C/041/002 Incoming
#5281

Canyon Fuel Company, LLC
A Subsidiary of Bowie Resources Partner, LLC

Sufco Mine
Kenneth L. May
General Manager
597 South SR24
Salina, Utah 84654
(435) 286-4400
Fax (435) 286-4499

September 19, 2016

Permit Supervisor
Utah Coal Regulatory program
Utah Division of Oil, Gas and Mining
1594 West North Temple, Suite 1210
PO Box 145801
Salt Lake City, UT 84114-5801

Re: Waste Sock Site Compaction Specification Amendment, Canyon Fuel Company, LLC, Sufco Mine

Dear Sirs:

Please find enclosed with this letter a portion of chapter 5 and a new appendix for Sufco's Waste Rock Disposal Site Permit. These changes and additions are in regards to the compaction specifications associated with the placement of the waste rock.

We appreciate your cooperation in reviewing this material. If you have questions or need additional information please contact Vicky Miller (435) 286-4481 or Bryant Bunnell (435) 286-4490.

CANYON FUEL COMPANY
SUFCO Mine

Vicky L Miller
for

Jacob Smith
Technical Services Manager

Encl.

cc: DOGM Correspondence File

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SEP 21 2016
DIV. OF OIL, GAS & MINING

APPLICATION FOR COAL PERMIT PROCESSING
Detailed Schedule Of Changes to the Mining And Reclamation Plan

Permittee: Canyon Fuel Company, LLC
Mine: Sufco Mine **Permit Number:** C/041/002
Title: Waste Rock Site Compaction Specification Amendment

Provide a detailed listing of all changes to the Mining and Reclamation Plan, which is required as a result of this proposed permit application. Individually list all maps and drawings that are added, replaced, or removed from the plan. Include changes to the table of contents, section of the plan, or other information as needed to specifically locate, identify and revise the existing Mining and Reclamation Plan. Include page, section and drawing number as part of the description.

			DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED
☒ Add	☐ Replace	☐ Remove	Table of Contents, Add Appendix VIII
☐ Add	☒ Replace	☐ Remove	Chapter 5, Pages 5-12, 5-13
☒ Add	☐ Replace	☐ Remove	Appendix VIII
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Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.

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APPLICATION FOR COAL PERMIT PROCESSING

Permit Change·X New Permit ☐ Renewal ☐ Exploration ☐ Bond Release ☐ Transfer ☐

Permittee: Canyon Fuel Company, LLC
Mine: Sufco Mine **Permit Number:** C/041/002
Title: Waste Rock Site Compaction Specification Amendment
Description, Include reason for application and timing required to implement:
Increase efficiency by modifying compaction QC/QA methods for the waste rock site.

Instructions: If you answer yes to any of the first eight (gray) questions, this application may require Public Notice publication.

☐ Yes X No 1. Change in the size of the Permit Area? Acres: _____ Disturbed Area: _____ ☐ increase ☐ decrease.
☐ Yes X No 2. Is the application submitted as a result of a Division Order? DO# _____
☐ Yes X No 3. Does the application include operations outside a previously identified Cumulative Hydrologic Impact Area?
☐ Yes X No 4. Does the application include operations in hydrologic basins other than as currently approved?
☐ Yes X No 5. Does the application result from cancellation, reduction or increase of insurance or reclamation bond?
☐ Yes X No 6. Does the application require or include public notice publication?
☐ Yes X No 7. Does the application require or include ownership, control, right-of-entry, or compliance information?
X Yes ☐ No 8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?
☐ Yes X No 9. Is the application submitted as a result of a Violation? NOV # _____
☐ Yes X No 10. Is the application submitted as a result of other laws or regulations or policies?
Explain: _____
☐ Yes X No 11. Does the application affect the surface landowner or change the post mining land use?
☐ Yes X No 12. Does the application require or include underground design or mine sequence and timing? (Modification of R2P2)
X Yes ☐ No 13. Does the application require or include collection and reporting of any baseline information?
☐ Yes X No 14. Could the application have any effect on wildlife or vegetation outside the current disturbed area?
☐ Yes X No 15. Does the application require or include soil removal, storage or placement?
☐ Yes X No 16. Does the application require or include vegetation monitoring, removal or revegetation activities?
☐ Yes X No 17. Does the application require or include construction, modification, or removal of surface facilities?
☐ Yes X No 18. Does the application require or include water monitoring, sediment or drainage control measures?
X Yes ☐ No 19. Does the application require or include certified designs, maps or calculation?
☐ Yes X No 20. Does the application require or include subsidence control or monitoring?
☐ Yes X No 21. Have reclamation costs for bonding been provided?
☐ Yes X No 22. Does the application involve a perennial stream, a stream buffer zone or discharges to a stream?
☐ Yes X No 23. Does the application affect permits issued by other agencies or permits issued to other entities?

Please attach one (1) review copy of the application.

I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments, undertakings, and obligations, herein.

John D Byars
Print Name

J D Byars Coen Mgr. 9-20-16
Sign Name, Position, Date

Subscribed and sworn to before me this 20 day of September, 2016

Jacquelyn Nebeker
Notary Public

My commission Expires: _____, 20___}
Attest: State of _____ } ss:
County of _____

JACQUELYN NEBEKER
Notary Public
State of Utah
My Commission Expires 03/24/2018
COMMISSION NUMBER 681827

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LIST OF APPENDICES

APPENDIX I Cultural Resource Evaluations
APPENDIX I (A) Cultural Resource Evaluations - **Confidential**
APPENDIX II Geotechnical/Hydrological Investigation Report Waste Rock Disposal Site
APPENDIX II(A) Slope Stability Report Waste Rock Disposal Site
APPEDNIX III Engineering Calculations
APPENDIX IV Vegetation of the Proposed Waste Rock Disposal Site
APPENDIX IV(A) Vegetation Report of the Proposed Waste Rock Disposal Site
APPENDIX V Soils Report
APPENDIX V (A) Soils Report
APPENDIX VI Vegetation Guidelines
APPENDIX VII Waste Rock Pile Hydrology
APPENDIX VIII Compaction Specifications

Once the topsoil and subsoil has been removed (Sections 222 and 231), subgrade surface will be scarified and re-compacted to a minimum of 90% maximum density. Densities will be taken on subgrade at a minimum of one per 5000 square yards using a nuclear density gauge. Scarification will be done using earth moving equipment such as a grader, dozer or excavator. Compaction will be done utilizing the same type of equipment by wheel rolling the subgrade surface prior to any waste rock being placed. Water will be added to material as needed to obtain compaction.

