Memorandum

To: Austin Edge, P.E.
Facilities Engineer, Laramie Energy, LLC

From: Andrew Lockman, P.G., Courtney Mattson, P.E.

Date: August 13, 2020

Re: 12-13 Annex Well Pad Slope Stability Evaluation

GEI Consultants, Inc. (GEI) prepared this technical memorandum to summarize results of a slope stability evaluation performed for the Laramie Energy 12-13 Annex Well Pad in western Colorado (Figure 1). The Colorado Oil and Gas Conservation Commission (COGCC) recently raised concerns of the stability of a stockpile composed of reclaimed drill cuttings near an existing excavated highwall. This evaluation was performed to assess the stability of the stockpile under static loading conditions.

SITE DESCRIPTION AND BACKGROUND

The 12-13 Annex is a gas production well pad located in Garfield County, approximately 16 miles north of the town of De Beque, Colorado and has an approximate elevation (El.) of 8529. The site topography includes a small ridge and the well pad is located on a cut-slope on the southeast face, just below the ridgeline. Approximately one-half of the well pad area is composed of bedrock, and the other half is composed of compacted fill materials obtained from the cut slope, as shown in Figure 2. The well pad and facilities are owned and operated by Laramie Energy, LLC (Laramie Energy).

GEI performed a global slope stability evaluation of the Annex 12-13 well pad in 2019. That evaluation focused on the compacted fill that formed the downslope areas of the well pad. The current evaluation is focused on a cuttings stockpile positioned at the northwest portion of the well pad near a large cliff excavated into the slope. The well pad has been partially reclaimed and temporary facilities have been removed since the previous stability analysis was performed. The downstream slope of the well pad has been revegetated and the structure appears stable. The drill cuttings stockpile has been capped with a protective cover of fill and topsoil and was revegetated.

During a recent site inspection, the COGCC raised concerns regarding the stability of the drill cuttings stockpile. The stockpile was mostly constructed during reclamation and is composed of an approximate 50/50 blend of on-site soils and drill cuttings, and was placed and compacted in lifts. The stockpile is placed directly on bedrock with a bedrock highwall directly to the northwest and has an approximate 2H:1V slope. Although as-built construction records are not available the contractor who performed the reclamation provided a narrative which is included as an attachment to this memo.

Laramie Energy provided GEI with two samples of the blended drill cuttings and soil from a nearby well pad that is similar to the stockpile at the 12-13 Annex. GEI sent the samples to Advanced Terra

Testing (ATT) in Lakewood, Colorado for laboratory analysis that includes grain size distribution, Atterberg Limits, and standard proctor testing to characterize the blended fill materials.

GEI was also provided with as-built surfaces of the well pad following initial construction and post interim reclamation in 2020. A centerline alignment was created along the well heads closest to the downslope edge of the pad. Sections were cut every 50 feet northeast of the well heads for 300 feet to determine the maximum section of the reclaimed slope. The maximum section of the slope that contained the largest area between the construction and interim reclamation surfaces was located 100 feet northeast from well head (B1 or CC0697-04-15W) along the alignment. The section was extended 300 feet to the northwest and 150 feet to the southeast to capture the full topography of the pad.

MATERIAL PROPERTIES

Information on the material properties of the drill cuttings stockpile is based on laboratory evaluations of select materials as well as descriptive information provided by the reclamation contractor. The on-site materials are described below:

Zone 1 – Blended Drill Cuttings

The Zone 1 – Blended Drill Cuttings are composed of a blended mix of fine-grained drilling spoils and coarse-grained on-site materials obtained from excavations for construction of the well pad. The materials were blended in approximate 50/50 proportions prior to placement. Attachment A describes how the materials were mixed and placed.

At the time the slope stability evaluation was performed, the Zone 1 materials had been placed, compacted, and covered with a protective cap that had recently been revegetated. Due to the difficulties associated with obtaining samples of the placed Zone 1 material, samples from a nearby well pad in the same geologic setting were provided for the evaluation. The collected samples are assumed to be the same as those that are currently in place at the stockpile at the 12-13 Annex. Laboratory test results of the two samples indicate the blended cuttings have a Unified Soil Classification System (USCS) of Silty Sand (SM) with approximately 41 to 44% material finer than the #200 sieve. The fine-grained soil has liquid limits of 33 and 34%, with a plastic limit of 24%. Results of Standard Proctor testing show maximum dry density values of approximately 106 lb/ft^3 and optimum moisture contents of 16.3 to 17.5%. Attachment B contains results of the laboratory testing.

Zone 2 – Stockpile Cover

The Zone 2 materials were placed as a berm at the toe of the slope and as protective cap for the drill cuttings stockpile. The berm is approximately 5 feet tall by 15 feet wide and the cap ranges from 3-16 feet thick, with the thickest portion at the top of the slope. Laboratory testing was not performed on the Zone 2 material, but it is generally assumed to be coarse-grained and granular, most similar to a gravelly silty sand to silty gravel soil with some cobbles. This material was also used to construct the well pad.

Bedrock

Bedrock at the site is the Uinta Formation, a sedimentary unit composed of siltstone, fine to medium grained sandstone, and shale. For the purposes of the slope stability evaluation the Uinta Formation is assumed to be impermeable and provides an unyielding and stable foundation.

Phreatic Conditions

The reclaimed slope containing the cuttings is not anticipated to develop a phreatic surface that would compromise slope stability. The 12-13 Annex well pad is positioned on a ridgeline with steep slopes and there is no watershed upstream of the site, and rainfall will likely not pond on the surface of the stockpile due to its sloping surface. Zone 1 and Zone 2 soils are relatively permeable soil types and therefore saturated conditions could only develop with extended periods of wet weather. Although this condition is not likely to develop, a slope stability evaluation was also performed with an assumed phreatic surface to evaluate the "worse case" scenario with respect to pore pressures within the slope.

Strength of Materials

The strength of the Zone 1 – Blended Drill Cuttings materials was developed using relationships established by the United States Bureau of Reclamation and information obtained from the laboratory evaluation and the USCS classification (Attachment D). The unit weight of the Zone 1 soil was selected from the results of the Standard Proctor Testing and assuming the soils were compacted to 95% of the maximum dry density. Strength properties for the Zone 2 – Stockpile Cover were slightly reduced from the values used in the 2019 drill pad slope stability evaluation. The unit weights and material strengths used in the analysis are summarized in Table 1.

Table 1: Summary of strength parameters for the drill cuttings stockpile

Material	Total Unit Weight (lb/ft^3)	Friction Angle (deg)	Cohesion (psf)
Zone 1 – Blended Drill Cuttings	115	34	0
Zone 2 – Stockpile Cover	125	40	0
Bedrock	Impenetrable		

SLOPE STABILITY EVALUATION

The slope profile was developed using topographic information collected after drill pad construction and following recent reclamation activities. The internal zoning was established using descriptions from the reclamation contractor. Due to the location of the slope and lack of anticipated loading, no additional surcharge loads are included in the evaluation.

The slope stability analysis was performed at the maximum section of the 12-13 Annex Well Pad using the GeoStudio 2019 Slope/W v.10.1.018696 software program and Spencer's method, which satisfies both force and moment equilibrium. Spencer's method divides a potential slip surface into vertical slices, and in order to reach numerical convergence, the method approximates that interslice forces acting between each slice are parallel to each other.

Trial circular slip surfaces were defined using the entry-and-exit method. Initial ranges of entry points were defined at the top of the stockpile to approximately the mid-point of the slope, and exit points were defined extending from the lower portion of the slope to its base. In each stability case, hundreds of trial failure surfaces were evaluated. Slip surfaces less than 5 feet deep or that did not include the Zone 1 – Blended Drill Cuttings were generally discounted.

RESULTS AND DISCUSSION

The results of the stability analyses showed high factors of safety for both conditions and are summarized in Table 2. A factor of safety of 1.3 is considered across the industry to be the minimum acceptable factor for slope failures (U.S. Bureau of Reclamation 2011; U.S. Army Corps of Engineers 2003) and is considered appropriate for the 12-13 Annex well pad. Model outputs from the stability analyses and critical failure surfaces are contained in Attachment C.

Table 2: Results of Slope Stability Analyses

Condition	Factor of Safety
Existing Slope Conditions	1.75
Saturated Slope	1.50

Both conditions analyzed have critical slip surface failures that extend to the Zone 1 material. The Existing Slope Conditions analysis has a relatively shallow failure surface that is mostly confined to the upper Zone 2 material, and the Saturated Slope analysis has a failure surface that extends deeper into the Zone 1 material, below the assumed phreatic level.

A sensitivity analysis was performed to evaluate the potential impacts of using a lower unit weight for the Zone 1 – Blended Drill Cuttings in the event the materials were not compacted to the assumed density. The analysis showed the reduced unit weight had a negligible impact on the factor of safety and indicated that the geometry of the slope and the high friction angle of the coarse-grained materials have more control over slope stability.

GEI does not recommend any changes be made to the slope. It should be monitored periodically for signs of distress and to evaluate impacts that surface water may have on the protective cover of the slope surface. Special attention should be placed where the top of the slope meets bedrock, as this area should be protected from excessive groundwater infiltration and to ensure that a gap does not form at the contact between the fill materials and the bedrock.

REFERENCES

D.R. Griffin & Associates (2020). " Interim Reclamation As-Built," Drawn: June 24, 2020.

