviation the instrument is in calibration.

7. Proceed with monitoring activities.

3.1.4.2 *Calibration*

All beta-gamma survey instruments are sent out every six months for calibration. Additional calibration, if necessary, may be performed on site using techniques described in Reg. Guide 8.30, Appendix C – Beta Calibration of Survey Instruments for calibration performed by a qualified calibration laboratory using the indicated source as listed in Appendix 2.

3.1.5 Gamma Monitors

Instruments for gamma measurements are listed in Appendix 1.

3.1.5.1 *Calibration*

Independent calibration service laboratories shall perform calibrations every six months. Meters are calibrated to Cs-137 or other radioisotopes as suggested by the calibration laboratory or manufacturer. Most calibration service laboratories calibrate Beta/Gamma instruments electronically in accordance with their standard calibration procedures. However, electronic calibration basically consists of the steps described below:

1. Connect survey instrument to be calibrated to the Model 500.

2. Turn both instruments on.

3. Record high voltage reading on Model 500.

4. Set cpm and the range multiplier on the Model 500 to the desired meter deflection. The model 500 frequency controls consist of the three-digit readout, range selector, coarse tuning knob, and the fine tuning knob. The three-digit readout is in cpm times the frequency multiplier.

5. Calibrating survey instruments in cpm:

    A. Set Model 500 frequency to value that will provide a ¾ meter deflection on the survey instrument's highest count scale. Set pulse height/amplitude to twice instrument input sensitivity.

    B. Adjust the range calibration potentiometer on the survey meter to provide correct reading record.

    C. De-code Model 500 frequency to next lower value; then do the same for the survey instrument.

    D. Adjust the range calibration potentiometer for correct reading on survey instrument. Record readings.

    E. Repeat process until all ranges have been calibrated at ¾ meter deflection. Record readings.

    F. Return to highest count scale on survey meter.

    G. Set Model 500 for ¼ scale deflection readings.

    H. Survey instrument should read within ± 10% of Model 500 frequency. Record readings.

1) If readings are outside of the tolerance, re-calibrate for ¾ meter deflection.

2) Tap instrument meter lightly to check for sticky meter. Meter tolerance is ± 3% from the initial readings to the final reading.

I. Decode Model 500 to next lower scale. Check survey instruments for ¼ scale reading. Record.

6. Record input sensitivity.

A. Select the most sensitive amplitude range 0-5 mv on the Model 500.

B. Observe meter on survey instrument.

C. Increase pulse amplitude, switching to next higher range, if necessary, until the rate meter indicates a stable reading (i.e., further increase of pulse amplitude does not cause an increase in meter reading). Now, decrease pulse height until the survey instrument meter reading drops 15 ± 5%. Record this pulse height as the instrument sensitivity.

D. If your instrument has a gain or threshold control to set instrument sensitivity, set pulse height on the Model 500 to desired sensitivity level. Now adjust your instrument threshold or gain control until the rate meter reading is within 85 ± 5% of its stable reading value (see step C). Record the pulse height as instrument sensitivity.

7. Calibrating survey instrument to cps.

A. Set frequency in Model 500. Divide the Model 500 readings by 60 to convert to counts per second.

B. Repeat calibration steps as in item 5 above.

3.1.5.2 *Frequency of Calibration*

If electronic calibration is performed using the above method by the Radiation Safety Department, the Model 500 pulse generator will be sent out for calibration on an annual basis.

3.2 PERSONNEL AIR SAMPLERS

The calibration procedure for personnel air samplers involves one of three calibration procedures. Samplers will be calibrated prior to each use by one of the three methodologies: bubble tube, electronic or mass flow determinations. Air samplers may be calibrated to standard air conditions.

3.2.1 Bubble Tube Calibration Method

The Bubble Tube Calibration Method is a calibration method and does not require corrections to or from standard conditions for temperature and pressure. Personal air samplers are calibrated for the flow rate for the sampling being performed, typically 2-4 lpm.

The equipment utilized is as follows:

1. Burette – 1,000 ml capacity, 10 ml divisions
2. Support, iron, rectangular base, with rod
3. Burette clamps – 2
4. Soap solution, dish
5. Tubing, Gelman filter holder, filter media (0.8 micron glass fiber Gelman type A/E)
6. Stopwatch
7. Small screwdriver
8. Sample pump

The procedures utilized are:

1. Assemble a filter train – place a filter in an in-line filter. Attach two lengths of tubing to each connector of the in-line filter holder.

2. Make sure the Burette is clean. Clamp the 1,000 ml Burette upside down on the ring stand with the Burette clamps.

3. Attach the pump to be calibrated to one end of the filter train, connect the other end of the filter train to the small end of the 1,000 ml Burette, as per Figure 1.

4. Check all tubing connections for air tightness.

5. Pour approximately ½ inch (12 mm) of soap solution into the dish.

6. Start the pump.

7. Raise the dish up under the Burette opening, and then immediately lower the dish. This should cause a film of soap to form over the Burette opening (i.e., a bubble). Repeat this procedure until the film (bubble) will travel up the inverted Burette the length of the graduation marks on the Burette without breaking.

8. When the film (bubble) has wetted the Burette inside and will travel the entire length of the graduated area of the Burette, proceed with the actual calibration run.

9. Quickly form three bubbles and start the stopwatch when the middle bubble is at the bottom graduation line (actually the 1,000 ml mark, but for purposes here, it will be called the "zero" line).

10. Time the travel of the bubble from the zero line to the top line of the graduated distance (0 ml). Since the capacity of the Burette is 1,000 ml (1.0 liter), then the volume of air that is displaced above the bubble (i.e., needed to raise the bubble) is 1.0 liter. Stopping the stopwatch at the top mark is the time elapsed for the pump to accomplish this. The rate of rise of the bubble through the apparatus is the flow rate of air being pulled by the pump.

11. Increase or decrease the pump collection rate by adjusting the appropriate screw or knob designed for this purpose.

12. Set the pump flow collection rate to the desired valued usually between 2 and 4 liters per minute for low volume collection pumps and between 30 and 80 liters per minute for high volume collection pumps.

3.2.2 Mass Flow Method

Mass flow meters are manufactured equipment designed to measure air collection flow rates for a variety of purposes. Mass flow meters may be subject to temperature and pressure corrections of air movement depending on whether they are calibrated/manufactured for standard conditions.

Utilizing an air mass flow meter, traceable to NBS, the airflow rate of pumps can be quickly adjusted to correct standard flow rate conditions. However, the mass flow meter must be calibrated annually using a primary calibration method.

The equipment consists of the following:

1. Kurz air mass flow model 543 or equivalent
2. Suitable filter head adapter connections
3. Filter heads with filter media
4. Pump to be calibrated

Note: The meter is calibrated directly in standard air conditions – 25° C., 29.82" Hg.

The procedures utilized are:

1. Ensure pump batteries are fully charged.

2. Ensure flow meter batteries are fully charged.

3. Assemble filter train.

4. Connect (with a suitable adapter) the Kurz probe onto the filter train. Ensure an airtight seal with tape, if necessary.

5. Set the meter function switch to the highest range: 40 std liters per minute.

6. Turn the pump on.

7. Select appropriate range on the meter. (Do not allow meter needle to be forcibly pegged.)

8. Adjust the pump flow rate as necessary to desired flow rate. Allow the meter to stabilize before adjustment of the pump.

9. Meter reads directly in standard air conditions, correcting for temperature and barometric pressure.

Pump is now calibrated. Low volume pumps are set 4 lpm.

3.2.3 Electronic Calibration Method

The electronic calibration is the calibration method and does not require corrections to or from standards conditions for temperature and pressure. Personal air samplers are calibrated for the flow rate for the sampling being performed typically 2 – 4 lpm. Area Airborne high volume air samplers should be calibrated to a minimum of 40 lpm.

The equipment utilized is as follows:

1. UltraFlo Primary Gas Flow Calibrator, or equivalent
2. Soap solution
3. Tubing
4. Small screwdriver
5. Sample pump

The procedure proceeds as follows:

1. Remove the two nipples on the back of the UltraFlo Primary Gas Flow Calibrator.
2. Attach the connection tubing from the top nipple to the sample pump.
3. Turn calibrator on.
4. Turn sample pump on.

5. Press the plunger style button on top of the soap dispensing portion of the device.
6. Write down the digital reading from the calibrator device.
7. Repeat steps 5 and 6 three times.
8. Take an average of the three readings.
9. If the sample pump requires adjustment, take the screwdriver and adjust the set screw on the face of the sample pump and then repeat steps 5 through 7.
10. After the sample pump is calibrated, document the calibration on the Breathing Zone/Radon or the High Volume Calibration Sheet depending on which device is being calibrated, in the Radiation department.
11. Replace nipple caps on the back of the calibrator.

3.3 AREA AIR SAMPLERS

The calibration procedure for area air samplers involves one of the following procedures; Kurz Mass Flow, Wet Test Gas Meter, Electronic or Bubble Tube Method.

3.3.1 Kurz Mass Flow Method

Repeat procedures discussed in 3.2.2 – except – airflow rate is adjusted to 40 slpm and samplers utilized are:

1. Eberline RAS-1
2. Scientific Industries Model H25004
3. Equivalent

3.3.2 Wet Test Gas Meter Method

The wet test gas meter method utilizes a Precision Scientific wet test meter rated at one cubic foot per revolution of the main dial. This method is used to calibrate the Kurz air mass flow meter in addition to direct calibration of the area air samplers.

The procedures are:

1. Attached coupling to sampler filter assembly; secure it with tape.

2. Connect wet test meter hose to coupling.

3. Check water level of wet test meter. The needle should be on slightly above the water level.

4. Check the thermometer temperature of the wet test meter. Record this on the calibration sheet. Assume that the wet and dry bulb temperatures are the same.

5. Turn on the sampler. Check the west test meter's manometer reading. This reading is obtained by adding the left and right column values. (A typical reading might be .3). Log these values for each ball height on the "Static pressure … H_2O" column.

6. For the following sampler approximate settings, pull one cubic foot of air through the wet test meter and record the time (in seconds) for each: 20, 30, 40, and 50 lpm.

<u>Sampler Calibration Procedures – Calculations and Equations</u>

1. To convert the static pressure (of the manometer attached to the wet test meter) from inches of water to inches of mercury, divide the number of inches to water by 13.6. Example: 0.4/13.6-0.02941176" Hg

2. To compute the actual flow rate ("Q rate act. lpm"), first divide the number of cubic feet by the number of seconds. Example: 1 ft.^{3}/90 sec = .01111 ft.^{3}/awx. Convert the cubic feet to liters. The conversion factor is 28.317. Example: .01111 ft.^{3}/sec x 28.317 L ft.^{3} = .3146 L/sec. Multiply this by 60 to convert from seconds to minutes. Example: .3146 L/sec x 60 sec = 1888 L/m or 18.88 lpm.

3. Using the "Vapor Pressures of Water" chart, find the vapor pressure inside the wet test meter by matching the wet bulb temperature with the corresponding vapor pressure. This number is the vapor pressure at the standard wet bulb (Pvpstw).

4. Find the vapor pressure at dewpoint using this formula: Pv dewpoint = Pvpstw = 0.0003613 (td-tw) Bp (Where +d = dry bulb temp; tw = wet bulb temp; bp = barometric pressure in inches of mercury.) Assume that the dry bulb temperature and the wet bulb temperature are the same, so the difference between them will always be zero. Thus, Pv dewpoint will equal Pvpstw.

5. Determine the actual air density (D act) with this formula:

$$D\ act = \frac{1.327}{td + 459.67\ \ [(Pg-Sp) - 0.378\ (Pv\ dewpoint)]}$$

(Where td - dry bulb temp in degrees F.; Bp = barometric pressure in inches of mercury; Sp = static pressure of wet test meter in inches of mercury.)

Example:

$$D\ act = \frac{1.327}{70.5 + 459.67} [(24,8031 - 0.02941176) - 0.378\ (.875)]$$

$$= \frac{1.327}{530.17} (24,773688 - 0.33075)$$

$$= (0.00250297)\ (24.442938)$$

D act = 0.06117996

Log this in "Air Density lbs/ft^3" column of log sheet.

6. Find the flow rate of the sampler at standard conditions (Q std) using this formula:

$$Q\ std = Q\ act\ \frac{D\ act}{D\ std}$$

(Where D std = .075 lbs/ft^3)

$$(\text{i.e., } Q\ std = 18.88\ \frac{(0.06117996)}{0.075}$$

$$= 18.88\ (0.8157328)$$

$$= 15.40$$

Q std = 15.40 (write this down for each position in the Q 0.075 column)

3.3.3 Bubble Tube Method

Refer to Section 3.2.1 to perform this method.

3.3.4 Electronic Calibration

Refer to Section 3.2.3 to perform this method.