Once subgrade has been scarified and compacted, waste rock will be delivered to the site using haul trucks such as 10 wheeled dump trucks and double trailer belly dumps. As the waste pile is being constructed a berm along the outside edge of the pile will be constructed to comply with MSHA regulations. In addition the berm will act as a diversion to direct on site water into the ditches and eventually into the sediment pond. As the waste rock is delivered on site, it will be handled and placed in its final position using earth moving equipment such as loaders, graders and dozers. The waste rock will be placed in ~~+/-1~~ approximately 2 foot compacted lifts. As each layer is being constructed, it will be keyed into the adjacent slope at a minimum of 1 foot per lift or at a 1:1 keyed in slope (Map 3C). ~~The material will be compacted to 95% of maximum laboratory compaction. To determine compaction, a nuclear density gauge will be used. When necessary due to the hydro carbons in the material, a density of the material may also be determined using a sand cone which will assist the nuclear density gauge results by providing an additional factor. Densities will be taken every 5,000 square yards per lift. Potholing down to each lift will be done if additional layers have been placed prior to density testing.~~

In 2016, a geotechnical engineering firm was retained to determine the compaction specification for the waste rock being placed at the site. An onsite compaction study overseen by a professional engineer was conducted that involved creating a test pad 2 feet tall, 75 feet long and 35 feet wide. The test pad was tracked by a Caterpillar D6 dozer. After each pass, compaction was measured using a nuclear density gauge and by measuring the lift thickness. It was observed that the density did not significantly increase and the lift thickness did not significantly decrease after approximately 6 to 8 passes. Material samples were also obtained during the testing process for gradation analysis. Using this data, gradation limits were established

(See Appendix VIII, p. 7, Table 4) and it was recommended that additional sampling and laboratory testing be performed until a consistent range of gradations for the waste rock are observed.

The onsite study also included measuring the angle of repose (Appendix VIII, p. 4, Table 1) to assure that the proposed compaction method doesn't void the previous slope stability evaluation done by EarthFax Engineering in 2015. Piles of material were created from both compacted and uncompacted material and then measured. The angle of repose values were higher than those used by EarthFax in their slope stability evaluation. Therefore, it's determined that the proposed compaction method does not decrease the slope integrity of the waste rock material.

In summary the following are required to ensure proper compaction of the waste rock material:

1. Waste rock shall be placed in approximately 2-foot-thick lifts.
2. Each lift shall be tracked a minimum of 6 passes with equipment with similar or greater track pressures as a Caterpillar D6 dozer (18 tons).
3. One sample shall be taken for gradation analysis each quarter (unless no material was placed during that quarter) to assure that the material is meeting the gradation limit (Appendix VIII, p. 7, Table 4).

As the pile is constructed a 1:1 sideslope on the outside of the pile adjacent to the adjoining phases will remain. As the phase is completed, the top of the waste rock pile will be reclaimed by placing the designated depth of topsoil on the top of the pile. Once the topsoil is placed, the surface will be pocked and gouged using equipment with a maximum bucket width of 30 inches wide. As construction from one phase to the other occurs, steps above will repeat.

Appendix VIII

Compaction Specifications

TECHNICAL MEMORANDUM

To:	Jake Smith, P.E. Engineering and Environmental Compliance Manager Southern Utah Fuel Company (SUFCO) Mine 5976 SR-24 Salina, Utah 84654
From:	Ryan Maw, PE
Reviewed by:	Ryan Cole, PhD, PE
Date:	August 30, 2016
Job Number:	16GCI677
Subject:	SUFCO Waste Rock Pile Construction Study

BACKGROUND AND PURPOSE

The SUFCO mine, owned and operated by Canyon Fuel Company, separates waste rock from production coal based on combustibility and ash content. As a result, waste rock is intermittently generated from SUFCO mining activities in quantities that vary depending on mining location and conditions. Historic construction of SUFCO's waste rock piles, prior to waste rock pile expansion, consisted of placing waste rock in 2-foot thick lifts and tracking materials into place with a dozer and haul trucks. We understand this process resulted in satisfactory performance.

Revisions to SUFCO's waste rock disposal permit (Canyon Fuel Company 2015), included quality control provisions that the waste rock materials "be compacted to 95% of maximum laboratory compaction." This document also covered expansion of the waste rock pile further to the east. We understand the intent of this revision was to provide additional quality control measures for placement of materials in the waste rock pile. We understand this quality control revision, referencing laboratory compaction, has proven difficult to achieve in the field and has required mobilization of additional equipment in an effort to satisfy the laboratory compaction revision. Such quality control measures, additional testing requirements, and coordination with field / laboratory testing companies have impacted production and operations.

Gerhart Cole (GCI) was retained by SUFCO to assess current and historic waste rock placement including quality control methodologies and to develop recommendations for future placement. Prior to performing our studies and assessments, we met with representatives from the Utah Division of Oil, Gas, and Mining (DOGM) and SUFCO to understand historic construction and background related to the revisions and quality control provisions. The meeting discussion also included an overview of our proposed approach and feedback from DOGM.

Reference documents provided to us to assist in developing our scope of work included a) a summary report of previous field studies and slope stability analyses performed by EarthFax Engineering (Earthfax 2015) and b) mining permitting documents (Canyon Fuel Company 2015). The slope stability report (Earthfax 2015) included recommendations for compaction and quality control testing of the sedimentation pond

and basin embankments. Relative to the waste rock placement, the following recommendations were provided; no reference was found relative to compaction effort or quality control.

- *Although MSHA requires that the lift thickness not exceed 2 feet, it may be advantageous to reduce this to facilitate drainage and improve condition. This should be evaluated by trial and error early in the operation.*
- *New lifts should be placed only over waste rock that has had time to drain and has properly compacted to provide a stable base for a new lift. Areas which remain wet and soft should be allowed more time to dry and/or be scarified and recompacted, if necessary.*
- *The dump surface should always be graded to facilitate drainage away from recently placed fill toward surface drainage courses. It may be advantageous to bulldoze shallow ditches at each lift elevation to improve surface drainage.*
- *Care should be taken not to fill over any frozen waste rock which has not been properly drained and compacted.*
- *It may often be necessary to place waste rock and allow time for drying before compacting the lift.*
- *Truck-loads containing predominantly filter cake should be spread out in a thin lift, and allowed sufficient time to dry before compacting, particularly during adverse weather.*
- *In the unlikely event that severe waste rock handling, placement and compaction problems are encountered, consideration should be given to temporarily flattening of dump face slope angles or utilizing artificial waste rock stabilization measure. Other measures may be considered on a case-by-case basis.*

This technical memorandum (TM) summarizes our field and laboratory studies and provides recommendations for waste rock placement and quality control. Slope stability of the waste rock is specifically addressed by Earthfax (2015); this TM is specific to waste rock placement methodologies needed to achieve waste rock properties assumed by Earthfax (2015). For reference, a map of the general vicinity is shown in Figure 1, with a more specific site aerial overview (together with field study locations) included in Figure 2.

