LARAMIE ENERGY

LARAMIE 0993-29-01 WELL PAD
TOPSOIL PROTECTION PLAN

Prepared for:

Laramie Energy, LLC
760 Horizon Drive, Suite 101
Grand Junction, CO 81506

Prepared by:

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GRAND JUNCTION, COLORADO 81505

October 2023

CERTIFICATION STATEMENT:

"I hereby certify that this topsoil protection plan was prepared by me (or under my direct supervision) in accordance with the provisions of Rule 304.c.(14) of the Energy and Carbon Management Commission (ECMC)."

Amie Wilsey, President  10/17/2023

Preparer's Name **DATE**

I. INTRODUCTION

Laramie Energy, LLC. requested that WestWater Engineering (WestWater) prepare a topsoil protection plan for the Laramie 0993-29-01 well pad location. The proposed project would be located within Mesa County, Colorado in Sections 20, 28, and 29, Township 9 South, Range 93 West on privately owned lands. Initial disturbance associated with the well pad would be 8.3 acres. Upon interim reclamation, approximately 2.2 acres would remain as production pad surface. An estimated 1.1 acre would be disturbed for construction of the access road.

This topsoil protection plan applies to the areas where Laramie plans to cause surface disturbance associated with the well pad and access road and addresses the requirements of the Energy and Carbon Management Commission (ECMC) 304.c.(14), 1001.a, 1002.b and 1002.c rules for reclamation regulations. It should be noted that per the ECMC 304.c.(14) rule, in no case will topsoil be used for building the location, nor will it be left in place and covered by subsoil in a cut and fill situation.

II. PROJECT AREA DESCRIPTION

The proposed project would be located in a valley east of Groundhog Gulch at an elevation of approximately 7,500 feet. The proposed access road would be located along an existing two-track road for a portion of the alignment. The existing two-track crosses an ephemeral stream at one location which is currently culverted under the road.

Vegetation communities within the proposed disturbance area and immediately surrounding the proposed well pad are comprised of dense mountain shrublands, dryland pasture grasses, mountain sagebrush shrublands, and excavated material that has been reclaimed with perennial grass species. Mountain shrublands present in the project area include serviceberry (*Amelanchier utahensis*), Gambel oak (*Quercus gambelii*), mountain mahogany (*Cercocarpus montanus*), mountain sagebrush (*Artemisia tridentata* ssp. *vaseyana*), and mountain snowberry (*Symphoricarpos oreophilus*), along with an understory of native grasses and forbs. The dry pasturelands and reclaimed areas are composed primarily of western wheatgrass (*Pascopyrum smithii*), smooth brome (*Bromus inermis*), intermediate wheatgrass (*Thinopyrum intermedium*), and annual forbs.

Soils

The well pad would be located in a basin with predominant slopes ranging from 5 to 10 percent. The dominant native vegetation community in the project area and vicinity would be characterized as a montane shrubland.

The well pad would be located on two soil types as described in Table 1, and shown on Figure 2 (NRCS 2023).

Table 1. Soils occurring within the project area.

Map Unit Symbol	Soil Name	Description	Project Feature
39	Fughes-Hesperus complex, 3 to 12 percent slopes	This soil type occurs on terraces at elevations from 7,400 feet to 7,800 feet. The parent material is alluvium derived from shale and/or localized mudflow deposits derived from shale.	Well Pad, Access Road, Pipelines
47	Hesperus-Empedrado, moist-Pagoda complex 5 to 35 percent slopes	This soil type occurs on mountainsides at elevations from 6,200 feet to 8,500 feet. This is a well-drained soil. Parent material is residuum weathered from sandstone and shale.	Well Pad

It should be noted that the majority of Soil Unit 39 within the project area has been previously disturbed as a result of soil storage for spoils that were removed during the construction of a freshwater pond. Laramie completed a soil bore within these soils for analysis. The results of the geotechnical soil bore are attached in Appendix A.

III. SOIL ASSESSMENT

The Laramie 0993-29-01 well pad would be newly built, disturbing approximately 8.3 acres during initial clearing and grading of the well pad and an additional 1.1 acres for the access road and associated pipelines for a total of 9.4 acres of initial disturbance. Of the 9.4 acres of surface disturbance, approximately 3.7 acres would occur on previously disturbed soils. The previously disturbed soils were spoils from a pond excavation project that occurred during 2014. The top 6-inches of soil were segregated and stockpiled separately from other spoils during excavation of the pond. The excavated spoils were transferred to the current location for the proposed Laramie 0993-29-01 well pad. Excavated soils were graded to natural contours of the surrounding area. Topsoil was spread immediately over the spoils and reseeded with an appropriate seed mix.

Methods

Soil survey and baseline soils information were obtained from the Natural Resources Conservation Service (NRCS), U.S. Department of Agriculture (USDA) (NRCS 2023). On-site visual and tactile soil investigations were conducted on hand-dug soil pits to evaluate macroscopic characteristics of disturbed soils from four locations for fertility testing within the proposed disturbance area as shown on Figure 2.

The soil samples were collected from within the proposed disturbance area at depths ranging from 2 to 27 inches. Soil samples within the spoils storage area were collected to a depth of 6-inches since this was likely the depth of the original topsoil that was replaced after excavation of the pond. All soil samples were analyzed for soil chemical and physical properties to determine topsoil quality and recommendations for nutrient amendments.

Results

A total of 5 soil pits were reviewed during the field assessment. Soil samples from each of the 5 soil pits were sent to an accredited laboratory in agronomics for analysis, results of the analysis are attached in Appendix B. Two soil pits and samples (Soil Pit #4 and #5) were collected within Mapped Soil Unit #39, which is located within the spoils storage area. Field observations, including photographs, of the topsoil including color, texture, and other information, is also provided in Appendix B for each soil sample and pit location.

Based on field observations, the soils present in the project area appear to provide suitable topsoil to a minimum depth of 6 inches. Where topsoil appeared to be less than 6-inches deep based on laboratory analysis, the soils are still suitable to be stripped to a minimum depth of 6-inches. In some areas, topsoil availability is present to a depth of +/- 27 inches. Low to moderate organic matter was present at all sample sites. Topsoil depths were determined based on root structure, organic content, and soil color/texture changes.

Topsoil Stripping Notes – The entire well pad is suitable to be stripped for topsoil to a minimum depth of 6-inches. It is estimated that 4,324 cubic yards are available to be stripped and stockpiled at the Laramie 0993-29-01 well pad.

There appears to be no visual difference in vegetative cover in the area where the spoils from the pond excavation were placed versus the area beyond the spoils disturbance area. The spoils area exhibited good perennial grass cover across the entire site. Based on current field conditions, results from the laboratory analysis, and results from the soil bore, the spoils soils appear to be suitable to be stripped for topsoil storage to a minimum depth of 6-inches.

IV. TOPSOIL MANAGEMENT

Working Surface Preparation/Construction Activities

Topsoil protection considerations will be applied to the storage of topsoil to ensure erosion and sediment transportation are minimized, in addition to ensuring that potential contamination and compaction are also mitigated per ECMC Regulation 1002.c and e.

Topsoil Handling

Proper handling and storage of topsoil is critical to successful revegetation, especially in the case of reestablishing important native plant species on disturbed areas. The topsoil contains soil microbes (i.e., bacteria, mycorrhiza, invertebrates), and seed banks of viable seed for the native plants present on the site. Many native plant species depend upon the activity of soil microbes for germination in some instances and for establishment and survival of most seedlings.

Per Regulation 1002.b(2) and (3), the top 6-inchs or the topsoil horizon (whichever is deeper) of soil should be stockpiled and separated to prevent mixing with any other trench material. If the topsoil horizons are too rocky, or too thick, the topsoil shall be segregated to the greatest extent possible and stored. Soils that are comprised of 35% or more rock, or have soil horizons that are less than 6-inches in thickness, fit this classification. Based on the soil pits dug for this location, the soils do not contain more than 35% rock. The soils are clay loam to loam soils with very little rock or gravel in the soil horizons. Topsoil stockpile locations for the well pad are depicted on Figure 2.

During construction of access roads and pipelines, the topsoil will be stripped and windrowed along the access road and pipeline alignments. Stormwater controls will be installed to reduce sediment transport. The construction of access roads and pipelines and subsequent reclamation and re-seeding is a short-term activity, resulting in the stripped topsoil windrows being distributed over those areas of disturbance and seeded as construction is completed.

Topsoil will be protected from erosion and weed invasion. Straw wattles will be used along the perimeter of the stockpiled topsoil pile. Topsoil slopes will not be greater than 2:1. Soils will be stockpiled on stable slopes and will be positioned to minimize exposure to wind and water erosion. Topsoil piles that will be stored for longer than 30 days will be seeded to provide cover which will help to reduce erosion, provide competition for weed species, and to maintain viability of the soil fungi and microbe communities.

Using the recommended seed mix on long-term storage piles helps maintain biological activity and provide a seed bank of viable seed. If long-term stockpiling or deep stockpiling cannot be avoided, application of mycorrhizal inoculants (see section below) may also be beneficial to help ensure the topsoil maintains optimal condition for reclamation purposes.

The stockpiled topsoil will be spread out along the non-working area surface after drilling and completions operations have been completed. Re-contouring of the pad surface to its original or near-original grade will occur after soils have been re-spread.

A Storm Water Management Plan (SWMP) will be prepared in accordance with ECMC Regulation 1002.f for this project which will include additional descriptions of soil stabilization methods and Best Management Practices (BMPs) that should be used during and post-construction.

Soil Preparation

Before seeding begins, the soil needs to be prepared. The objective is to have the top 12-inches of soil decompacted to allow for root growth and still be firm enough on the surface to allow for good seed to soil contact (Whisenant 2003). Compaction can reduce water infiltration and also hinder the penetration of the sprouting seed. During interim reclamation, it is recommended that the following practices are implemented to help reduce compaction and prepare the seedbed: scarification, tillage, disking, chisel plowing, cultipacking, or harrowing (Colorado Natural Areas Program et al. 1998). In the event there is significant compaction, ripping with heavy equipment should be implemented when soil moisture levels are below 35% of field capacity, to a depth of 18-inches as recommended by ECMC Regulation 1003.c.

Imprinting the soil is recommended to help reduce soil runoff. Imprinting can be done in the form of dozer tracks or furrows perpendicular to the direction of slope. When utilizing hydro-seeding followed by mulching, imprinting should be done prior to seeding unless the mulch is to be crimped into the soil surface. If broadcast seeding and harrowing, imprinting should be done as part of the harrowing. Other simple imprinting methods include deep hand raking and harrowing, always perpendicular to the direction of slope. The effectiveness of the imprinting should be reviewed during standard storm water inspections. If needed, the imprinting will undergo maintenance to ensure the topsoil conditions facilitate revegetation efforts and minimize erosion.