4. EXPOSURE CALCULATIONS AND RECORD MAINTENANCE

4.1 PERSONNEL EXPOSURE CALCULATIONS

4.1.1 DACs for Conventional Ores

4.1.1.1 *Solubility Classes*

The solubility class, chemical form and abundance of conventional ores at the Mill, and the resulting DACs to be used are as set out in the following table:

Table 4.1.1.1-1
Solubility Class, Chemical Form and Abundance of Conventional Ores

Location	DAC	U nat	Th-230	Ra-226	Pb-210
Ore-Grind	6.00E-11	DAC is specified in 10 CFR Part 20			
Leach	2.8E-10	½ Ore, ½ Precipitation	½ Ore, ½ Precipitation	½ Ore, ½ Precipitation	½ Ore, ½ Precipitation
CCD	1.2E-11	Class D Sulfate 25%	Class W [1] Sulfate 25%	Class W [1] Sulfate 25%	Class D [1] Sulfate 25%
SX	1.2E-11	Class D Sulfate 25%	Class W [1] Sulfate 25%	Class W [1] Sulfate 25%	Class D [1] Sulfate 25%
Precipitation	5.00E-10	Class D [2] Diuranate 100%	NA	NA	NA
Yellowcake Packaging	2.20E-11	Class Y: 90 % and Class W: 10 % Oxide 100%	NA	NA	NA
Tailings	1.70E-11	Class Y Oxide 4%	Class Y [2] Oxide 32%	Class W [1] Oxide 32%	Class W [1] Oxide 32%

[1] 10 CFR Part 20, Appendix B
[2] NUREG/CR-0530, PNL-2870, D.R. Kalkwarf, 1979, "Solubility Classifications of Airborne Products from Uranium Ores and Tailings Piles"

4.1.1.2 *Application of Conventional Ore DACs to Workplace Locations*

The Conventional Ore DACs will be applied as follows to the various locations in the Mill site:

Table 4.1.1.2-1
Application of Conventional Ore DACs to Workplace Locations

Type of DAC	DAC (µCi/ml)	Individual Location
Ore/Grind	6.00E-11	Ore Scalehouse Ore Storage Maintenance Shop Warehouse Lunch Room Change Room Administration Bldg
Ore/Grind	6.00E-11	Dump Station
Ore/Grind	6.00E-11	SAG Mill SAG Mill Control Shifter's Office Operations Lunch Room Filter Press
Leach	2.80E-10	Leach Tank Area
CCD	1.20E-11	CCD Circuit Thickeners
SX	1.20E-11	SX Building South Boiler
Ore/Grind	6.00E-11	Control Room
Yellowcake Precipitation	5.00E-10	YC Precipitation &Wet Storage
Yellowcake Packaging	2.20E-11	North YC Dryer Encl. South YC Dryer Encl. YC Pkg Enclosure YC Drying & Packaging Area Packaged YC Staging Area
Tailings	1.70E-11	Truck Shop Tailings
Yellowcake Precipitation	5.00E-10	Vanadium Circuit

4.1.2 Sampling Time

Calculate the sampling time required to detect 10% of the DAC by solving for sampling time in the following equation:

$$\frac{\text{LLD}}{(\text{Sampling Time})\ (\text{Flow Rate of Sampler})} = 0.1\ \text{DAC}$$

For example:

To detect 10% of the DAC for U-Nat, a 40 lpm air sampler would have to operate 57 minutes, assuming the sample counter has a lower level of detection of 10 dpm above background, i.e.:

$$\frac{(10\ \text{DPM})\ \left(\frac{\text{pCi}}{2.22\ \text{DPM}}\right)\ \left(\frac{\text{E-6}\ \mu\text{Ci}}{\text{pCi}}\right)}{(X\ \text{min.})\ \left(\frac{40\ \text{lit}}{\text{min.}}\right)\ \left(\frac{10^3\ \text{ml}}{\text{lit}}\right)} = 2\text{E-12}\ \frac{\mu\text{Ci}}{\text{ml}}$$

X = 56.8 minutes

4.1.3 Dose Calculations (10 CFR 20.1201-20.1202)

1. Analytical results of airborne particulate samples may be obtained in several different units that need to be converted into mg soluble natural uranium to determine the weekly exposures and into uCi-hr/ml or WL-hr to determine annual exposures. The following table presents a summary of the conversions that may be necessary. The first row of the table presents the operations to be performed in the conversions. Enter the measured weight or activity, the sampler flow rate, the sampling time, and the exposure time into the first four columns. Divide the values in column 1 by the values in column 2 and column 3, and then multiply by the values in columns 4 and 5 to obtain the units in column 6, or:

$$\frac{(\text{Column 1})\ (\text{Column 4})\ (\text{Column 5})}{(\text{Column 2})\ (\text{Column 3})} = \text{Column 6}$$

UNIT CONVERSION TABLE

1	2	3	4	5	6
OPERATION	DIVIDE	DIVIDE	MULTIPLY	MULTIPLY	ANSWER
MEASURED VALUE	SAMPLER FLOW RATE	SAMPLING TIME	EXPOSURE TIME	CONSTANT	ANSWER
µg soluble U-Nat	L/min	min	hrs	1.2	mg soluble U-Nat
pCi soluble U-Nat	L/min	min	hrs	1.77	mg soluble U-Nat
pCi gross alpha	L/min	min	hrs	E-9	µCi-hrs / ML
µg U-Nat	L/min	min	hrs	6.77E-10	µCi-hrs / ML
µCi mL Radon	---	---	hrs	E7	WL-hrs

For example:

$$\frac{(10\ \mu g\ \text{Soluble U-Nat})\ (10\ \text{hrs})\ (1.2)}{(2\ \text{L/min})\ (30\ \text{min})} = 2\ \text{mg Soluble U-Nat}$$

See notes for a description of the unit conversions.

2. The table on the following page is divided into four quadrants. Different quadrants are for soluble uranium, insoluble uranium, tailings dust, and radon. Select the proper quadrant for the type of airborne particulate being sampled. Enter the area, particulate concentration, and hours of exposure in the labeled columns of the selected quadrant.

3. The protection factors are whole numbers, e.g., 10, 50, 1,000. Divide 1 by the protection factor and enter the quotient in the fourth column of each quadrant, e.g., for a protection factor of 1,000, enter 1/1,000 or 0.001 in the column. The 1/PF values are unit-less.

4. Enter the product of the airborne concentration, the hours of exposure, the time, and 1/PF in the fifth column of each quadrant. Add these values and enter the total at the bottom of the column.

5. On the dose calculations form which follows, enter the total for Soluble Uranium in the equation and calculate the corresponding mg. If a value exceeds 10 mg, an over-exposure may have occurred. If verified by a high uranium in urine results, an over-exposure has probably occurred and needs to be reported to the NRC.

6. Enter the totals for Soluble Uranium, Insoluble Uranium, Tailings Dust, and Radon in their respective equations. Perform the indicated calculations, add the fractions

together, and record as the subtotal. (Use the DAC for Th-230 or the DAC for tailings dust to determine the contribution of tailings dust to the subtotal.) If a subtotal exceeds 1, an over-exposure may have occurred. If verified by a high uranium in urine result, an over-exposure has probably occurred and needs to be reported to the NRC.

7. Enter the TLD determinations of whole body dose as the <u>Deep Dose Equivalent</u> on the form. If the Deep Dose Equivalent exceeds 5 rems, an over-exposure may have occurred and needs to be reported to the NRC.

8. If the Deep Dose Equivalent exceeds 0.5 rem <u>and</u> the subtotal exceeds 0.1, calculate the <u>Total Effective Dose Equivalent</u> by adding the Deep Dose Equivalent to the product of 5 rems times the subtotal and enter on the form. If the total effective dose equivalent exceeds 5 rems, an over-exposure may have occurred and may have to be reported to the NRC.

DOSE CALCULATIONS (10 CFR 20.1201 + 20.1202)

______________ ______________ ______________ ______ ______
Name Soc. Sec. No. Co. I.D. No. Week Year

AREA	SOL. U µCi/ML	HR	1 / PF	µCi-HR / ML	AREA	INSOL. U µCi/ML	HR	1 / PF	µCi-HR / ML
TOTAL	---	---	---		TOTAL	---	---	---	---
AREA	TAILINGS DUST µCi/ML	HR	1 / PF	µCi-HR / ML	AREA	RADON WL	HR	1 / PF	WL-HR

TOTAL	---	---	---		**TOTAL**	---	---	---	

DOSE CALCULATIONS (10 CFR 20.1201 + 20.1202)

______	______	______	______	______
Name	Soc. Sec. No.	Co. I.D. No.	Week	Year

Weekly Soluble Uranium $\frac{(\mu Ci\text{-}hr)\ (1.77E9)}{(mL)}$ = ______ mg

Limit 10 mg

Annual Soluble Uranium $\frac{(\quad \mu Ci\text{-}hr) / mL}{(2000\ hr)\ (5E\text{-}10)}$ = ______

Annual Insoluble Uranium $\frac{(\quad \mu Ci\text{-}hr) / mL}{(2000\ hr)\ (2E\text{-}11)}$ = ______

Annual Tailings Dust $\frac{(\quad \mu Ci\text{-}hr) / mL}{(2000\ hr)\ (\quad *)}$ = ______

* = DAC for Th-230 = 6E-12;
or = DAC for tailings dust.

Annual Radon with Daughters Present $\frac{(\quad WL\text{-}hr)}{(2000\ hr)\ (0.33\ WL)}$ = ______

Subtotal ______

Limit 1

Deep Dose Equivalent = TLD Whole Body Dose in rem = ______ rem

Limit 5 rem

If the Deep Dose Equivalent is > 0.5 rem
and
the Subtotal is > 0.1, then

Total Effective Dose Equivalent = Deep Dose Equivalent + Committed Effective Dose Equivalent

= (rem) + (5 rem) (Subtotal) = ______ rem

Limit 5 rem

DOSE CALCULATIONS (10 CFR 20.1201 + 20.1202)

Notes:µ

1. PF = Respiratory Protection Factor.

2. The 10 mg soluble uranium per week limit in 10 CFR Part 20.1201 is more restrictive than the (40 hour) (DAC) limit for natural uranium, thus compliance is based on 10 mg per week.

3. The conversion of uCi-hr/mL to mg natural uranium is the product of:

   (air concentration) (hours of exposure) (breathing rate for light work) (conversion of minutes to hours) (specific activity of natural uranium) (conversion of ug to mg) which is:

$$\left(\frac{\mu\text{Ci-hr}}{\text{mL}}\right)\left(\frac{2\text{E4 mL}}{\text{min}}\right)\left(\frac{60\text{ min}}{\text{hr}}\right)\left(\frac{\mu\text{g}}{6.77\text{E-7 }\mu\text{Ci}}\right)\left(\frac{\text{E-3 mg}}{\mu\text{g}}\right) =$$

$$\left(\frac{\mu\text{Ci-hr}}{\text{mL}}\right)(1.77\text{E9}) = \text{mg U-Nat}$$

   Thus to obtain mg natural uranium, multiply the µCi-hr/mL by 1.77E9.

4. Soluble Uranium DAC (Class D) = 5E-10 µCi/mL
   Insoluble Uranium DAC (Class Y) = 2E-11 µCi/mL
   Thorium-230 DAC (Class Y) = 6E-12 µCi/mL
   Radon with Daughters DAC = 3E-8 µCi/mL = 0.33 WL
   Tailings Dust DAC is a Site Specific Value = µ5. Description of unit conversions:

   a. ug soluble U-Nat → mg soluble U-Nat

$$\left(\frac{\mu\text{g}}{(\text{L/min})\ (\text{min sampler})\ (\text{E3 mL})/\text{L}}\right)\left(\frac{\text{E-3 mg}}{\mu\text{g}}\right)\left(\frac{60\text{ min}}{\text{hr}}\right)(\text{hr exposure}) =$$

$$\left(\frac{\mu\text{g}}{(\text{L/min})\ (\text{min sampler})}\right)(\text{hr exposure})\ (1.2) = \text{mg soluble U-Nat}$$

   b. pCi soluble U-Nat → mg soluble U-Nat

$$\left(\frac{\text{pCi}}{(\text{L/min})\ (\text{min sampler})}\right)\left(\frac{\text{E3 mL}}{\text{L}}\right)\left(\frac{\text{E-9 mCi}}{\text{pCi}}\right)\left(\frac{\text{mg}}{\text{6.77E-7 mCi}}\right)\left(\frac{\text{2E4 mL}}{\text{min}}\right) \rightarrow$$

$$\left(\frac{\text{60 min}}{\text{hr}}\right)(\text{hr exposure}) =$$

$$\left(\frac{\text{pCi}}{(\text{L/min})\ (\text{min sampler})}\right)(\text{hr exposure})\ (1.77) = \text{mg soluble U-Nat}$$

c. pCi gross alpha $\rightarrow$ $\frac{\mu\text{Ci-hr}}{}$

$$\left(\frac{\text{pCi}}{\left(\frac{\text{L}}{\text{min}}\right)(\text{min sampler})\left(\frac{\text{E-3 mL}}{\text{L}}\right)}\right)\left(\frac{\text{E-6 }\mu\text{Ci}}{\text{pCi}}\right)(\text{hr exposure}) =$$

$$\left(\frac{\text{pCi}}{\left(\frac{\text{L}}{\text{min}}\right)(\text{min sampler})}\right)(\text{hr exposure})\ (\text{E-9}) = \frac{\mu\text{Ci-hr}}{\text{mL}}$$

d. µg U-Nat $\rightarrow$ $\frac{\mu\text{Ci- hr}}{\text{mL}}$

$$\left(\frac{\mu\text{g}}{\left(\frac{\text{L}}{\text{min}}\right)(\text{min sampler})\left(\frac{\text{E3 mL}}{\text{L}}\right)}\right)\left(\frac{6.77\text{E-7 }\mu\text{Ci}}{\mu\text{g}}\right)(\text{hr exposure}) =$$

$$\left(\frac{\mu\text{Ci}}{\left(\frac{\text{L}}{\text{min}}\right)(\text{min sampler})}\right)(\text{hr exposure})\ (6.77\text{E-10}) = \frac{\mu\text{Ci-hr}}{\text{mL}}$$

e. $\frac{\mu\text{Ci}}{\text{mL}}$ of Radon-222 $\rightarrow$ WL

$$\left(\frac{\mu\text{Ci}}{\text{mL}}\right)\left(\frac{\text{E6 pCi}}{\mu\text{Ci}}\right)\left(\frac{\text{E3 mL}}{\text{L}}\right)\left(\frac{\text{L-WL}}{\text{E2 pCi}}\right) =$$

$$\left(\frac{\mu\text{Ci}}{\text{mL}}\right)(\text{E7}) = \text{WL}$$

4.2 Personnel Exposure Files

The Company will generate and maintain individual exposure records for each employee that works at the White Mesa Mill. The record system will be designed to meet the specifications of the Federal Code of Regulations 10 CFR Part 20.