TEST PAD CONSTRUCTION AND WASTE ROCK CHARACTERIZATION

Field studies included excavation of previously placed waste rock materials using the revised construction approach (i.e., tandem roller to crush and compact waste rock), sampling and testing of stockpiled and compacted waste rock materials, and construction of a test pad using a D6 dozer; the on-site equipment planned for future waste rock placement. Photos of the waste rock pile are found in Figure 3.

Equipment used in the field studies consisted of a dozer (D6) and backhoe (446B). The dozer was used in test pad construction and backhoe used to excavate test pits for stockpile and bulk sample collection (e.g., 5 gallon buckets). Bulk samples were

collected from the mine stockpile (prior to placement), existing waste rock pile, and the test pad.

Waste Rock Test Pad and Testing

The objective of the test pad was to construct a fill section of materials using methods of construction similar to historic operations with an understanding that these methods are the mines preferred means of placement. Materials used to construct the test pad were hauled by truck directly from the mine and end-dumped into stockpiles. The stockpiles were then spread into place using a D6 dozer with track widths of 1.84 feet. Test pad dimensions were 75 feet long with a width of 35 feet, and a starting lift thickness of 24-inches.

Measurements of in-place density and lift thickness were taken at intervals of two passes, as this was representative of the equipment, with two tracks, moving over the material a single time. Measurements of density were made using a nuclear densometer/gauge and readings were taken at two locations using a consistent offset from wood reference stakes. Lift thicknesses were also measured by hand excavating a near vertical face at the edge of the test pad. Test pad construction, observations, and material testing were overseen by a licensed professional engineer. Photos summarizing test pad construction have been included in Figures 4 through 7.

Given the larger particle in the waste rock, density gauge readings were taken in two directions orthogonal to each other to provide more representative readings that account for disturbance from driving a pin to take density readings and oversized particles. The averaged values of in-place dry density, from both orientations tested, are plotted in Figure 8 as well as lift thickness relative to number of equipment passes in Figure 9. As can be seen in Figure 8, dry density readings varied between location and number of passes. In-place testing with the densometer included the challenges described by SUFCO in successfully driving a drill pin to create a space for nuclear densometer rod insertion and testing.

It was our observation that the erratic density results shown in Figure 8 were a function of waste rock material and nuclear densometer testing limitations (i.e., driving pin can actually loosen material after hitting coarse rock). In order to address this field observation, measurements of test pad height were recorded alongside density test results. Furthermore, after test pad construction a tandem drum roller (CB-534B), was used to vibratory compact a section of the test pad (offset from NGTL-02) using several passes. The results of density testing and measured lift thickness after heavy compaction with the roller have also been plotted in Figure 8 and 9 for reference.

Our experience has been that measurement of moisture content using a nuclear densometer in materials with coal materials are inconsistent. As such, locations where density testing was performed were potholed after test pad construction with a backhoe and grab samples collected to perform oven dried moisture and gradation testing. These moisture values were used to correct dry unit weight values obtained from the density gage. Photos of excavated materials from the test pad section have been

included in Figure 10. A 24-inch lift was used in test pad construction given historic construction and mine preference for future construction. Pot holes were also used to establish consistent compaction throughout the 24-in lift.

Field Measurement of Angle of Repose

Previous studies included laboratory measurement of the angle of repose for waste rock with a reported angle of 33.6° (Earthfax 2015). Given the large aggregate particles in the waste rock, greater than 3-inches, our field studies included large scale testing of waste rock materials produced from three sources: 1) uncompacted (delivered to the site by haul truck and end-dumped into a stockpile) 2) tandem roller compacted Waste Rock (placed prior to our site visit) and collected from test pits, and 3) grab samples collected from test pad construction near density testing.

Construction of a stockpile for large scale angle of repose testing consisted of excavation of material from test pits or end-dumped waste stockpiles using a backhoe bucket. The material was then lifted to above the top of the stockpile and allowed to fall freely from the bucket into a stockpile. After a stockpile was constructed, the slopes around the sides of the stockpile were measured using a 4-foot level and a geologic clinomoter placed along the levels edge. The slope was measured 3 to 4 times, depending on stockpile size, with average measured angles of repose summarized in Table 1. Photos of stockpile construction and completed stockpiles for the three cases are shown in Figures 11 through 15. Photos of the uncompacted waste rock stockpiles are provided in Figures 16 through 18.

As a field level check on clinometer measurements, the 4-foot level and a tape measure/yardstick were also used to measure the slope at four locations around the stockpile.

Table 1 Summary of Angle of Repose Measurements by Material Source

Waste Rock Material Source	Angle of Repose (degrees)	Comment
Uncompacted Waste Rock	38	End-dumped from haul trucks loaded at mine
Tandem Roller Compacted Waste Rock	34	Average value from Stockpiles of Six Test Pits
Waste Rock Test pad	35	Average value from Stockpiles of Two Test Pits

Laboratory Testing

Selected bulk samples obtained during our field studies were tested in our geotechnical laboratory. Samples were collected from uncompacted waste rock stockpiles, compacted waste rock test pits, and test pad test pits. Testing included moisture content, grain-size distribution, and specific gravity. A summary of samples collected, sample naming convention, and source is provided in Table 2. Laboratory testing results are summarized in Table 3 with gradation results plotted in Figure 19. Additional information on laboratory test results are included in Appendix A.