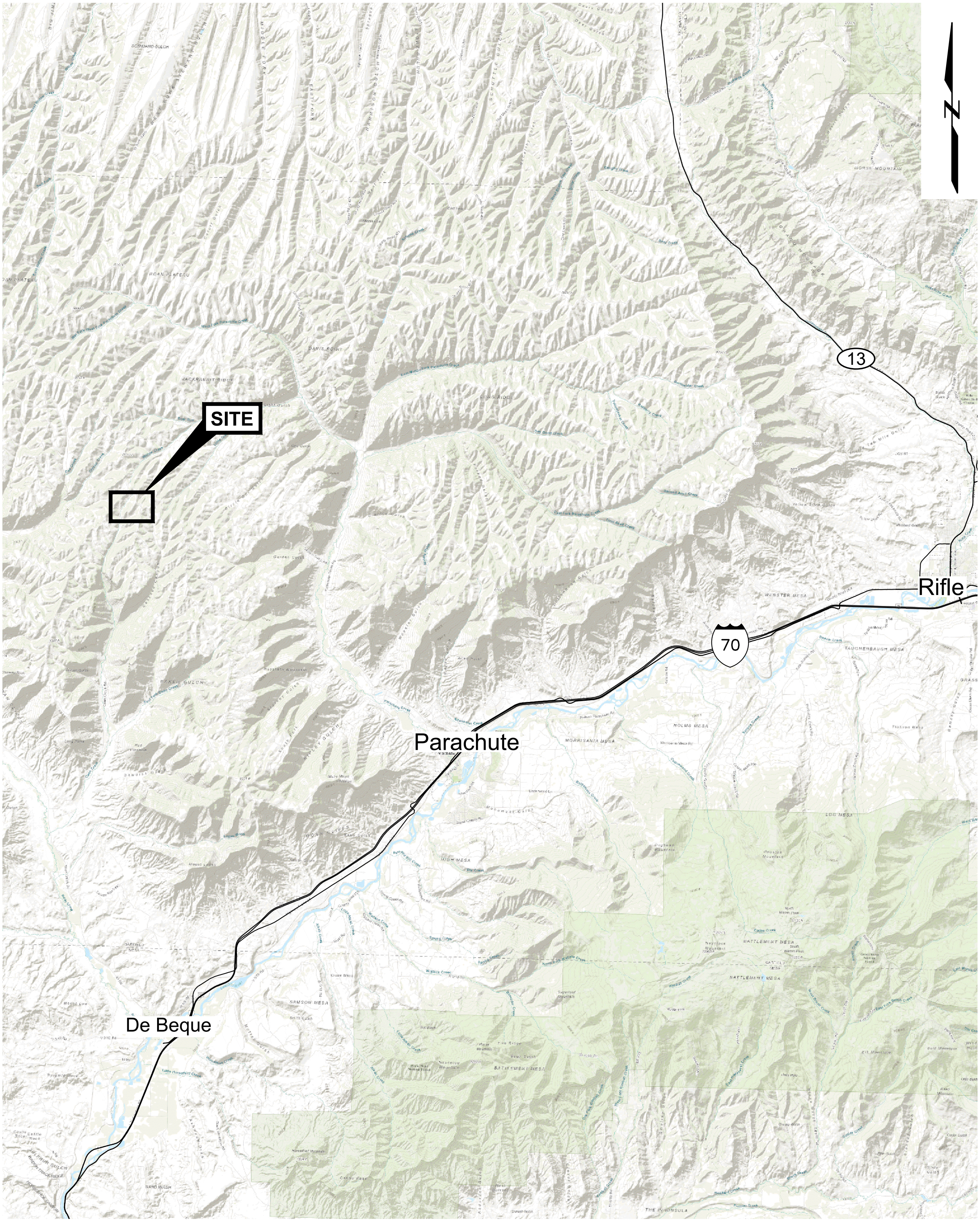
D.R. Griffin & Associates (2018). " Estimated Earthwork: Construction Layout Drawing 1 of 5," Drawn: December 26, 2017; Revised July 11, 2018.

GEI (2019). GEI Consultants Inc. (GEI), J. Deuto, B. Taylor, "12-13 Annex Well Pad Stability Evaluation," July 9, 2019.

Moody Construction & Sons, Inc (2020). "12-13 Annex reclaim cuttings stability," June 30, 2020.

USBR (1998). U.S. Department of the Interior Bureau of Reclamation (USBR), Part 1, 3rd Edition, 1998.

FIGURES



Stability Evaluation: Interim Reclamation Slope 12-13 Annex Well Pad Garfield County, Colorado	GEI Consultants	SITE VICINITY MAP
Laramie Energy, LLC Denver, Colorado	Project 2003435	August 2020 Fig. 1

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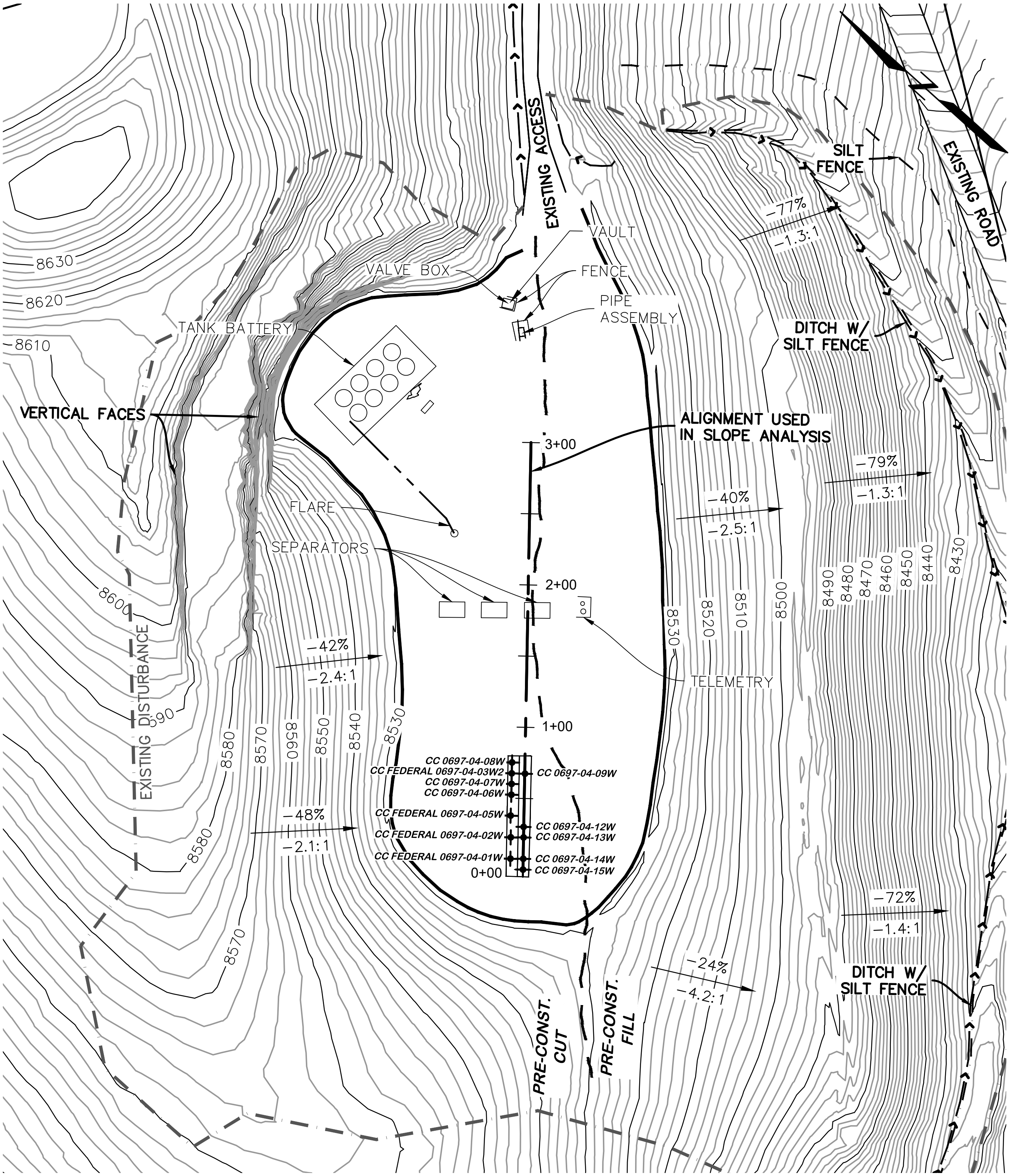

0 100 200

SCALE: 1" = 100'

SOURCE:

1. PLAN BASED ON SURVEY PREPARED BY D.R. GRIFFIN & ASSOCIATES, INC. "INTERIM RECLAMATION" - DRAWN 6/24/20; "CONSTRUCTION LAYOUT DRAWING 1 OF 5" - DRAWN 12/26/17, REVISED 7/11/18.

Stability Evaluation: Interim Reclamation Slope 12-13 Annex Well Pad Garfield County, Colorado	GEI Consultants	WELL PAD INTERIM RECLAMATION PLAN
Laramie Energy, LLC Denver, Colorado	Project 2003435	August 2020 Fig. 2

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ATTACHMENT A

Drill Cutting Stockpile Reclamation

Laramie Energy June 30,2020

Austin Edge

12-13 Annex reclaim cuttings stability.

Austin

In regards to the questions you had sent to me about the 12-13 Annex cuttings reclamation here are the procedures we used.

1.The cuttings were still moist inside, when we were working on this project the late fall and they were getting stormed on occasionally. We did not add any water.

2. As we blended native material into the cuttings, we benched across them in approximately 6-foot lifts in order to get a good mix. We did not pull all of the cuttings away from the slope, they were stacked in a strip along the bottom of the 1;1 cut slope which was solid rock. After mixing the cuttings we built a berm in front of them approximately 4 to 6-foot-tall by 15 foot wide. As we came up with the fill for the reclaim, we used the same process over and over just stepping in toward the cut slope each time. Most of the cuttings were on the North West side of the cut slope then faded out to nothing going to the East. In the North West corner and to the west for some distance the cuttings had approximately 16 to 18 foot of cover over them. On the far East side due to site limitations we could not extend the slope as far so they had 3 foot of cover.