When an employee is hired, a file will be generated specifically for that individual. All records that are to be in the radiation exposure file will be maintained during the term of employment. When the employee terminates, all records will be preserved until the NRC authorizes their disposition.

Personnel exposure records will be maintained at the mill site and will be accessible only to the employee and the Radiation Safety staff. No copy of the exposure history will be furnished to anyone outside of the Radiation Safety Department without a signed consent form from the employee.

Contents of the exposure file:

Each personnel exposure file will contain the following records:

1. Information Sheet – Each information sheet will include the following information:

   A. Employee's full name
   B. Birth date
   C. Social Security number
   D. Date of hire
   E. Date of termination

2. Record of Urinalyses – A multiple entry log of all urinalyses conducted at this work site will include the following information:

   A. Employee's full name
   B. Sample dates
   C. Sample identification number
   D. Concentration of uranium in µg/l
   E. An entry for any quality assurance "spikes" entered in µg/l

3. Internal personnel Exposure Records – These will be calculated and prepared using the forms above or by the computer and the printout will be used as the permanent record in the exposure file. The internal exposure records will contain the following information:

   A. Employee's full name
   B. Social Security number

C. Birth date
D. Exposure to airborne uranium expressed in both μCi and percent MPC
E. Any breathing zone samples collected for airborne uranium to be expressed in μCi
F. Radon daughters expressed in working levels (WL) and period of exposure (date)

4. External Exposure Record (OSL, Dosimeter) – The date received from the Dosimeter contractor will be posted to the Dosimeter record in the exposure file. The following information will be included on the Dosimeter record:

   A. Employee's full name
   B. Birth date
   C. Social Security number
   D. Period of exposure (dates)
   E. Exposure in millirems (mrem) for a given period
   F. Total accumulated exposure while at the White Mesa Mill
   G. Identification number of the Dosimeter badge

5. Record of Exposure from Previous Employment (NRC form 4 or similar) – A record of occupational exposures that occurred prior to employment at the mill must be obtained for each employee. If no such exposure record is available, the employee must sign a statement to that affect. If previous exposure records were kept, a copy must be secured and placed in the individual's file.

6. Reports of Over-exposure – If an individual has been found to be over-exposed, the RSO will draft a letter of explanation. The report will explain the circumstances and/or reasons for the over-exposure. It will also state any actions taken to correct the problem or to prevent future over-exposures. The report must be placed in the individual's exposure file.

5. RADIATION WORK PERMITS

5.1 General

A Radiation Work Permit ("RWP") system has been established for non-routine activities where there is a potential for a significant radiation exposure, or for certain routine activities where there is a potential to spread radioactive materials.

Specifically, an RWP is required for:

a) All non-routine maintenance work, or work for which there is no effective procedure, which may, by the determination of the RSO, exceed 25% of the R313-15 limits;

b) All routine work, not covered by an procedure, that could involve the spread of radioactive materials; and

c) The receipt, handling or processing of any alternate feed material or other radioactive material, which has been determined by the RSO, not to fall within an existing operating procedure.

An RWP may also be used on a temporary basis for routine activities in lieu of an procedure, while a procedure is being developed for the activity.

5.2 All Non-Routine Activities Require RSO Review

All non-routine activities require review by the RSO. The RSO will advise the Mill Manager on a regular basis of any activities that require an RWP.

5.3 Radiation Work Permit

The RWP is a form that describes the work to be performed, the location, duration and personnel involved, and the radiological controls needed, such as respirator, urine samples, breathing zone monitoring, time limitations for the activity, etc. The form must also have an area for the RSO, or his designee's, signature. A copy of a form of RWP is attached.

5.4 Procedure for Obtaining a Radiation Work Permit

The procedure for obtaining an RWP is:

a) When RWP-type work is to be performed, the Shift Foreman, Maintenance Superintendent or other supervisory personnel shall complete the top portion of the RWP, which will provide information on the specific work locations, estimated work duration, type of work to be performed, and personnel utilized, and present it to the RSO;

b) The RSO will indicate the radiological controls needed based on the information given and the safety of personnel. The RSO or his designee will provide the necessary surveillance and respiratory protection equipment;

c) No work can be performed until the RSO or his designee has approved the RWP;

d) Any maintenance or RWP jobs done in the yellowcake dryer or packaging enclosures will require a member of the Radiation Staff to be present for the duration of the job;

e) All supervisors will be given training in and copies of the requirements for using RWPs, with the permits remaining on file for five years; and

f) Any supervisor found to be knowingly and willfully violating these procedures will be issued a written warning, and the situation will be reviewed by appropriate management for remedial action.

EMPLOYEE SPOT ALPHA CONTAMINATION SURVEY

DATE	NAME	BOOTS	CLOTHES	HANDS	COMMENTS

Alpha Instrument Information:

Instrument Model: ______________________________

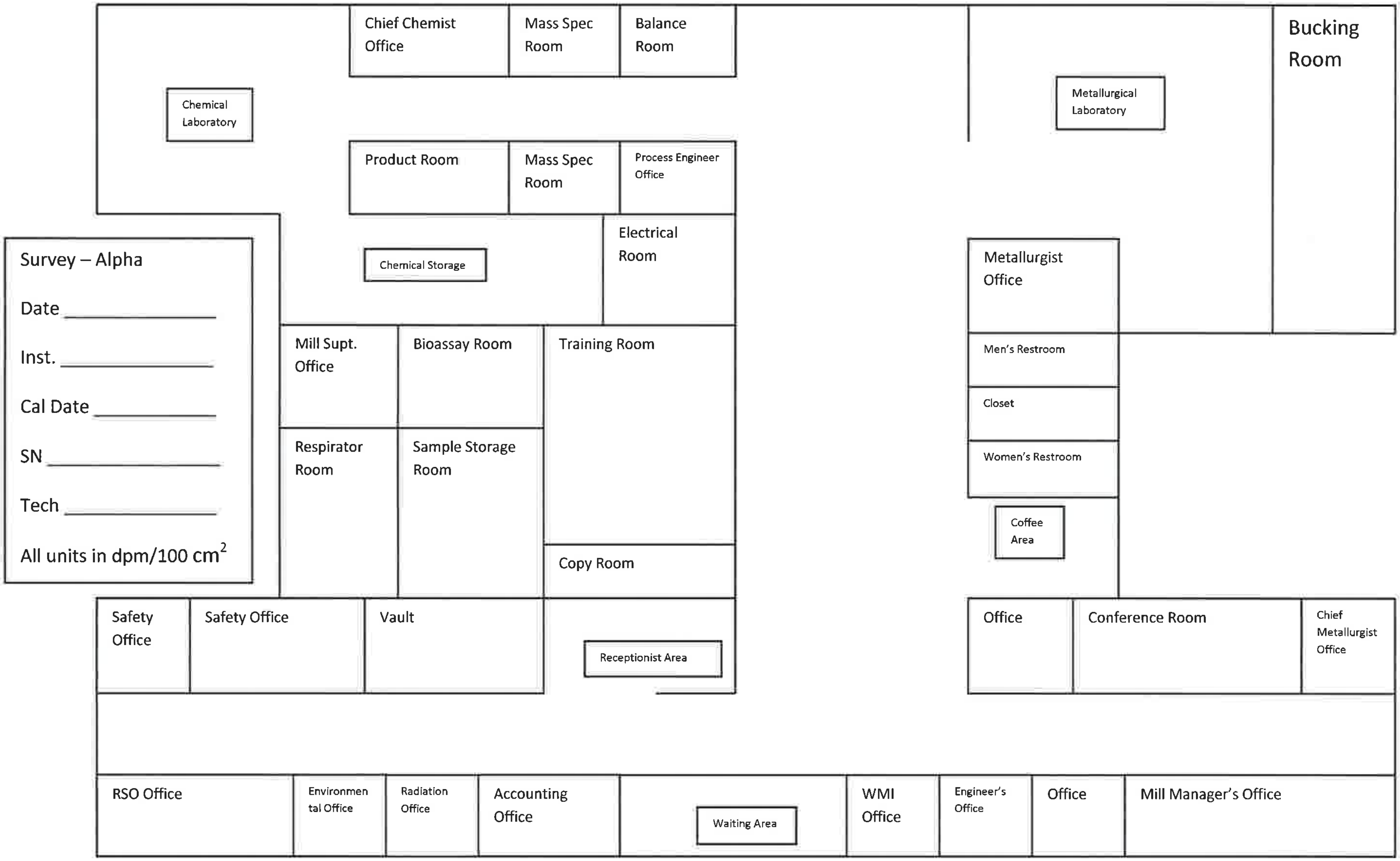
Instrument SN: ________________________________

Th_{230} Source SN: ______________________________

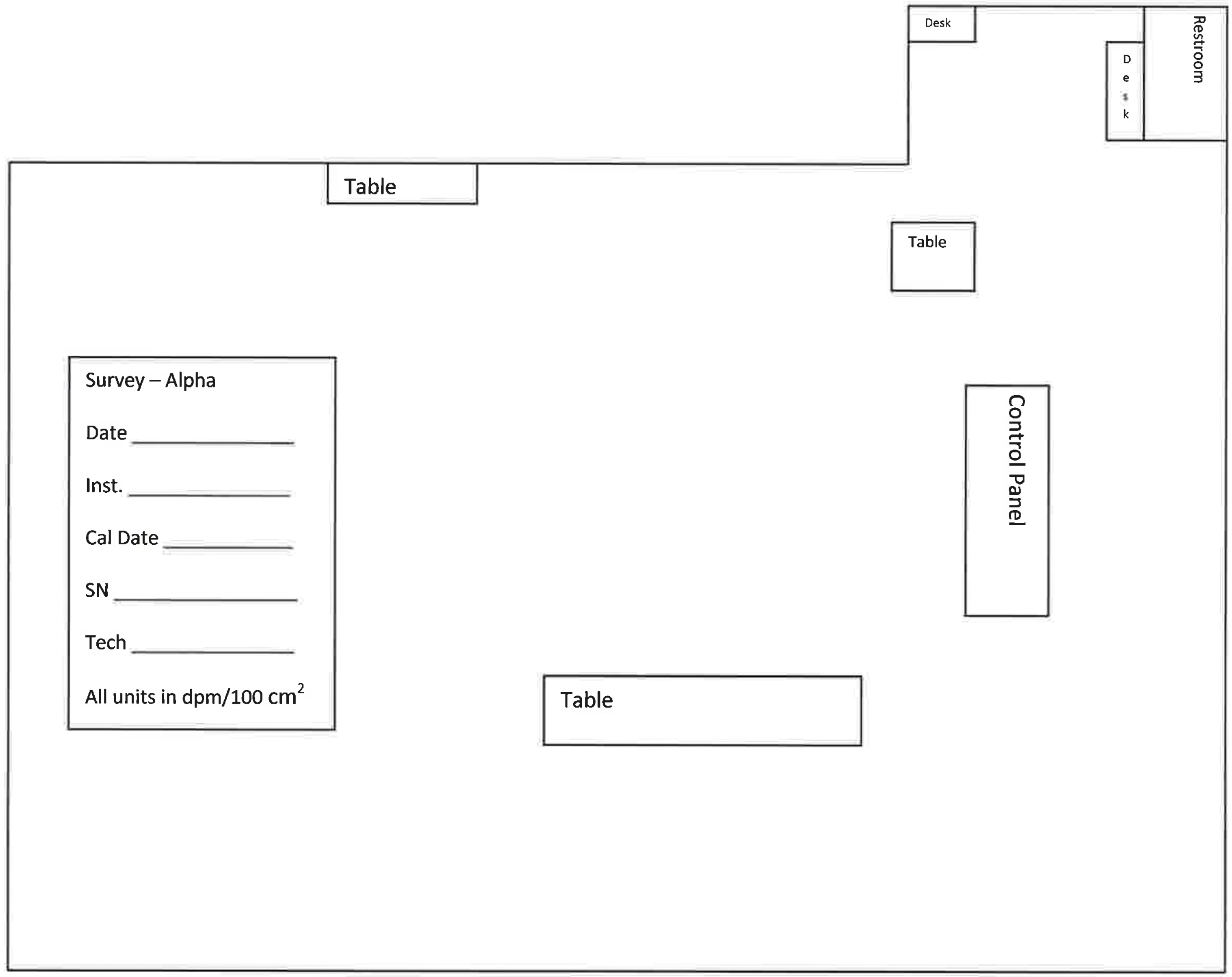
DPM: ________________ CPM: ________________