Soil Amendments

The addition of soil amendments in rangeland reclamation projects can create more optimal growing conditions for non-native or invasive plant species, with which native plants compete poorly. There is potential that the use of soil amendments (fertilizer) containing nitrogen will disproportionately benefit undesirable annual plants (Perry et al. 2010). If the company determines the use of soil amendments to be beneficial, the type and rate should be based on results from lab analysis of soil samples collected at the site. The bioavailability of the nutrients found in the soil is an important consideration when assessing whether or not to add particular amendments.

A potentially beneficial alternative method to enhance reclamation success, particularly where there is poor or destroyed topsoil, is the application of vesicular-arbuscular mycorrhizal fungi (AMF). These fungi, mostly of the genus *Glomus*, are symbiotic with about 80 percent of all vegetation. Endo-mycorrhizal fungi are associated mostly with grasses and forbs and could be helpful in reclamation. In symbiosis, the fungi can increase water and nutrient transfer capacity of the host root system (Barrow and McCaslin 1995). Over-the-counter commercial products are available, and the best products should contain more than one fungus species.

Compacted soils respond well to fossilized humic substances and by-products called humates. These humates, including humic and fulvic acids and humin were formed from pre-historic plant and animal deposits and can benefit reclamation efforts on compacted soils when applied as directed. The use of these humic products will also help facilitate an environment in which the beneficial microbial activity is increased while also improving the soil structure and making the nutrients in the native soils more bioavailable for plant uptake (Khaled and Fawy 2011).

Seed Mixture

Upon interim and/or final reclamation, the seed mix below (Table 2) will be used. This seed mix is adapted from the Bureau of Land Management's Colorado River Valley Field Office seed menu recommendations (BLM 2021). The seed mix is well suited for the vegetation communities present in the project area. The mix includes perennial native grasses and forbs that should establish well, protect topsoil, and provide a basis for rehabilitation of the site upon reclamation. The seed mix was included to meet the requirements of the ECMC Regulation 1003.e.(2).

Table 2. Seed Mix: Mixed Mountain Shrubland – Mesic (Gambel's Oak/Mountain Sagebrush) (16 to 22 inches precipitation)

Common Name	***Species Name***	***Variety***	***Seeds per Pound***	***PLS lbs/acre***
Plant Three of the Following Grasses (15% of Mix Each, 45% Total)				
Mountain Brome	*Bromus marginatus*	UP* Cold Springs preferred, or Bromar, Garnet	64,000	6.1
Slender Wheatgrass	*Elymus trachycaulus*	San Luis	159,000	1.6
Bluebunch Wheatgrass	*Pseudoroegneria spicata*	Native Colorado/Utah source, or Anatone, Goldar	140,000	2.8
Rocky Mountain Fescue	*Festuca saximontana*	Colorado/Utah source preferred	1,200,000	0.3

Common Name	*Species Name*	*Variety*	*Seeds per Pound*	*PLS lbs/acre*
And <u>One</u> of the Following Grasses (10% of Mix Each, 20% Total)				
Prairie Junegrass	*Koeleria macrantha*	Native Colorado/Utah source preferred	2,315,000	0.1
Mutton Bluegrass	*Poa fendleriana*	Native Colorado/Utah source preferred	890,000	0.3
And <u>One</u> of the Following Grasses (10% of Mix Each, 10% Total)				
Western Wheatgrass	*Pascopyrum smithii*	UP* variety native Colorado/Utah source, or Arriba, Recovery, Rodan, Rosana	110,000	2.4
Thickspike Wheatgrass	*Elymus lanceolatus*	Bannock, Critana, Schwendimar	154,000	1.7
And <u>One</u> of the Following Grasses (10% of Mix Each, 10% Total)				
Columbia Needlegrass	*Achnatherum nelsonii*	Native sources within 500 miles preferred	150,000	1.7
Letterman Needlegrass	*A. lettermanii*	Native sources within 500 miles preferred	225,000	1.2

And <u>Five</u> of the Following Forbs (3% of Mix Each, 15% Total) *					
Common Name	***Scientific Name***	***PLS lbs/acre***	***Common Name***	***Scientific Name***	***PLS lbs/acre***
American Vetch	*Vicia americana*	2.4	Rocky Mountain Penstemon	*Penstemon strictus*	0.1
Bigelow's Tansy-aster	*Machaeranthera bigelovii*	0.05	Scarlet Gilia	*Ipomopsis aggregata*	0.2
Blanketflower	*Gaillardia aristata*	0.6	Showy Daisy	*Erigeron speciosus*	0.05
Great Basin Penstemon	*Penstemon subglaber*	0.19	Sticky Geranium	*Geranium viscosissimum*	1.6
Hairy Goldenaster	*Heterotheca villosa*	0.1	Sulphur Buckwheat	*Eriogonum umbellatum*	0.4
Lewis Blue Flax	*Linum lewisii*	0.5	Tailcup Lupine	*Lupinus caudatus*	4.4
Little Sunflower	*Helianthella uniflora*	1.9	Utah Sweetvetch	*Hedysarum boreale*	1.7
Mule's-ears	*Wyethia amplexicaulis*	2.8	Western Yarrow	*Achillea millefolium*	0.03

*Preferred source = Uncompahgre Project (UP), Kathy See, nativeplant@upartnership.org, 970-240-9498, 970-901- ther native Colorado/Utah source is preferred.

Seeding Methods

Seeding should be conducted no more than 24 hours following completion of final seedbed preparation. For best results and success, reseeding should be done in late autumn. It is

recommended that a combination of drill seeding and hydroseeding should be used for reseeding the site.

Along moderate to steep slopes, hydroseeding would be the preferred method of seeding the site at the standard seeding rate. If the site is hydroseeded, it is recommended that an erosion control mulch is applied to help with vegetation establishment. Along gentle slopes, drill seeding would be the preferred method at the standard seeding rate.

For broadcast seeding, the following two seeding methods can also be implemented to improve germination success.

- harrow with just enough soil moisture to create a rough surface, broadcast seed and re-harrow, preferably at a 90-degree angle to the first harrow; or
- hand raking and broadcast followed by re-raking at a 90-degree angle to the first raking.

These are not the only means of replanting the site. However, these methods have been observed to be effective in similar landscapes.

After two years of controlling weeds (with herbicides) and allowing the grasses to become established, woody species should be inter-seeded or hand-planted to increase the diversity and value of the reclamation plantings. Regular surveys for noxious weeds should be completed to help ensure the seedbank of undesirable species is not inadvertently increased during reclamation processes in accordance with ECMC Regulation 1003.f.

Mulching

If areas are broadcast seeded, it is recommended that an application of certified weed-free straw, mulch, erosion control netting (i.e., Jute, wood excelsior, etc.), or erosion control blankets are installed within 24 hours of seeding to help protect soil from erosion and increase soil moisture content. Potential detrimental effects of mulching include the introduction of weed species and the establishment of non-native cereal grains. Use of a certified weed-free sterile wheat hybrid straw mulch would limit these effects. Straw mulch is most effective on gentle to moderate slopes and can be hand broadcast in a uniform depth across the project site of 2-3 inches. The application rate of straw mulch is approximately 2 tons per acre (NRCS 2002). If straw mulch is used, it should be crimped into the soil surface. Erosion control blankets and netting are typically used in applications where there is a steep slope, but can also be used to help maintain soil stability while seedlings establish in areas where the slope is not considered moderate to steep. The material is often biodegradable and does not need to be removed once it has been installed.

BMPs

A Storm Water Management Plan will be prepared for this project which will provide additional details for the appropriate Best Management Practices (BMPs) to be utilized during and post-construction activities. For more specific details, please refer to the respective document. BMPs such as hydromulching, installation of small earthen berms, diversion ditches, and straw wattles are common BMPs with regards to storage and reclamation of stockpiled topsoil. A summary of BMPs that will be used for topsoil protection are outlined in Appendix C.

Noxious Weeds

Increased traffic and activities in the project area may promote conditions that facilitate the spread of invasive noxious weeds from outside the project area. The application of a weed management plan for this project site is recommended to: 1) prevent the invasion and expanded range of noxious weeds; and 2) promote the establishment of desirable plant life upon rehabilitation of the proposed well pad during interim and final reclamation.

Laramie will implement the protocol specified in the Mesa County Noxious Weed Management Plan. This Noxious Weed and Vegetation Management Plan was written with respect to the Colorado Noxious Weed Act, C.R.S 35-5.5-115 (Mesa County 2020).

Subsequent to soil disturbances, vegetation communities can be susceptible to infestations of invasive or exotic weed species. Vegetation removal and soil disturbance during construction can create optimal conditions for the establishment of invasive, non-native species. Construction equipment traveling from weed-infested areas into weed-free areas could disperse noxious or invasive weed seeds and propagates, resulting in the establishment of these weeds in previously weed-free areas.

Several simple practices should be employed to prevent most weed infestations. The following practices should be adopted for any activity to reduce the costs of noxious weed control through prevention. The practices include:

- Prior to delivery to the site, equipment should be thoroughly cleaned of soils remaining from previous construction sites which may be contaminated with noxious weeds.
- If working in sites with weed-seed contaminated soil, equipment should be cleaned of potentially seed-bearing soils and vegetative debris at the infested area prior to moving to uncontaminated terrain.
- All maintenance vehicles should be regularly cleaned of soil.
- Avoid driving vehicles through areas where weed infestations exist.