Table 2 Summary of Collected Waste Rock Samples

Sample[1]	Material Source	Sample Depth (ft)
WRSP-GR01	End-dumped waste rock from mine	Stockpile
WRSP-GR02	End-dumped waste rock from mine	Stockpile
WRSP-GR03	End-dumped waste rock from mine	Stockpile
WRSP-GR04	End-dumped waste rock from mine	Stockpile
WRSP-GR05	End-dumped waste rock from mine	Stockpile
16-WRSP-TP01	Existing waste rock pile	0 to 3
16-WRSP-TP02	Existing waste rock pile	0 to 3
16-WRSP-TP03	Existing waste rock pile	0 to 3
16-WRSP-TP04	Existing waste rock pile	0 to 1
16-WRSP-TP05	Existing waste rock pile	0 to 1
16-WRSP-TP06	Existing waste rock pile	0 to 1
16-NGTL-TP01	Test pad waste rock after construction	0 to 1
16-NGTL-TP02	Test pad waste rock after construction	0 to 1

Note: 1. Waste Rock Stock pile – Grab samples (WRSP-GR),
Waste Rock Stockpile-Test Pit (16-WRSP-TP01), and
Test Pad Nuclear Densometer Gauge Test location-Test Pit (16-NGTL-TP)

Specific Gravity and Bulk Density

Samples of coarse waste rock were tested for bulk specific gravity and apparent specific gravity. Given the angular nature of the samples, dimensions were measured at multiple locations to develop dimensions used in calculations. Calculated apparent specific gravity values ranged from 1.37 to 2.80. The tested sample with a specific gravity of 1.37 was visually observed to consist of a larger percentage of coal material.

Table 3 Laboratory Test Results Summary

SUFCO Waste Rock (16GCI744)

GERHART COLE INC.
GEOTECHNICAL ENGINEERS

Test Hole	Depth (ft)	Moisture content (%)	Grain-Size Analysis (Percent Finer)													Other Tests (Interpretative Data in Appendix)
			12-in (300 mm)	6-in (150 mm)	3-in (75 mm)	1.5-in (37.5 mm)	3/4-in (19 mm)	3/8-in (9.5 mm)	No.4 (4.75 mm)	No.10 (2 mm)	No.20 (0.85 mm)	No.40 (0.425 mm)	No.60 (0.25 mm)	No.100 (0.15 mm)	No.200 (0.075 mm)	
WRSP-GR-01	Stockpile	10.2	100	100	84	64	50	39	28	17	10	7.0	5.3	4.1	2.9	
WRSP-GR-02	Stockpile	9.6	100	91	74	51	36	28	21	14	8.8	6.1	4.5	3.3	2.2	
WRSP-GR-04	Stockpile	11.9	100	93	62	42	31	24	17	11	6.7	4.6	3.5	2.6	1.7	
16-WRSP-TP-01	0-3 ft	9.9	100	100	95	87	72	62	50	39	31	25	21	18	14	
16-WRSP-TP-06	0-1 ft	9.6	100	100	93	81	63	48	39	30	23	18	15	12	9.0	
NGTL-01	0-1 ft	13.3	100	100	98	87	70	61	47	34	25	20	16	13	9.8	ASG 1=2.77, 2=2.80, 3=1.37, 4=2.76, 5=2.73
NGTL-02	0-1 ft	12.4	100	100	94	86	69	52	38	28	21	16	13	11	7.8	

CONCLUSIONS AND RECOMMENDATIONS

Field and laboratory studies were completed for the waste rock pile with the following objectives:

1) Observe construction of a test pad using methods proposed for future construction of the waste rock pile and develop recommendations for a minimum number of equipment passes, using a D6 dozer, for future construction; and
2) Collect and characterize samples of waste rock using grain size, apparent specific gravity, moisture, and field angle of repose measurements for uncompacted, tandem roller compacted, and test pad compacted construction methods.

Our conclusions and recommendations can be summarized relative to these objectives as follows:

1) Measured dry densities and material thicknesses, summarized in Figures 8 and 9, suggest dry densities do not significantly increase and lift thickness did not significantly decrease beyond 6 to 8 passes. Additionally, after heavy compaction using a tandem drum roller only minor changes in dry density and lift thickness were observed.
2) Our field observations suggest that after 6 to 8 passes the waste rock material appears to breakdown and densify resulting in crushing and moisture loss of the waste rock. This moisture loss was observed in pockets of increased moisture material that developed at fourteen passes. As such it is recommended that a minimum of 6 passes, using equipment with similar or greater track pressures as the D6 dozer used in construction of the test pad, be used to compact waste rock pile materials in 2-foot loose lifts. We feel 6 passes is appropriate given the test pad did not include the compactive effort of haul trucks traveling on the waste rock during construction.
3) Haul trucks traveling across the placed waste rock should stagger their wheel paths and travel lanes as they enter and exit the waste rock pile to provide additional compactive effort as well as to observe any localized areas of poor compaction or material degradation below the tires. If excessive deflections are observed in a localized area under haul truck traffic these sections should be excavated, to below degraded materials, and replaced with waste rock meeting placement requirements above.
4) Our gradation analyses and field observations suggest that material degradation, in terms of grain size, does occur to softer waste rock materials during construction.
5) Our field measured angle of repose values from all three of the waste rock sources studied suggest values higher than those measured by Earthfax (2015) and used in their waste rock slope stability evaluation.
6) Table 4 summarizes gradation criteria over which these placement criteria are applicable. Table 4 was developed from data collected (see Figure 19) and our experience with similar materials and placement practices.
7) We recommend additional sampling and lab testing be performed until a consistent range of gradations for the waste rock are observed. This sampling and testing

program should include, at a minimum, one gradation test per quarter from material placed and tracked into place for the waste rock pile. The sample may be collected with oversized material (e.g., 3-inch minus) weighted and discarded on-site. The remaining sample material should be collected in 5 gallon bucket(s) and shipped to a geotechnical laboratory for grain size testing. If the as placed gradations fall outside the criteria provided in Table 4, we should be retained for additional assessments (i.e., analyses, field studies, and/or laboratory studies as needed) to provide revised placement recommendations.

Table 4 Gradation Limits for Waste Rock Pile Earthwork Recommendations

U.S. Standard Sieve Size	Percent Passing (by weight)
12 inch	100
3 inch	40-100
¾ inch	20-100
No. 4	5-60
No. 200	0-30

LIMITATIONS

The assessments and recommendations presented in this document are based on limited field studies and laboratory testing, as well as our understanding of the project's design and manner of construction. If the project's design or manner of construction changes, or if conditions are found later that are different from those described, we should be notified immediately so that we can make revisions as necessary.

This document was prepared solely for the use of the addressee and may not contain sufficient information for other parties or uses.

We represent that our services are performed within the limitations prescribed by our Client, in a manner consistent with the level of care and skill ordinarily exercised by other professional consultants under similar circumstances. No other representation, expressed or implied, and no warranty or guarantee is included or intended. We do not assume responsibility for the accuracy of information provided by others.