Efficiency: _____________ Efficiency Factor: __________

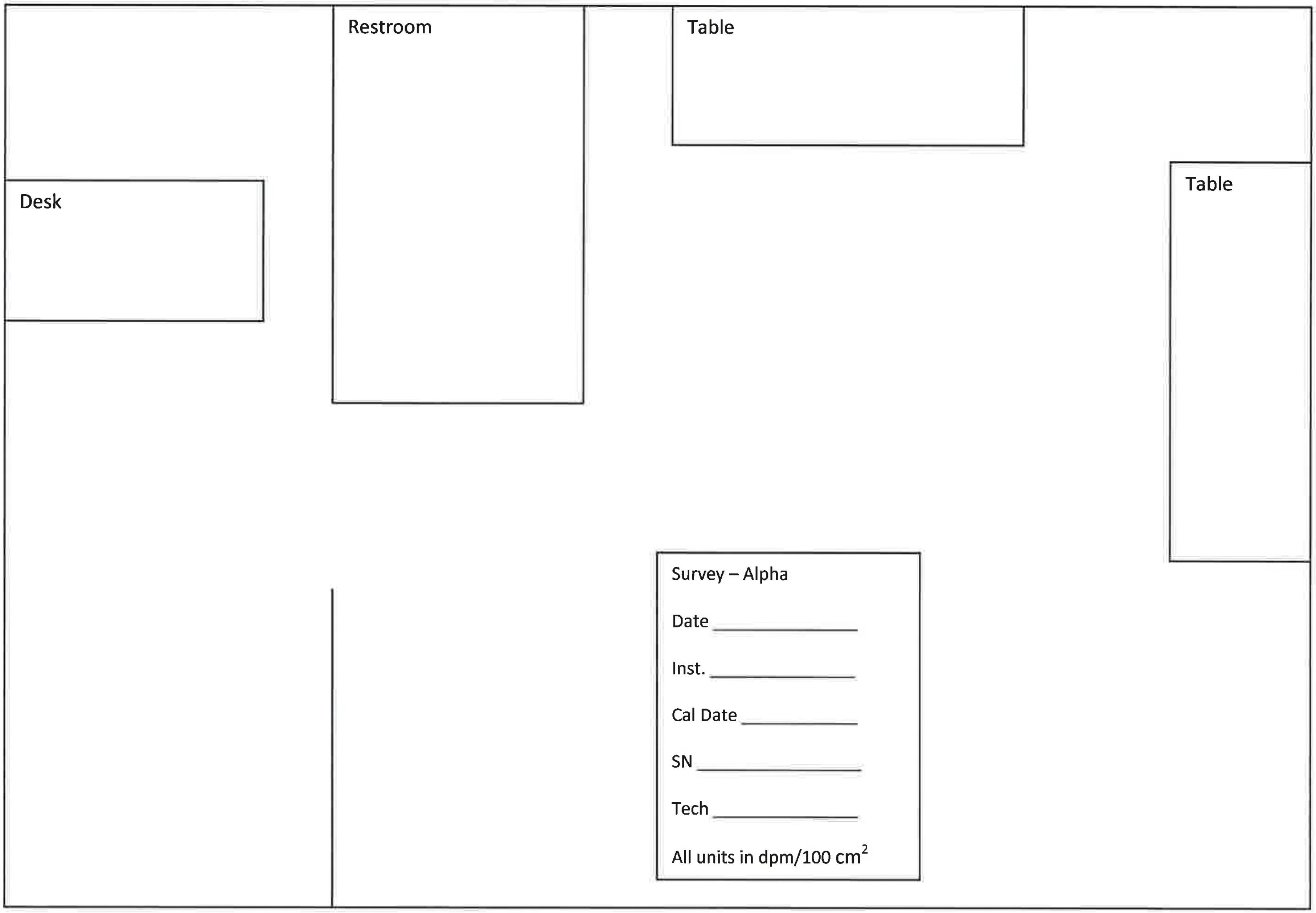
Administration Building



Central Control Room



Scalehouse



Survey – Alpha

Date ______________

Inst. ______________

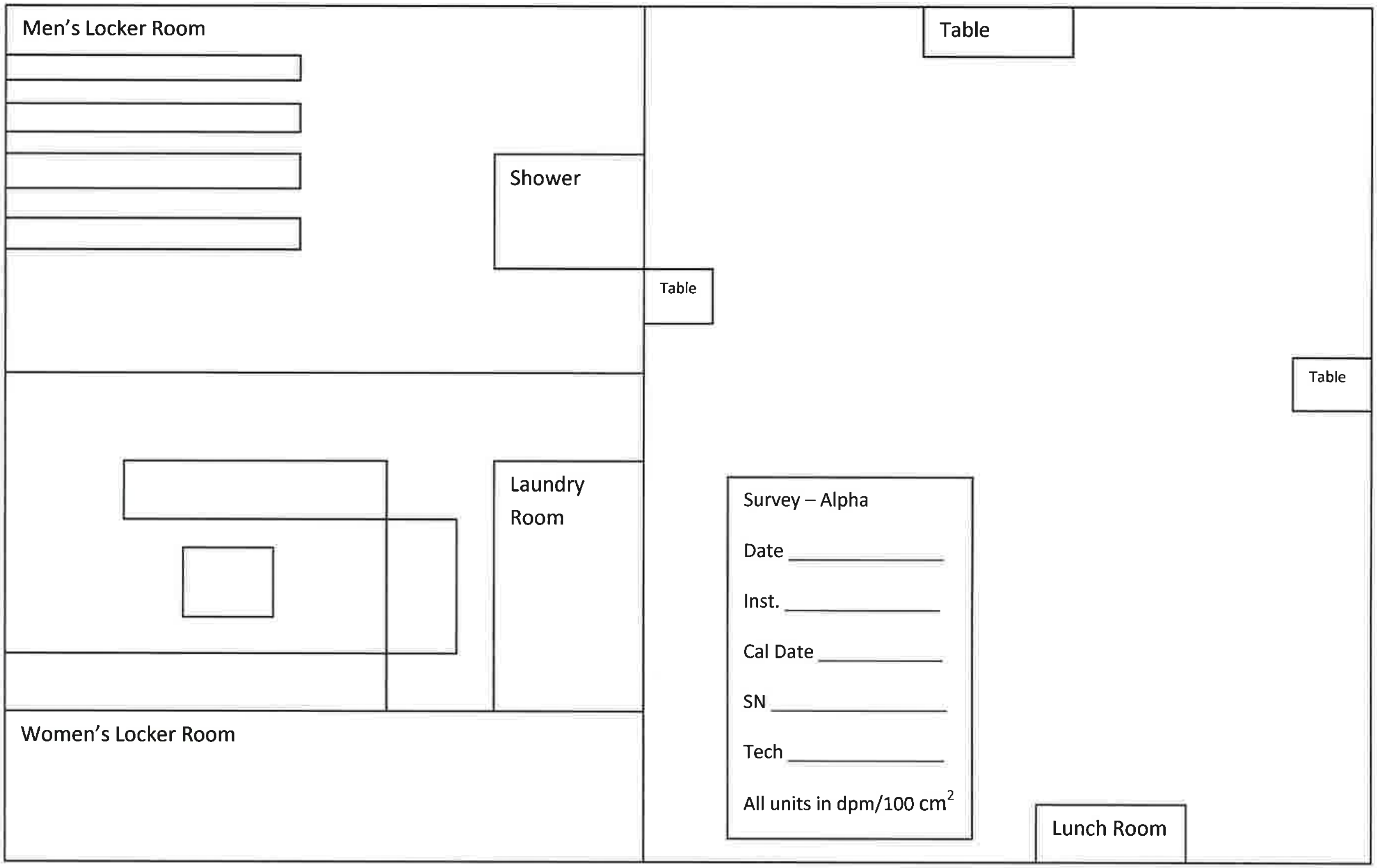
Cal Date ___________

SN ________________

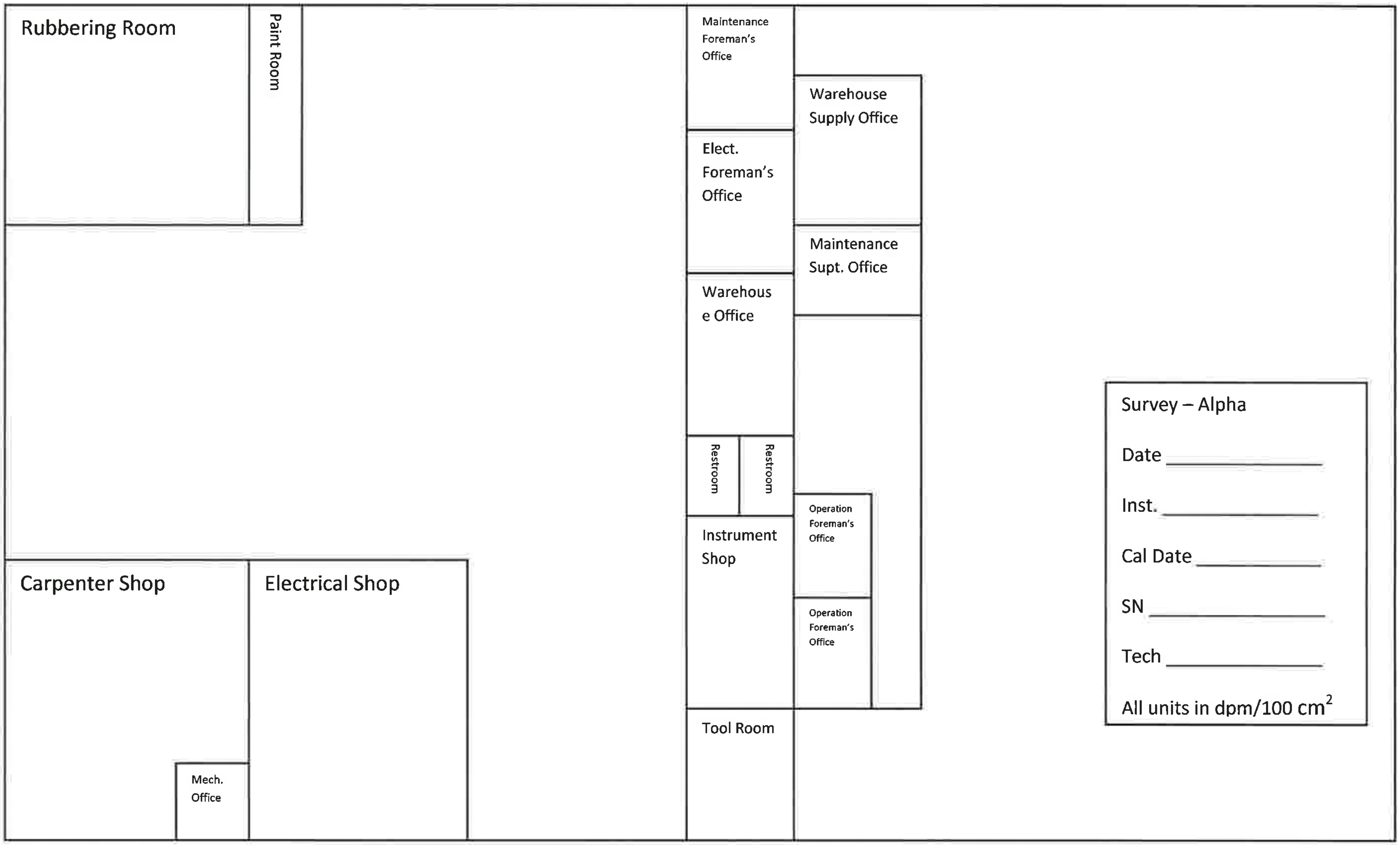
Tech ______________

All units in dpm/100 cm^2

Change/Lunch Room



Maintenance and Warehouse Areas



SX Building

Survey – Beta/Gamma