V. REFERENCES

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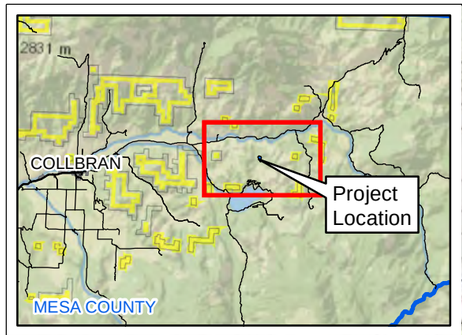


Laramie 0993-29-01 Working Pad Surface

T9S R94W

T9S R93W

330

64 6/10 RD

HARRISON CREEK RD

Legend

- Pipeline
- Pad Disturbance
- Working Pad Surface
- Access Road
- Road
- BLM

Figure 1

Laramie Energy

Laramie 0993-29-01

Topsoil Protection Plan

NENE, Section 29, T.9S., R.93 W., 6th P.M., Mesa County, Colorado

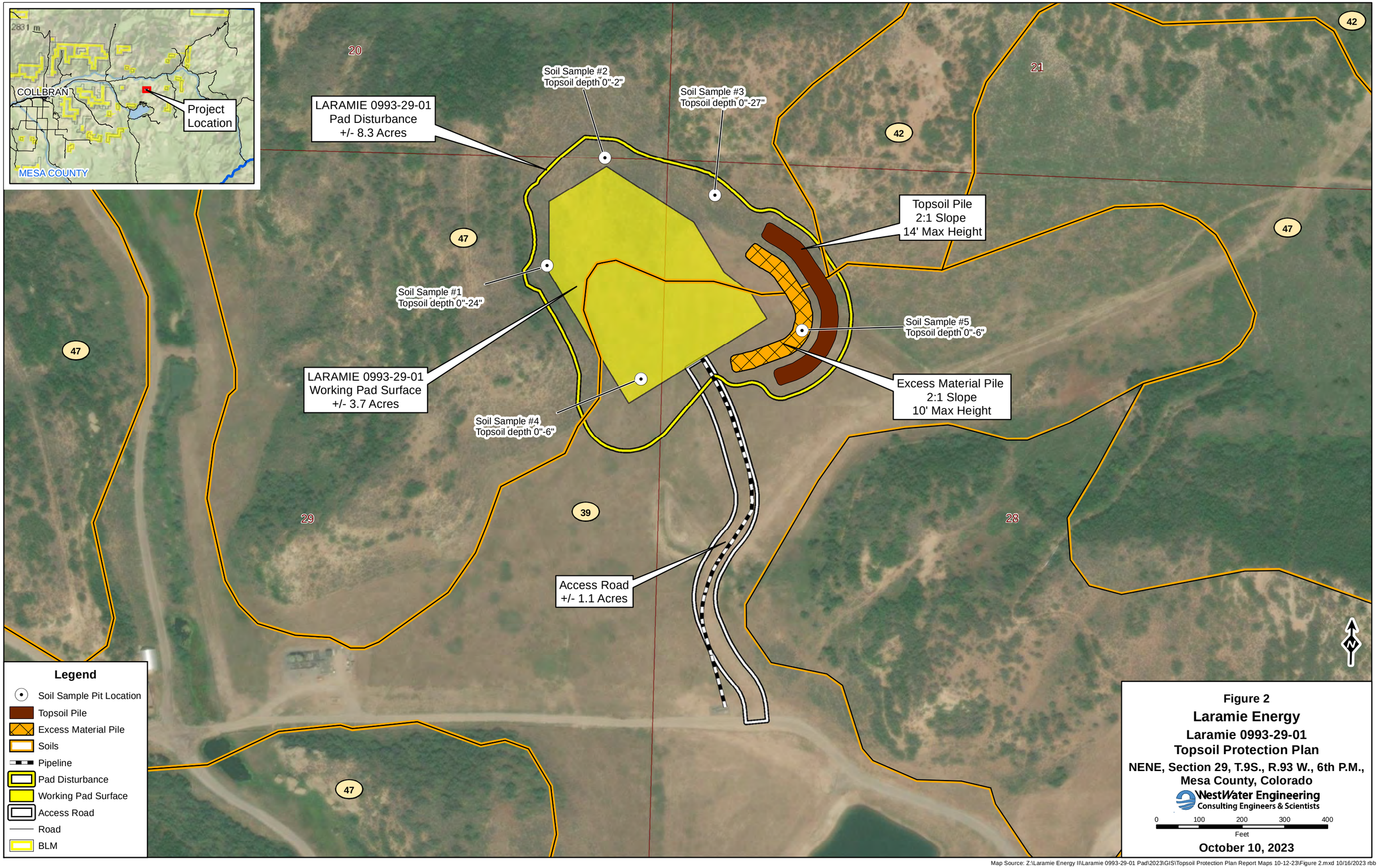
WestWater Engineering
Consulting Engineers & Scientists

0 1,000 2,000 3,000 4,000

Feet

October 10, 2023

Map Source: Z:\Laramie Energy II\Laramie 0993-29-01 Pad\2023\GIS\Topsoil Protectin Plan Report Maps 10-12-23\Figure 1.mxd 10/12/2023 rbb



Map Source: Z:\Laramie Energy II\Laramie 0993-29-01 Pad\2023\GIS\Topsoil Protection Plan Report Maps 10-12-23\Figure 2.mxd 10/16/2023 rbb

APPENDIX A

SOIL BORING ANALYSIS

Subsurface Exploration and Testing Results

GEI Consultants conduced a geotechnical deep soil boring at the Groundhog Spoils site. The soil boring was advanced using hollow-stem auger (HSA) methods. Disturbed and undisturbed samples were collected. A Geotechnical Data Report including boring logs and laboratory results is included below.

Figure 1 Soil Boring Locations

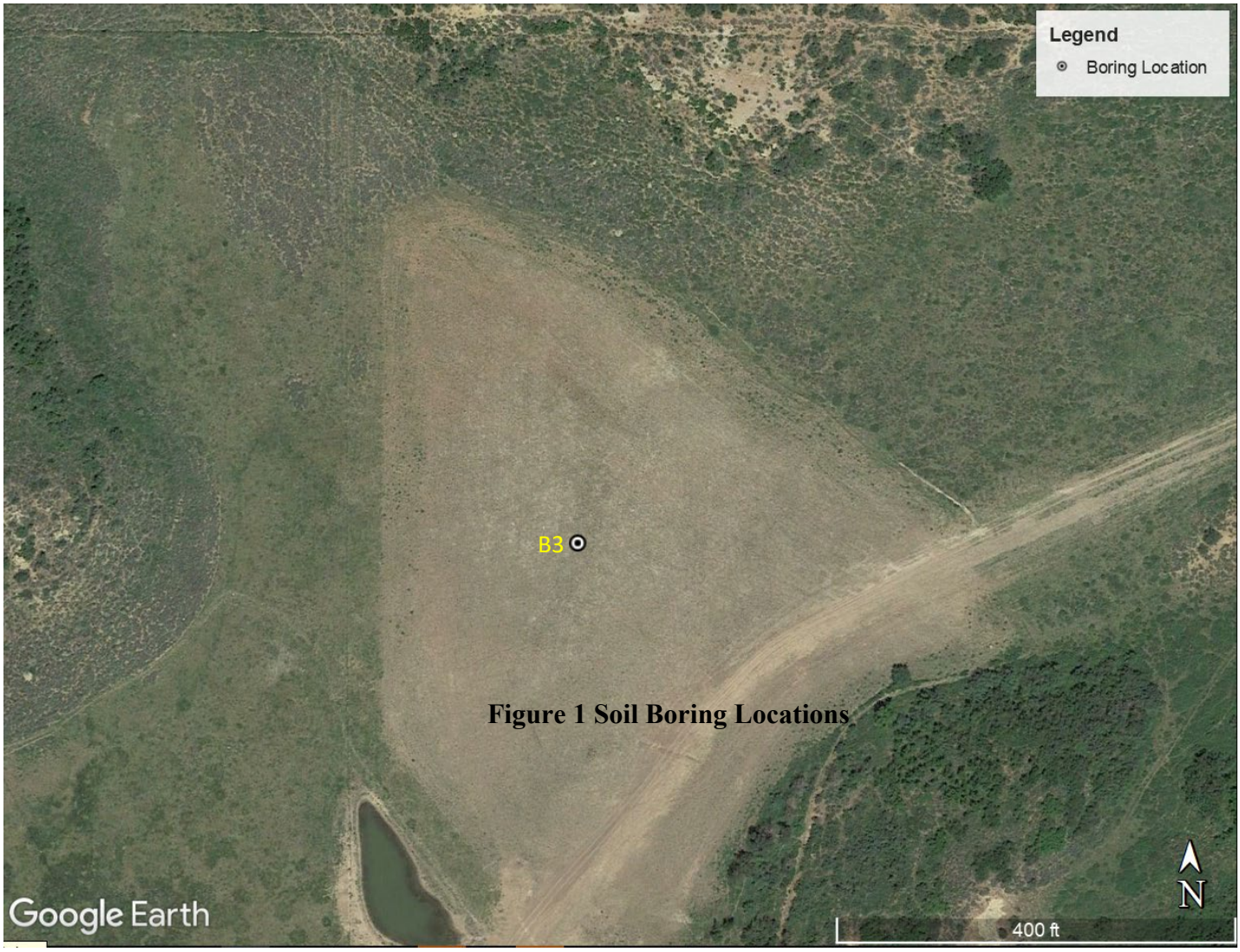


Figure 1 Soil Boring Locations

intertek psi	DATE November 29, 2022	Groundhog Pond Spoils Collbran, Colorado 81624	PSI PROJECT #: 07061900
PSI, INC. 2779 South 600 West Salt Lake City, Utah 84115 (801) 484-8827	DRAWN BY: RDS	**Exploration Plan**	

GENERAL NOTES

SAMPLE IDENTIFICATION

The Unified Soil Classification System (USCS), AASHTO 1988 and ASTM designations D2487 and D-2488 are used to identify the encountered materials unless otherwise noted. Coarse-grained soils are defined as having more than 50% of their dry weight retained on a #200 sieve (0.075mm); they are described as: boulders, cobbles, gravel or sand. Fine-grained soils have less than 50% of their dry weight retained on a #200 sieve; they are defined as silts or clay depending on their Atterberg Limit attributes. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size.

DRILLING AND SAMPLING SYMBOLS

SFA: Solid Flight Auger - typically 4" diameter flights, except where noted.
HSA: Hollow Stem Auger - typically 3¼" or 4¼ I.D. openings, except where noted.
M.R.: Mud Rotary - Uses a rotary head with Bentonite or Polymer Slurry
R.C.: Diamond Bit Core Sampler
H.A.: Hand Auger
P.A.: Power Auger - Handheld motorized auger

SS: Split-Spoon - 1 3/8" I.D., 2" O.D., except where noted.
ST: Shelby Tube - 3" O.D., except where noted.
RC: Rock Core
TC: Texas Cone
BS: Bulk Sample
PM: Pressuremeter
CPT-U: Cone Penetrometer Testing with Pore-Pressure Readings

SOIL PROPERTY SYMBOLS

N: Standard "N" penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2-inch O.D. Split-Spoon.
N_{60}: A "N" penetration value corrected to an equivalent 60% hammer energy transfer efficiency (ETR)
Q_u: Unconfined compressive strength, TSF
Q_p: Pocket penetrometer value, unconfined compressive strength, TSF
w%: Moisture/water content, %
LL: Liquid Limit, %
PL: Plastic Limit, %
PI: Plasticity Index = (LL-PL),%
DD: Dry unit weight, pcf
▼,▽,▼ Apparent groundwater level at time noted

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Relative Density	N - Blows/foot
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	50 - 80
Extremely Dense	80+

ANGULARITY OF COARSE-GRAINED PARTICLES

Description	Criteria
Angular:	Particles have sharp edges and relatively plane sides with unpolished surfaces
Subangular:	Particles are similar to angular description, but have rounded edges
Subrounded:	Particles have nearly plane sides, but have well-rounded corners and edges
Rounded:	Particles have smoothly curved sides and no edges