FIGURES

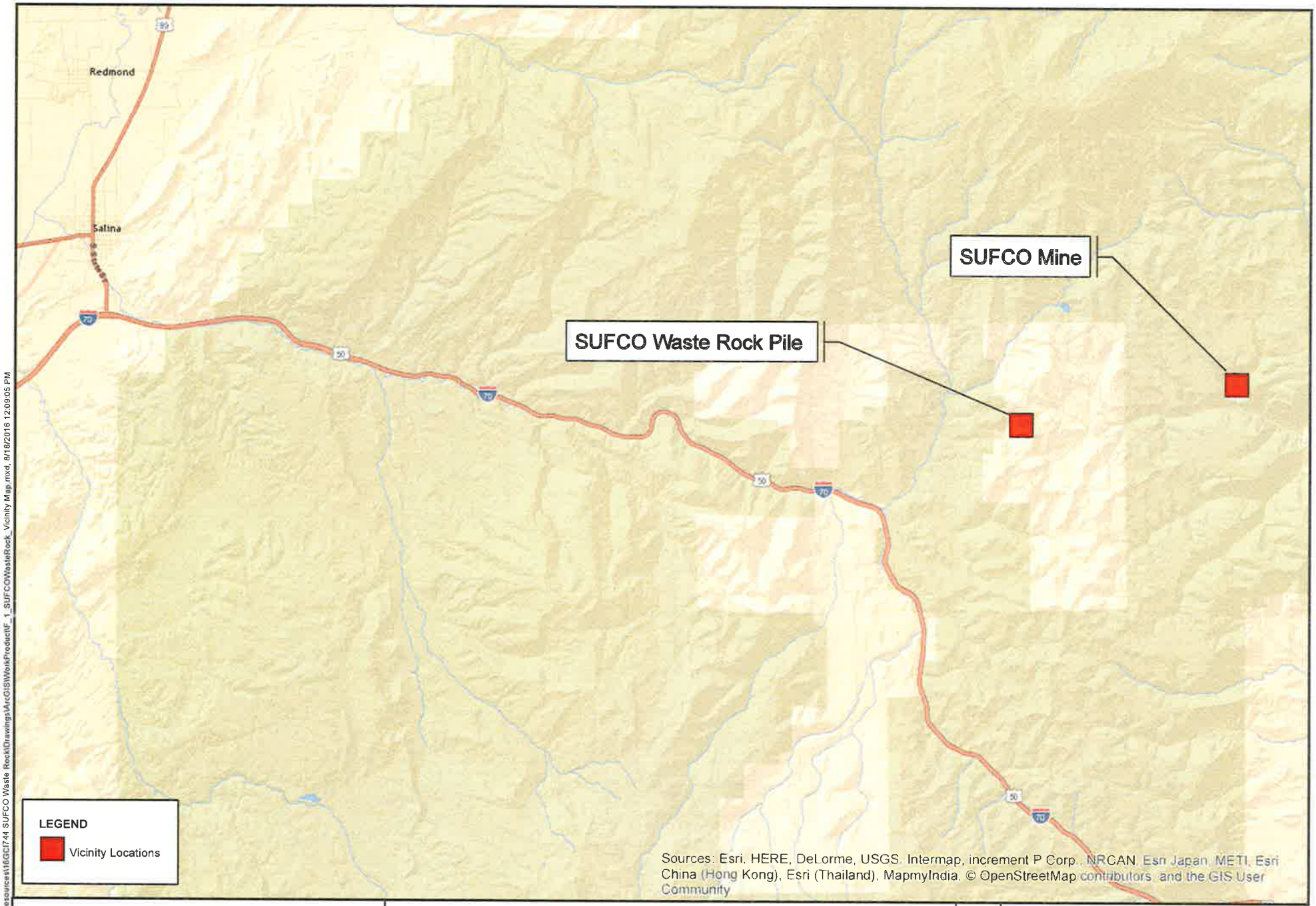
TABLES

APPENDICES

REFERENCES

EarthFax Engineering, LLC., January 2015, "SUFCO Mine Waste Rock Pile Expansion Slope Stability Analysis." Salt Lake County, Utah

Canyon Fuel Company, LLC., October 2015, "SUFCO Mine – C/041/002, Waste Rock Disposal Site Expansion, 2015, Volume 1." Sevier County, Utah



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GERHART COLE INC.
GEOTECHNICAL ENGINEERS

SUFCO Waste Rock Pile Embankment Construction Study (16GCI577)

Vicinity Map

N

0 1.25 2.5 5 Miles

Figure 1

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GERHART COLE INC.
GEOTECHNICAL ENGINEERS

SUFCO Waste Rock Pile Embankment Construction Study (16GCI577)

Site and Field Study Locations Map

N

0 75 150 300 Feet

Figure 2

Location:	Waste Rock Pile Expansion Area	Description:	View of waste rock pile looking southeast

Location:	Waste Rock Pile Expansion Area	Description:	View of waste rock pile looking south

SELECT PHOTOS OF SUFCO WASTE ROCK PILE FIELD STUDIES: ROCK PILE EXPANSION

SUFCO Waste Rock Pile
Embankment Construction Study

GERHART COLE INC. GEOTECHNICAL ENGINEERS

Figure 3

J:\PROJECTS\Bowie Resources\16GCI744 SUFCO Waste Rock\Analyses\Report

Location:	Waste Rock Pile Test Pad Area	Description:	View of hauled/ not compacted waste rock materials for test pad construction

Location:	Waste Rock Pile Test Pad Area	Description:	View of hauled/not compacted waste rock materials for test pad construction

SELECT PHOTOS OF SUFCO WASTE ROCK PILE FIELD STUDIES: TEST PAD CONSTRUCTION (1 OF 4)

SUFCO Waste Rock Pile
Embankment Construction Study

GERHART COLE INC. GEOTECHNICAL ENGINEERS

Figure 4

J:\PROJECTS\Bowie Resources\16GCI744 SUFCO Waste Rock\Analyses\Report

Location:	Waste Rock Pile Test Pad Area	Description:	View of D6 dozer placement of waste rock stockpiles in test pad section

Location:	Waste Rock Pile Test Pad Area	Description:	View of tracked (2 passes with D6 dozer) waste rock materials

SELECT PHOTOS OF SUFCO WASTE ROCK PILE FIELD STUDIES: TEST PAD CONSTRUCTION (2 OF 4)

SUFCO Waste Rock Pile
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Figure 5

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Location:	Waste Rock Pile Test Pad Area	Description:	View of tracked waste rock test pad and nuclear densometer testing.