Date ________________

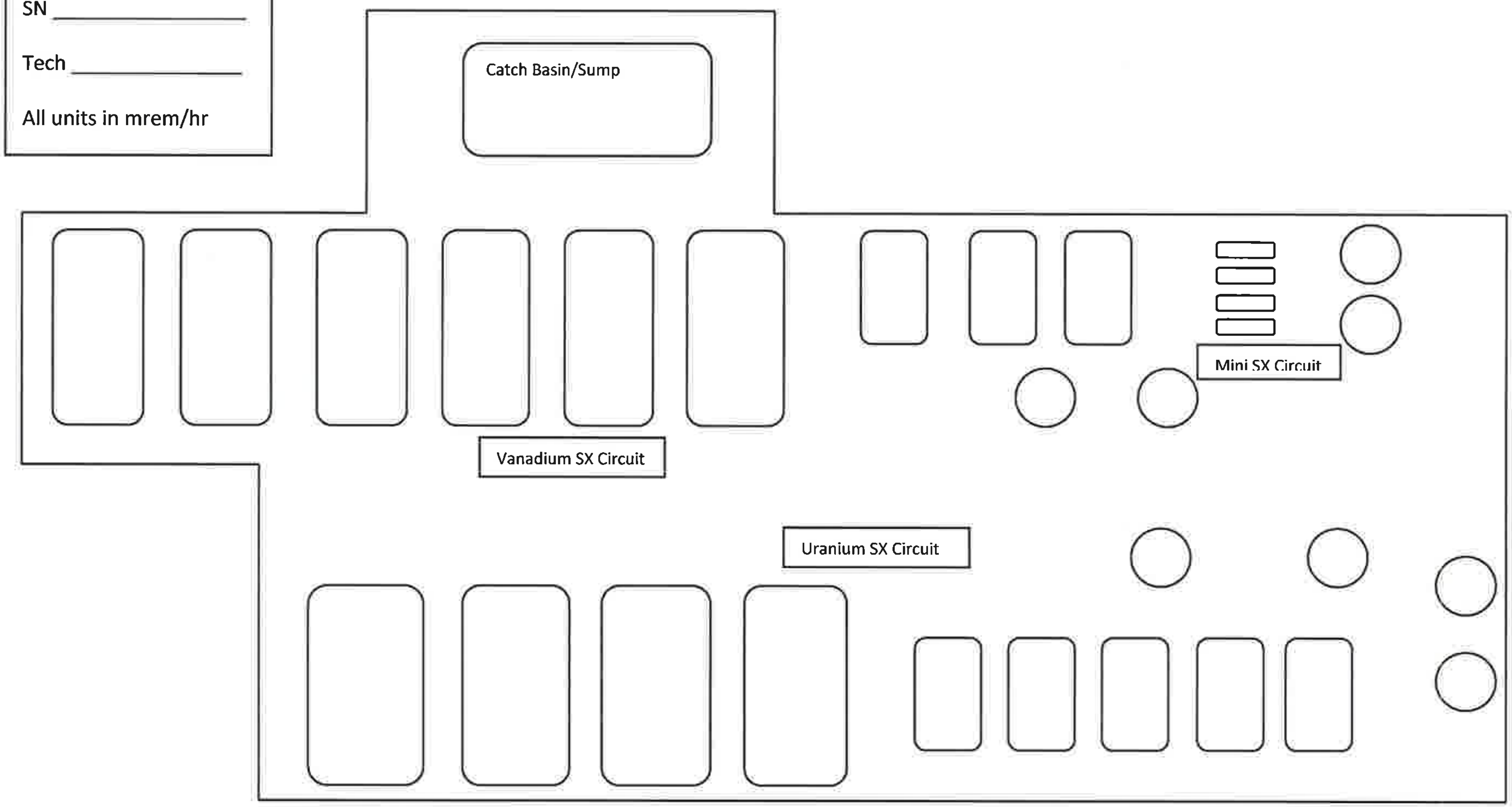
Inst. ________________

Cal Date _____________

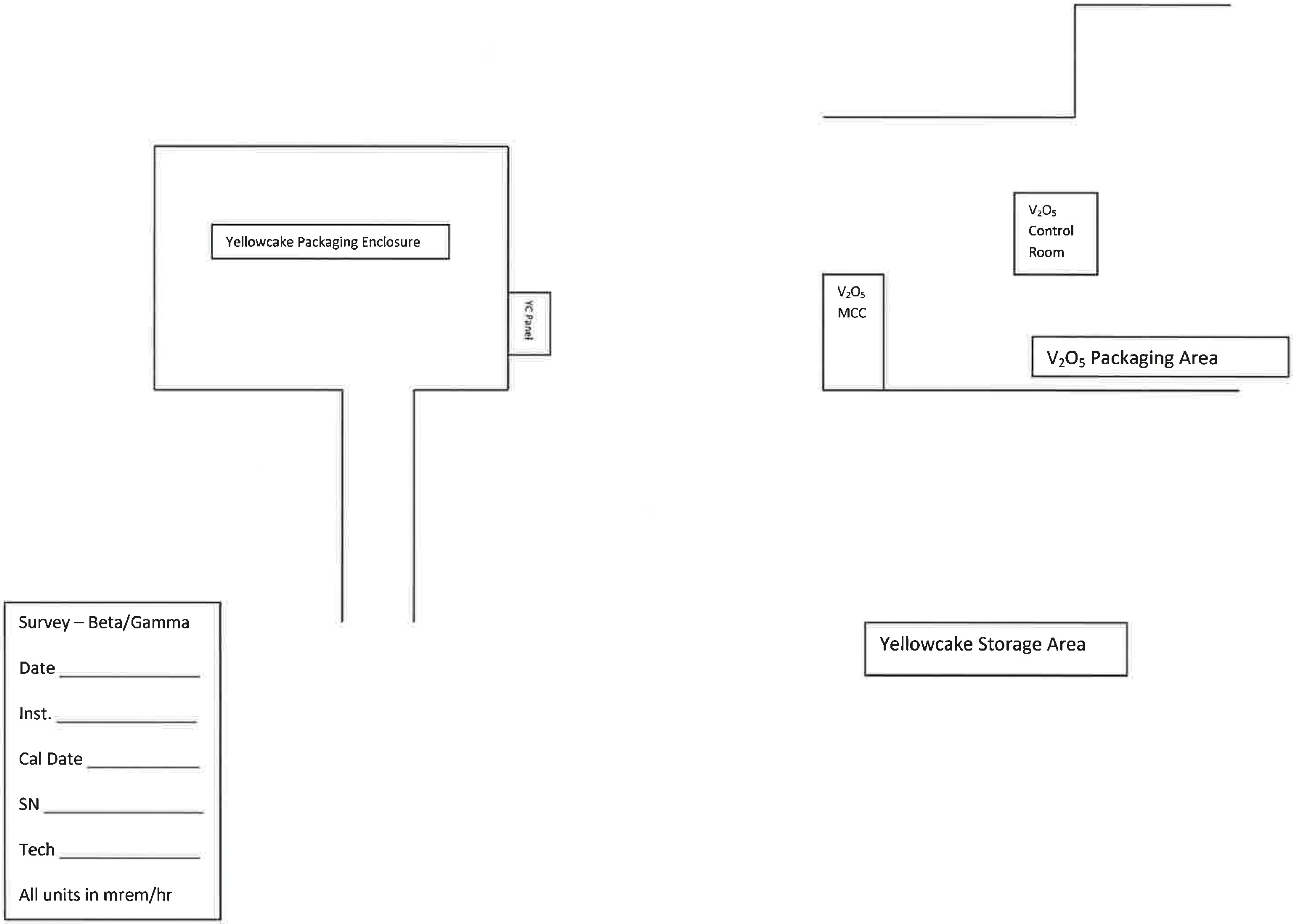
SN ___________________

Tech _________________

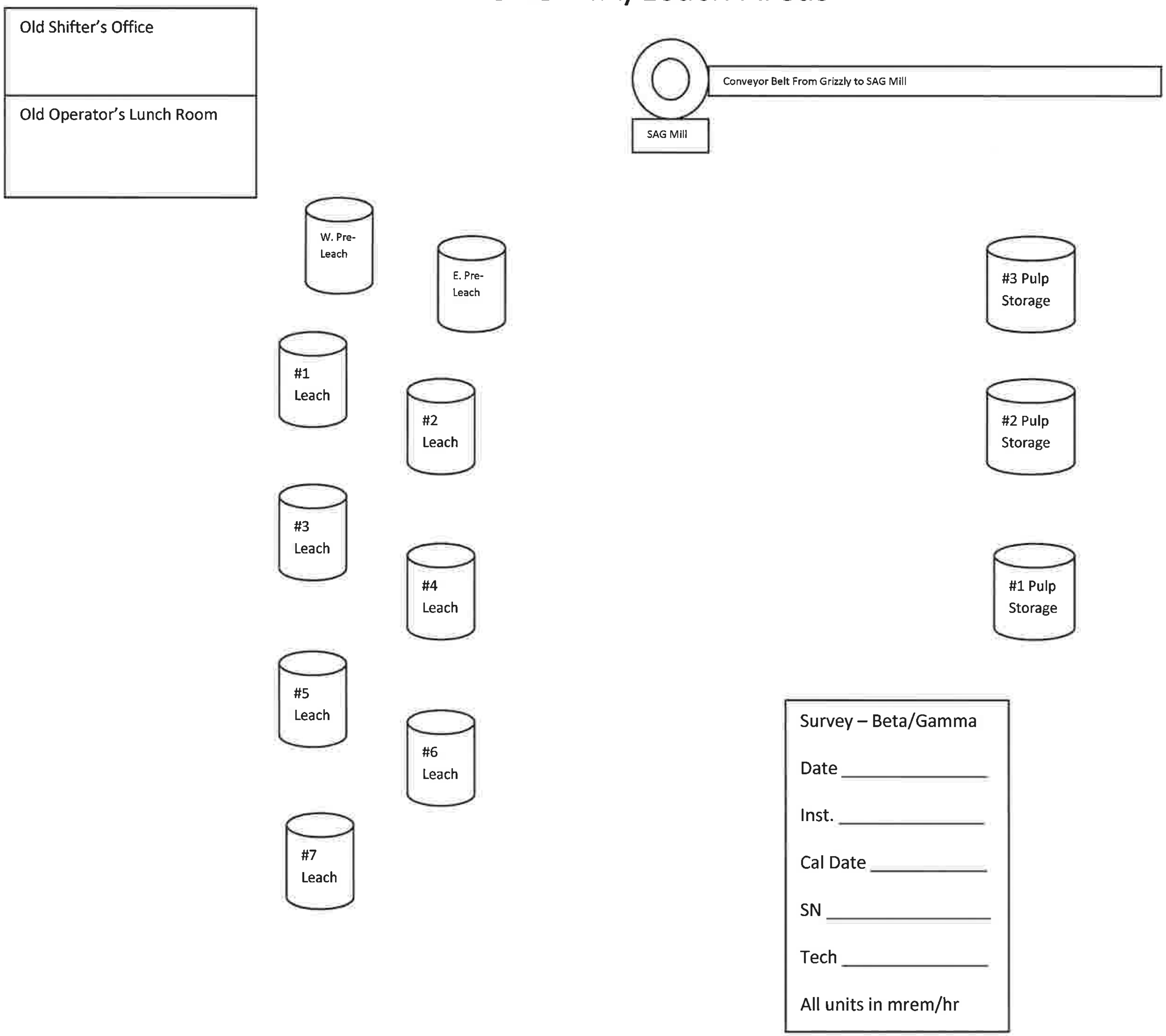
All units in mrem/hr



Product Packaging Areas



SAG Mill/Leach Areas



Emergency Generator Building

Survey – Beta/Gamma

Date ______________

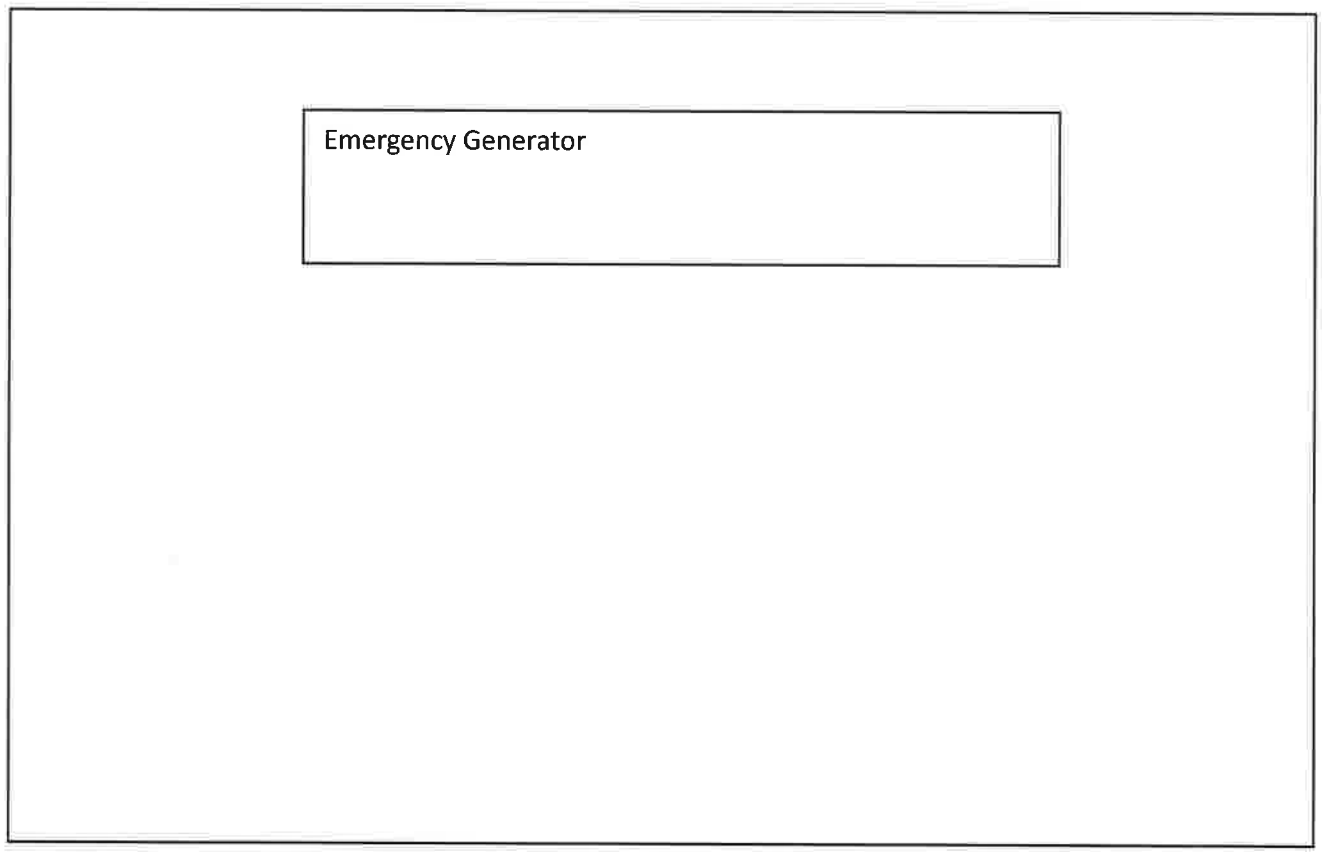
Inst. ______________

Cal Date ___________

SN ________________