3. The compaction methods were tracking back and forth with the Excavator and D8T. The rocks that we brought into the fill were from 3 inch to 3 to four feet and sometimes larger. We tracked back and forth and tried not stack any rocks to eliminate having voids between them. The material would have to have been sorted in order to do smaller lifts that could be tested for compaction. After we finished building benches, we then cut the slopes to tie them together and produce a seed able slope. After the slope was cut in, we track walked the slopes with a D8T, this was to tighten up the slope and produce good divots for the seed to set in.

4. we seeded the slopes when this process was completed In December of 2019. This spring when we went back to spread topsoil on the largest part of the cut slope, there was a good amount of vegetation coming up. After we top soiled the slope, we tracked it in again with a D8T then seeded it. We did not have enough topsoil above the pad to do the whole cut slope so we used it on the larger area. The cut slope behind the tanks could not be worked due to Safety reasons concerning the Tanks below them.

Thank You

Shawn Moody

1629 P ROAD, LOMA CO 81524 970-379-9192 MOODY CONSTRUCTION

ATTACHMENT B

Laboratory Testing Results of Blended Drill Cuttings

ADVANCED TERRA TESTING

Atterberg Limits
ASTM D 4318

CLIENT	GEI Consultants Inc.	BORING NO.	--
JOB NO.	2076-254	DEPTH	--
PROJECT	Laramie Energy 12-13 Well Pad	SAMPLE NO.	Laramie Energy Sample #1
PROJECT NO.	1516280	DATE SAMPLED	--
LOCATION	--	SAMPLED BY	--
DATE TESTED	07/15/20	DESCRIPTION	--
TECHNICIAN	ASE		

Plastic Limits

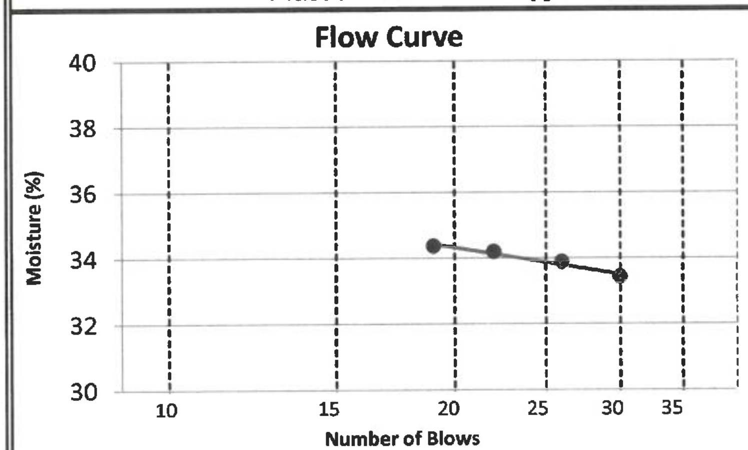
Mass of Wet Pan and Soil (g):	8.96	8.69	8.93
Mass of Dry Pan and Soil (g):	7.46	7.22	7.45
Mass of Pan (g):	1.14	0.97	1.14
Moisture (%)	**23.7**	**23.5**	**23.4**

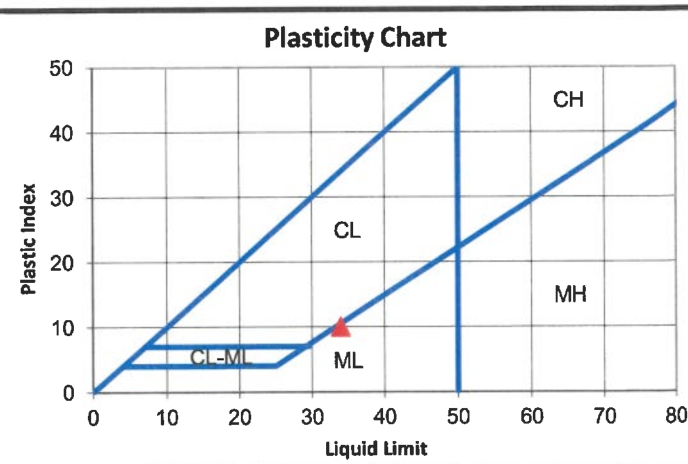
Liquid Limits

Number of Blows	19	22	26	30
Mass of Wet Pan and Soil (g):	10.87	12.77	10.49	12.20
Mass of Dry Pan and Soil (g):	8.39	9.80	8.13	9.42
Mass of Pan (g):	1.17	1.13	1.16	1.10
Moisture (%)	**34.4**	**34.2**	**33.9**	**33.4**

Plastic Index

Plastic Limit:	**24**	Atterberg Classification:	ML
Liquid Limit:	**34**	Method:	A
Plastic Index:	**10**		





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File name:	2076254__Atterberg ASTM D4318_1.xlsm		

Atterberg Limits
ASTM D 4318

ADVANCED TERRA TESTING

CLIENT	GEI Consultants Inc.	BORING NO.	--
JOB NO.	2076-254	DEPTH	--
PROJECT	Laramie Energy 12-13 Well Pad	SAMPLE NO.	Laramie Energy Sample #2
PROJECT NO.	1516280	DATE SAMPLED	--
LOCATION	--	SAMPLED BY	--
DATE TESTED	07/14/20	DESCRIPTION	--
TECHNICIAN	ALH		

Plastic Limits

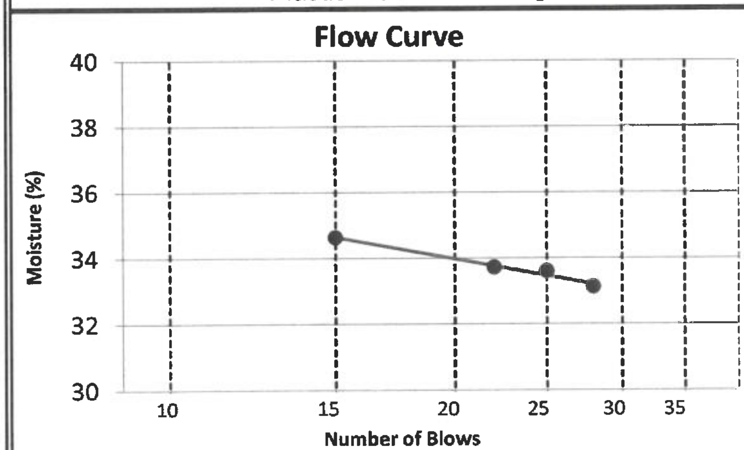
Mass of Wet Pan and Soil (g):	8.50	8.53
Mass of Dry Pan and Soil (g):	7.08	7.13
Mass of Pan (g):	1.14	1.14
Moisture (%)	**24.0**	**23.5**

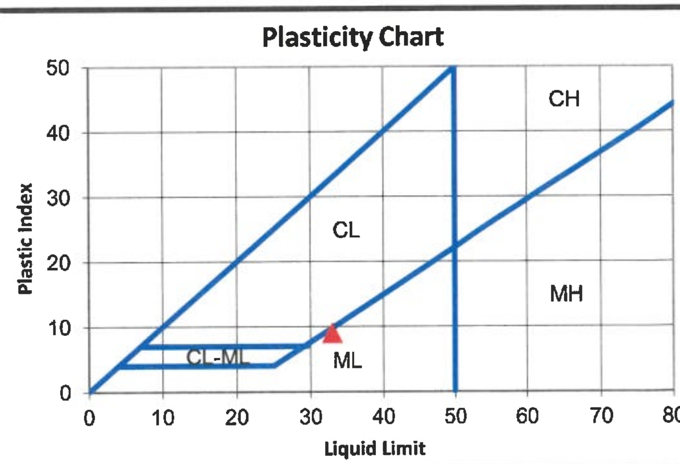
Liquid Limits

Number of Blows	15	22	25	28
Mass of Wet Pan and Soil (g):	10.53	10.25	11.47	10.12
Mass of Dry Pan and Soil (g):	8.12	7.93	8.87	7.89
Mass of Pan (g):	1.14	1.08	1.13	1.15
Moisture (%)	**34.6**	**33.7**	**33.6**	**33.1**

Plastic Index

Plastic Limit:	**24**	Atterberg Classification:	ML
Liquid Limit:	**33**	Method:	A
Plastic Index:	**9**		





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ADVANCED TERRA TESTING

Grain Size Analysis
ASTM D 6913

CLIENT	GEI Consultants Inc.	BORING NO.	--
JOB NO.	2076-254	DEPTH	--
PROJECT	Laramie Energy 12-13 Well Pad	SAMPLE NO.	Laramie Energy Sample #1
PROJECT NO.	1516280	DATE SAMPLED	--
LOCATION	--	DESCRIPTION	--
DATE TESTED	07/13/20		
TECHNICIAN	ASE		

Hygroscopic Moisture of Fines

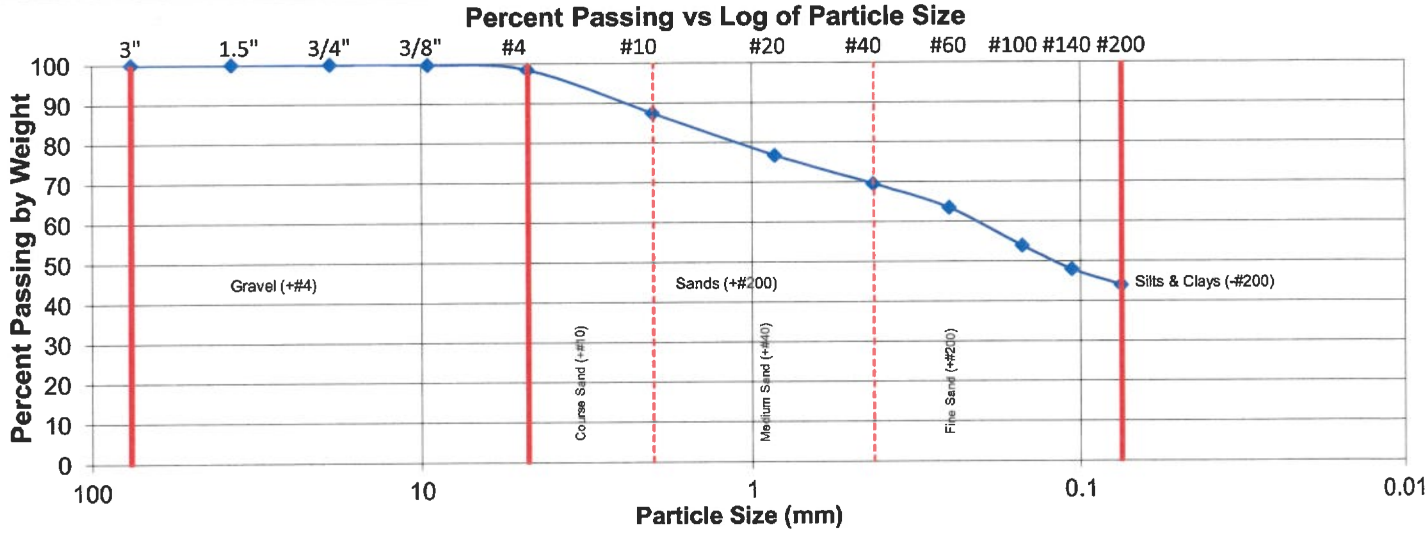
Mass Wet Pan and Soil (g): 467.22
Mass Dry Pan and Soil (g): 443.70
Mass of Pan (g): 118.33
Moisture (%): **7.2**