GRAIN-SIZE TERMINOLOGY

Component	Size Range
Boulders:	Over 300 mm (>12 in.)
Cobbles:	75 mm to 300 mm (3 in. to 12 in.)
Coarse-Grained Gravel:	19 mm to 75 mm (¾ in. to 3 in.)
Fine-Grained Gravel:	4.75 mm to 19 mm (No.4 to ¾ in.)
Coarse-Grained Sand:	2 mm to 4.75 mm (No.10 to No.4)
Medium-Grained Sand:	0.42 mm to 2 mm (No.40 to No.10)
Fine-Grained Sand:	0.075 mm to 0.42 mm (No. 200 to No.40)
Silt:	0.005 mm to 0.075 mm
Clay:	<0.005 mm

PARTICLE SHAPE

Description	Criteria
Flat:	Particles with width/thickness ratio > 3
Elongated:	Particles with length/width ratio > 3
Flat & Elongated:	Particles meet criteria for both flat and elongated

RELATIVE PROPORTIONS OF FINES

Descriptive Term	% Dry Weight
Trace:	< 5%
With:	5% to 12%
Modifier:	>12%

GENERAL NOTES

(Continued)

CONSISTENCY OF FINE-GRAINED SOILS

Q_U - TSF	N - Blows/foot	Consistency
0 - 0.25	0 - 2	Very Soft
0.25 - 0.50	2 - 4	Soft
0.50 - 1.00	4 - 8	Firm (Medium Stiff)
1.00 - 2.00	8 - 15	Stiff
2.00 - 4.00	15 - 30	Very Stiff
4.00 - 8.00	30 - 50	Hard
8.00+	50+	Very Hard

MOISTURE CONDITION DESCRIPTION

Description	Criteria
Dry:	Absence of moisture, dusty, dry to the touch
Moist:	Damp but no visible water
Wet:	Visible free water, usually soil is below water table

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term	% Dry Weight
Trace:	< 15%
With:	15% to 30%
Modifier:	>30%

STRUCTURE DESCRIPTION

Description	Criteria
Stratified:	Alternating layers of varying material or color with layers at least ¼-inch (6 mm) thick
Laminated:	Alternating layers of varying material or color with layers less than ¼-inch (6 mm) thick
Fissured:	Breaks along definite planes of fracture with little resistance to fracturing
Slickensided:	Fracture planes appear polished or glossy, sometimes striated
Blocky:	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Lensed:	Inclusion of small pockets of different soils
Layer:	Inclusion greater than 3 inches thick (75 mm)
Seam:	Inclusion 1/8-inch to 3 inches (3 to 75 mm) thick extending through the sample
Parting:	Inclusion less than 1/8-inch (3 mm) thick

SCALE OF RELATIVE ROCK HARDNESS

Q_U - TSF	Consistency
2.5 - 10	Extremely Soft
10 - 50	Very Soft
50 - 250	Soft
250 - 525	Medium Hard
525 - 1,050	Moderately Hard
1,050 - 2,600	Hard
>2,600	Very Hard

ROCK BEDDING THICKNESSES

Description	Criteria
Very Thick Bedded	Greater than 3-foot (>1.0 m)
Thick Bedded	1-foot to 3-foot (0.3 m to 1.0 m)
Medium Bedded	4-inch to 1-foot (0.1 m to 0.3 m)
Thin Bedded	1¼-inch to 4-inch (30 mm to 100 mm)
Very Thin Bedded	½-inch to 1¼-inch (10 mm to 30 mm)
Thickly Laminated	1/8-inch to ½-inch (3 mm to 10 mm)
Thinly Laminated	1/8-inch or less "paper thin" (<3 mm)

ROCK VOIDS

Voids	Void Diameter
Pit	<6 mm (<0.25 in)
Vug	6 mm to 50 mm (0.25 in to 2 in)
Cavity	50 mm to 600 mm (2 in to 24 in)
Cave	>600 mm (>24 in)

GRAIN-SIZED TERMINOLOGY

(Typically Sedimentary Rock)

Component	Size Range
Very Coarse Grained	>4.76 mm
Coarse Grained	2.0 mm - 4.76 mm
Medium Grained	0.42 mm - 2.0 mm
Fine Grained	0.075 mm - 0.42 mm
Very Fine Grained	<0.075 mm

ROCK QUALITY DESCRIPTION

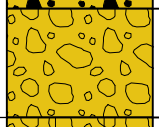
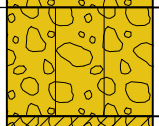
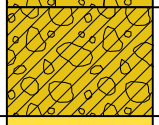
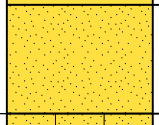
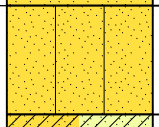
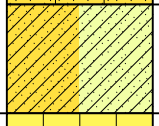
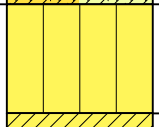
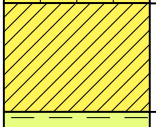
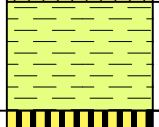
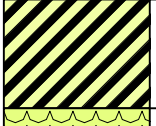
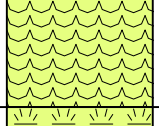
Rock Mass Description	RQD Value
Excellent	90 -100
Good	75 - 90
Fair	50 - 75
Poor	25 -50
Very Poor	Less than 25

DEGREE OF WEATHERING

Slightly Weathered:	Rock generally fresh, joints stained and discoloration extends into rock up to 25 mm (1 in), open joints may contain clay, core rings under hammer impact.
Weathered:	Rock mass is decomposed 50% or less, significant portions of the rock show discoloration and weathering effects, cores cannot be broken by hand or scraped by knife.
Highly Weathered:	Rock mass is more than 50% decomposed, complete discoloration of rock fabric, core may be extremely broken and gives clunk sound when struck by hammer, may be shaved with a knife.

SOIL CLASSIFICATION CHART

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

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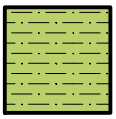
Graphic Symbols for Materials and Rock Deposits

CONCRETE
Portland Cement Concrete

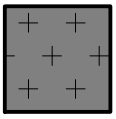
BITUMINOUS CONCRETE



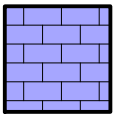
CLAYSTONE

COAL
Coal, Anthracite Coal

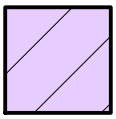
CONGLOMERATE/BRECCIA
Conglomerate, Breccia



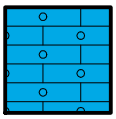
IGNEOUS ROCK
Anorthsite, Basalt, Metabasalt, Diabase (Gabbro), Gabbro, Granite/Granodionite, Homfels, Pegmatite, Rhyolite/Metarhyolite



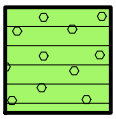
LIMESTONE
Limestone, Dolomite



METAMORPHIC ROCK
Amphibolite, Gneiss, Marble, Phyllite, Quartzite, Schist, Serpentinite, Slate

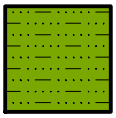


CHERT

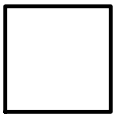


SANDSTONE
Sandstone, Orthoquarzite (Sandstone)

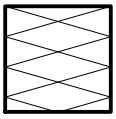
SHALE



SILTSTONE



NO RECOVERY



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BORING B3

DATE STARTED:	10/21/22	**DRILL COMPANY:**	South Slope
DATE COMPLETED:	10/21/22	**DRILLER:** LG	**LOGGED BY:** RDS
COMPLETION DEPTH	44.0 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	N/A	**SAMPLING METHOD:**	2-in SS
LATITUDE:	39.254398	**HAMMER TYPE:**	Automatic
LONGITUDE:	107.78312	**EFFICIENCY**	72%
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	BRJ

REMARKS:

Water		
	While Drilling	N/A feet
	Upon Completion	N/A feet
	Delay	N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0 25 50) STRENGTH, tsf ▲ Qu ✳ Qp (0 2.0 4.0)	Additional Remarks
	0			B3-1	18	Topsoil approximately 1 foot thick Dry, Brown, Medium Stiff to Very Stiff, **Sandy LEAN CLAY:**		4 - 7 - 8 N=15	9		
				B3-2	18			3 - 4 - 3 N=7	15		LL = 33 PL = 14
	5			B3-3	18			2 - 4 - 5 N=9	17		DD = 101 pcf
				B3-4	18			4 - 6 - 6 N=12	14		Fines=67.6%
	10			B3-5	12			4 - 6 - 8 N=14	19		LL = 29 PL = 10
				B3-6	10			4 - 5 - 6 N=11	17		DD = 92 pcf
	15			B3-7	10			3 - 4 - 4 N=8	14		Fines=69.2%
				B3-8	16			3 - 3 - 3 N=6	13		LL = 29 PL = 12
	20			B3-9	18		CL	3 - 4 - 6 N=10	15		DD = 98 pcf Fines=76.1%
				B3-10	18			3 - 3 - 4 N=7	11		Fines=59.7%
	25			B3-11	17			3 - 3 - 3 N=6	14		
				B3-12	16			3 - 5 - 4 N=9	10		
	30			B3-13	18			4 - 3 - 4 N=7	13		
				B3-14	16			6 - 7 - 12 N=19	9		
	35			B3-15	18			6 - 8 - 10 N=18	7		Fines=45.5%
				B3-16	18			5 - 4 - 4 N=8	13		Fines=60.9%
	40			B3-17	18			3 - 5 - 5 N=10	14		
				B3-18	18	Auger Refusal at approximately 42 feet 4 inches		3 - 4 - 6 N=10			
									16		