Tech ______________

All units in mrem/hr



CCD/Precipitation Circuits

Survey – Beta/Gamma

Date ________________

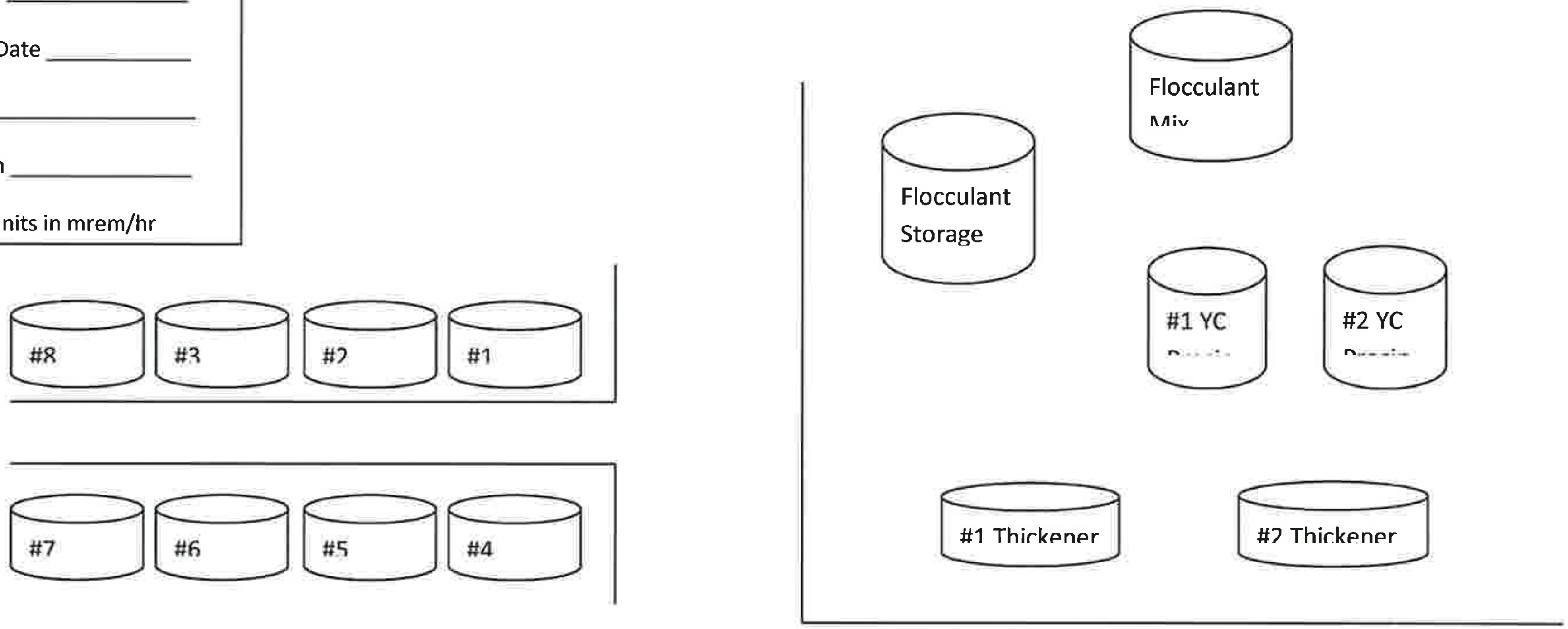
Inst. ________________

Cal Date _____________

SN __________________

Tech ________________

All units in mrem/hr



Uranium Packaging Circuit Upper Levels

Survey – Beta/Gamma

Date ________________

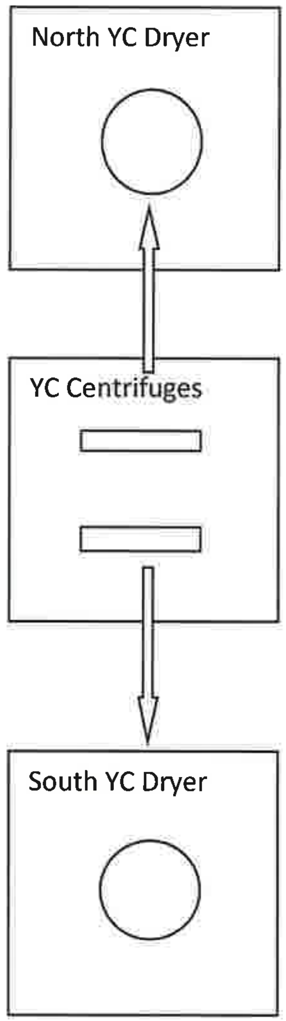
Inst. ________________

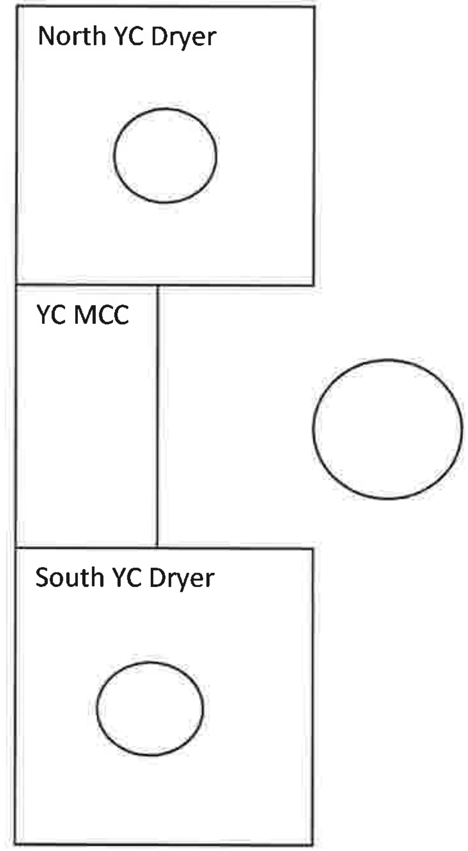
Cal Date _____________