Sample Data

Total Wet Mass of Sample (g): 25808.8
Total Dry Mass of Sample (g): 24094.0
Split Fraction: #4
Mass of Sub-Sample Fraction (g): 348.89

Sieve Number	Sieve Size (mm)	Mass of Pan and Soil (g)	Mass of Pan (g)	Mass of Individual Retained Soil (g)	Correction Factor	Percent Passing by Weight (%)
3"	76.2	0.0	--	--	--	--
1.5"	38.1	0.0	--	--	--	--
3/4"	19.05	7.2	--	7.2	1.00	**100.0**
3/8"	9.53	50.4	--	50.4	1.00	**99.8**
#4	4.75	314.5	--	314.5	1.00	**98.5**
#10	2.00	36.3	--	36.3	0.98	**87.5**
#20	0.850	35.3	--	35.3	0.98	**76.8**
#40	0.425	23.9	--	23.9	0.98	**69.6**
#60	0.250	20.1	--	20.1	0.98	**63.5**
#100	0.150	31.7	--	31.7	0.98	**53.9**
#140	0.106	19.7	--	19.7	0.98	**48.0**
#200	0.075	13.1	--	13.1	0.98	**44.0**

Percent Passing vs Log of Particle Size



USCS Classification ASTM D 2487

Atterberg Classification: ML
Group Symbol: SM
USCS Classification: Silty Sand

Coefficient of Curvature - C_c: --
Coefficient of Uniformity - C_u: --

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Grain Size Analysis
ASTM D 6913

ADVANCED TERRA TESTING

CLIENT	GEI Consultants Inc.	BORING NO.	--
JOB NO.	2076-254	DEPTH	--
PROJECT	Laramie Energy 12-13 Well Pad	SAMPLE NO.	Laramie Energy Sample #2
PROJECT NO.	1516280	DATE SAMPLED	--
LOCATION	--	DESCRIPTION	--
DATE TESTED	07/13/20		
TECHNICIAN	ASE		

Hygroscopic Moisture of Fines

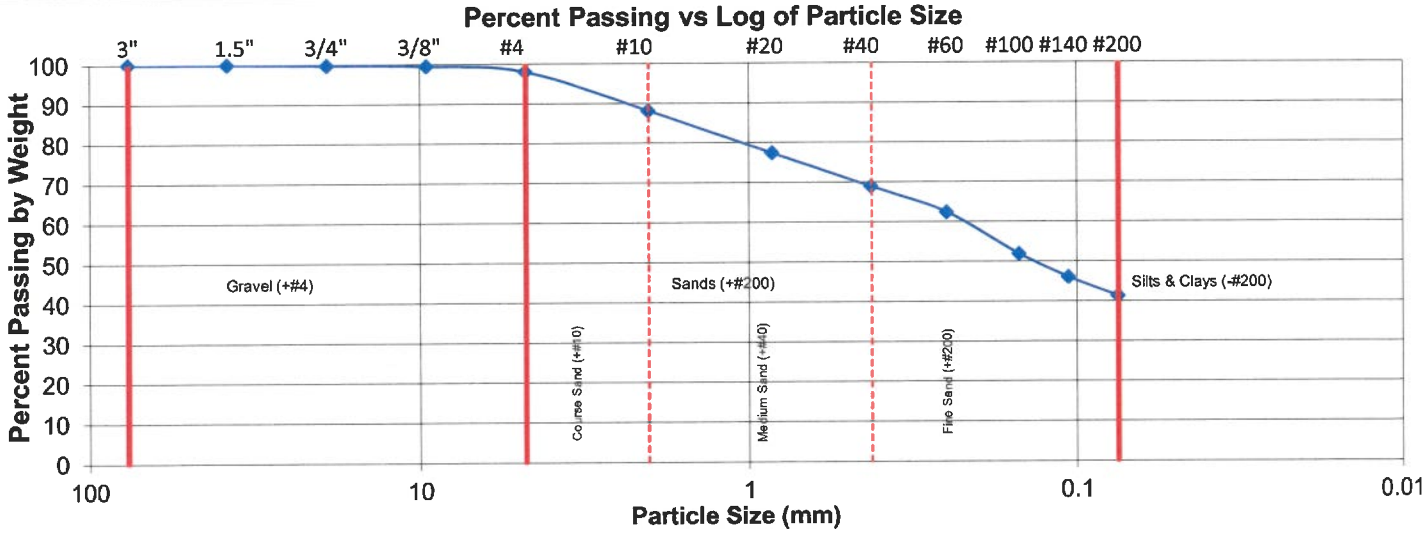
Mass Wet Pan and Soil (g): 422.02
Mass Dry Pan and Soil (g): 399.03
Mass of Pan (g): 119.64
Moisture (%): **8.2**

Sample Data

Total Wet Mass of Sample (g): 25748.0
Total Dry Mass of Sample (g): 23825.7
Split Fraction: #4
Mass of Sub-Sample Fraction (g): 302.38

Sieve Number	Sieve Size (mm)	Mass of Pan and Soil (g)	Mass of Pan (g)	Mass of Individual Retained Soil (g)	Correction Factor	Percent Passing by Weight (%)
3"	76.2	0.0	--	--	--	--
1.5"	38.1	0.0	--	--	--	--
3/4"	19.05	53.8	--	53.8	1.00	**99.8**
3/8"	9.53	70.8	--	70.8	1.00	**99.5**
#4	4.75	340.1	--	340.1	1.00	**98.0**
#10	2.00	28.2	--	28.2	0.98	**88.1**
#20	0.850	30.5	--	30.5	0.98	**77.4**
#40	0.425	24.2	--	24.2	0.98	**69.0**
#60	0.250	18.6	--	18.6	0.98	**62.4**
#100	0.150	29.9	--	29.9	0.98	**51.9**
#140	0.106	16.8	--	16.8	0.98	**46.0**
#200	0.075	13.3	--	13.3	0.98	**41.4**

Percent Passing vs Log of Particle Size



USCS Classification ASTM D 2487

Atterberg Classification: ML
Group Symbol: SM
USCS Classification: Silty Sand

Coefficient of Curvature - C_c: --
Coefficient of Uniformity - C_u: --

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Laboratory Compaction Characteristics

ASTM D698

ADVANCED TERRA TESTING

CLIENT	GEI Consultants Inc.	BORING NO.	--
JOB NO.	2076-254	DEPTH	--
PROJECT	Laramie Energy 12-13 Well Pad	SAMPLE NO.	Laramie Energy Sample #1
PROJECT NO.	1516280	DATE SAMPLED	--
LOCATION	--	DESCRIPTION	--
DATE TESTED	07/13/20		
TECHNICIAN	BDF		

Laboratory Compaction Characteristics

Hygroscopic Moisture

Mass of Wet Pan and Soil (g):	467.22
Mass of Dry Pan and Soil (g):	443.70
Mass of Pan (g):	118.33
Moisture (%):	7.2

Rock Correction ASTM D 4718

Method:	A
Course Fraction (%):	1.7
Rock Correction Applied:	NO
Mass of Dry Aggregate (g):	--
Mass of SSD Aggregate (g):	--
Mass of Aggregate in Water (g):	--
Rock Specific Gravity:	N/A
Zero Air Voids Specific Gravity:	2.65

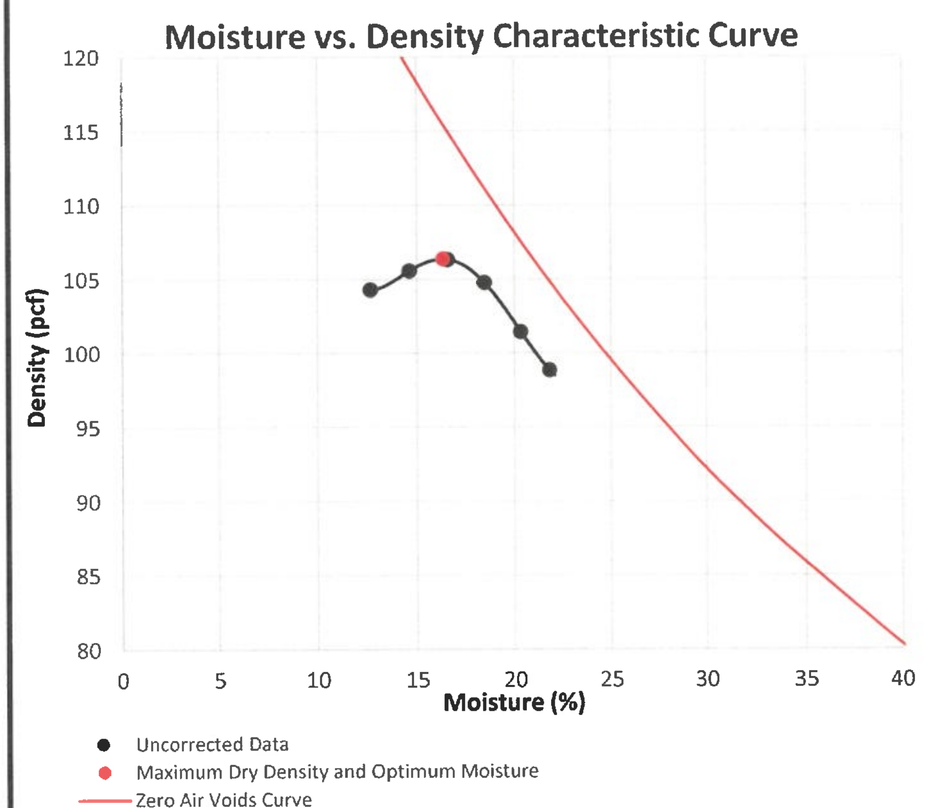
Optimum Dry Density and Moisture

Uncorrected

Dry Density (pcf):	**106.3**
Dry Density (kg/m³):	**1703**
Moisture (%):	**16.3**

Corrected

Dry Density (pcf):	**N/A**
Dry Density (kg/m³):	**N/A**
Moisture (%):	**N/A**



Sample Number:	1	2	3	4	5	6
Mass of Wet Pan and Soil (g):	251.64	273.81	210.29	241.87	222.01	291.27
Mass of Dry Soil and Pan (g):	220.33	235.83	178.55	202.15	183.46	259.26
Mass of Pan (g);	6.61	6.60	6.54	6.75	6.69	6.64
Moisture (%):	14.7	16.6	18.5	20.3	21.8	12.7
Mass of Wet Soil and Mold (g):	6406.6	6450.6	6452.9	6422.1	6397.2	6353.2
Mass of Mold (g):	4576.8	4576.8	4576.8	4576.8	4576.8	4576.8
Wet Density (pcf):	121.0	123.9	124.1	122.0	120.4	117.5
Dry Density (pcf):	105.6	106.3	104.8	101.4	98.8	104.3
Wet Density (kg/m³):	1939	1985	1988	1955	1929	1882
Dry Density (kg/m³):	1691	1703	1678	1625	1583	1670

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File name:	2076254__compaction ASTM D698 D1557_0.xls		

ADVANCED TERRA TESTING

Laboratory Compaction Characteristics

ASTM D698

CLIENT	GEI Consultants Inc.	BORING NO.	--
JOB NO.	2076-254	DEPTH	--
PROJECT	Laramie Energy 12-13 Well Pad	SAMPLE NO.	LARAMIE ENERGY SAMPLE #2
PROJECT NO.	1516280	DATE SAMPLED	--
LOCATION	--	DESCRIPTION	--
DATE TESTED	07/13/20		
TECHNICIAN	BDF		

Laboratory Compaction Characteristics

Hygroscopic Moisture

Mass of Wet Pan and Soil (g):	422.02
Mass of Dry Pan and Soil (g):	399.03
Mass of Pan (g):	119.64
Moisture (%):	8.2

Rock Correction ASTM D 4718

Method:	A
Course Fraction (%):	2.1
Rock Correction Applied:	NO
Mass of Dry Aggregate (g):	--
Mass of SSD Aggregate (g):	--
Mass of Aggregate in Water (g):	--
Rock Specific Gravity:	N/A
Zero Air Voids Specific Gravity:	2.65

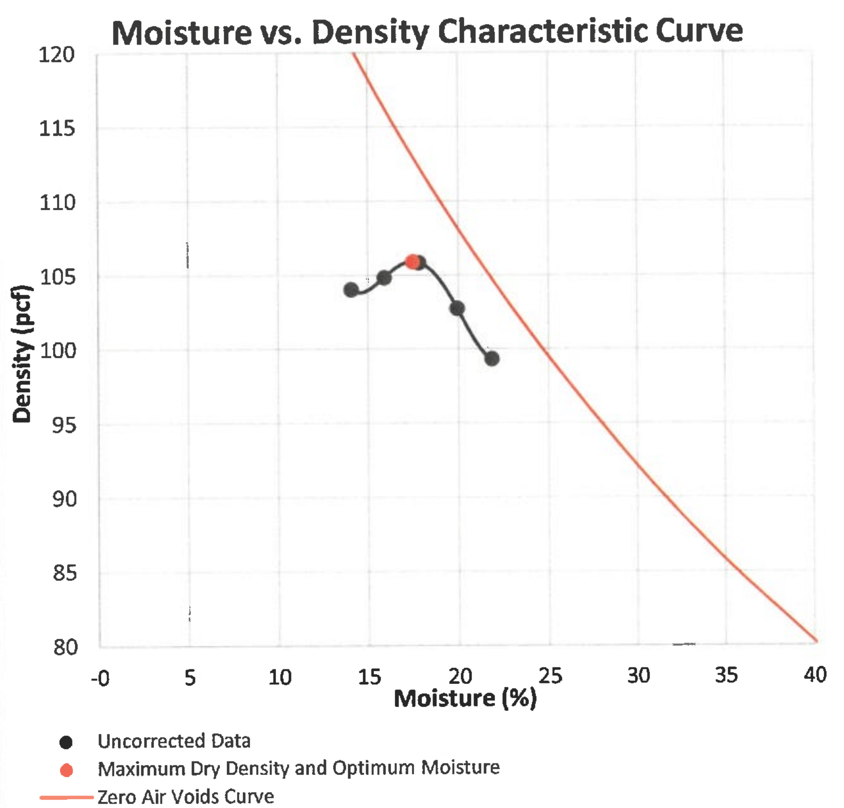
Optimum Dry Density and Moisture

Uncorrected

Dry Density (pcf):	**105.9**
Dry Density (kg/m³):	**1696**
Moisture (%):	**17.5**

Corrected

Dry Density (pcf):	**N/A**
Dry Density (kg/m³):	**N/A**
Moisture (%):	**N/A**



Sample Number:	1	2	3	4	5
Mass of Wet Pan and Soil (g):	236.04	238.14	286.70	262.78	256.50
Mass of Dry Soil and Pan (g):	201.33	199.66	236.50	227.60	225.68
Mass of Pan (g):	6.69	6.68	6.70	6.71	6.75
Moisture (%):	17.8	19.9	21.8	15.9	14.1
Mass of Wet Soil and Mold (g):	6462.2	6440.0	6406.8	6414.1	6371.1
Mass of Mold (g):	4576.8	4576.8	4576.8	4576.8	4576.8
Wet Density (pcf):	124.7	123.2	121.0	121.5	118.7
Dry Density (pcf):	105.8	102.7	99.3	104.8	104.0
Wet Density (kg/m³):	1997	1974	1939	1947	1901
Dry Density (kg/m³):	1695	1646	1591	1679	1666

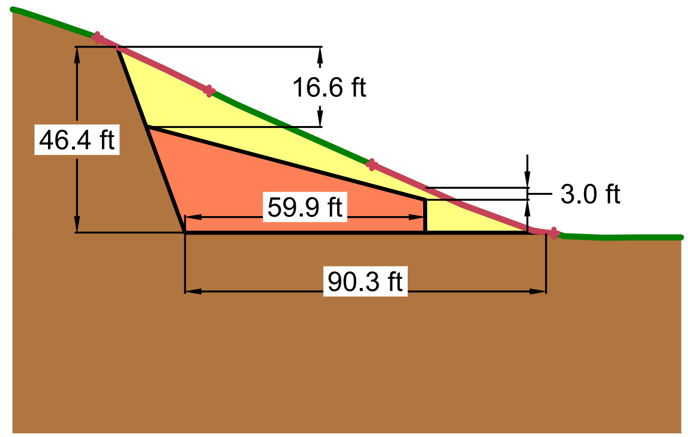
Data entry by:	TAF	Date:	7/14/2020
Checked by:	KMS	Date:	7/15/20
File name:	2076254__compaction ASTM D698 D1557_1.xls		

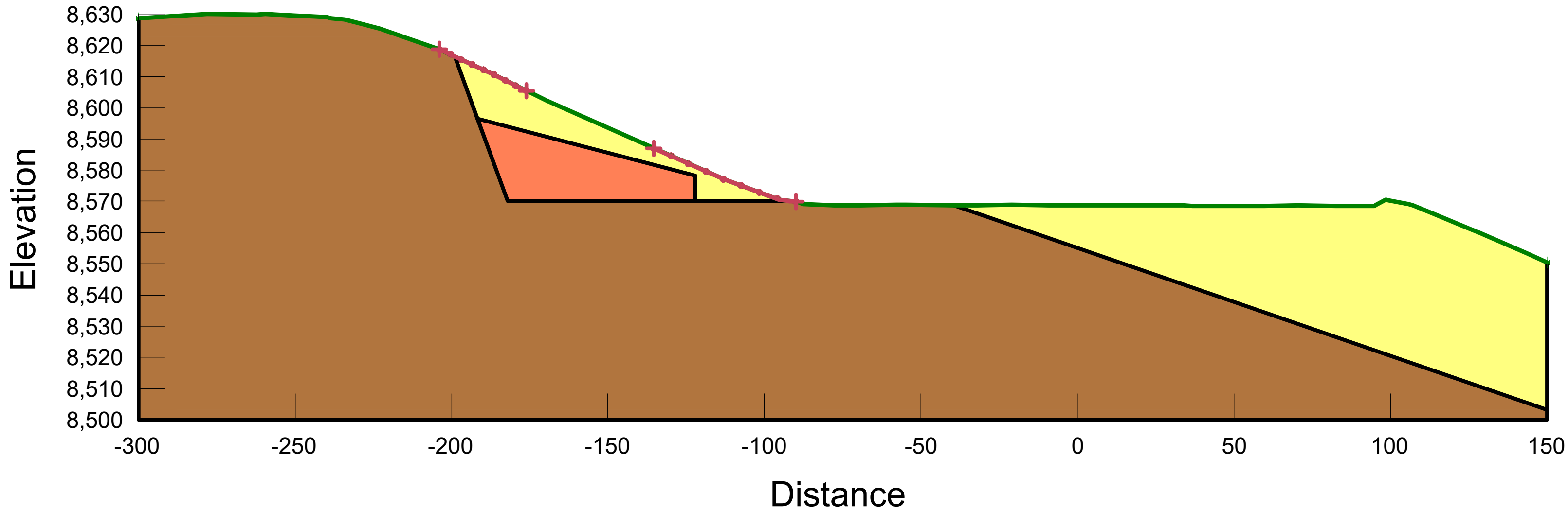
ATTACHMENT C

Geostudio Slope Stability Output Files

Laramie Energy
12-13 Well Pad NW Slope Stability
Project No. 2003435
August 2020

Model Definition

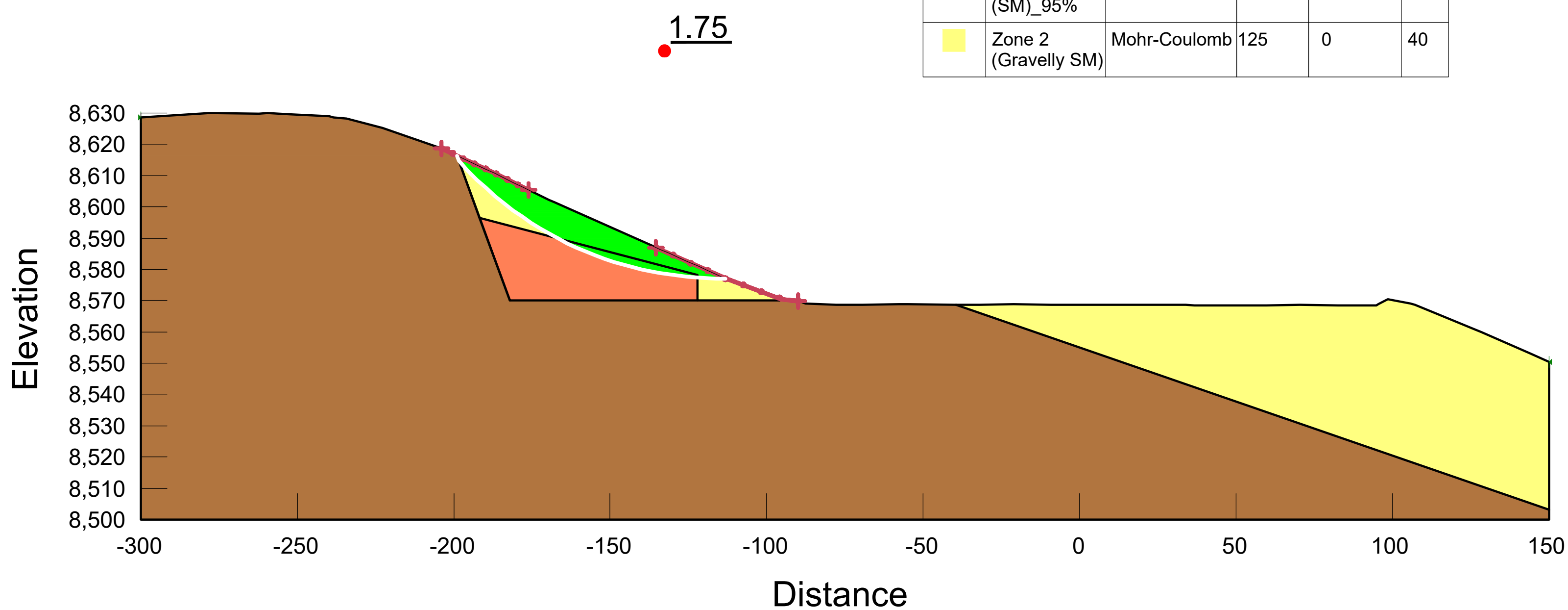




Stability Evaluation: Interim Reclamation Slope 12-13 Annex Well Pad Garfield County, Colorado	GEI Consultants	SLOPE/W ANALYSIS MODEL DEFINITION
Laramie Energy, LLC Denver, Colorado	Project 2003435	August 2020 Fig. G-1

Laramie Energy
12-13 Well Pad NW Slope Stability
Project No. 2003435
August 2020

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
(brown)	Bedrock	Bedrock (Impenetrable)			
(orange)	Zone 1 (SM)_95%	Mohr-Coulomb	115	0	34
(yellow)	Zone 2 (Gravelly SM)	Mohr-Coulomb	125	0	40

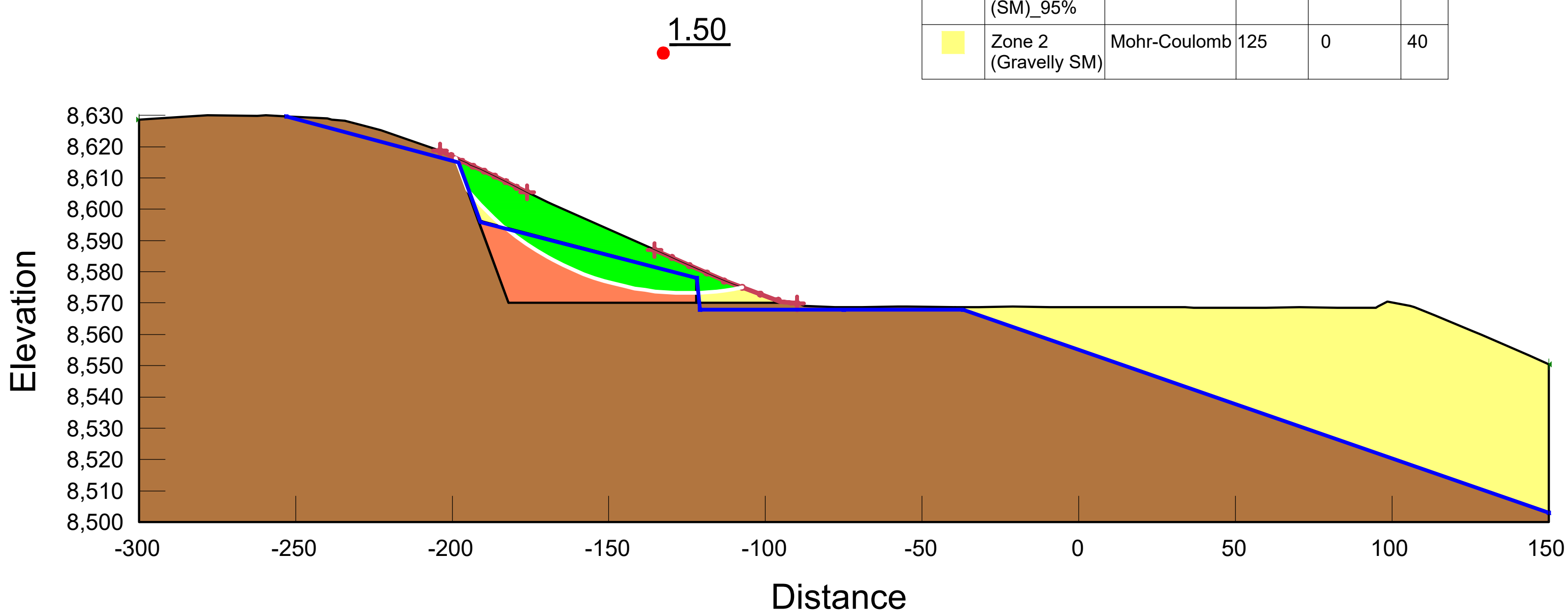


Stability Evaluation: Interim Reclamation Slope 12-13 Annex Well Pad Garfield County, Colorado	GEI Consultants	SLOPE/W ANALYSIS DRY CONDITIONS
Laramie Energy, LLC Denver, Colorado	Project 2003435	August 2020 Fig. G-2

\\geiconsulta B:\Working\LARAMIE ENERGY\2003435 12-13 Annext Stability Evaluation Update\00_CAD\Figures\Well Pad NW Slope Stability\GeoStudio.dwg - 8/4/2020

Laramie Energy
12-13 Well Pad NW Slope Stability
Project No. 2003435
August 2020

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedrock	Bedrock (Impenetrable)			
	Zone 1 (SM)_95%	Mohr-Coulomb	115	0	34
	Zone 2 (Gravelly SM)	Mohr-Coulomb	125	0	40



Stability Evaluation: Interim Reclamation Slope
12-13 Annex Well Pad
Garfield County, Colorado