Location:	Waste Rock Pile Test Pad Area	Description:	View of tracked waste rock materials and nuclear densometer testing.at end of test pad construction

SELECT PHOTOS OF SUFCO WASTE ROCK PILE FIELD STUDIES: TEST PAD CONSTRUCTION (3 OF 4)

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Figure 6

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Location:	Waste Rock Pile Test Pad Area	Description:	View of completed test pad with test pits for material sampling (viewed looking south)

Location:	Waste Rock Pile Test Pad Area	Description:	View of completed test pad with test pits for material sampling (viewed looking northwest)

SELECT PHOTOS OF SUFCO WASTE ROCK PILE FIELD STUDIES: TEST PAD CONSTRUCTION (4 OF 4)

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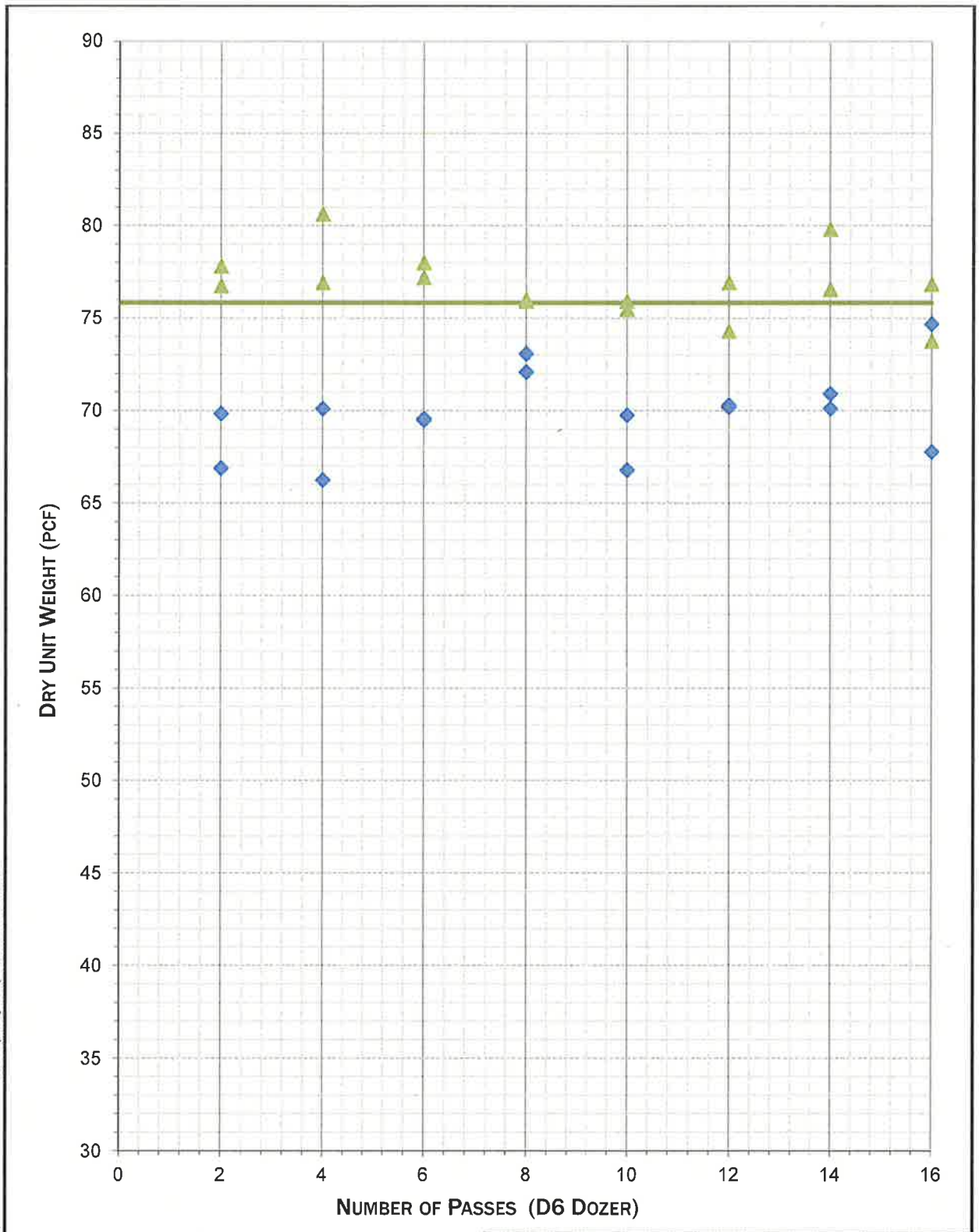
Figure 7