SN ___________________

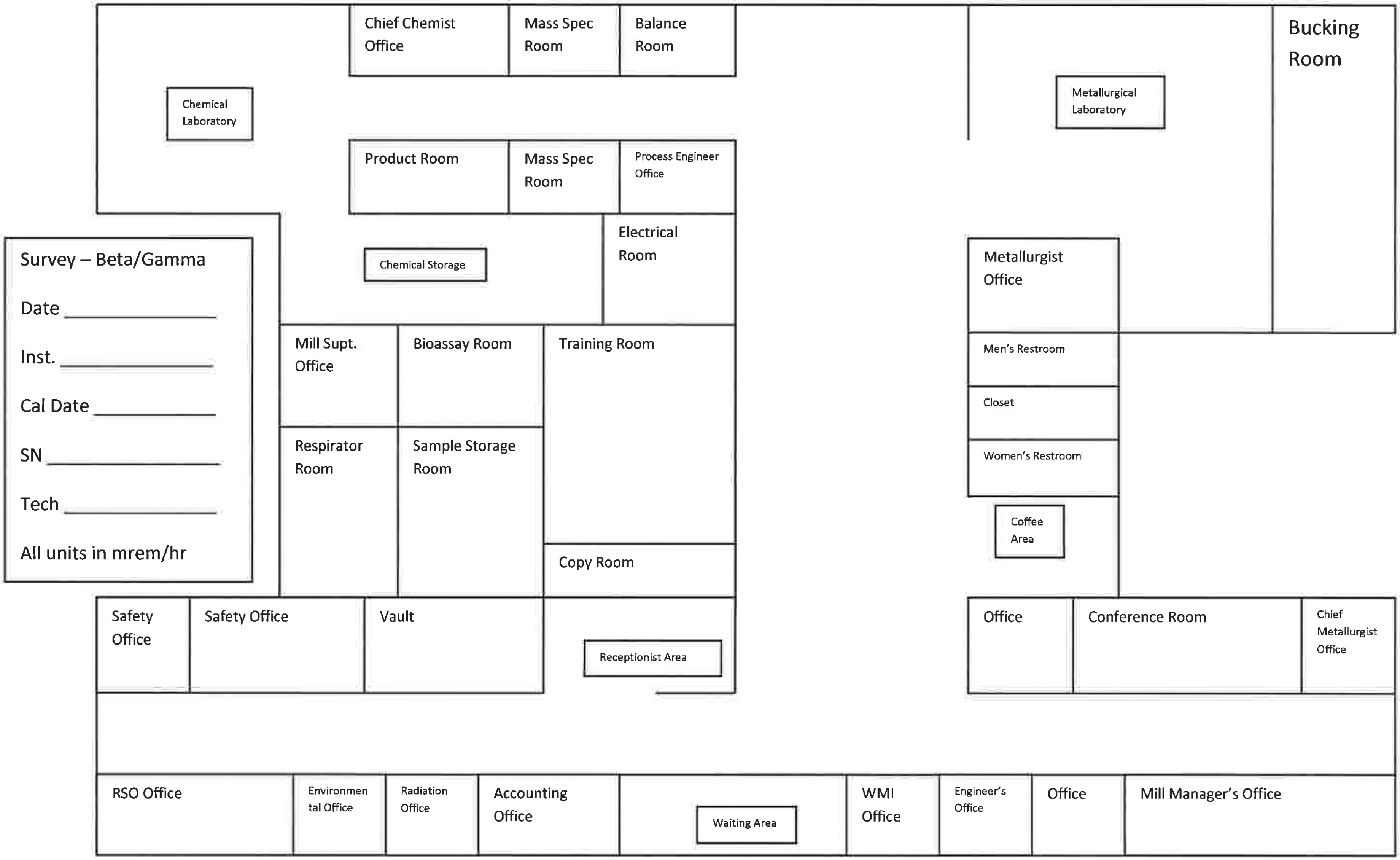
Tech ________________

All units in mrem/hr

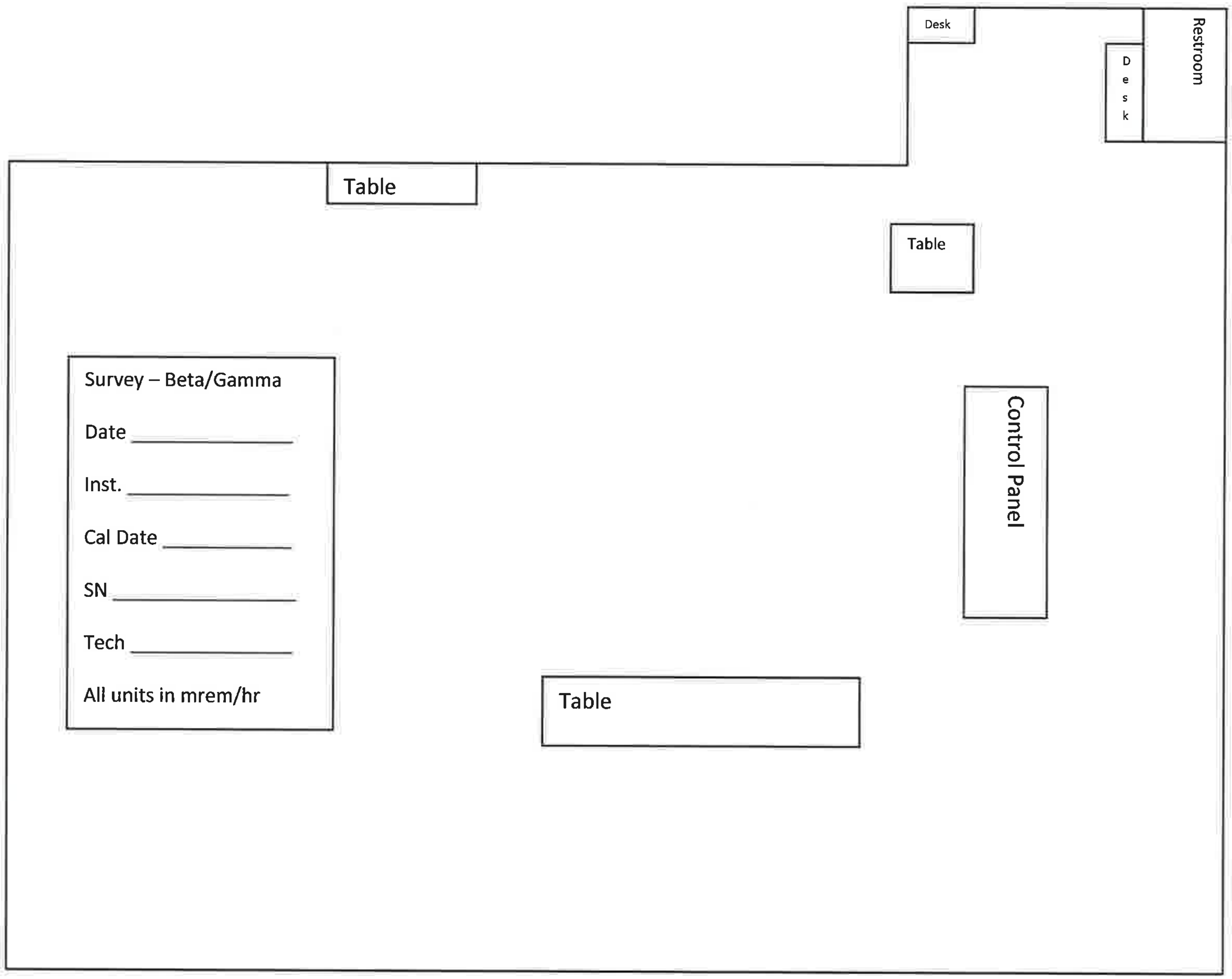




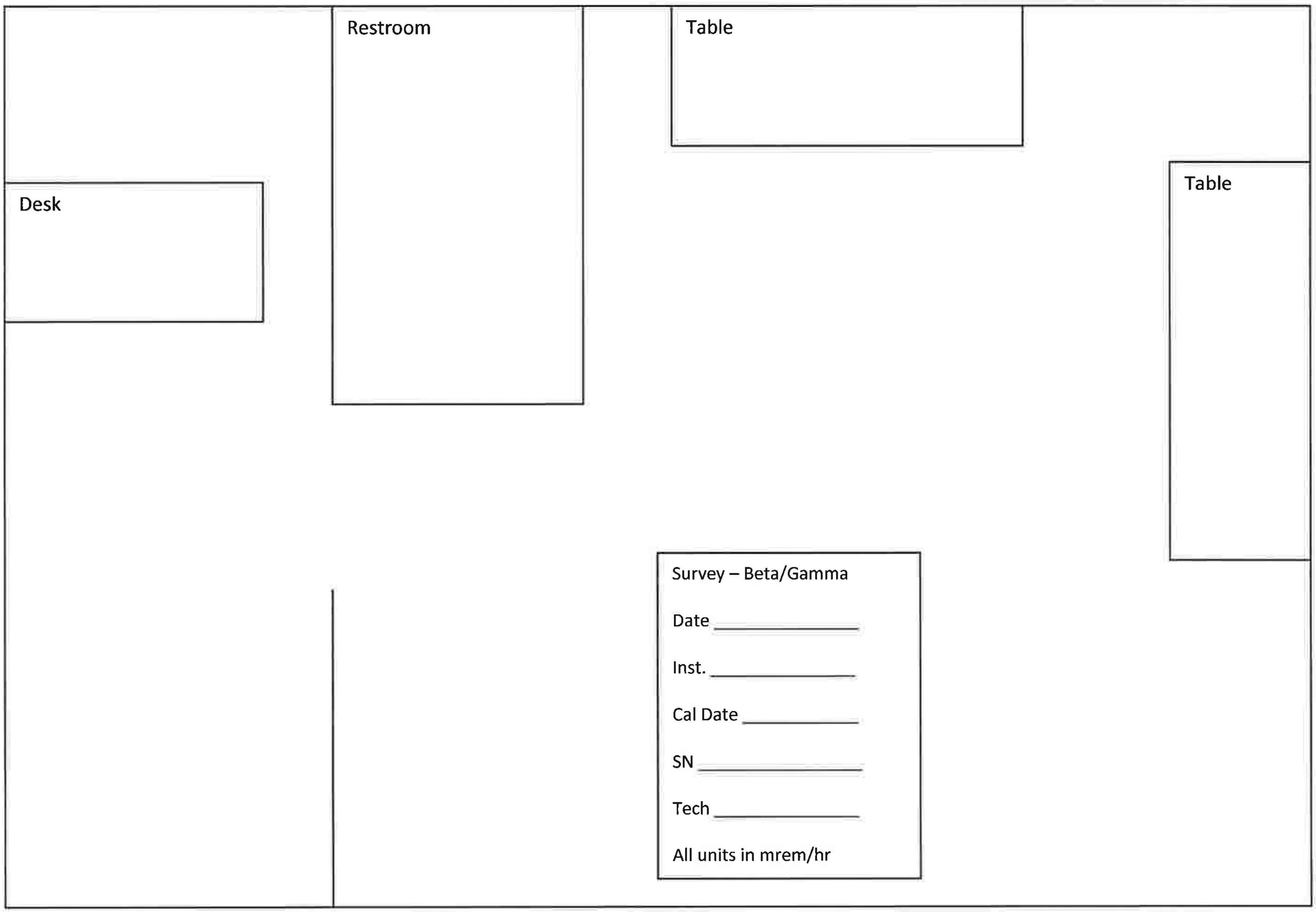
Administration Building



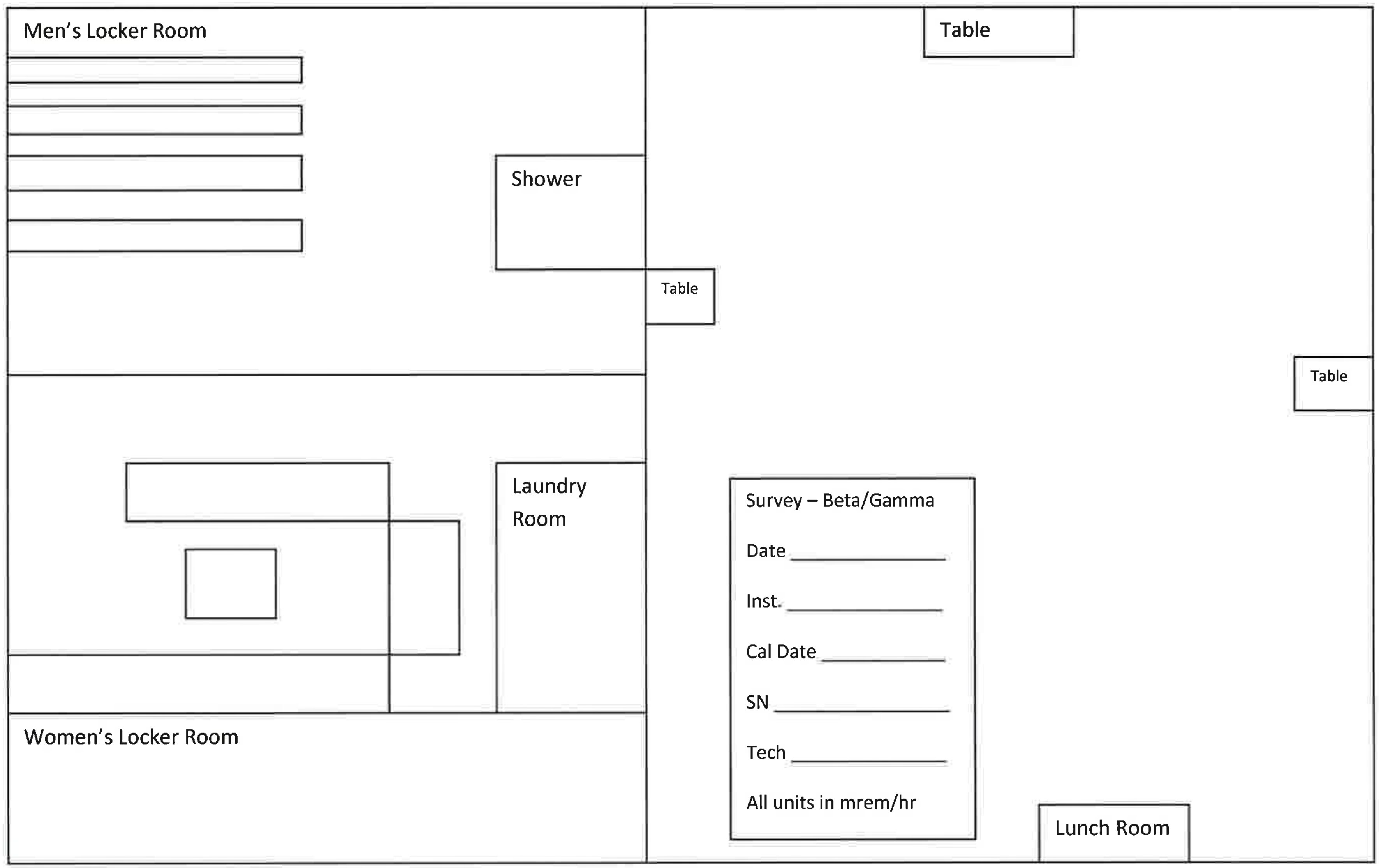
Central Control Room



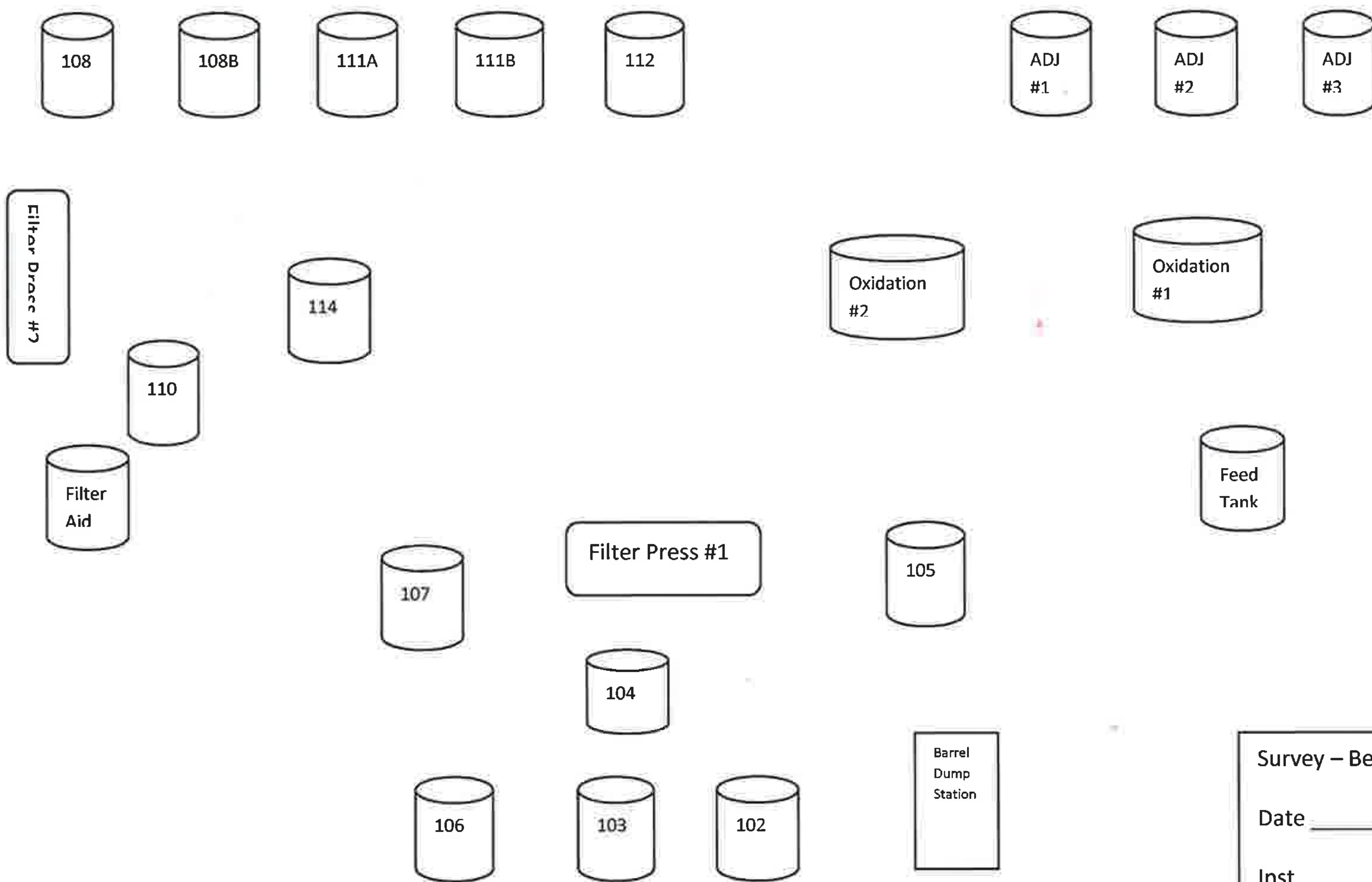
Scalehouse


Restroom
Table
Desk
Table
Survey – Beta/Gamma
Date ____________
Inst. ____________
Cal Date ____________
SN ____________
Tech ____________
All units in mrem/hr

Change/Lunch Room



Alternate Feed Circuit



Survey – Beta/Gamma

Date ______________

Inst. ______________

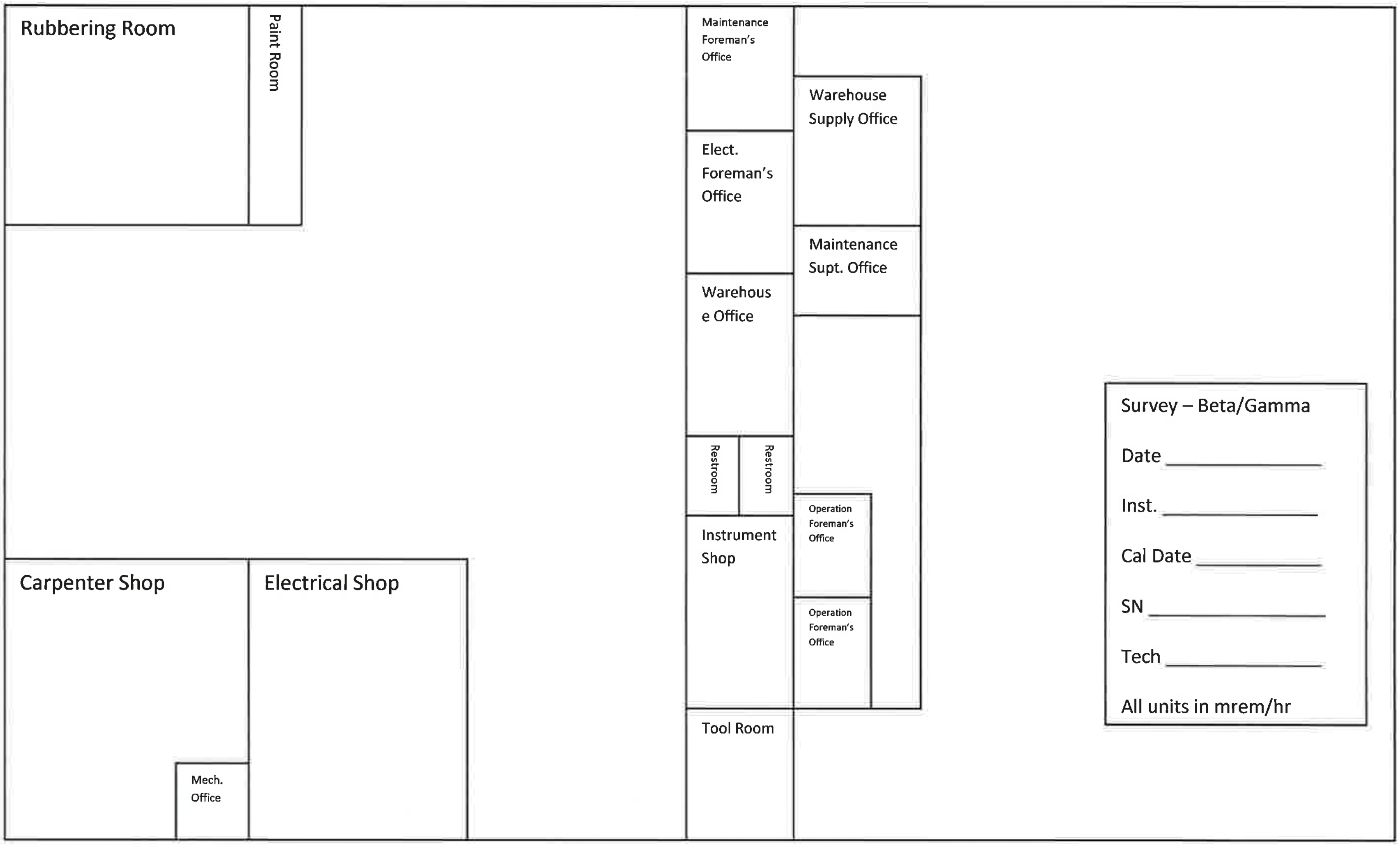
Cal Date ___________

SN ________________

Tech ______________

All units in mrem/hr

Maintenance and Warehouse Areas



Monthly Beta-Gamma Survey

Date: ______________________________

Technician: ______________________________

Function Check of Survey Instrument

Model #: ______________________
Serial #: ______________________
Calibration: ____________________
Source: ______________________
Source #: ____________________
Reading mrem/hr: ______________
All units are in mrem/hr.

RSO Reviewed: ________________________
RSO Comments: ________________________

Feedstock Areas

Feedstock Source	Reading

Survey – Beta/Gamma

Date ________________

Inst. ________________

Cal Date _____________

SN __________________

Tech ________________

All units in mrem/hr

Tails Area

Survey – Beta/Gamma

Date ______________

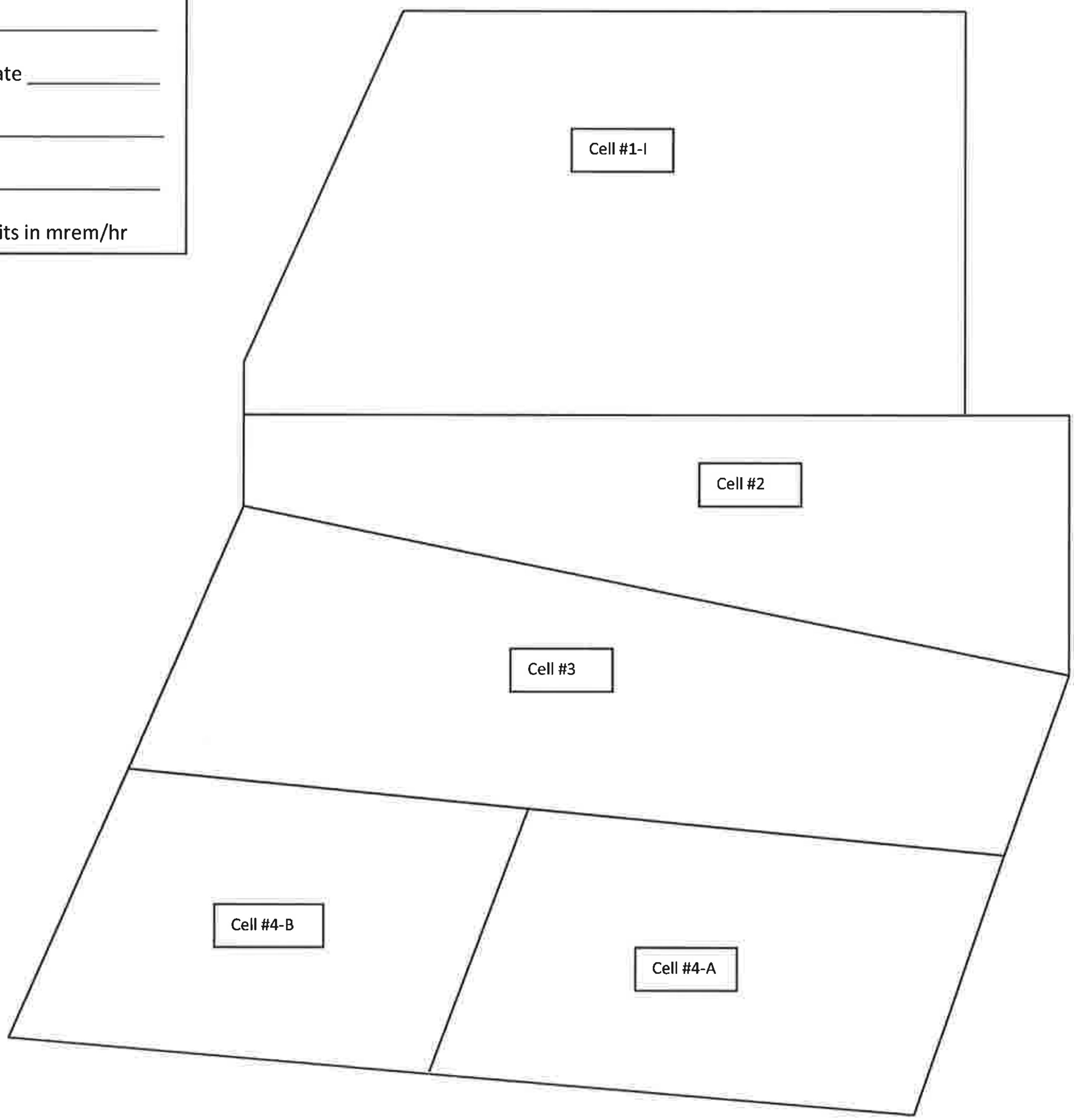
Inst. ______________

Cal Date ___________

SN ________________

Tech ______________

All units in mrem/hr



White Mesa Mill Weekly Alpha Survey

Date: ______________________________

Technician: ______________________________

Alpha Survey Instruments

Fixed

Model #: ____________________

Serial #: ____________________

Calibration: ____________________

Efficiency: ____________________

Factor: ____________________

Background: ____________________

MDA: ____________________

Removable

Model #: ____________________

Serial #: ____________________

Calibration: ____________________

Efficiency: ____________________

Factor: ____________________

Background: ____________________

MDA: ____________________

Notes:

All fixed readings are in dpm/100 cm^2

T or t = Total or Fixed Alpha Reading in dpm/100 cm^2

R or r = Removable Alpha Reading per swipe or filter (approximately 100 cm^2)

RSO Reviewed: ____________________

RSO Comments: ____________________

Energy Fuels Resources (USA) Inc.
White Mesa Mill
Radiation Survey of Equipment Released for Unrestricted Use

All equipment or material released from the White Mesa Mill to an unrestricted area must be surveyed for release in accordance with the following procedure.

1. Monitor for Gross alpha contamination with the appropriate survey meter.
2. If calculated assay exceeds 1,000 dpm/100cm^2, then perform swipe analysis at applicable points.
3. Decontaminate if a removable alpha exceeds 1,000 dpm/100cm^2 or fixed alpha exceeds 5,000 dpm/100cm^2.
4. Release equipment or material if alpha contamination and Beta-Gamma levels are below the following limit:

Removable alpha – 1,000 dpm/100cm^2
Fixed alpha- 5,000 dpm/100cm^2 average
15,000 dpm/100cm^2 maximum

Beta-Gamma- 0.2 mr/hr @1cm average
1.0 mr/hr @ 1cm maximum

Released from White Mesa Mill to: ____________________

Released by (print name): ____________________ Signature: ____________________

Date: ____________

List of Equipment	Total Alpha dpm/100cm^2	Removable Alpha dpm/100cm^2	Beta/Gamma mr/hr
1.			
2.			
3.			
4.			
5.			

Instrument Function checks

Alpha Meter:
Inst. Model__________SN__________
Th-230 Source SN__________
dpm_______ cpm_______ eff_______
Efficiency Factor__________
Cal. Date: ______________
Bkg __________
MDA __________

Beta-Gamma Meter:
Inst. Model__________SN__________
Cs-137 Source SN__________
Inst. Response__________
Cal. Date: ____________

Removable Alpha:
Inst. Model__________SN__________
Th-230 Source SN__________
dpm_______ cpm_______eff_______
Efficiency Factor__________
Cal. Date: ______________

Was a copy of this document offered to the recipient? Yes or No Signature of recipient ____________________

Comments: ____
____