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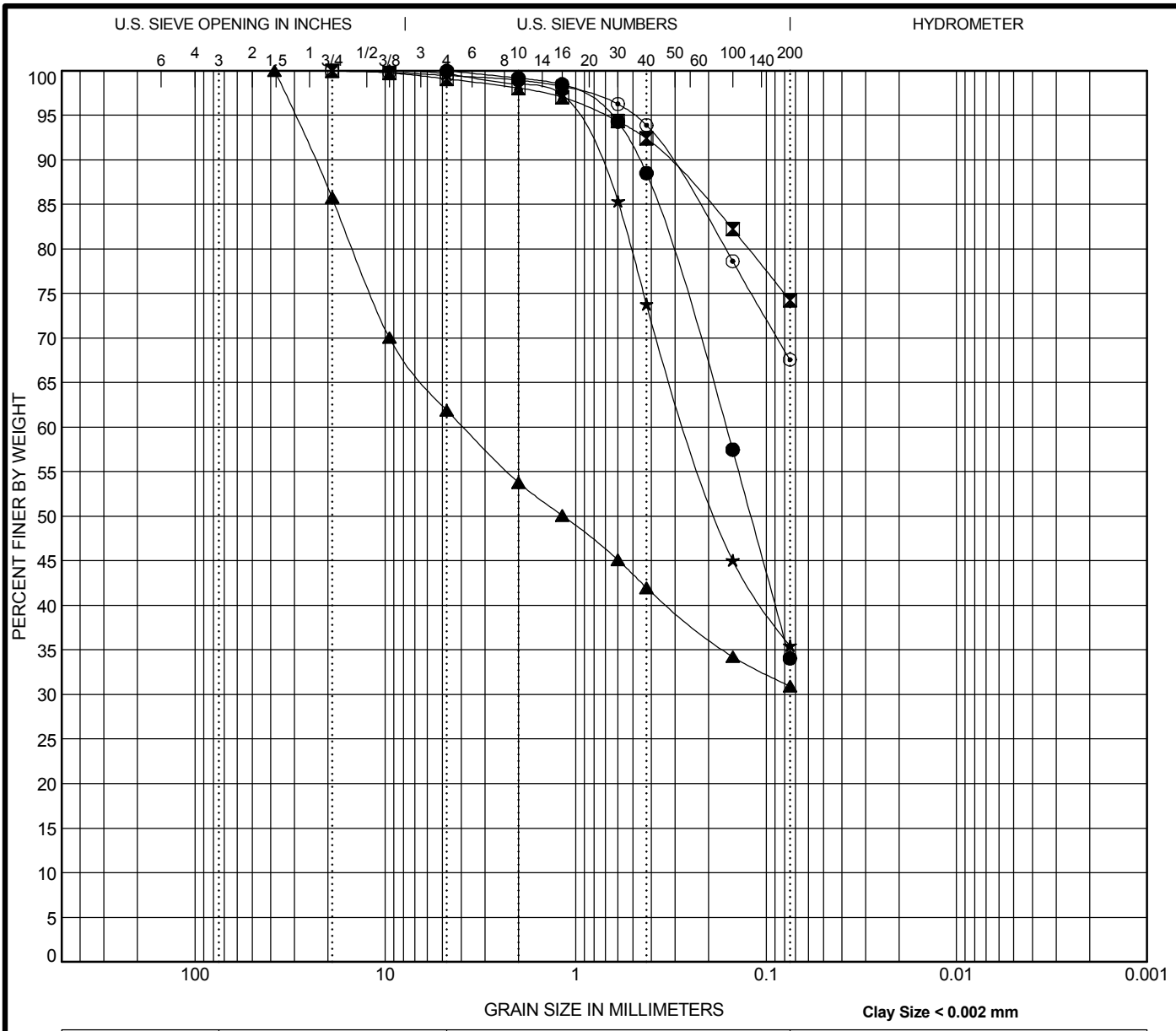
Professional Service Industries, Inc.
2779 South 600 West
Salt Lake City, UT 84115
Telephone: (801) 484-8827

PROJECT NO.: 07061900
PROJECT: Laramie Engergy -
LOCATION: Collbran, CO

The stratification lines represent approximate boundaries. The transition may be gradual.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	B1	5.0	Clayey SAND (SC)					
⊠	B2	0.0	Lean CLAY with Sand (CL)					
▲	B2	5.0	Clayey GRAVEL with Sand (GC)					
★	B2	20.0	Clayey SAND (SC)					
⊙	B3	7.5	Sandy LEAN CLAY (CL)					

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B1	5.0	4.75	0.163			0.0	65.9	34.1	
⊠	B2	0.0	19.05				0.9	24.8	74.3	
▲	B2	5.0	38.1	3.887			38.1	30.9	30.9	
★	B2	20.0	9.525	0.258			0.3	64.2	35.5	
⊙	B3	7.5	19.05				0.5	31.9	67.6	

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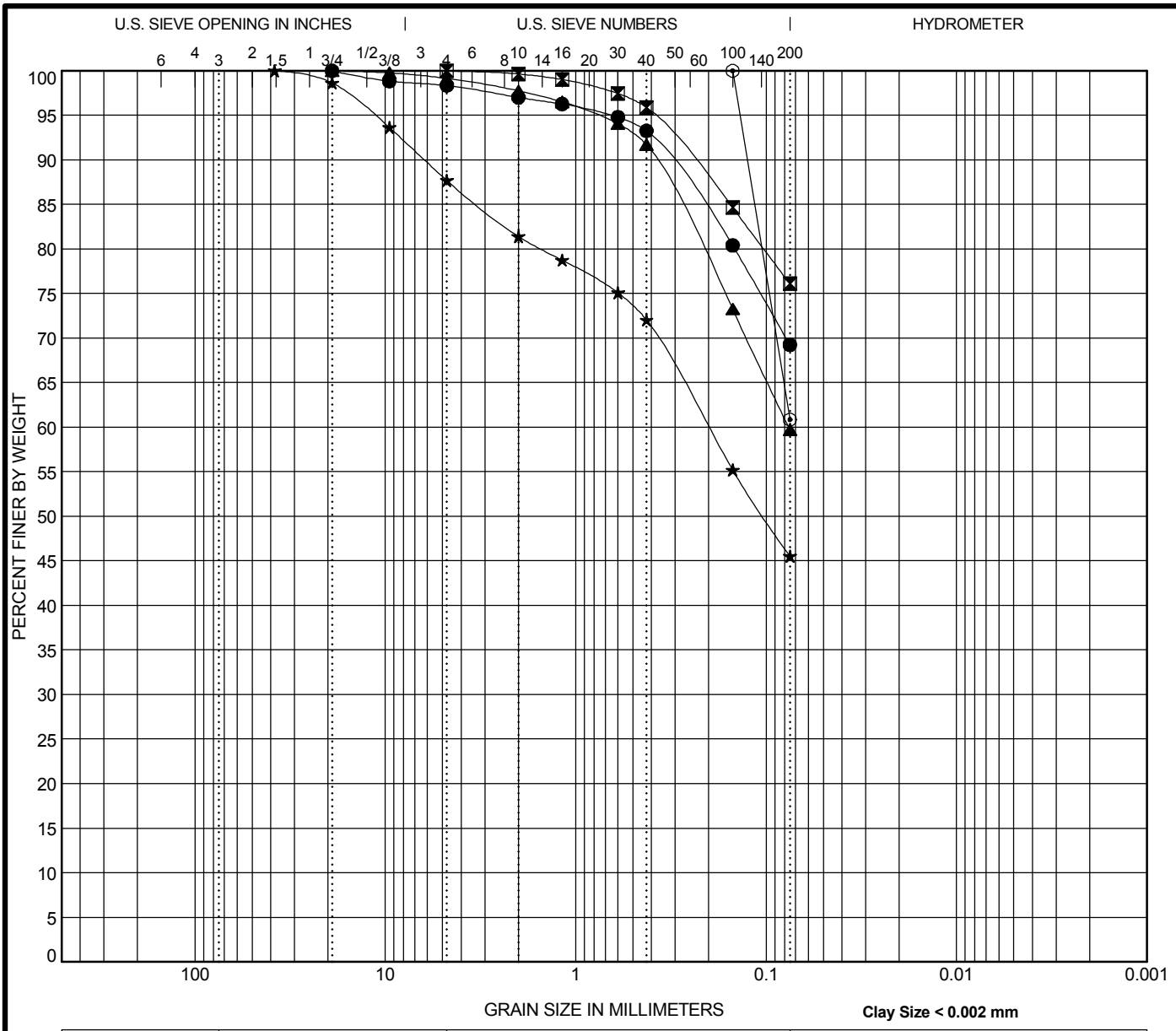
GRAIN SIZE DISTRIBUTION

Project: Laramie Energy
PSI Job No.: 07061900
Location: Collbran, CO



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	B3	15.0	Sandy LEAN CLAY (CL)					
⊠	B3	20.0	LEAN CLAY with Sand (CL)					
▲	B3	22.5	Sandy LEAN CLAY (CL)					
★	B3	35.0	Sandy LEAN CLAY (CL)					
⊙	B3	37.5	Sandy LEAN CLAY (CL)					

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B3	15.0	19.05				1.6	29.1	69.2	
⊠	B3	20.0	4.75				0.0	23.9	76.1	
▲	B3	22.5	19.05	0.076			0.9	39.4	59.7	
★	B3	35.0	38.1	0.202			12.3	42.2	45.5	
⊙	B3	37.5	0.15				0.0	39.1	60.9	

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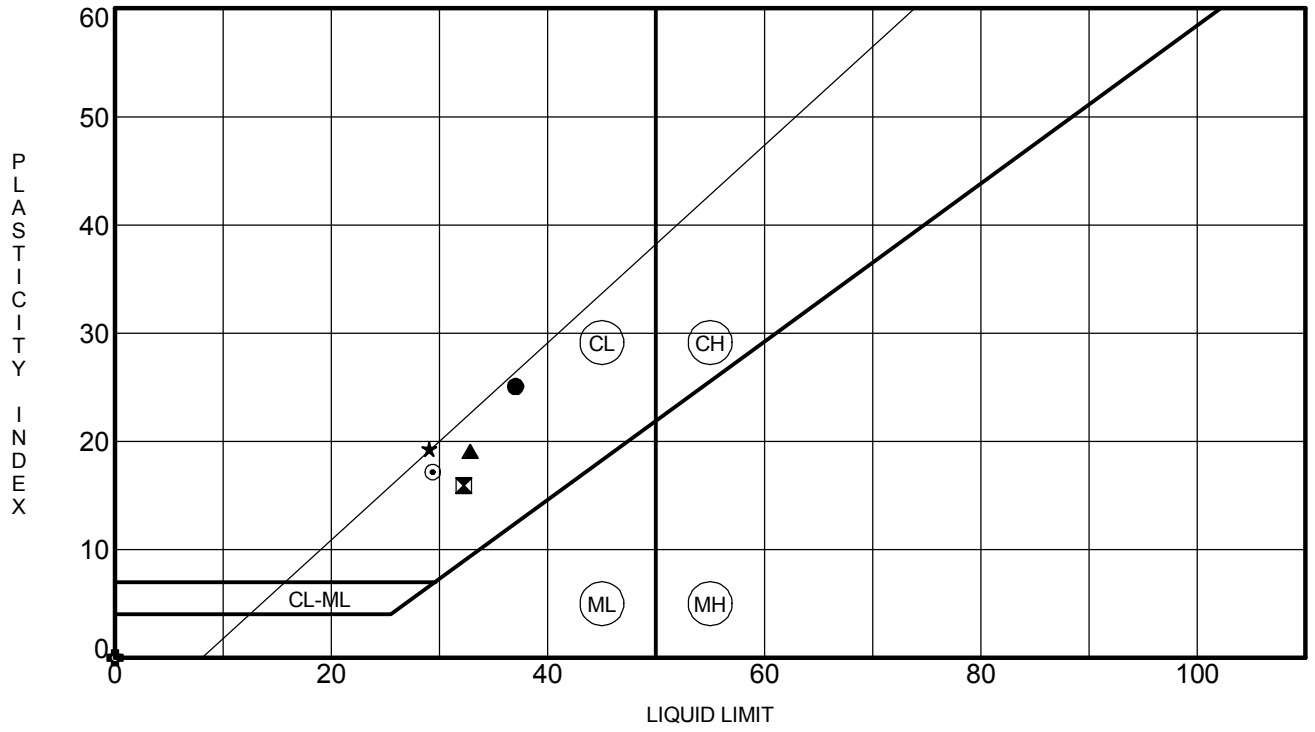
GRAIN SIZE DISTRIBUTION

Project: Laramie Energy -
PSI Job No.: 07061900
Location: Collbran, CO



	Boring	Depth (ft)	LL	PL	PI	MC	Classification (*Visual)
●	B1	0.0	37	12	25	15	Clayey SAND (SC)
⊠	B2	7.5	32	16	16	9	Clayey SAND (SC)
▲	B3	2.5	33	14	19	15	Lean CLAY (CL)
★	B3	10.0	29	10	19	19	Lean CLAY (CL)
⊙	B3	17.5	29	12	17	13	Lean CLAY (CL)
✿	B4	0.0	NP	NP	NP	13	Clayey SAND (SC)

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ATTERBERG LIMIT RESULTS

PSI Job No.: 07061900
Project: Laramie Energy -
Location: Collbran, CO

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(In general accordance with ASTM D6913 and ASTM D7928)

Project: Intertek - PSI
No: M00278-006 (07061900)
Location: Laramie Well Pad
Date: 12/13/2022
By: LM/RT/BRR/LM

Boring No.: B3-1
Sample: Grade
Depth: 0"
Description: Brown clay with sand

ASTM Standard(s)	ASTM D6913 and ASTM D7928
Split:	Yes
First Split sieve:	No.4
Second split:	No

	Moist	Dry
Total sample wt. (g):	660.06	652.12
+No.4 Coarse fraction (g):	1.49	1.49
-No.4 Split fraction (g):	117.76	116.34
Hydrometer fraction (g):	60.72	59.76
First Split fraction:	0.998	

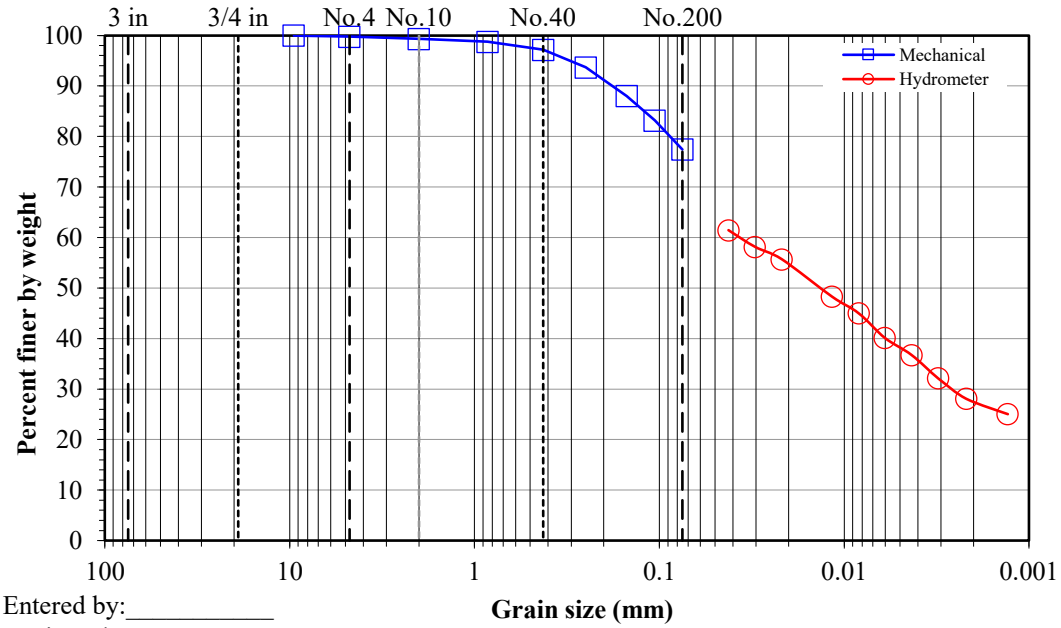
Water content data	C.F.1(+No.4)	S.F.1(-No.4)	Hyd.(-No.10)
Moist soil + tare (g):	23.68	239.32	77.49
Dry soil + tare (g):	23.68	237.90	76.64
Tare (g):	22.19	121.56	23.66
Water content (%):	0.00	1.22	1.60

Hydrometer data			
Hyd. split:	No.10		
Gs:	2.7	Assumed	
Bulb No.	7	Hyd. fraction:	99.34
Cylinder ID:	N35	Dispersion device:	Air-jet

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	
6"		150	-	
4"		100	-	
3"		75	-	
1.5"		37.5	-	
1"		25	-	
3/4"		19	-	
3/8"		9.5	100.0	
No.4	1.49	4.75	99.8	<=1st Split
No.10	0.50	2	99.3	<=Split hyd.
No.20	1.19	0.85	98.8	
No.40	3.06	0.425	97.1	
No.60	7.08	0.25	93.7	
No.100	13.71	0.15	88.0	
No.140	19.39	0.106	83.1	
No.200	26.02	0.075	77.5	

Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
1	21.8	42.0	0.0423	61.44
2	21.8	40.0	0.0304	58.16
4	21.8	38.5	0.0217	55.69
15	21.8	34.0	0.0116	48.29
30	21.8	32.0	0.0083	45.01
60	21.9	29.0	0.0060	40.13
120	21.7	27.0	0.0043	36.73
240	20.9	24.5	0.0031	32.16
500	21.0	22.0	0.0022	28.11
1440	21.4	20.0	0.0013	25.05

Gravel (%): 0.2
Sand (%): 22.3
Fines (%): 77.5



Entered by:_____
Reviewed:_____

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(In general accordance with ASTM D6913 and ASTM D7928)

Project: Intertek - PSI
No: M00278-006 (07061900)
Location: Laramie Well Pad
Date: 12/13/2022
By: RT/BRR/CJ

Boring No.: B3-3
Sample: 5
Depth: 5'
Description: Light brown clay with sand

ASTM Standard(s): ASTM D6913 and ASTM D7928
Split: No
Second split: No

	Moist	Dry
Total sample wt. (g):	122.55	120.99
Hydrometer fraction (g):	60.46	59.49

Water content data	S.F.	Hyd.(-No.10)
Moist soil + tare (g):	249.21	77.08
Dry soil + tare (g):	247.65	76.22
Tare (g):	126.66	23.40
Water content (%):	1.29	1.63

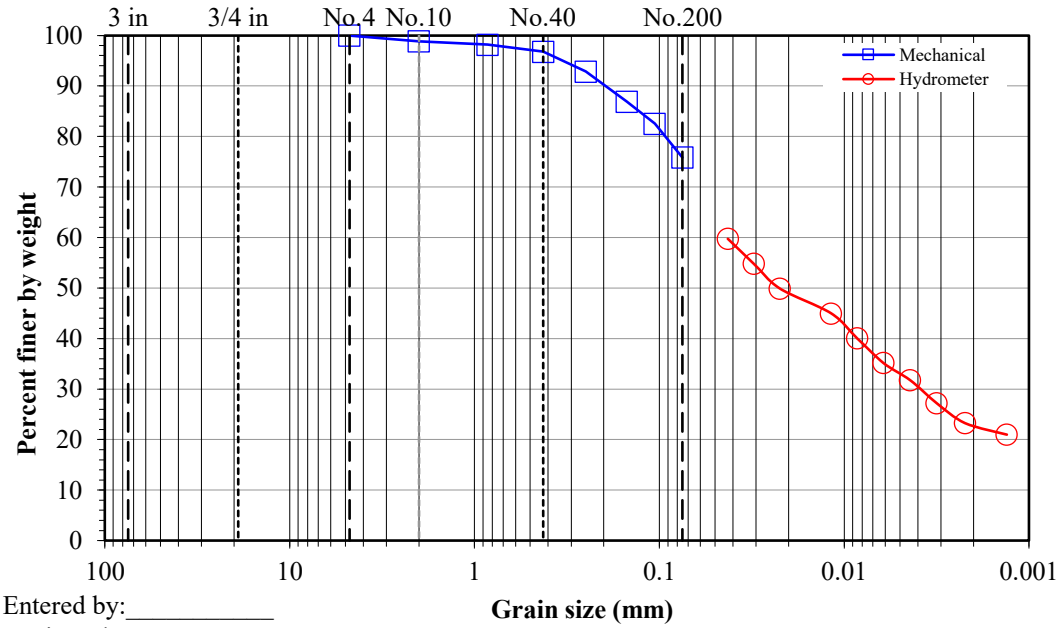
Hydrometer data
Hyd. split: No.10
Gs: 2.7 Assumed
Bulb No. 7 — Hyd. fraction: 98.84
Cylinder ID: 11 — Dispersion device: Air-jet

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
6"		150	-
4"		100	-
3"		75	-
1.5"		37.5	-
1"		25	-
3/4"		19	-
3/8"		9.5	-
No.4		4.75	100.0
No.10	1.40	2	98.8
No.20	2.24	0.85	98.1
No.40	3.88	0.425	96.8
No.60	8.65	0.25	92.9
No.100	15.85	0.15	86.9
No.140	21.12	0.106	82.5
No.200	29.22	0.075	75.8

<=Split hyd.

Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
1	21.8	41.0	0.0425	59.77
2	21.8	38.0	0.0308	54.84
4	21.8	35.0	0.0223	49.91
15	21.8	32.0	0.0118	44.98
30	21.8	29.0	0.0085	40.06
60	21.9	26.0	0.0061	35.19
120	21.7	24.0	0.0044	31.78
240	20.9	21.5	0.0032	27.21
500	21.2	19.0	0.0022	23.28
1440	21.5	17.5	0.0013	20.99

Gravel (%): 0.0
Sand (%): 24.2
Fines (%): 75.8



Entered by:_____
Reviewed:_____

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Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(In general accordance with ASTM D6913 and ASTM D7928)

Project: Intertek - PSI
No: M00278-006 (07061900)
Location: Laramie Well Pad
Date: 12/13/2022
By: LM/RT/BRR/LM

Boring No.: B3-12
Sample: 27.5
Depth: 27.5'
Description: Brown sandy clay

ASTM Standard(s)	ASTM D6913 and ASTM D7928
Split:	Yes
First Split sieve:	3/8"
Second split:	No

	Moist	Dry
Total sample wt. (g):	661.78	653.83
+3/8" Coarse fraction (g):	4.09	4.08
-3/8" Split fraction (g):	231.82	229.02
Hydrometer fraction (g):	61.07	60.27
First Split fraction:	0.994	

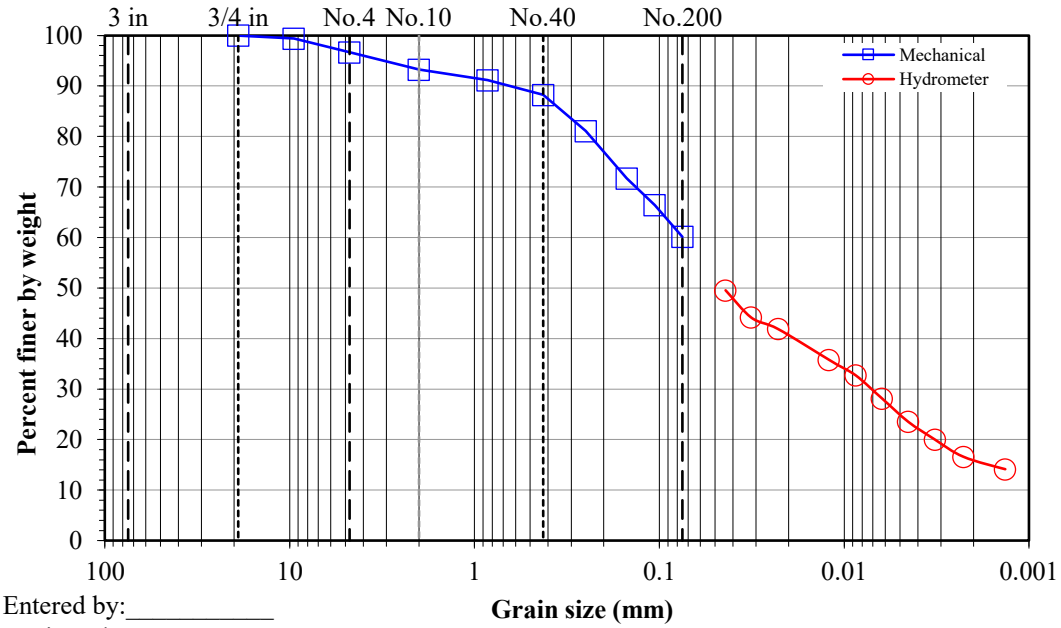
Water content data	C.F.1(+3/8")	S.F.1(-3/8")	Hyd.(-No.10)
Moist soil + tare (g):	29.19	351.98	85.46
Dry soil + tare (g):	29.18	349.18	84.65
Tare (g):	25.10	120.16	23.70
Water content (%):	0.25	1.22	1.33

Hydrometer data			
Hyd. split:	No.10		
Gs:	2.7	Assumed	
Bulb No.	7	Hyd. fraction:	93.27
Cylinder ID:	N3	Dispersion device:	Air-jet

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	
6"		150	-	
4"		100	-	
3"		75	-	
1.5"		37.5	-	
1"		25	-	
3/4"		19	100.0	
3/8"	4.08	9.5	99.4	<=1st Split
No.4	6.27	4.75	96.7	
No.10	14.08	2	93.3	<=Split hyd.
No.20	18.90	0.85	91.2	
No.40	25.66	0.425	88.2	
No.60	42.11	0.25	81.1	
No.100	63.82	0.15	71.7	
No.140	75.96	0.106	66.4	
No.200	90.42	0.075	60.1	

Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
1	21.8	37.0	0.0439	49.55
2	21.8	33.5	0.0319	44.19
4	21.8	32.0	0.0228	41.90
15	21.8	28.0	0.0121	35.78
30	21.8	26.0	0.0087	32.72
60	21.8	23.0	0.0062	28.13
120	21.8	20.0	0.0045	23.54
240	20.9	18.0	0.0032	19.99
500	21.7	15.5	0.0023	16.59
1440	21.4	14.0	0.0013	14.14

Gravel (%): 3.3
Sand (%): 36.5
Fines (%): 60.1



Entered by:_____
Reviewed:_____

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(In general accordance with ASTM D6913 and ASTM D7928)

Project: Intertek - PSI
No: M00278-006 (07061900)
Location: Laramie Well Pad
Date: 12/13/2022
By: BRR/RT

Boring No.: B3-13
Sample: 30
Depth: 30'
Description: Brown sandy clay

ASTM Standard(s)	ASTM D6913 and ASTM D7928
Split:	Yes
First Split sieve:	No.4
Second split:	No

	Moist	Dry
Total sample wt. (g):	696.27	689.49
+No.4 Coarse fraction (g):	4.44	4.42
-No.4 Split fraction (g):	93.09	92.18
Hydrometer fraction (g):	61.08	60.14
First Split fraction:	0.994	

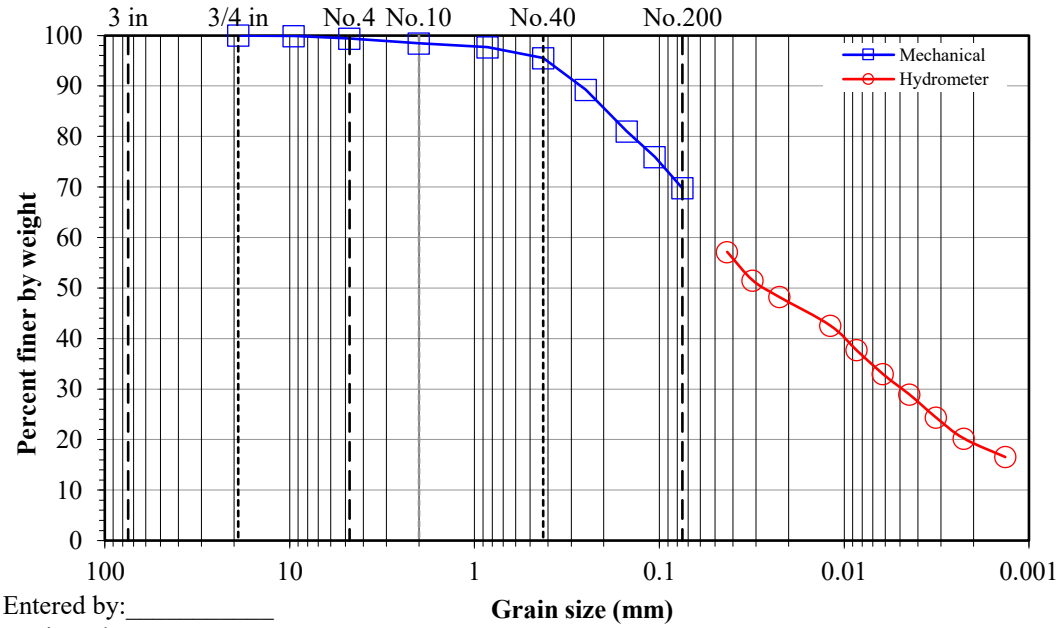
Water content data	C.F.1(+No.4)	S.F.1(-No.4)	Hyd.(-No.10)
Moist soil + tare (g):	42.33	220.81	78.17
Dry soil + tare (g):	42.31	219.90	77.33
Tare (g):	37.89	127.72	23.70
Water content (%):	0.45	0.99	1.57

Hydrometer data			
Hyd. split:	No.10		
Gs:	2.7	Assumed	
Bulb No.	7	Hyd. fraction:	98.44
Cylinder ID:	N34	Dispersion device:	Air-jet

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	
6"		150	-	
4"		100	-	
3"		75	-	
1.5"		37.5	-	
1"		25	-	
3/4"		19	100.0	
3/8"	0.98	9.5	99.9	
No.4	4.42	4.75	99.4	<=1st Split
No.10	0.85	2	98.4	<=Split hyd.
No.20	1.54	0.85	97.7	
No.40	3.58	0.425	95.5	
No.60	9.40	0.25	89.2	
No.100	17.00	0.15	81.0	
No.140	21.71	0.106	76.0	
No.200	27.44	0.075	69.8	

Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
1	21.6	40.0	0.0430	57.15
2	21.6	36.5	0.0312	51.49
4	21.6	34.5	0.0224	48.25
15	21.6	31.0	0.0119	42.59
30	21.6	28.0	0.0086	37.73
60	21.8	25.0	0.0062	32.99
120	21.8	22.5	0.0044	28.94
240	20.9	20.0	0.0032	24.38
500	22.1	17.0	0.0023	20.22
1440	21.4	15.0	0.0013	16.57

Gravel (%): 0.6
Sand (%): 29.6
Fines (%): 69.8



Entered by:_____
Reviewed:_____

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(In general accordance with ASTM D6913 and ASTM D7928)

Project: Intertek - PSI
No: M00278-006 (07061900)
Location: Laramie Well Pad
Date: 12/13/2022
By: LM/RT/BRR/LM

Boring No.: B3-18
Sample: 45
Depth: 45'
Description: Brown sandy silty clay

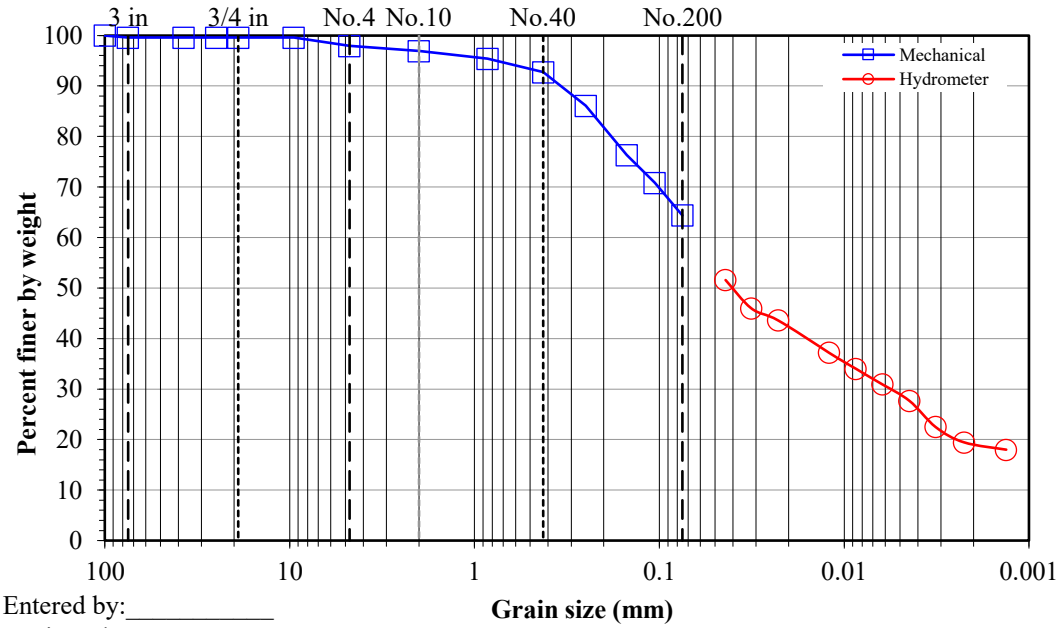
ASTM Standard(s)	ASTM D6913 and ASTM D7928	
Split:	Yes	
First Split sieve:	4"	
Second split:	No	
	Moist	Dry
Total sample wt. (g):	464.51	457.95
+4" Coarse fraction (g):	1.92	1.92
-4" Split fraction (g):	119.16	117.47
Hydrometer fraction (g):	60.96	60.01
First Split fraction:	0.996	

Water content data	C.F.1(+4")	S.F.1(-4")	Hyd.(-No.10)
Moist soil + tare (g):	26.80	259.02	84.79
Dry soil + tare (g):	26.80	257.33	83.83
Tare (g):	24.88	139.86	23.28
Water content (%):	0.00	1.44	1.59

Hydrometer data			
Hyd. split:	No.10		
Gs:	2.7	Assumed	
Bulb No.	7	Hyd. fraction:	96.91
Cylinder ID:	N33	Dispersion device:	Air-jet

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	
6"		150	-	
4"		100	100.0	<=1st Split
3"		75	99.6	
1.5"		37.5	99.6	
1"		25	99.6	
3/4"		19	99.6	
3/8"		9.5	99.6	
No.4	1.92	4.75	98.0	
No.10	3.15	2	96.9	<=Split hyd.
No.20	4.94	0.85	95.4	
No.40	8.05	0.425	92.8	
No.60	15.96	0.25	86.1	
No.100	27.41	0.15	76.3	
No.140	33.91	0.106	70.8	
No.200	41.50	0.075	64.4	

Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
1	21.6	37.0	0.0439	51.59
2	21.6	33.5	0.0318	46.01
4	21.6	32.0	0.0228	43.61
15	21.6	28.0	0.0121	37.22
30	21.6	26.0	0.0087	34.03
60	21.8	24.0	0.0062	30.95
120	21.7	22.0	0.0044	27.70
240	21.0	19.0	0.0032	22.51
500	21.2	17.0	0.0022	19.43
1440	21.5	16.0	0.0013	18.00



Gravel (%): 2.0
Sand (%): 33.6
Fines (%): 64.4

Comments:
These results are in nonconformance with ASTM D6913 and ASTM D7928 because the minimum dry mass was not met.

Entered by:_____
Reviewed:_____

APPENDIX B

Topsoil Sample Field Observations

&

Laboratory Analysis Results

SOIL SAMPLE AND PIT #1

Topsoil Depth	Munsell Color	Texture	Comments
0-24”	7.5 YR 2.5/2	Clay loam	Upper A horizon, roots present, crumb structure, organic content approximately 5% .
+24”	7.5 YR 3/2	Silty clay loam	Subtle lightening of soil near 24-inch depth. A change in soil texture, change in structure to sub-angular blocky, and reduced organic material to 3%.

Photo of Soil Sample and Pit #1

Soil Laboratory Analysis Results

Soil Sample #1 0-24 Inches Composite Soil Sample	
Parameter	**Results**
Texture	Loam
pH	6.7
EC (Conductivity) mmhos/cm	0.13
Nitrate-N KCI, ppm N	1.8
Nitrate-N, lbs N/Acre	13
Phosphorus Olsen P, ppm P	12.6
K- Potassium NH4OAc, ppm K	356
Sulfate M-3, ppm S	8.4
Zinc DTPA, ppm Zn	0.93
Iron DTPA, ppm Fe	40.0
Manganese DTPA, ppm Mn	7.5
Copper DTPA, ppm Cu	1.0
Calcium NH4OAc, ppm Ca	2415
Magnesium NH4OAc, ppm Mg	352
Sodium NH4OAc, ppm Na	7
Soil Organic Matter LOI, %	3.3
Boron Hot Water, ppm B	0.51
SAR	0.2

SOIL SAMPLE AND PIT #2

Topsoil Depth	Munsell Color	Texture	Comments
0-2”	7.5 YR 3/2	Clay loam	Upper A horizon, roots present, sub-angular blocky structure, organic content 10%.
3-13”	10 YR 3/3	Sandy clay loam	A change in soil color, texture, and reduced organic content to 5%.

Photo of Soil Sample and Pit #2

Soil Laboratory Analysis Results

Soil Sample #2 0-6 Inches Composite Soil Sample	
Parameter	**Results**
Texture	Sandy clay loam
pH	7.0
EC (Conductivity) mmhos/cm	0.15
Nitrate-N KCI, ppm N	8.1
Nitrate-N, lbs N/Acre	5
Phosphorus Olsen P, ppm P	25.7
K- Potassium NH4OAc, ppm K	574
Sulfate M-3, ppm S	11.7
Zinc DTPA, ppm Zn	1.0
Iron DTPA, ppm Fe	19.9
Manganese DTPA, ppm Mn	3.8
Copper DTPA, ppm Cu	0.81
Calcium NH4OAc, ppm Ca	2630
Magnesium NH4OAc, ppm Mg	195
Sodium NH4OAc, ppm Na	5
Soil Organic Matter LOI, %	5.0
Boron Hot Water, ppm B	0.82
SAR	0.1

SOIL SAMPLE AND PIT #3

Topsoil Depth	Munsell Color	Texture	Comments
0-27”	10 YR 3/3	Sandy clay loam	Upper A horizon, roots present, sub-angular blocky structure, organic content 5%.
+27”	10 YR 3/4	Clay loam	Subtle lightening of soil, a change in soil texture and lack of root structure.

Photo of Soil Sample and Pit #3

Soil Laboratory Analysis Results

Soil Sample #3 0-27 Inches Composite Soil Sample	
Parameter	
Texture	Sandy loam
pH	7.1
EC (Conductivity) mmhos/cm	0.06
Nitrate-N KCI, ppm N	1.8
Nitrate-N, lbs N/Acre	15
Phosphorus Olsen P, ppm P	7.6
K- Potassium NH4OAc, ppm K	162
Sulfate M-3, ppm S	4.4
Zinc DTPA, ppm Zn	0.56
Iron DTPA, ppm Fe	16.7
Manganese DTPA, ppm Mn	3.4
Copper DTPA, ppm Cu	0.56
Calcium NH4OAc, ppm Ca	1982
Magnesium NH4OAc, ppm Mg	177
Sodium NH4OAc, ppm Na	5
Soil Organic Matter LOI, %	1.8
Boron Hot Water, ppm B	0.31
SAR	0.1

SOIL SAMPLE AND PIT #4

Topsoil Depth	Munsell Color	Texture	Comments
0-6”	5 YR 3/2	Silty clay	Roots present, organic content 5%, crumb structure.
+6”	5 YR 3/3	Silty clay	Sub-angular blocky structure, organic content 2%.

Photo of Soil Sample and Pit #4

Soil Laboratory Analysis Results

Soil Sample #4 0-6 Inches Composite Soil Sample	
Parameter	**Results**
Texture	Clay loam
pH	7.8
EC (Conductivity) mmhos/cm	0.15
Nitrate-N KCI, ppm N	0.7
Nitrate-N, lbs N/Acre	4
Phosphorus Olsen P, ppm P	7.4
K- Potassium NH4OAc, ppm K	585
Sulfate M-3, ppm S	5.7
Zinc DTPA, ppm Zn	0.56
Iron DTPA, ppm Fe	23.4
Manganese DTPA, ppm Mn	5.1
Copper DTPA, ppm Cu	1.85
Calcium NH4OAc, ppm Ca	5201
Magnesium NH4OAc, ppm Mg	263
Sodium NH4OAc, ppm Na	8
Soil Organic Matter LOI, %	2.9
Boron Hot Water, ppm B	0.55
SAR	0.2

SOIL SAMPLE AND PIT #5

Topsoil Depth	Munsell Color	Texture	Comments
0-10”	7.5 YR 3/3	Silty clay	Upper A horizon, roots present, crumb structure, organic content 5%.
+10 inches	10 YR 4/3	Silty clay	A change in soil texture, lack of root structure, and reduced organic content was noted.

Photo of Soil Sample and Pit #5

Soil Laboratory Analysis Results

Soil Sample #5 0-6 Inches Composite Soil Sample	
Parameter	**Results**
Texture	Clay loam
pH	7.9
EC (Conductivity) mmhos/cm	0.16
Nitrate-N KCI, ppm N	1.5
Nitrate-N, lbs N/Acre	4
Phosphorus Olsen P, ppm P	7.3
K- Potassium NH4OAc, ppm K	246
Sulfate M-3, ppm S	7.5
Zinc DTPA, ppm Zn	0.64
Iron DTPA, ppm Fe	16.8
Manganese DTPA, ppm Mn	3.8
Copper DTPA, ppm Cu	1.17
Calcium NH4OAc, ppm Ca	4447
Magnesium NH4OAc, ppm Mg	318
Sodium NH4OAc, ppm Na	9
Soil Organic Matter LOI, %	3.6
Boron Hot Water, ppm B	0.56
SAR	0.1

APPENDIX C

TOPSOIL PROTECTION BEST MANAGEMENT PRACTICES

Short-term Stabilization

During initial clearing and grading activities, the following BMPs will be used:

- Protection from Contamination - based on changes in physical characteristics (e.g., organic content, color, texture, density, or consistency) soil horizons will be segregated and stockpiled separately; topsoil stockpiles will be separated by compacted earthen berms, sediment control logs, straw bale barriers, etc.; and stabilizing stockpile surfaces to control for erosion and sedimentation;
- Protection from Compaction - topsoil stockpiles will be indicated on site with signage; stockpiles will be placed in areas away from vehicle and equipment traffic; and when stockpiling, compaction will be minimized by limiting the number of equipment passes, limiting stockpile height, and using vegetation;
- Protection from Wind Erosion - surface roughening, applying hydro-seed/mulch, using soil tackifier, covering stockpiles with rolled erosion control products or other similar measures;
- Protection from Water Erosion - surface roughening, applying hydro-seed/mulch, using soil tackifier, covering stockpiles with rolled erosion control products or other similar measures; and
- Weed Establishment Prevention - mechanical, biological, and chemical controls will be used to prevent the establishment of weeds.
- Laramie will implement and adhere to the Mesa County Noxious Weed Management Plan for this location.

Long-term Stabilization

Interim Reclamation: Upon interim reclamation the area not needed for the Production Pad surface will be graded and recontoured. Topsoil will be spread across the interim reclaimed area. The following BMPs will be used during interim reclamation:

- The seed bed will be prepared on all topsoil areas. The top 12 to 18 inches of soil will be decompacted by one of the following practices: scarification, tillage, disking, chisel plowing, cultipacking, or harrowing.
- Areas not needed for the Production Pad surface will be seeded with an appropriate native seed mix.
- Protection from Wind Erosion - surface roughening, applying hydro-seed/mulch, using soil tackifier, covering stockpiles with rolled erosion control products or other similar measures;

- Protection from Water Erosion - surface roughening, applying hydro-seed/mulch, using soil tackifier, covering stockpiles with rolled erosion control products or other similar measures; and
- Weed Establishment Prevention - mechanical, biological, and chemical controls will be used to prevent the establishment of weeds.
- Laramie will implement and adhere to the Mesa County Noxious Weed Management Plan for this location.

Final Reclamation: During final reclamation of the well pad all topsoil will be stripped and stockpiled separately during final grading and recontouring of the well pad. The BMPs listed above for Short-term Stabilization and during interim reclamation will be implemented for final reclamation activities.