J:\PROJECTS\Bowie Resources\16GCI744 SUFCO Waste Rock\Analyses\Report



CHANGE IN DRY DENSITY RELATIVE TO EQUIPMENT PASSES

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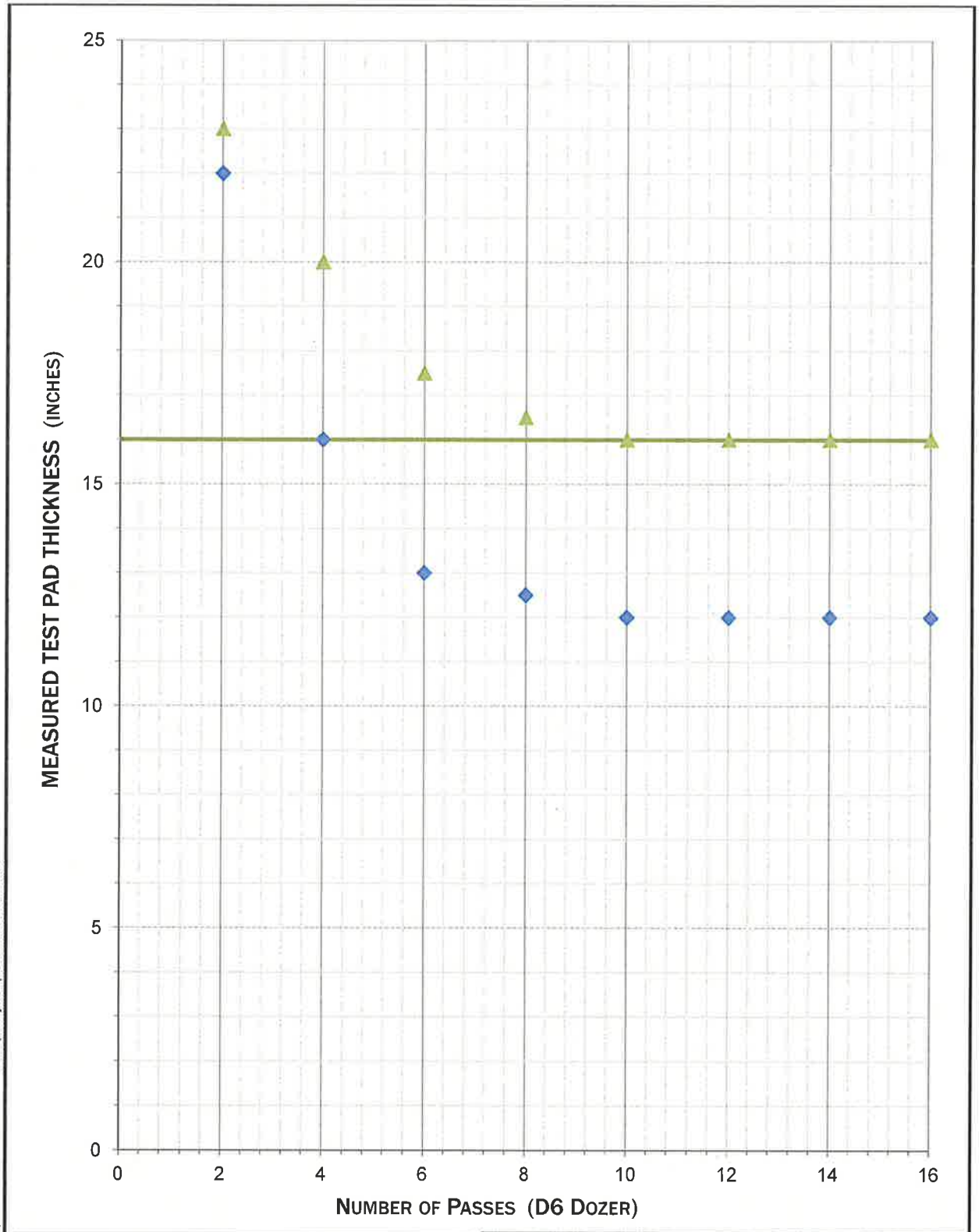
Figure 8

J:\PROJECTS\Bowie Resources\16GCI744 SUFCO Waste Rock\Analyses\FieldMeasurements



CHANGE IN TEST PAD THICKNESS RELATIVE TO EQUIPMENT PASSES

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Figure 9

J:\PROJECTS\Bowie Resources\16GCI744 SUFCO Waste Rock\Analyses\FieldMeasurements

Location:	Waste Rock Pile Test Pad Area	Description:	View of excavated test pad density testing location (NGTL #1) for sampling

Location:	Waste Rock Pile Test Pad Area	Description:	View of excavated test pad density testing location (NGTL #2) for sampling

SELECT PHOTOS OF SUFCO WASTE ROCK PILE FIELD STUDIES: TEST PAD TEST PIT STOCKPILES

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Figure 10

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Location:	Waste Rock Pile Test Pad Area	Description:	View of construction of hauled waste rock stockpile (not compacted) for angle of repose measurements

Location:	Waste Rock Pile Test Pad Area	Description:	View of completed hauled waste rock stockpile (not compacted) for angle of repose measurements

SELECT PHOTOS OF SUFCO WASTE ROCK PILE FIELD STUDIES: UNCOMPACTED WASTE ROCK STOCKPILE

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Figure 11

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Location:	Waste Rock Pile	Description:	View of test pit excavation and stockpile (previously compacted with roller) of 16-WRSP-TP01.

Location:	Waste Rock Pile	Description:	View of test pit excavation and stockpile (previously compacted with roller of 16-WRSP-TP02.

SELECT PHOTOS OF SUFCO WASTE ROCK PILE FIELD STUDIES: TEST PIT WASTE ROCK STOCKPILE (1 OF 4)

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Figure 12

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Location:	Waste Rock Pile	Description:	View of test pit excavation and stockpile (previously compacted with roller of16-WRSP-TP03.

Location:	Waste Rock Pile	Description:	View of test pit excavation and stockpile (previously compacted with roller) of 16-WRSP-TP04.

SELECT PHOTOS OF SUFCO WASTE ROCK PILE FIELD STUDIES: TEST PIT WASTE ROCK STOCKPILE (2 OF 4)

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Figure 13

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Location:	Waste Rock Pile	**Description:**	View of test pit excavation and stockpile (previously compacted with roller) of 16-WRSP-TP05.

Location:	Waste Rock Pile	**Description:**	View of test pit excavation and stockpile (previously compacted with roller) of 16-WRSP-TP06.

SELECT PHOTOS OF SUFCO WASTE ROCK PILE FIELD STUDIES: TEST PIT WASTE ROCK STOCKPILE (3 OF 4)

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Figure 14

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Location:	Waste Rock Pile	**Description:**	View of test pit excavation and stockpile (previously compacted with roller of 16-WRSP-TP05.

Location:	Waste Rock Pile	**Description:**	View of test pit excavation and stockpile (previously compacted with roller of 16-WRSP-TP06.

SELECT PHOTOS OF SUFCO WASTE ROCK PILE FIELD STUDIES: TEST PIT WASTE ROCK STOCKPILE (4 OF 4)

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Figure 15

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Location:	Waste Rock Pile Test Pad Area	Description:	View of hauled stockpiles (uncompacted) location WRSP-GR01 for sampling

Location:	Waste Rock Pile Test Pad Area	Description:	View of hauled stockpiles (uncompacted) location WRSP-GR02 for sampling

SELECT PHOTOS OF SUFCO WASTE ROCK PILE FIELD STUDIES: UNCOMPACTED WASTE ROCK STOCKPILE (1 OF 3)

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Figure 16

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Location:	Waste Rock Pile Test Pad Area	Description:	View of hauled stockpiles (uncompacted) location WRSP-GR03 for sampling

Location:	Waste Rock Pile Test Pad Area	Description:	View of hauled stockpiles (uncompacted) location WRSP-GR04for sampling

SELECT PHOTOS OF SUFCO WASTE ROCK PILE FIELD STUDIES: UNCOMPACTED WASTE ROCK STOCKPILE (2 OF 3)

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Figure 17

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Location:	Waste Rock Pile Test Pad Area	Description:	View of hauled stockpiles (uncompacted) location WRSP-GR05 for sampling

SELECT PHOTOS OF SUFCO WASTE ROCK PILE FIELD STUDIES: UNCOMPACTED WASTE ROCK STOCKPILE (3 OF 3)