Laramie Energy, LLC
Denver, Colorado

GEI Consultants

Project 2003435

SLOPE/W ANALYSIS
WET CONDITIONS

August 2020

Fig. G-3

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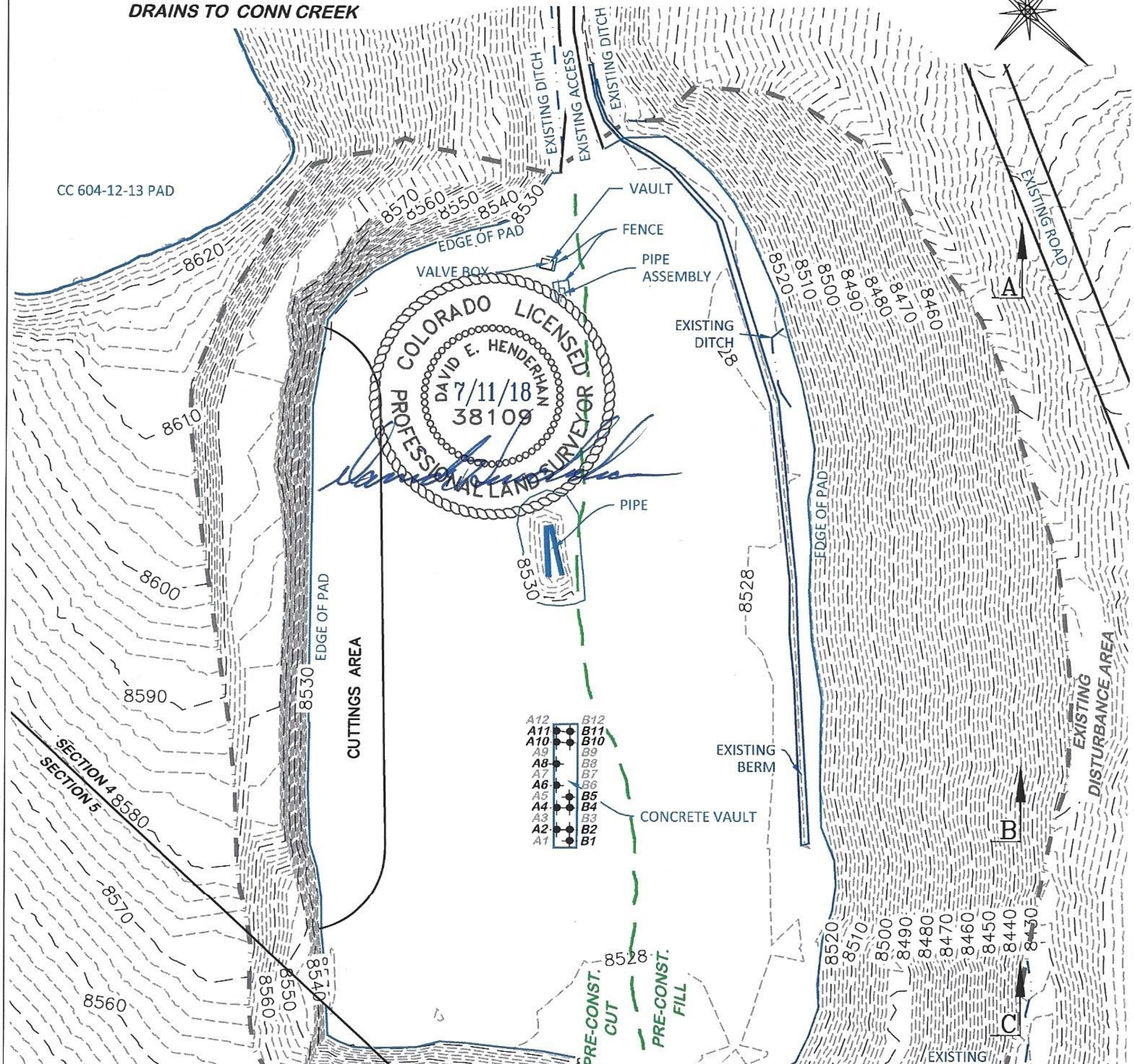
ATTACHMENT D

Supporting Information

TOP OF CONCRETE ELEVATION: 8528.8'
FINAL ELEVATION: 8528.8'
EXISTING AREA OF DISTURBANCE: 8.3± ACRES
DRAINS TO CONN CREEK

ESTIMATED EARTHWORK



BEFORE DIGGING CALL FOR UTILITY LINE LOCATION

NOTE: NO EARTHWORK TO BE PERFROMED

CC 604-12-13 ANNEX PAD

NOTE: THE EARTH QUANTITIES ON THIS DRAWING ARE ESTIMATED AND THE USE OF SAID QUANTITIES IS AT THE RESPONSIBILITY OF THE USER.

100 0 100
SCALE FEET

CONSTRUCTION LAYOUT DRAWING 1 OF 5

LARAMIE ENERGY, LLC.
CC 604-12-13 ANNEX
LOT 16, SECTION 4, T. 6 S., R. 97, 6th P.M.,
GARFIELD COUNTY, COLORADO

DRG RIFFIN & ASSOCIATES, INC.
(307) 362-5028 1414 ELK ST., ROCK SPRINGS, WY 82901

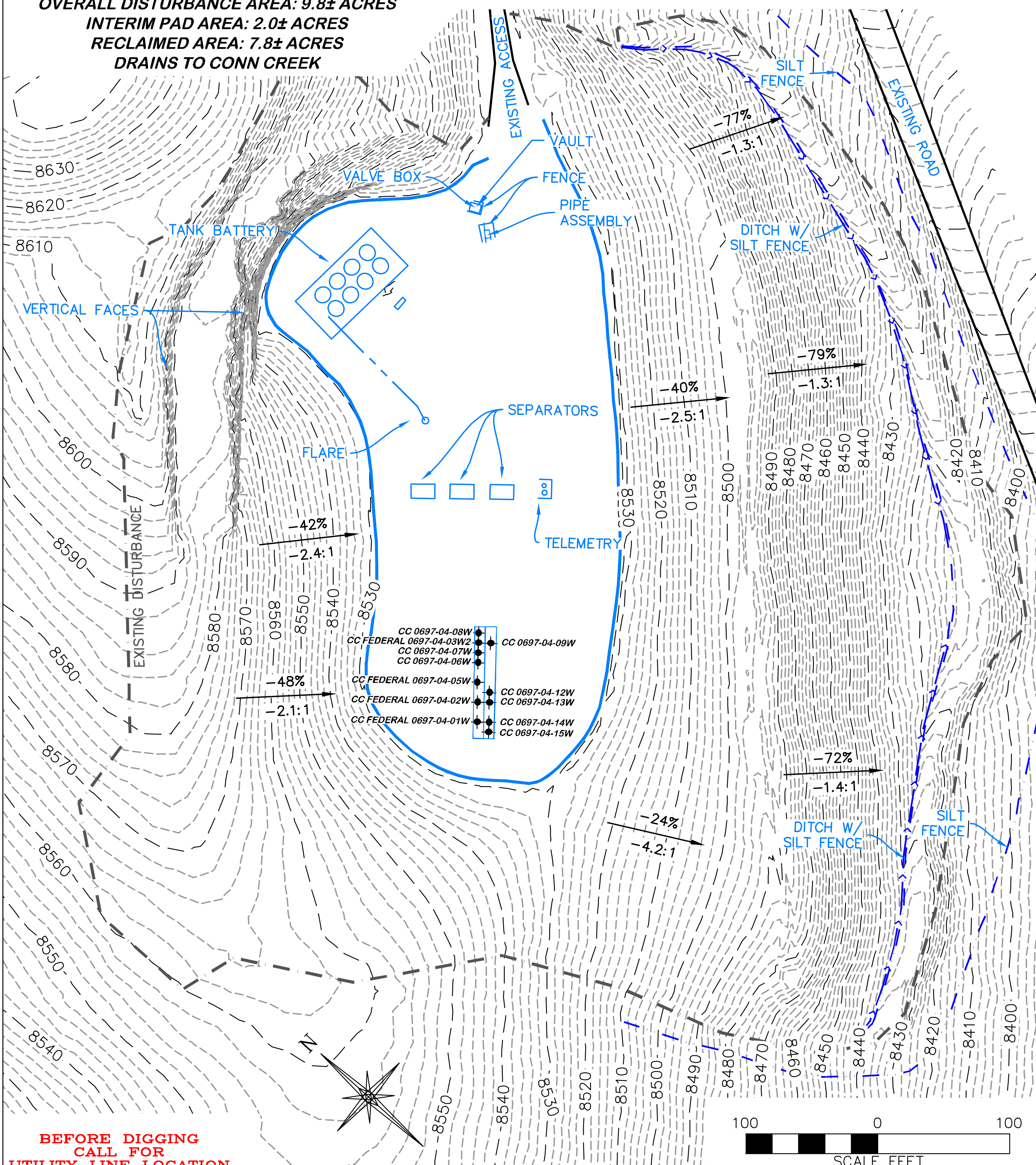
DRAWN: 12/26/2017 - DEH	SCALE: 1" = 100'
REVISED: 7/11/2018 - TCM	DRG JOB No. 21376
MISC. REVISIONS	01 ERTHWRK

ESTIMATED EARTHWORK

ITEM	CUT	FILL	TOPSOIL	EXCESS
PAD	EXISTING	EXISTING	EXISTING	EXISTING
PIT	EXISTING			EXISTING
TOTALS	EXISTING	EXISTING	EXISTING	EXISTING

AS-BUILT PAD ELEVATION: 8529.0'
OVERALL DISTURBANCE AREA: 9.8± ACRES
INTERIM PAD AREA: 2.0± ACRES
RECLAIMED AREA: 7.8± ACRES
DRAINS TO CONN CREEK

INTERIM RECLAMATION



BEFORE DIGGING
CALL FOR
UTILITY LINE LOCATION

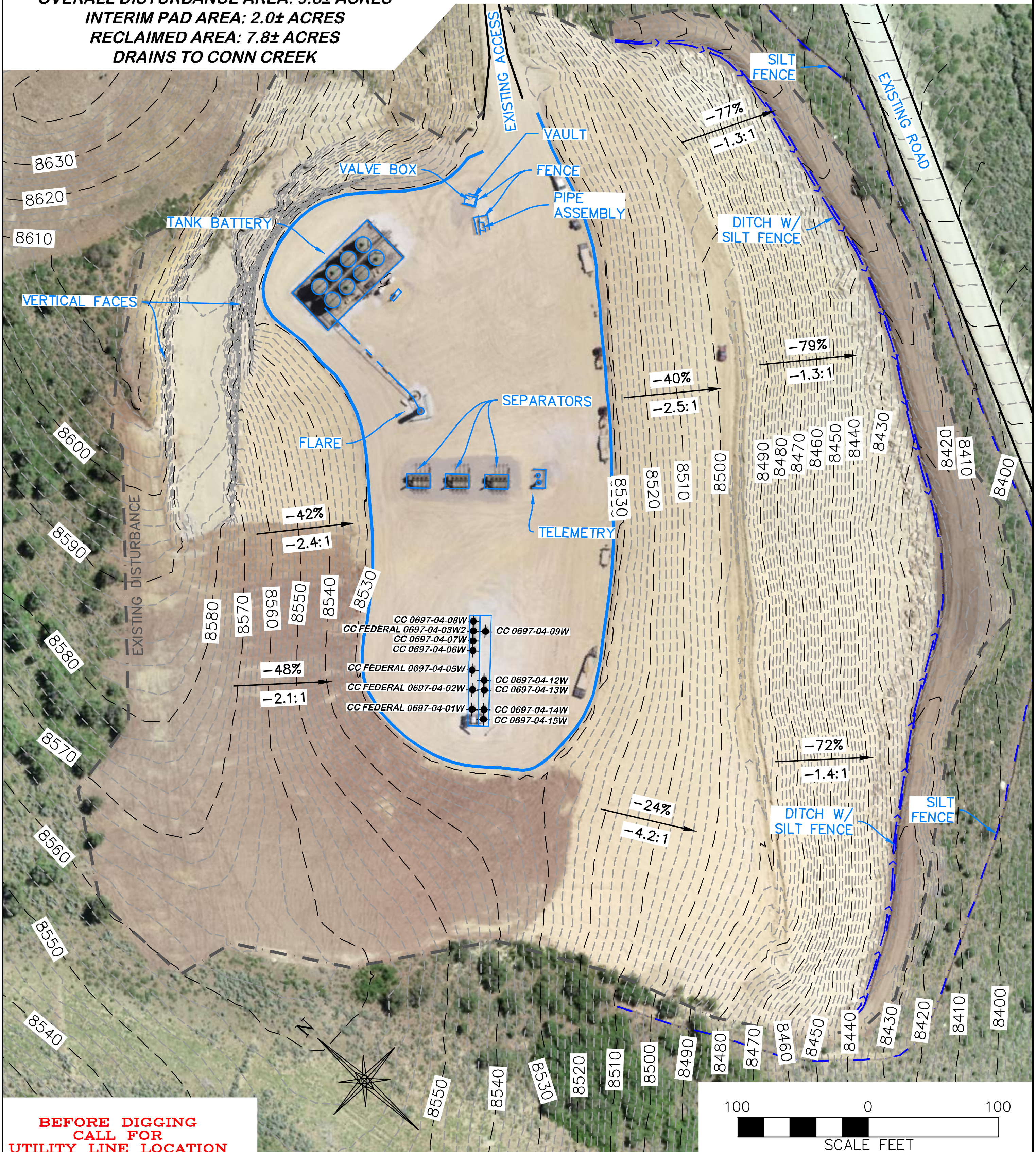
DRG RIFFIN & ASSOCIATES, INC.
(307) 362-5028
1414 ELK ST., ROCK SPRINGS, WY 82901

DRAWN: 6/24/2020 - DEH	SCALE: 1" = 100'
REVISED: N/A	DRG JOB No. 21376
	EXHIBIT A - 1 OF 2

INTERIM RECLAMATION
AS-BUILT
LARAMIE ENERGY, LLC.
CC 604-12-13 ANNEX
LOT 16, SECTION 4, T.6 S., R.97, 6th P.M.,
GARFIELD COUNTY, COLORADO

AS-BUILT PAD ELEVATION: 8529.0'
OVERALL DISTURBANCE AREA: 9.8± ACRES
INTERIM PAD AREA: 2.0± ACRES
RECLAIMED AREA: 7.8± ACRES
DRAINS TO CONN CREEK

INTERIM RECLAMATION



DRG GRIFFIN & ASSOCIATES, INC.
(307) 362-5028
1414 ELK ST., ROCK SPRINGS, WY 82901

DRAWN: 6/24/2020 - DEH	SCALE: 1" = 100'
REVISED: N/A	DRG JOB No. 21376
	EXHIBIT A - 2 OF 2

INTERIM RECLAMATION
AS-BUILT
LARAMIE ENERGY, LLC.
CC 604-12-13 ANNEX
LOT 16, SECTION 4, T.6 S., R.97, 6th P.M.,
GARFIELD COUNTY, COLORADO

EARTH MANUAL

PART 1

Third Edition

Earth Sciences and Research Laboratory
Geotechnical Research
Technical Service Center
Denver, Colorado
1998

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Table 1-3.—Average engineering properties of compacted soils from the 17 Western United States. Data from reports published between June 1960 and December 1985. Data from 2005 tests on 1110 samples. Table compiled January 1988

				Compaction				Shear Strength								
		Specific gravity		Laboratory		Index density		Consolidated-drained and consolidated-undrained triaxial shear tests				Unconsolidated-undrained triaxial shear tests				
								Av. placement conditions		Effective stress		Av. placement conditions		Effective stress		
USCS soil type	Total No. of samples tested	No. 4 minus	No. 4 plus	Max. dry density kg/m^3	Optimum moisture content %	Max. kg/m^3	Min. kg/m^3	Dry density kg/m^3	Moisture content %	Friction angle degrees	Cohesion kPa	Dry density kg/m^3	Moisture content %	Friction angle degrees	Cohesion kPa	Values listed
GW	22	2.69	2.58	1989	11.4	2167	1746									Average
		0.03	0.08	51	1.2	139	128									Std. dev.
		2.63	2.39	1907	9.9	1810	1417									Minimum
		2.75	2.67	2042	13.3	2332	1896									Maximum
		17	10	5		20										# of tests
GP	62	2.68	2.52	1907	12.2	2212	1808	1933	7.5	42.2	8.1					Average
		0.04	0.21	153	4.3	113	124	238	4.1	2.1	16.3					Std. dev.
		2.54	1.76	1436	9.1	1826	1375	1489	3.3	38.0	0.0					Minimum
		2.77	2.65	2045	26.5	2383	1986	2144	15.1	43.8	40.7					Maximum
		37	15	16		50		5								# of tests
GM	37	2.73	2.43	1819	15.7											Average
		0.07	0.18	189	5.9											Std. dev.
		2.65	2.19	1393	5.8											Minimum
		2.92	2.92	2130	29.5											Maximum
		35	17	35												# of tests
GC	32	2.73	2.50	1854	14.2											Average
		0.09	0.15	126	3.9											Std. dev.
		2.67	2.38	1537	6.0											Minimum
		3.11	2.78	2066	23.6											Maximum
		30	5	32												# of tests
SW	20	2.67	2.57	2019	9.1	1987	1576									Average
		0.03	0.03	96	1.7	128	142									Std. dev.
		2.64	2.54	1896	7.4	1683	1278									Minimum
		2.72	2.59	2162	11.2	2207	1758									Maximum
		13	2	4		13										# of tests
SP	81	2.66	2.62	1827	10.5	1890	1542									Average
		0.04	0.08	160	2.1	120	144									Std. dev.
		2.60	2.52	1649	7.8	1621	1252									Minimum
		2.86	2.75	2159	13.4	2199	1960									Maximum
		50	5	8		43										# of tests
SM	174	2.68	2.50	1877	12.3	1803	1379	1760	13.2	34.0	20.7	1821	12.6	33.5	59.3	Average
		0.06	0.12	140	3.3	147	136	145	5.2	4.9	25.5	201	5.5	6.1	42.1	Std. dev.
		2.51	2.24	1488	6.8	1417	1034	1459	4.6	23.7	0.0	1488	7.6	23.3	0.0	Minimum
		3.11	2.69	2114	25.5	1968	1555	2019	23.0	40.7	90.3	2122	25.0	45.0	146.2	Maximum
		162	10	133		20		10				8				# of tests
SC	112	2.69	2.47	1906	12.4			1773	15.4	32.7	19.3	1967	11.1	35.1	53.8	Average
		0.04	0.18	99	2.4			225	5.2	3.8	14.5	88	2.1	0.7	4.1	Std. dev.
		2.56	2.17	1547	6.7			1459	7.5	25.5	0.0	1843	9.7	34.2	49.0	Minimum
		2.84	2.59	2109	22.1			2111	22.7	38.3	42.1	2035	14.0	35.8	58.6	Maximum
		110	4	90				11				3				# of tests
ML	63	2.70		1645	20.1			1528	25.2	35.2	4.8	1678	17.4	31.8	61.4	Average
		0.09		168	5.7			179	9.5	2.5	3.4	161	5.7	4.3	24.1	Std. dev.
		2.52		1355	10.6			1292	13.5	31.4	0.0	1512	11.1	25.2	21.4	Minimum
		3.10		2018	34.6			1778	40.3	38.3	10.3	1909	25.8	37.2	82.0	Maximum
		60		36				11				4				# of tests
MH	11	2.79		1372	33.1											Average
		0.27		35	1.5											Std. dev.
		2.47		1327	31.5											Minimum
		3.50		1425	35.5											Maximum
		9		4												# of tests
CL	395	2.70	2.48	1768	16.4			1665	18.3	28.1	15.2	1760	15.3	24.4	91.0	Average
		0.05	0.13	97	3.1			174	5.7	5.0	18.6	86	2.4	7.0	49.0	Std. dev.
		2.56	2.34	1398	10.7			1297	10.2	10.8	0.0	1622	11.6	8.0	0.0	Minimum
		2.87	2.75	2002	30.9			1922	35.0	36.8	104.1	1986	20.2	33.8	164.1	Maximum
		361	8	286				31				24				# of tests
CH	101	2.73		1531	24.8			1406	30.6	20.5	32.4	1574	22.7	15.1	124.1	Average
		0.06		102	5.2			107	5.7	6.3	31.0	92	4.6	6.7	25.5	Std. dev.
		2.51		1318	16.6			1249	22.4	10.8	0.0	1438	17.9	5.1	85.5	Minimum
		2.89		1720	41.8			1555	42.0	30.9	108.2	1680	29.1	26.1	148.2	Maximum
		93		36				11				5				# of tests

Conversion factors: 1 kg/m^3 = 0.06243 lb/ft^3; 1 kPa = 0.145 lb/in^2