SUFCO Waste Rock Pile
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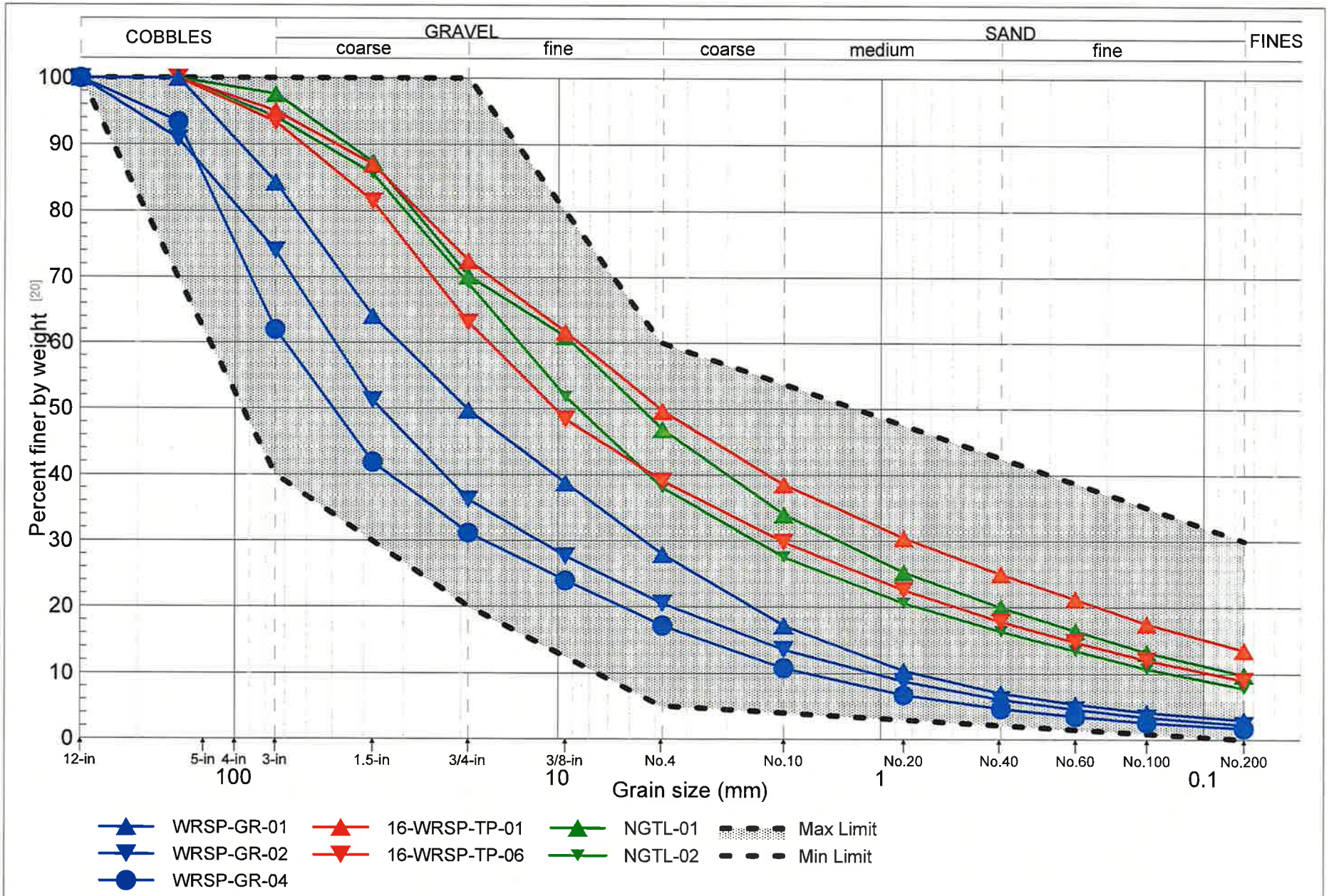
Figure 18

J:\PROJECTS\Bowie Resources\16GC1744 SUFCO Waste Rock\Analyses\Report



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Grain Size Distribution and Max/Min Ranges

SUFCO Waste Rock

Figure 19

Specific Gravity for Rock

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ASTM D6473

Project: **SUFCO Waste Rock**

No: **16GCI744**

J:\PROJECTS\Bowie Resources\16GCI744 SUFCO Waste Rock\Data\Lab\[SG_WRock.xlsx]SG

Sample Info.		Test Hole:	16-NGTL-TP01	16-NGTL-01	16-NGTL-01	16-NGTL-01	16-NGTL-01	-
		Depth:	0-1	0-1	0-1	0-1	0-1	-
		Sample:	1	2	3	4	5	-
		Comment:	-	-	primarily coal material	-	-	-
		Date Sampled:	8/9/2016	8/9/2016	8/9/2016	8/9/2016	8/9/2016	-
Density and Volume Data	Sample height, Hi (in)	0°	4.476	2.649	3.202	3.124	2.443	-
		120°	4.769	2.775	3.329	3.429	2.319	-
		240°	5.153	3.022	2.776	2.953	2.188	-
	Avg. height, Havg (in)		4.799	2.815	3.102	3.169	2.317	
	Sample diameter, Di (in)	top	1.885	2.082	1.888	1.283	2.709	-
		mid	1.885	2.082	1.888	1.283	2.709	-
		bot	1.885	2.082	1.888	1.283	2.709	-
	Average diameter, Davg (in)		1.885	2.082	1.888	1.283	2.709	
	Sample volume, V (ft^3)		0.0078	0.0055	0.0050	0.0024	0.0077	
	Moist Mass (g)		491.40	334.52	144.93	127.74	133.50	-
	Sample Desity (kg/m^3)		2184.51	2061.91	933.86	1860.91	595.72	
	Specific Gravity, SG		2.18	2.06	0.93	1.86	0.60	
SG Data	Oven-dry mass, A (g)		479.68	323.81	132.98	124.94	130.31	-
	Saturated-surface dry mass, B (g)		490.95	333.71	144.91	127.43	133.13	-
	Buoyant mass, C (g)		306.27	208.30	35.95	79.60	82.62	-
	Moisture Content, w (%)		2.44	3.31	8.99	2.24	2.45	
	bulk specific gravity, A/(B-C)		2.60	2.58	1.22	2.61	2.58	
	bulk specific gravity (SSD), B/(B-C)		2.66	2.66	1.33	2.66	2.64	
	apparent specific gravity, A/(A-C)		2.77	2.80	1.37	2.76	2.73	
	absorption, (B-A)/A		0.0235	0.0306	0.0897	0.0199	0.0216	

Comments: