Alton Coal Development, LLC
463 North 100 West, Suite 1
Cedar City, Utah 84720
Phone (435) 867-5311 Fax (435) 867-1192

C/025/0005
Received 2/11/20
Task #6066

Steve Christensen
Coal Program Manager
Oil, Gas & Mining
1594 West North Temple, Suite 1210
Salt Lake City, UT 84114-5801

Re: **Coal Hollow Mine addition of Appendix 9-1, Alton Coal Development, LLC, Coal Hollow Mine, Kane County, Utah, C/025/0005**

Dear Mr. Christensen:

Alton Coal Development, LLC (ACD) is submitting the attached Appendix 9-1 containing information collected in 2018 prior to removal of prime farmland soils in Area 2 of the North Private Lease. Also included is a marked copy of the text of Chapter 9 of the MRP with changes referencing the addition of Appendix 9-1.

Changes to the MRP associated with this amendment have been uploaded to the DOGM's server for review. Upon approval, 2 (two) clean hard copies of the text and certified drawings for insertion into the MRP will be submitted. Please do not hesitate to contact me if you have any questions 435-691-1551.

Very truly yours,

B. Kirk Nicholes
Environmental Specialist
Alton Coal Development

APPLICATION FOR COAL PERMIT PROCESSING

Permit Change ☒ New Permit ☐ Renewal ☐ Exploration ☐ Bond Release ☐ Transfer ☐

Permittee: Alton Coal Development, LLC
Mine: Coal Hollow Mine **Permit Number:** C/025/0005
Title: Addition of Appendix 9-1

Description. Include reason for application and timing required to implement:
Addition of soil information for North Private Lease prime farmland

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

☐ Yes ☒ No 1. Change in the size of the Permit Area? Acres: _____ Disturbed Area: _____ ☐ increase ☐ decrease.
☐ Yes ☒ No 2. Is the application submitted as a result of a Division Order? DO# _____
☐ Yes ☒ No 3. Does the application include operations outside a previously identified Cumulative Hydrologic Impact Area?
☐ Yes ☒ No 4. Does the application include operations in hydrologic basins other than as currently approved?
☐ Yes ☒ No 5. Does the application result from cancellation, reduction or increase of insurance or reclamation bond?
☐ Yes ☒ No 6. Does the application require or include public notice publication?
☐ Yes ☒ No 7. Does the application require or include ownership, control, right-of-entry, or compliance information?
☐ Yes ☒ No 8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?
☐ Yes ☒ No 9. Is the application submitted as a result of a Violation? NOV # _____
☐ Yes ☒ No 10. Is the application submitted as a result of other laws or regulations or policies?
Explain: _____
☐ Yes ☒ No 11. Does the application affect the surface landowner or change the post mining land use?
☐ Yes ☒ No 12. Does the application require or include underground design or mine sequence and timing? (Modification of R2P2)
☐ Yes ☒ No 13. Does the application require or include collection and reporting of any baseline information?
☐ Yes ☒ No 14. Could the application have any effect on wildlife or vegetation outside the current disturbed area?
☒ Yes ☐ No 15. Does the application require or include soil removal, storage or placement?
☐ Yes ☒ No 16. Does the application require or include vegetation monitoring, removal or revegetation activities?
☐ Yes ☒ No 17. Does the application require or include construction, modification, or removal of surface facilities?
☐ Yes ☒ No 18. Does the application require or include water monitoring, sediment or drainage control measures?
☐ Yes ☒ No 19. Does the application require or include certified designs, maps or calculation?
☐ Yes ☒ No 20. Does the application require or include subsidence control or monitoring?
☐ Yes ☒ No 21. Have reclamation costs for bonding been provided?
☐ Yes ☒ No 22. Does the application involve a perennial stream, a stream buffer zone or discharges to a stream?
☐ Yes ☒ No 23. Does the application affect permits issued by other agencies or permits issued to other entities?
☐ Yes ☒ No 24. Does the application include confidential information and is it clearly marked and separated in the plan?

Please attach three (3) review copies of the application. If the mine is on or adjacent to Forest Service land please submit four (4) copies. thank you. (These numbers include a copy for the Price Field Office)

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

B. Kirk Nicholes	Environmental Specialist	12/13/2019	B Kirk Nicholes
Print Name	Position	Date	Signature (Right-click above choose certify then have notary sign below)

Subscribed and sworn to before me this 13th day of December 2019

Notary Public: Megan Wagner State of Utah. County of Iron

My commission Expires: Oct. 2, 2023
Commission Number: 708538
Address: 377 N. Main St.
City: Cedar City State: UT Zip: 84721

ss:

MEGAN WAGNER
Notary Public - State of Utah
Comm. No. 708538
My Commission Expires on
Oct 2, 2023

For Office Use Only:	Assigned Tracking Number:	Received by Oil, Gas & Mining

Form DOGM- C1 (Revised December 10, 2007)

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

Permittee: Alton Coal Development, LLC
Mine: Coal Hollow Mine
Permit Number: C/025/0005
Title: Addition of Appendix 9-1

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

			DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED
☐ Add	☒ Replace	☐ Remove	Chapter 9
☒ Add	☐ Replace	☐ Remove	Chapter 9, Appendix 9-1
☐ Add	☐ Replace	☐ Remove	
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Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.	Received by Oil, Gas & Mining

R645-302-200. Special Categories of Mining

200 INTRODUCTION

In this section, the Alton Coal Project will present the requirements for information to be included in the permit application to conduct coal mining and reclamation operations for designated special categories of mining and present procedures to process said permit application.

R645-302-240 AUGER MINING AND REMINING OPERATIONS.

Prior to 2014, coal mining operations at the Coal Hollow Mine were performed using conventional surface mining (open pit) techniques. Beginning in 2014, ACD began using highwall mining techniques in selected portions of the mine permit area in addition to conventional open pit techniques. Mining operations in the North Private Lease area will be performed using both conventional open-pit surface mining techniques and highwall mining techniques.

Highwall mining operations will be performed at the Coal Hollow Mine using a remotely operated highwall mining machine. Access to the Smirl coal seam will be made where the coal seam is exposed in the highwalls of pit mining areas. Typically, the remote highwall mining machine will be used to drive a series of parallel holes into the coal seam that will be up to 1,000 feet in length and 12 feet wide. As the highwall mining operation progresses, the coal excavated by the highwall miner is conveyed via an auger type mechanism to the surface. The mined coal is then transported by truck to the coal stockpiling and loadout area. Areas of un-mined coal approximately 12 to 15 feet wide (web pillars) will be left between individual highwall mining holes to guarantee stability and support the mine roof and eliminate subsidence at the land surface. Additionally, between every 10 holes (panel), a more substantial un-yieldable barrier pillar of coal (approximately 30 feet wide) will be left in place effectively isolating each adjacent panel. Because web pillars and barrier pillars are left in place for ground control and stabilization, the overall coal recovery rate is less than that achieved using conventional open pit mining techniques.

241.100 Due Diligence Investigation

As required under R645-302-240, the purpose of this this due diligence investigation is to identify potential environmental and safety problems related to prior mining activity at the site and that could be reasonably anticipated to occur. The identification is based on this due diligence investigation which includes visual observations at the site, a record review of past mining at the site, and environmental sampling tailored to current site conditions.

Visual observations have been made at the North Private Lease and adjacent area by Petersen Hydrologic, LLC personnel during numerous site visits since 2005. During these site visits,

Petersen Hydrologic found no visual indications of the presence of past mining within the North Private Lease or areas immediately bordering the lease. Additionally, during conversations with residents and landowners from the Alton Town area, there were no indications of past mining at the North Private Lease.

A record review was performed to investigate whether there are records of prior mining activity in the North Private Lease. Information from the Utah Geological Survey (Doelling, 1972) was obtained and reviewed. Additional information on historic mining operations in the vicinity of the North Private Lease area was obtained from Tilton (2001). Information from the United States Geological Survey, Alton, Utah 7.5-minute quadrangle was also obtained and reviewed. It is apparent that historically there were some small-scale underground coal mining operations in the area surrounding the North Private Lease. However, there are no records in these sources of past mining within the North Private Lease boundaries. Information obtained and reviewed from the U.S. Bureau of Land Management (2015) indicates that there are no coal leases within the area (other than the existing Coal Hollow Mine lease). The BLM (2015a) also indicates that in the past, 31 coal leases have been issued, but no mining ever occurred before termination or expiration of the leases. The BLM is currently processing a lease to mine coal in the Alton coal field adjacent to the Coal Hollow Mine area.

As described throughout the Coal Hollow Mine MRP, extensive environmental sampling has been performed on and adjacent to the North Private Lease. This includes the collection of hydrologic sampling data from streams, springs, and wells, geologic sampling data obtained during drilling and field mapping activities, soils sampling data, vegetation sampling data, and other related information. Through this environmental sampling and associated scientific analysis, which has been tailored to current site conditions, a comprehensive characterization of the environmental characteristics at the North Private Lease has been developed.

241.200

Based on the findings of this due diligence investigation (the absence of prior mining activity in the North Private Lease), we do not identify any significant environmental or safety problems related to prior mining activity at the site that could be reasonably anticipated to occur. Thus, no mitigative measures in this regard are proposed.

It should be noted that while no prior mining activity has been identified within the North Private Lease area, a deep well was drilled by Nevada Power in 1961 within the North Private Lease area. This well, which is identified as the Nevada Power #1 Well, is a large-diameter well that was drilled by Nevada Power in 1961 to a depth of 1,600 feet into the upper Navajo Sandstone geologic formation. The well was drilled to evaluate the groundwater production potential from the Navajo Sandstone aquifer in the area. Additionally, two shallow monitoring wells (Y-103 and Y-70) were installed within the North Private Lease area during a previous unsuccessful coal mine permitting activity by Utah International, Inc. in the mid-1980s. Well Y-103 is completed in the alluvial groundwater system and well Y-70 is completed in the Smirl coal seam. These wells will be appropriately managed as required during mining and reclamation operations to prevent damage to the environment.

302-242

Information describing the proposed highwall mining locations and mining methods to be used at the Coal Hollow Mine (including the North Private Lease) is provided here and in Chapter 5 of the Coal Hollow Mine MRP. A description of the measures to be used to comply with R645-302-244 and R645-302-245 are presented below.

302-244

The plan for the proposed highwall mining at the Coal Hollow Mine, including the North Private Lease, has been designed to maximize the utilization, recoverability, and conservation of the solid-fuel resource. The proposed highwall mining activities have also been designed to protect against adverse water-quality impacts.

302-245. Performance Standards.

245.100. Coal Recovery.

245.110

The highwall mining activities at the Coal Hollow Mine, including those at the North Private Lease, will be conducted so as to maximize the utilization and conservation of the coal, while utilizing the best technology currently available to maintain environmental integrity so that reaffecting the land in the future through coal mining and reclamation operations is minimized. By using highwall mining techniques, the coal resource can be extracted from an above-ground surface location without causing disturbance of the land surface overlying coal extraction areas. Because of the hydrogeologic characteristics of the Tropic Shale bedrock present above the coal seam to be mined, highwall mining operations can be performed without disruption of overlying shallow alluvial groundwater systems or surface water resources. It is noted that the coal recovery percentage typically obtained using highwall mining methods is not as great as that obtained using typical surface mining techniques (open pits). Consequently, as approved by the Division and as shown in Drawings 5-9 and 5-52, highwall mining techniques will be employed in those areas where the overburden thickness is large or in areas where there are sensitive environmental conditions overlying the coal seam that could be impacted using conventional pit mining techniques.

245.120.

The highwall mining has been planned to maximize the recoverability of the coal reserves remaining after the mining and reclamation has been completed. As shown in Drawings 5-9 and 5-52 and also as required by the Division, the highwall mining will be conducted so as to leave undisturbed coal in place that will allow for future underground coal mining and reclamation activities after the mining is completed, unless the coal reserves have been depleted or are so limited in thickness or extent that it will not be practical to recover the remaining coal. All underground reserves located to the east of the current private leases will be readily accessible for extraction should leases become available.

245.200. Hydrologic Balance.

Auger mining and remining operations will be conducted to minimize disturbances to the prevailing hydrologic balance.

Using highwall mining techniques, the coal resource can be extracted from an above-ground surface location without causing disturbance of the land surface overlying coal extraction areas. Additionally, because of the hydrogeologic characteristics of the Tropic Shale bedrock unit present above the coal seam to be mined, highwall mining operations may be performed without disrupting overlying shallow alluvial groundwater systems or sensitive surface environments.

The highwall mining holes are planned to exist entirely within the Smirl coal seam. Appreciable excavation of the Dakota Formation underlying the Smirl coal seam or the Tropic Shale bedrock overlying the coal seam is not anticipated. To minimize the possibility that highwall mining holes could come into hydraulic communication with overlying alluvial groundwater systems, the highwall mining plan specifies that a minimum thickness of undisturbed Tropic Shale bedrock shall be present above the coal seam in highwall mining areas. The required thickness of Tropic Shale will be based on site specific engineering considerations, but the holes will be planned to maintain at least a 10 ft. thickness of Tropic Shale overlying the highwall mining holes to maintain a low-permeability barrier between the mining holes and overlying groundwater systems.

The highwall mining plan at the Coal Hollow Mine has been designed to minimize the potential for adverse impacts to water quality. The proposed highwall mining holes in the North Private Lease area have been designed to minimize the potential for groundwater discharge. Highwall holes that originate in regions west of Kanab Creek will be advanced down-dip (toward the west). In the event that groundwaters were to flow into the mined highwall holes, the intercepted water would tend to accumulate in the down-dip, distal portions of the holes rather than flowing toward the up-dip surface locations. Because the highwall holes will be sealed and the highwall trenches will be backfilled and reclaimed when mining in the area is complete, water that could potentially accumulate in the holes should remain in the holes after reclamation and not enter into actively flowing groundwater or surface-water systems.

Auger holes (highwall holes) will be sealed within 72 hours after completion with an impervious and noncombustible material if the holes are discharging water containing acid- or toxic-forming material. If sealing is not possible within 72 hours, the discharge will be treated within 72 hours after completion to meet applicable effluent limitations and water-quality standards until the holes are sealed. If the holes are not discharging water containing acid- or toxic-forming material, the holes will be sealed as contemporaneously as practicable with the augering operation.

245.300. Subsidence Protection

In those portions of the Coal Hollow Mine that will be mined using highwall mining techniques, surface disturbance above highwall mined areas is not anticipated. The highwall mining plan has been designed and engineered (see Appendix 5-8) to prevent subsidence of the land surface overlying highwall mined areas. It has been the experience at the existing south area of the Coal Hollow Mine under similar geologic conditions that subsidence of the land surface above highwall mined areas has not occurred and impacts to overlying shallow alluvial groundwaters that could be attributable to highwall mining activities have not been observed during rigorous monitoring of nearby springs and wells. Accordingly, impacts to overlying shallow alluvial groundwater systems and surface-water systems, including increases in sediment yield in areas overlying highwall mined areas in the North Private Lease area are not anticipated.

245.400 Backfilling and Grading

245.410

Highwall mining operations will be conducted in accordance with the backfilling and grading requirements and plans detailed in Chapter 5 sections 537.200 and 553.

245.420.

Remining activities are not proposed at the North Private Lease.

245.500. Protection of Underground Mining.

As shown on Drawings 5-9 and 5-52, highwall miner holes will not extend closer than 500 feet (measured horizontally) to any abandoned or active underground mine workings, except as approved in accordance with R645-301-513.700 and R645-301-523.200.

R645-302-316 Issuance of Permit

A permit to conduct coal mining and reclamation operations that include mining and reclamation on designated special areas of prime farmland may be granted by the Division, if it first finds, in writing, upon the basis of a complete application, that:

316.100. The approved proposed postmining land use of these prime farmlands will be cropland;

The planned post mining land use for all prime farmlands disturbed during mining will be for the same agricultural use as prior to mining.

316.200. The permit incorporates as specific conditions the contents of the plan submitted under R645-302-314, after consideration of any revisions to that plan suggested by the State Conservationist under R645-302-315.300;

316.300. The applicant has the technological capability to restore the prime farmland, within a reasonable time, to equivalent or higher levels of yield as nonmined prime farmland in the surrounding area under equivalent levels of management; and

316.400. The proposed coal mining and reclamation operations will be conducted in compliance with the requirements of R645-302-317 and other environmental protection performance and reclamation standards for mining and reclamation of prime farmland of the State Program.

316.500. The aggregate total prime farmland acreage shall not be decreased from that which existed prior to mining. Water bodies, if any, to be constructed during mining and reclamation operations must be located within the post-reclamation non-prime farmland portions of the permit area. The creation of any such water bodies must be approved by the Division and the consent of all affected property owners within the permit area must be obtained.

The post mining topography of the prime farmland acreage does increase the slope in some areas, thus utilizing the K factor values found in Appendix C of the Supplemental Report Volume 11, and the greatest potential slope from Drawing 5-74 North Area Post Mining Topography an Erodibility Factor can be calculated for the reclaimed prime farmland area. As can be seen in the table that follows the erodibility factor for prime farmland soils would be well below 2 with the highest value occurring in the C horizon at 1.76. The erodibility factors in the A horizon at the surface would be expected to be a maximum of 0.87.

Reclaimed Prime Farmland and Soils of State Wide Importance
Weighted Average Erodibility Factor

	Soil Type	Sample ID	Begin Depth cm	End Depth cm	K Factor1 Lab Calc.	Horizon	Horizon Depths inches	Weighted Ave. K Factor	Maximum Reclaim Slope2 %	Erodibility Factor
Prime Farmland	G	DP-29	0.00	20.32	0.18	A-horizon	0-8	0.18	2.3	0.41
			20.32	24.00	0.18	B-horizon	8-45	0.27	2.3	0.62
			24.00	52.00	0.23					
			52.00	72.00	0.27					
			72.00	97.00	0.26					
			97.00	114.30	0.31					
			114.30	119.38	0.31	C-horizon	45-47	0.31	2.3	0.71
Soils of Statewide Importance	E	12AS020	0.00	13.00	0.13	A-horizon	0-6	0.15	4.3	0.63
			13.00	15.00	0.25					
			15.00	30.00	0.25	B-horizon	6-44	0.28	4.3	1.22
			30.00	80.00	0.29					
			80.00	96.50	0.3					
			96.52	111.76	0.3	C-horizon	44-48	0.31	4.3	1.32
			111.76	121.92	0.32					
	E	12AS025	0.00	12.00	0.19	A-horizon	0-6	0.20	4.3	0.87
			12.00	15.24	0.25					
			15.24	30.00	0.25	B-horizon	6-44	0.41	4.3	1.74
			30.00	70.00	0.38					
			70.00	101.00	0.51					
			101.00	111.76	0.41					
			111.76	121.92	0.41	C-horizon	44-48	0.41	4.3	1.76

1 K Factor from MRP Volume 1, Appendix C Analytical Results

2 Maximum Reclaim Slope percentage as determined from Drawing 5-74 Post Mining Topography

All planned water bodies will be constructed during or following mining in non-prime farmland portions of the permit area.

R645-302-317 Prime Farmland Performance Standards

317.100 Scope and Purpose

317.200 Responsible Agencies

The Natural Resources Conservation Service and UDOGM will consult with ACD on Prime Farmland areas within the North Private Lease mine permit area.

R645-302-315 makes clear that the authority with regard to prime farmland soils is the Secretary of Agriculture through the Utah NRCS State Soil Conservationist. The Division has initiated consultation with the State Conservationist per R645-301-315.100 and R645-301-315.200. Prior to approval, the State Conservationist is required to review and comment on the details of the proposed plan.

317.210 Prime Farmland Specifications

The NRCS within Utah will establish specifications for prime farmland soil removal, storage, replacement, and reconstruction.

The Division is in consultation with the NRCS State Conservationist to determine the preferred Prime Farmland soil-reconstruction. That coordinated review is ongoing and the recommendations made by the NRCS will be incorporated into the mining plan.

317.220 Implementation of Prime Farmland Specifications

UDOGM will use the soil-reconstruction specifications established by the NRCS to carry out its responsibilities in accordance with R645-302-310 through R645-302-~~311~~ 316 and R645-302-316 and R645-301-800.

317.300 Applicability

The requirements of the R645-302-317 will not apply to prime farmland that has been excluded in accordance with R645-302-311 and R645-302-312.

The current Coal Hollow mine was permitted after August 3, 1977.

317.400 Soil Removal and Stockpiling

Soil will be removed from Prime Farmland areas by horizon (A, B, and C) and stockpiled separately by landowner. Estimated salvage depths for the A, B, and C horizons for soil map units in the Prime Farmland areas can be found in Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the*

Coal Hollow Mine (November 2014).

Soil samples will be collected from the Prime Farmland areas prior to salvaging to a depth of 48 inches and analyzed by horizons for pH, density, sodium adsorption ratio (SAR), conductivity (ECe), texture, and available water capacity. Sample locations will be approximately one per 2 acres. Horizon samples will be limited to depths of approximately 12 inches. Additional analysis parameters may be included after consultation with UDOGM and the NRCS. Prime Farmland soil samples were collected June 5 and August 16, 2018, data from the required analysis can be found in Appendix 9-1.

317.410 Timing

Prime farmland soils will be removed from the areas to be disturbed before drilling, blasting, or mining. ACD will minimize prime farmland soil removal and stockpiling activities during periods of soil saturation following storm events or spring runoff.

317.420 Salvage Depth of Prime Farmland Soils

The minimum depth of soil and substitute soil material to be reconstructed will be 48 inches, or a lesser depth equal to the depth to a subsurface horizon in the natural soil that inhibits or prevents root penetration, or a greater depth if determined necessary to restore the original soil productive capacity.

Table 13 in Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014) details the estimated total salvage depths for Prime Farmland soil map unit. It is anticipated that the salvage depths of B and C horizons in adjacent Prime Farmland soil map units can be increased in order to achieve a minimum final reclamation soil profile depth of 48 inches. The estimated average soil depth that can be salvaged from soil map units A1, A2, N and D is limited by the depth to Tropic shale.

317.430 Soil Removal and Stockpiling

Soil removal and stockpiling will be conducted to:

317.431 Separate Removal and Stockpiling of Topsoil

The A horizon or topsoil in Prime Farmland areas will be removed and stockpiled separately by landowner in a manner that will create a final soil having a greater productive value than prior to mining. It is anticipated that the duration of stockpiling Prime Farmland topsoil will be of short duration, since the Prime Farmland areas are at the north end of the proposed mining sequence. Estimated average salvage depths of the A horizon or topsoil in Prime Farmland areas is detailed in Table 13 in Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014).

317.432 Separate Removal and Stockpiling of B and C horizons

Removal and stockpiling of all Prime Farmland soil horizons will be directly monitored by a Certified Professional Soil Scientist.

The B and C horizons will be removed and stockpiled separately by landowner in a manner that will create a final soil having a greater productive value than prior to mining. It is anticipated that the duration of stockpiling Prime Farmland B and C soil horizons will be of short duration, since the Prime Farmland areas are at the north end of the proposed mining sequence. Estimated average salvage depths of the B and C horizons in Prime Farmland areas is detailed in Table 13 in Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014).

The C horizon will be stockpiled and stockpiled as B horizon soil, if the depth of C horizon soil to be stockpiled is less than 6 inches. It is anticipated that this consolidation of materials will not diminish the quality of the B horizon.

C horizon materials will primarily consist of soils with pH greater than 8.5.

317.440 Protection of Prime Farmland Stockpiles

Stockpiles of salvaged soil from the A, B, and C horizons will be placed at locations within the permit area where they will not be disturbed or be subject to excessive erosion. If left in place for more than 30 days, stockpiles will meet the requirements of R645-301- 232, R645-301-233.100, R645-301-234, R645-301-242, and R645-301-243.

Stockpiled Prime Farmland materials will be subject to the following conditions within 30 days of stockpiling.

(a) They will be selectively placed on a stable site within the permit area. Prime Farmland soils will be stockpiled by horizon and by landowner. Stockpile areas in the North Private Lease are shown on Drawing 2-4

(b) They will be protected from contaminants and unnecessary compaction that would interfere with revegetation.

(c) They will be protected from wind and water erosion through prompt establishment and maintenance of an effective, quick growing vegetative cover or through other measures approved by the UDOGM. The side slopes will be graded to a maximum 3h:1v. Drawing 2-4 shows the planned stockpile areas, anticipated storage time, quantities and size for the North Private Lease. The interim seed mix for the Prime Farmland stockpiles is the following:

Stockpile Interim Seed Mix		
		Rate (PLS/Acre)
Bromus carinatus	Mountain Brome	6
Elymus lanceolatus	Thickspike wheatgrass	4
Elymus amithii	Western wheatgrass	5
Elymus spicatus	Bluebunch wheatgrass	6
Poa pratensis	Kentucky bluegrass	0.4
Triticum aestivum x Secale cereal	Sterile Triticale	5.00
Total		**26.40**

(d) They will not be moved until required for redistribution unless approved by the UDOGM. Drawing 2-4 shows the anticipated storage time for each stockpile in the North Private Lease.

317.500 Soil Replacement

317.510 Soil Profile Reconstruction

Prime Farmland topsoil and subsoil will be replaced by horizons in the order that they existed prior to removal with the A horizon being on top, the B horizon in the middle, and the C horizon on the bottom of the reconstructed soil profile. Soil samples will be collected from the final graded surface in the Prime Farmland areas on a basis of approximately one sample per two acres on a random statistical grid. The soil samples will be analyzed for horizon depth, pH, density, sodium adsorption ration (SAR), conductivity (ECe), texture, and available water capacity. Horizon samples will be limited to depths of approximately 12 inches.

317.520 Depth of Reconstructed Soil Profile

The combined depth of the reconstructed A, B, and C horizons will be a minimum of 48 inches. Substitute subsoil from adjacent soil map units will be incorporated as either B or C horizon material in areas where the soil depth was less than 48 inches prior to mining. Table 13 in Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014) details the estimated soil profiles for each of the Prime Farmland soil map units.

317.530 -Soil Compaction Monitoring

Soil compaction or density will be monitored during replacement of the A, B, and C horizons. The soil will be ripped or disked as needed to achieve soil densities similar to those documented in the Prime Farmland soils prior to removal and stockpiling as detailed in R645-302-317.400. Prime Farmland soil samples were collected June 5 and August 16, 2018, density data from these samples can be found in Appendix 9-1. The overlying soil horizon will not be reconstructed until the desired soil density has been achieved in the underlying soil horizon.

317.540 Replacement of B and C horizons

The combined depth of the B and C horizons will be sufficient to achieve a total minimum depth of 48 inches when the A horizon is included as part of the depth.

317.550 Replacement of A horizon

The A horizon or topsoil will be replaced in Prime Farmland areas as the final soil surface layer. This surface soil layer will equal or exceed the thickness of the original surface soil layer. The thickness of the average original soil surface layer in Prime Farmland areas is detailed in Table 13 in Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014).

317.600 Revegetation and Restoration of Soil Productivity

317.610 Vegetation Establishment

Following prime farmland soil replacement, the soil surface will be stabilized with a vegetative cover or other means that effectively controls soil loss by wind and water erosion. Mulching and fertilization of prime farmland will be implemented as described in Chapter 2, Section 240. Unless the landowner specifies a change in the revegetation plans in the future, the pasture will be reclaimed with the existing pasture land species mixture (see Table 3-38). However, it is recommended that the landowner of each parcel work with local NRCS staff to develop a seeding mix suited to their specific site (irrigated vs. non-irrigated) and operation goals.

317.620 Restoration of Prime Farmland Productivity

317.621 Measurement of Prime Farmland Productivity

Productivity of the reconstructed Prime Farmland areas will be measured through the use of Animal Unit Months (AUM) for pasture as recommended by NRCS.

317.622 Productivity Monitoring Program

The productivity of the reconstructed Prime Farmland areas will be measured with a statistically valid program with 90 percent or greater confidence. The AUM yield assessment, for pastures land on prime farmland, will be at the rate of “26 pounds of dry forage consumed per 1,000 pound animal per day”.

317.623 Monitoring Period

The measurement period for determining average annual crop production will be a minimum of three years prior to release of the performance bond.

317.624 Management Level

The level of management applied to the reconstructed Prime Farmland during the measurement period will be equal to the management level on non-mined similar adjacent areas.

317.625 Restoration of Soil Productivity

Restoration of soil productivity will be considered achieved when the average yield during the measurement period equals or exceeds the average yield of the reference crop established for the same period for non-mined soils of the same or similar texture or slope phase of the soil series in the surrounding area under equivalent management practices.

317.626 Reference Crop

The reference crop on which restoration of soil productivity is proven will be selected from the crops most commonly produced on the surrounding prime farmland. Where row crops are the dominant crops grown on prime farmland in the area, the row crop requiring the greatest rooting depth will be chosen as one of the reference crops. For the North Private Lease Prime Farm Land, the reference crop will be pasture as in surrounding prime farmland supporting pasture lands.

317.627 Reference Crop Yields

Reference crop yields for the selected reference crop will be determined from, either:

317.627.1 Yield Records

Soil productivity standards of 2,000 lbs/ac for irrigated pastureland and 1,100 lbs/ac for dry pasturelands has been determined by the Division in consultation with the NRCS.

317.628 Adjustment of Reference Yields

Average reference crop yields in R645-302-317.627 may be adjusted, with concurrence of the NRCS, for:

ACD is not requesting adjustment of Reference Yields.

317.628.1 Environmental Impacts

Disease, pest, and weather-related seasonal variations; or

317.628.2 Management Practices

Differences in specific management practices where the overall management practices of the crops being compared are equivalent.

APPENDIX 9-1

North Private Lease

Prime Farmland Data

Introduction

It was determined prior to mining in the North Private Lease, that approximately 21.4 acres qualified as Prime farmland and 24.4 acres as Soils of Statewide Importance (see Drawing 2-3). Alton Coal Development, LLC (ACD) has elected to treat both of these soil classifications as Prime Farmland governed by those rules found in R645-302-316. Appendix 9-1 thus has been added to the MRP to store the information required in Chapter 9, 317.400 Soil Removal and Stockpiling

Prime Farmland soil samples were collected June 5 and August 16, 2018 under direction of Bruce Chesler, soil scientist. Data from the required analysis can be found in Appendix 9-1.

Fieldwork and Labwork Procedure

Twenty-one backhoe trench profiles and two hand augured holes were sampled on two separate dates in December, 2018. Sample locations are shown on Figure 1. Ninety-two 1-gallon bag bulk samples were filled from each soil horizon identified in the field by backhoe trench observations and by auger core sampling. These bulk bag samples were sent to Intermountain Labs in Sheridan, Wyoming (IML) on June 20, 2018 and September 14, 2018. Lab results can be found in Appendix A. Lab samples were reviewed and compared with UDOGM Guidelines for Topsoil Management 2008 in their suitability for use in reclamation planning. A summary of laboratory analytical results is presented in Table 1.

In addition to these bulk samples, soil micro-monolith boxes were prepared for each sampled horizon and are found in Appendix B of this document. Soil profile photos were also recorded and are found in Appendix C of this document.

Finally, as the ultimate goal of the sampling program is to determine the density of the prime farmland soils pre-mining to aid in replacing these at similar densities at the time of reclamation, ACD, also acquired field density test. Field density information was collected by Gem Engineering, Inc using nuclear density. A Gem Engineering technician was present at the time the backhoe trenches were excavated. For all trenches, the surface vegetation was removed with the backhoe creating a level, flat surface for the nuclear gage. The technician then would place a metal plate, similar in size to the nuclear gage, with a metal prob affixed vertically, on the prepared surface. The metal prob is pounded into the ground to pre-create a hole in the location that the probe of the nuclear density instrument could be inserted. The metal plate with prob is then carefully removed and replaced with the nuclear density instrument and the nuclear density prob can be lowered in the pre-created hole to the desired depth with in the hole. At this point, the technician proceeds to acquire the information necessary to determine compaction to the soil at the desired depth. The dry density measurement reported in lbs/cm^3 collected from the instrument can then be converted to g/cm^3 by a factor of 0.016. The backhoe was then employed to dig to the next desired depth of measurement with the nuclear density prob. This method was continued until the trench reached its final depth and density information obtained of in-place soil. Gem Engineering's Field Density Test Summary sheets can be found in Appendix D and a summary of this information ~~in comparison to the bulk densities determined from soil samples sent to Intermountain Labs~~converted to dry density gr./cm^3 is provided on Table 2.

Summary

Information required by Chapter 9, 317.400 has been collected within this document. The end results of the collection of the information contained in this document, is to aid in soil replacement to restore the prime farmland. Information contained herein will be utilized in fulfilling the requirements of MRP section 317.530 Soil Compaction Monitoring.

It should be noted that the IML data contains Bulk Density (gr./cm^3). This information is considered unsuitable for monitoring redistribution of prime farmland soils because it cannot be determined in a timely manner. Also, the IML bulk density data is not accurate, because the volume of the original soil core was not recorded. The IML bulk density data were obtained by picking out a soil clod from the 1-gallon sample bag at the lab. The volume of the clod was obtained by coating it in paraffin (to preserve the pore space within) and measuring its displacement in water.

It was determined that in order to achieve timely results at the time of soil replacement for soil compaction, an additional method that could be utilized as soil are being replaced was necessary. Therefore, the additional field density information obtained by Gem Engineering by the nuclear density method was added. From the information collected by Gem Engineering premining (Table 2), average dry densities of the prime farmland soil by horizon are as follow: A horizon – 1.35 gr./cm^3, B horizon – 1.53 gr./cm^3 and C horizon – 1.62 gr./cm^3.

It is anticipated that at the time of soil placement, ACD will place the horizons in separate layers and prior to placement of the overlying soil horizon, utilize the nuclear density to determine if the desired soil density has been achieved of the underlying soil horizon (desired soil densities will be equivalent to or less than the average premining soil density). In the event that an area has become excessively compacted, the immediate results of the nuclear density instrument would indicate this and the affected area could be disked to modify the soil density. The nuclear density method will allow placement of the successive soil horizons to proceed in a continuous manor without having to delay work until lab results can be obtained.

Figure 1 Soil Sample Locations in Prime Farmland and Soils of Statewide Importance

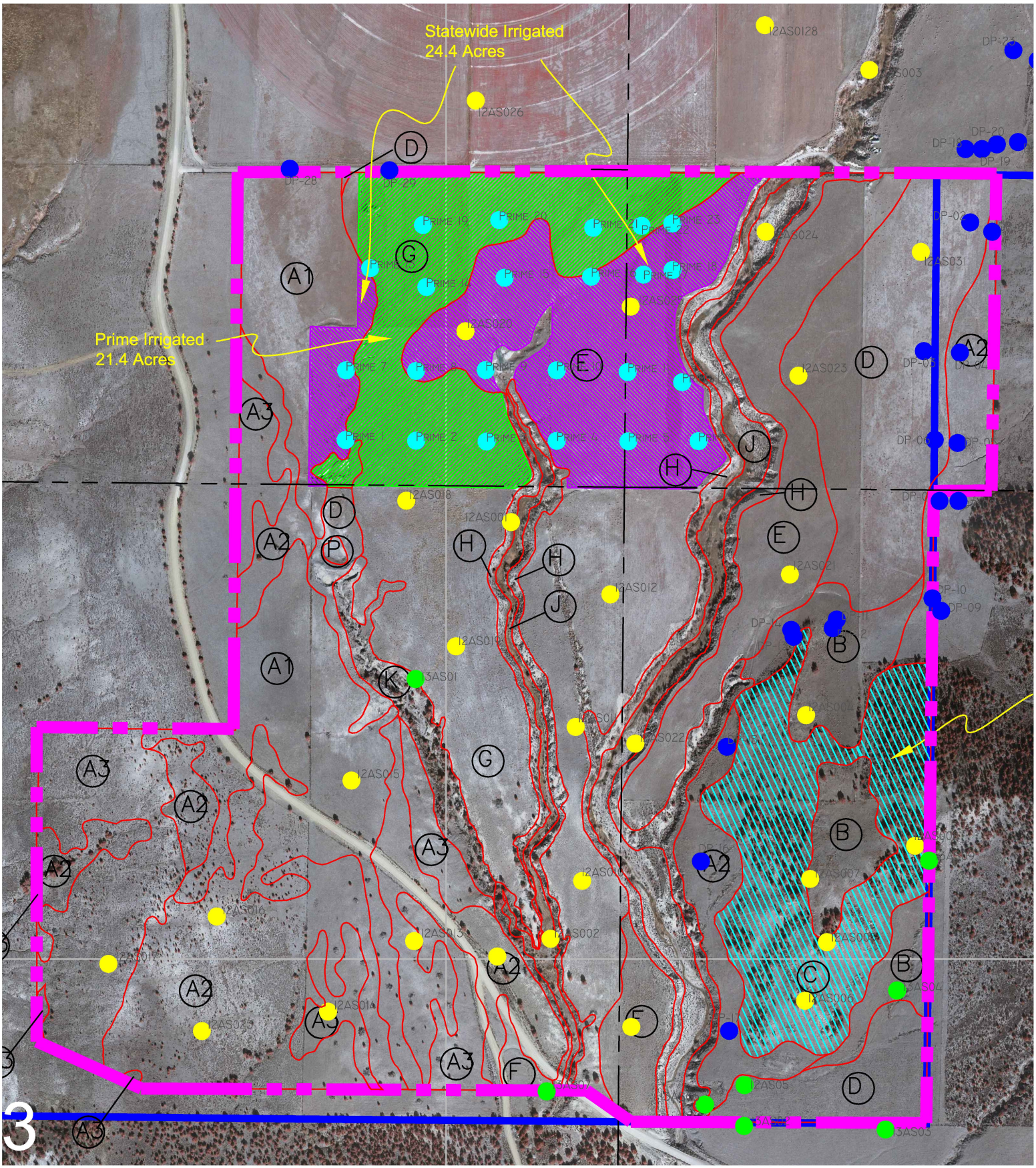


Table 1 Summary of laboratory analysis of soil samples collected from NPL Prime Farmland soils salvaged in 2018

SampleID	Sampled	Begin Depth	End Depth	pH	Electrical Conductivity	Field Capacity	Wilting Point	Calcium PE	Magnesium PE	Sodium PE	SAR	Sand	Silt	Clay	Texture	Bulk Density
		inches	inches	s.u.	dS/m	%	%	meq/L	meq/L	meq/L		%	%	%		g/cm³
Prime 1	6/11/18	0	12	7.7	1.04	38.9	30.0	6.82	3.29	0.35	0.16	9.0	43.0	48.0	Silty Clay	3.78
Prime 1	6/11/18	12	24	8.0	0.51	32.8	24.0	2.56	1.66	0.21	0.14	3.0	60.0	37.0	Silty Clay Loam	3.05
Prime 1	6/11/18	24	36	8.2	0.35	28.4	21.3	1.35	1.53	0.26	0.22	<0.1	62.0	38.0	Silty Clay Loam	2.69
Prime 1	6/11/18	36	48	8.2	0.87	28.5	18.3	1.39	5.20	1.23	0.68	3.0	67.0	30.0	Silty Clay Loam	3.13
Prime 2	6/11/18	0	12	8.0	0.65	42.0	29.1	3.34	2.27	0.16	0.10	17.0	50.0	33.0	Silty Clay Loam	12.3
Prime 2	6/11/18	12	20	8.1	0.46	42.9	29.0	2.29	1.72	0.16	0.11	6.0	55.0	39.0	Silty Clay Loam	3.98
Prime 2	6/11/18	20	32	8.1	0.36	33.4	24.1	1.72	2.00	0.33	0.25	<0.1	48.0	52.0	Silty Clay	2.82
Prime 2	6/11/18	32	48	8.2	0.48	32.4	23.4	1.04	2.88	0.32	0.23	1.0	53.0	46.0	Silty Clay	3.19
Prime 3	6/11/18	0	12	7.9	0.61	47.6	26.5	3.68	2.03	0.13	0.08	14.0	50.0	36.0	Silty Clay Loam	10.5
Prime 3	6/11/18	12	18	8.1	0.56	42.0	29.4	2.55	2.67	0.14	0.08	10.0	46.0	44.0	Silty Clay	8.77
Prime 3	6/11/18	18	30	8.4	0.47	36.8	25.6	0.88	3.31	0.21	0.14	6.0	59.0	35.0	Silty Clay Loam	3.90
Prime 3	6/11/18	30	48	8.4	0.46	32.1	23.0	1.09	3.18	0.32	0.22	1.0	65.0	34.0	Silty Clay Loam	2.91
Prime 4	6/11/18	0	12	8.0	0.75	32.5	20.2	3.54	3.32	0.10	0.06	18.0	48.0	34.0	Silty Clay Loam	3.82
Prime 4	6/11/18	12	24	8.2	0.60	35.5	23.1	2.26	3.60	0.41	0.24	9.0	60.0	31.0	Silty Clay Loam	4.27
Prime 4	6/11/18	24	36	8.3	0.42	33.0	16.3	1.16	2.81	0.25	0.18	5.0	71.0	24.0	Silty Loam	3.79
Prime 4	6/11/18	36	48	8.7	0.36	21.2	5.4	1.14	2.23	0.33	0.25	65.0	25.0	10.0	Sandy Loam	3.68
Prime 5	6/11/18	0	12	7.9	0.73	30.8	11.8	3.97	3.22	0.21	0.11	43.0	37.0	20.0	Loam	3.08
Prime 5	6/11/18	12	18	7.8	0.74	33.6	26.2	3.91	3.30	0.30	0.16	12.0	47.0	41.0	Silty Clay	3.17
Prime 5	6/11/18	18	30	8.1	0.62	33.0	24.6	2.26	3.32	0.49	0.29	<0.1	57.0	43.0	Silty Clay	3.23
Prime 5	6/11/18	30	48	8.4	0.60	29.5	17.8	1.30	4.33	0.42	0.25	12.0	63.0	25.0	Silty Loam	3.67
Prime 6	6/11/18	0	12	7.8	0.60	28.7	9.8	3.68	1.65	0.12	0.08	46.0	37.0	17.0	Loam	3.60
Prime 6	6/11/18	12	20	8.0	0.58	34.3	21.4	3.14	2.44	0.17	0.10	14.0	49.0	37.0	Silty Clay Loam	4.75
Prime 6	6/11/18	20	36	8.2	0.35	33.2	22.7	1.71	1.93	0.24	0.18	8.0	56.0	36.0	Silty Clay Loam	3.10
Prime 6	6/11/18	36	48	8.3	0.34	23.0	12.0	1.58	2.23	0.26	0.19	44.0	34.0	22.0	Loam	3.01
Prime 7	6/11/18	0	12	7.9	0.65	35.7	21.4	4.46	1.63	0.21	0.12	33.0	32.0	35.0	Clay Loam	5.13
Prime 7	6/11/18	12	24	8.1	0.57	46.1	32.6	2.57	3.07	0.50	0.30	4.0	42.0	54.0	Silty Clay	4.17
Prime 7	6/11/18	24	36	8.2	3.65	30.7	23.1	3.23	32.1	10.8	2.57	<0.1	50.0	50.0	Silty Clay	2.70
Prime 7	6/11/18	36	48	8.2	5.95	29.8	22.8	5.97	52.2	23.8	4.41	<0.1	54.0	46.0	Silty Clay	2.66
Prime 8	6/11/18	0	12	7.9	0.57	40.4	31.2	3.24	2.58	0.26	0.15	8.0	51.0	41.0	Silty Clay	5.96
Prime 8	6/11/18	12	20	8.2	0.36	37.0	27.0	1.73	1.50	0.18	0.14	7.0	50.0	43.0	Silty Clay	5.16
Prime 8	6/11/18	20	32	8.0	0.43	35.9	25.6	2.01	2.18	0.22	0.15	17.0	41.0	42.0	Silty Clay	3.67
Prime 8	6/11/18	32	48	8.1	0.30	27.8	21.9	1.86	1.98	0.33	0.24	<0.1	56.0	44.0	Silty Clay	2.78
Prime 9	6/11/18	0	12	8.0	0.56	47.5	27.5	3.29	2.03	0.29	0.18	14.0	48.0	38.0	Silty Clay Loam	24.5
Prime 9	6/11/18	12	20	8.2	0.43	60.8	26.0	2.41	2.13	0.17	0.11	14.0	59.0	27.0	Silty Clay Loam	6.51
Prime 9	6/11/18	20	32	8.3	0.65	34.8	27.4	1.85	4.70	0.54	0.30	4.0	49.0	47.0	Silty Clay	2.94
Prime 9	6/11/18	32	48	8.4	1.30	26.7	20.6	1.48	10.7	0.77	0.31	1.0	64.0	35.0	Silty Clay Loam	2.46
Prime 10	6/11/18	0	12	7.8	1.02	34.1	26.9	5.76	4.77	0.17	0.07	9.0	49.0	42.0	Silty Clay	3.55
Prime 10	6/11/18	12	24	8.2	0.50	30.6	23.8	1.98	2.86	0.27	0.18	1.0	65.0	34.0	Silty Clay Loam	3.52
Prime 10	6/11/18	24	36	8.2	0.40	28.9	22.3	1.80	2.41	0.37	0.26	3.0	61.0	36.0	Silty Clay Loam	2.97
Prime 10	6/11/18	36	48	8.2	0.38	26.3	14.7	1.08	2.37	0.25	0.19	13.0	62.0	25.0	Silty Loam	3.15
Prime 11	6/11/18	0	12	7.6	0.64	34.9	17.9	3.68	2.47	0.16	0.09	26.0	45.0	29.0	Clay Loam	3.51
Prime 11	6/11/18	12	18	7.9	0.74	35.5	23.3	4.17	3.85	0.36	0.18	15.0	45.0	40.0	Silty Clay	3.46
Prime 11	6/11/18	18	30	8.2	0.41	29.1	21.0	2.24	2.59	0.23	0.15	3.0	63.0	34.0	Silty Clay Loam	3.07
Prime 11	6/11/18	30	48	8.3	0.42	29.0	18.7	1.31	3.13	0.25	0.17	5.0	66.0	29.0	Silty Clay Loam	3.05
Prime 12	6/11/18	0	12	7.8	0.66	*	*	3.95	1.96	0.15	0.09	49.0	37.0	14.0	Loam	3.49
Prime 12	6/11/18	12	24	8.1	0.54	27.3	8.5	2.61	2.35	0.15	0.09	53.0	32.0	15.0	Sandy Loam	2.79
Prime 12	6/11/18	24	36	8.0	0.55	33.4	21.5	2.15	3.58	0.37	0.22	21.0	42.0	37.0	Clay Loam	3.12
Prime 12	6/11/18	36	48	8.3	0.88	35.2	26.6	2.67	6.64	0.89	0.41	1.0	56.0	43.0	Silty Clay	3.00
Prime #13	8/16/18	0	12	7.8	0.67	38.1	26.0	3.41	3.52	0.87	0.47	9.0	46.0	45.0	Silty Clay	7.08
Prime #13	8/16/18	12	24	8.3	0.43	29.1	11.8	1.27	2.88	0.81	0.56	50.0	27.0	23.0	Sandy Clay Loam	3.53
Prime #13	8/16/18	24	36	8.5	0.48	31.7	23.3	2.04	3.95	1.13	0.65	<0.1	46.0	54.0	Silty Clay	2.66
Prime #13	8/16/18	36	48	8.7	0.45	31.1	22.2	1.16	3.02	1.56	1.08	3.0	55.0	42.0	Silty Clay	3.12
Prime #14	8/16/18	0	12	7.9	0.47	41.0	29.8	3.37	2.17	0.37	0.22	15.0	42.0	43.0	Silty Clay	7.63
Prime #14	8/16/18	12	24	8.0	0.43	37.8	25.4	2.63	2.19	0.28	0.18	12.0	48.0	40.0	Silty Clay	6.94
Prime #14	8/16/18	24	36	8.2	0.35	46.6	22.7	1.60	2.36	0.35	0.25	29.0	35.0	36.0	Clay Loam	3.66
Prime #14	8/16/18	36	48	8.4	0.39	33.8	25.0	1.01	3.11	0.49	0.34	1.0	49.0	50.0	Silty Clay	2.74
Prime #15	8/16/18	0	12	7.9	0.44	40.7	28.7	3.12	1.75	0.12	0.08	12.0	51.0	37.0	Silty Clay Loam	*
Prime #15	8/16/18	12	24	8.2	0.34	25.8	17.5	2.07	1.51	0.24	0.18	35.0	34.0	31.0	Clay Loam	3.38
Prime #15	8/16/18	24	36	8.4	0.29	34.1	25.4	1.53	1.73	0.37	0.29	9.0	42.0	49.0	Silty Clay	2.83
Prime #15	8/16/18	36	48	8.5	0.34	31.2	22.8	1.42	2.48	0.42	0.30	<0.1	48.0	52.0	Silty Clay	2.75
Prime #16	8/16/18	0	12	7.7	0.62	44.0	27.5	4.04	2.79	0.18	0.09	11.0	49.0	40.0	Silty Clay	*
Prime #16	8/16/18	12	24	7.5	0.61	38.0	25.8	3.98	2.83	0.13	0.07	12.0	47.0	41.0	Silty Clay	*
Prime #16	8/16/18	24	36	8.0	0.35	35.7	28.0	2.53	1.63	0.12	0.09	10.0	48.0	42.0	Silty Clay	4.96
Prime #16	8/16/18	36	48	8.2	0.31	37.9	30.8	1.91	1.61	0.13	0.10	14.0	44.0	42.0	Silty Clay	5.32
Prime #17	8/16/18	0	12	7.8	0.71	35.4	25.3	4.05	3.40	0.15	0.08	11.0	46.0	43.0	Silty Clay	3.81
Prime #17	8/16/18	12	24	8.1	0.40	37.0	25.2	2.41	2.41	0.18	0.11	9.0	47.0	44.0	Silty Clay	4.71
Prime #17	8/16/18	24	36	8.4	0.29	27.4	19.9	1.02	2.31	0.24	0.19	8.0	63.0	29.0	Silty Clay Loam	3.96
Prime #17	8/16/18	36	48	8.5	0.30	21.8	7.8	1.01	2.56	0.28	0.21	44.0	43.0	13.0	Loam	3.82
Prime #18	8/18/18	0	12	7.6	0.40	33.1	26.4	2.94	2.05	0.27	0.17	11.0	50.0	39.0	Silty Clay Loam	*
Prime #18	8/18/18	12	24	8.0	0.37	32.5	23.1	2.16	2.20	0.19	0.13	4.0	64.0	32.0	Silty Clay Loam	4.95
Prime #18	8/18/18	24	36	8.1	0.32	28.6	18.9	1.34	1.83	0.44	0.35	1.0	66.0	33.0	Silty Clay Loam	3.28
Prime #18	8/18/18	36	48	8.1	0.33	22.6	10.9	1.19	1.97	0.52	0.41	24.0	54.0	22.0	Silty Loam	3.04
Prime #19	8/16/18	0	12	7.6	0.59	41.2	35.6	3.34	2.71	0.55	0.32	13.0	38.0	49.0	Clay	5.06
Prime #19	8/16/18	12	24	8.0	0.39	43.2	27.8	2.03	2.00	0.48	0.34	14.0	41.0	45.0	Silty Clay	*
Prime #19	8/16/18	24	36	8.3	0.39	39.1	28.3	0.96	2.74	0.58	0.42	8.0	43.0	49.0	Silty Clay	6.36
Prime #19	8/16/18	36	48	8.4	0.36	29.0	22.0	1.32	2.69	0.68	0.48	2.0	56.0	42.0	Silty Clay	2.63
Prime #20	8/16/18	0	12	7.7	0.56	40.6	29.4	3.59	1.46	0.63	0.40	17.0	36.0	47.0	Clay	5.06
Prime #20	8/16/18	12	24	7.9	0.41	38.5	29.8	2.22	2.01	0.49	0.34	4.0	50.0	46.0	Silty Clay	5.47
Prime #20	8/16/18	24	36	8.0	0.40	43.7	27.5	1.78	2.55	0.52	0.35	14.0	39.0	47.0	Clay	6.36
Prime #20	8/16/18	36	48	8.3	0.41	31.9	23.8	1.26	2.85	0.60	0.42	<0.1	50.0	50.0	Silty Clay	2.52
Prime #21	8/16/18	0	12	7.8	0.73	44.3	31.1	4.11	2.60	0.56	0.31	18.0	38.0	44.0	Clay	*
Prime #21	8/16/18	12	24	8.1	0.34	36.3	25.8	1.56	1.65	0.48	0.38	6.0	49.0	45.0	Silty Clay	2.91
Prime #21	8/16/18	24	36	8.4	0.33	25.9	18.9	1.18	2.73	0.51	0.36	7.0	57.0	36.0	Silty Clay Loam	2.99
Prime #21	8/16/18	36	48	8.4	0.33	26.0	19.1	1.16	2.89	0.52	0.37	<0.1	64.0	36.0	Silty Clay Loam	2.77
Prime #22	8/16/18	0	12	7.8	0.61	35.7	25.8	3.60	2.74	0.51	0.29	10.0	42.0	48.0	Silty Clay	3.78
Prime #22	8/16/18	12	24	7.8	0.52	40.4	21.8	2.45	3.22	0.53	0.32	23.0	36.0	41.0	Clay	2.85
Prime #22	8/16/18	24	36	8.2	0.38	28.1	21.4	1.56	2.51	0.50	0.35	11.0	49.0	40.0	Silty Clay	2.76
Prime #22	8/16/18	36	48	8.3	0.40	24.5	16.3	1.55	2.83	0.52	0.35	16.0	58.0	26.0	Silty Loam	2.74
Prime #23	8/21/18	0	12	7.6	0.63	36.8	25.9	3.89	2.79	0.41	0.23	14.0	40.0	46.0	Silty Clay	6.22
Prime #23	8/21/18	12	24	7.8	0.50	35.5	28.3	2.66	2.73	0.44	0.27	4.0	43.0	53.0	Silty Clay	*
Prime #23	8/21/18	24	36	8.2	0.32	30.1	22.1	1.87	2.38	0.48	0.33	<0.1	56.0	44.0	Silty Clay	2.99
Prime #23	8/21/18	36	48	8.5	0.30	25.8	16.0	0.88	2.18	0.51	0.41	7.0	67.0	26.0	Silty Loam	2.84

DOGM Suitability (200	Good	Fair	Poor	Unacceptable

Note: * Analysis was unable to be performed due to lack of suitable sample required by the method

Table 2 GEM data converted to Bulk Densities on NPL Prime Farmland soils salvaged in 2018

			GEM Engineering Field Density Test Summary				Converted Density Data	
			Field Data					
Sample ID	Horizon	Depth inches	Elev. inches	Dry Density lbs/ft^3	Moisture Content %	Compaction %	Lab Max Dry Density gr./cm^3	Dry Density gr./cm^3
Prime 1	A	0-12	-6	76.7	18.3	75	**1.64**	**1.23**
	B	12-24	-18	98.5	10.3	86	**1.84**	**1.58**
	B	24-36	-32	103.4	11.4	90	**1.84**	**1.65**
	B	36-48						
			-60	101.2	17.5	88	**1.84**	**1.62**
Prime 2	A	0-12	-6	70.5	12.1	69	**1.64**	**1.13**
	A	12-20	-20	93.8	18.7	82	**1.84**	**1.50**
	B	20-32	-38	87.4	14.1	76	**1.84**	**1.40**
	B	32-48						
			-53	100.3	15.9	87	**1.84**	**1.60**
Prime 3	A	0-12	-6	72.1	13.8	70	**1.64**	**1.15**
	A	12-18	-18	79.9	15.9	69	**1.84**	**1.28**
	B	18-30						
	B	30-48	-36	92.4	13.2	80	**1.84**	**1.48**
			-53	96.1	17.0	84	**1.84**	**1.54**
Prime 4	A	0-12	-6	86.9	9.0	85	**1.64**	**1.39**
	B	12-24	-18	80.7	10.5	79	**1.64**	**1.29**
	B	24-36	-28	85.0	6.3	74	**1.84**	**1.36**
	B	36-48	-48	no test same material				
Prime 5	A	0-12	-6	91.5	4.9	89	**1.64**	**1.46**
	A	12-18	-18	80.1	13.7	78	**1.64**	**1.28**
	B	18-30	-28	93.6	10.5	81	**1.84**	**1.50**
	B	30-48	-48	no test same material				
Prime 6	A	0-12	Not Tested					
	A	12-20						
	B	20-36						
	B	36-48						
Prime 7	A	0-12	-6	84.4	11.3	82	**1.64**	**1.35**
	A	12-24	-14	90.6	10.0	79	**1.84**	**1.45**
	B	24-36	-32	100.5	17.1	87	**1.84**	**1.61**
	C	36-48	-48	103.9	15.6	90	**1.84**	**1.66**
Prime 8	A	0-12	-6	76.6	15.7	75	**1.64**	**1.23**
	A	12-20	-18	78.2	14.9	76	**1.64**	**1.25**
	B	20-32						
	B	32-48	-38	95.6	17.9	83	**1.84**	**1.53**
			-53	no test same material				
Prime 9	A	0-12	-6	73.2	12.8	71	**1.64**	**1.17**
	A	12-20	-20	57.7	13.5	56	**1.64**	**0.92**
	B	20-32						
	B	32-48	-36	96.40	18.70	84	**1.84**	**1.54**
			-56	98.00	15.30	85	**1.84**	**1.57**
Prime 10	A	0-12	-6	76.5	11.9	75	**1.64**	**1.22**
	A	12-24	-18	87.3	8.9	76	**1.84**	**1.40**
	B	24-36	-28	98.1	7.4	85	**1.84**	**1.57**
	B	36-48	-48	no test same material				
Prime 11	A	0-12	-6	93.4	9.3	91	**1.64**	**1.49**
	A	12-18	-18	84.4	14.8	73	**1.84**	**1.35**
	B	18-30	-24	93.2	9.7	81	**1.84**	**1.49**
	B	30-48						
			-53	no test same material				
Prime 12	A	0-12	Not Tested					
	B	12-24						
	B	24-36						
	B	36-48						
Prime 13	A	0-12	-8	95.4	5.8	96	**1.58**	**1.53**
	A	12-24	-24	98.3	14.5	82	**1.92**	**1.57**
	B	24-36	-36	99.4	17.0	91	**1.75**	**1.59**
	B	36-48	-48	102.8	22.1	89	**1.85**	**1.64**
Prime 14	A	0-12	-12	84.7	6.9	86	**1.58**	**1.36**
	B	12-24	-26	78.4	16.3	65	**1.92**	**1.25**
	B	24-36	-36	96.4	18.7	88	**1.75**	**1.54**
	B	36-48	-48	102.1	18.1	88	**1.85**	**1.63**
Prime 15	A	0-12	-16	68.7	8.7	69	**1.58**	**1.10**
	A	12-24	-26	89.7	18.3	75	**1.92**	**1.44**
	B	24-36	-36	97.0	19.2	89	**1.75**	**1.55**
	B	36-48	-48	103.9	16.6	90	**1.85**	**1.66**
Prime 16	A	0-12	-8	85.9	13.8	87	**1.58**	**1.37**
	A	12-24	-24	85.1	12.6	71	**1.92**	**1.36**
	B	24-36	-36	84.3	16.0	77	**1.75**	**1.35**
	B	36-48	-48	83.2	17.4	72	**1.85**	**1.33**
Prime 17	A	0-12	-8	86.9	11.0	88	**1.58**	**1.39**
	A	12-24	-24	95.6	9.9	80	**1.92**	**1.53**
	B	24-36	-36	94.8	9.8	87	**1.75**	**1.52**
	B	36-48	-48	95.1	13.8	82	**1.85**	**1.52**
Prime 18	A	0-9	Not Tested					
Hand	B	9-24						
Augured	B	24-36						
	B	36-48						
	C	48-60						
Prime 19	A	0-12	-12	71.1	12.1	72	**1.58**	**1.14**
	A	12-24	-28	97.1	18.5	81	**1.92**	**1.55**
	B	24-36	-36	101.9	14.3	93	**1.75**	**1.63**
	B	36-48	-48	102.6	16.7	89	**1.85**	**1.64**
Prime 20	A	0-12	-12	76.0	11.3	77	**1.58**	**1.22**
	A	12-24	-28	86.1	12.9	72	**1.92**	**1.38**
	B	24-36	-38	90.4	20.7	83	**1.75**	**1.45**
	C	36-48	-48	98.8	20.1	86	**1.85**	**1.58**
Prime 21	A	0-12	-8	82.2	13.6	83	**1.58**	**1.32**
	A	12-24	-24	104.0	13.9	87	**1.92**	**1.66**
	B	24-36	-36	101.4	10.7	93	**1.75**	**1.62**
	B	36-48	-48	101.9	12.6	88	**1.85**	**1.63**
Prime 22	A	0-12	-8	82.3	9.6	83	**1.58**	**1.32**
	A	12-24	-24	89.7	16.9	75	**1.92**	**1.44**
	B	24-36	-36	92.5	10.5	84	**1.75**	**1.48**
	B	36-48	-48	100.4	12.4	87	**1.85**	**1.61**
Prime 23	A	0-12	Not Tested					
Hand	A	12-24						
Augured	B	24-36						
	B	36-48						

Appendix A----Intermountain Labs Analytical results

Appendix B

Soil Profile Location Photos

Soil Profile- Prime 1

Soil Profile- Prime 2

Soil Profile- Prime 3

Soil Profile- Prime 4

Soil Profile- Prime 5

Soil Profile- Prime 6

Soil Profile- Prime 7

Soil Profile- Prime 8

Soil Profile- Prime 9

Soil Profile- Prime 10

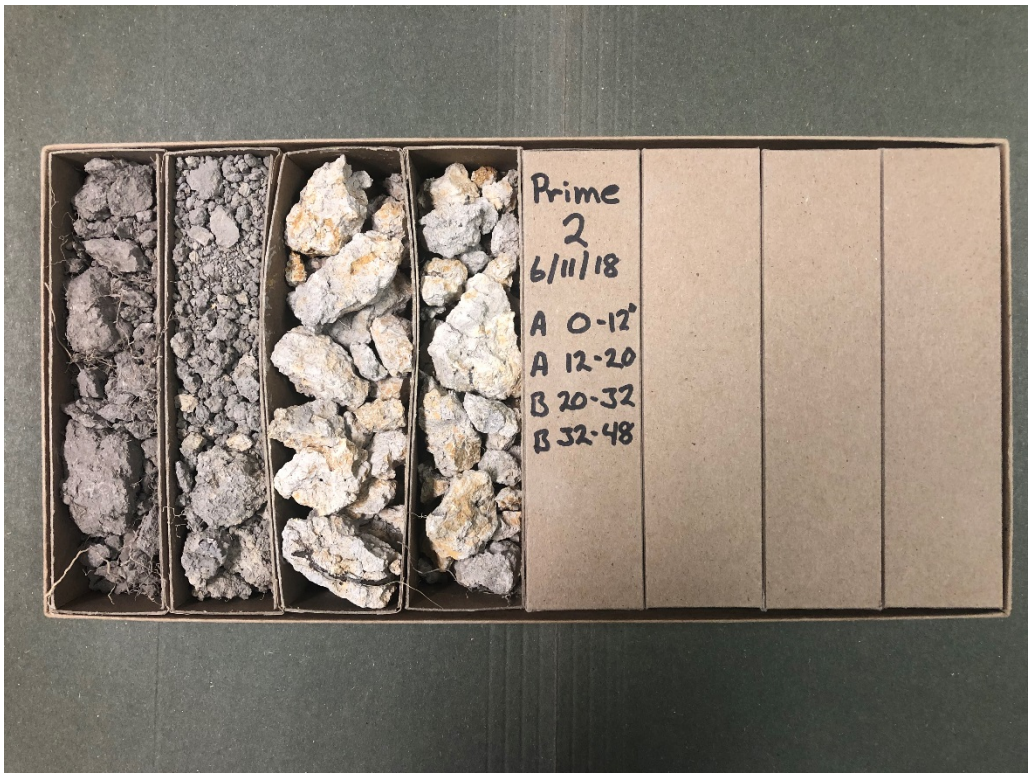
Soil Profile- Prime 11

Soil Profile- Prime 12

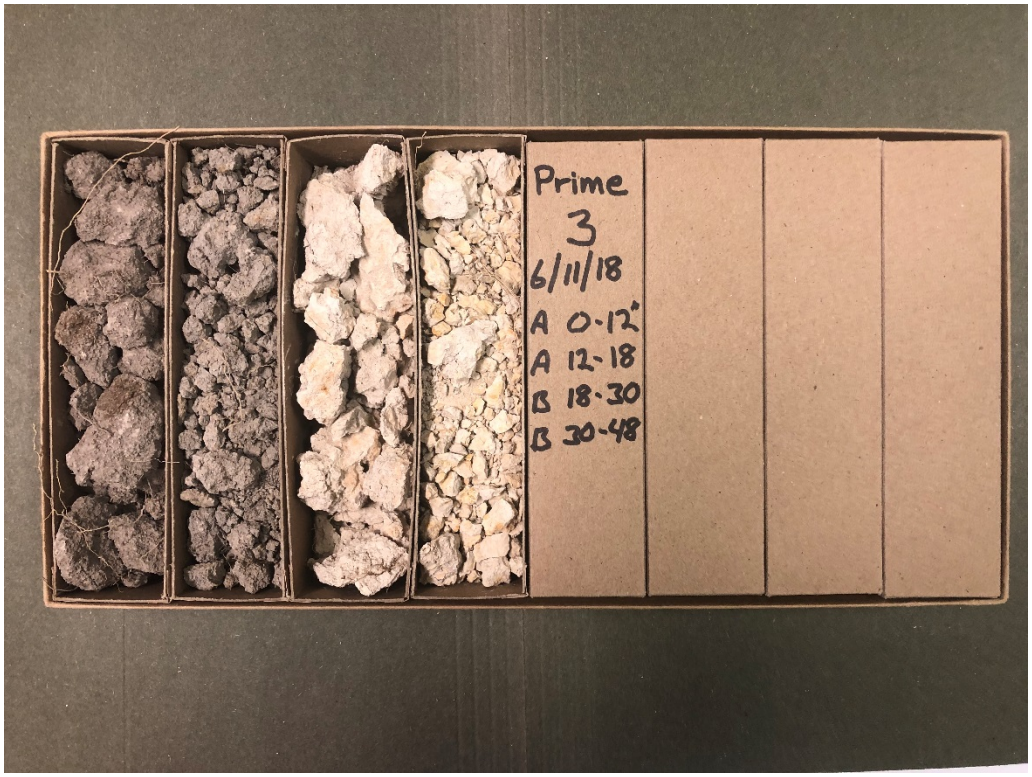
Appendix C

Soil Profile Box Photographs

Profile Box - Prime 1

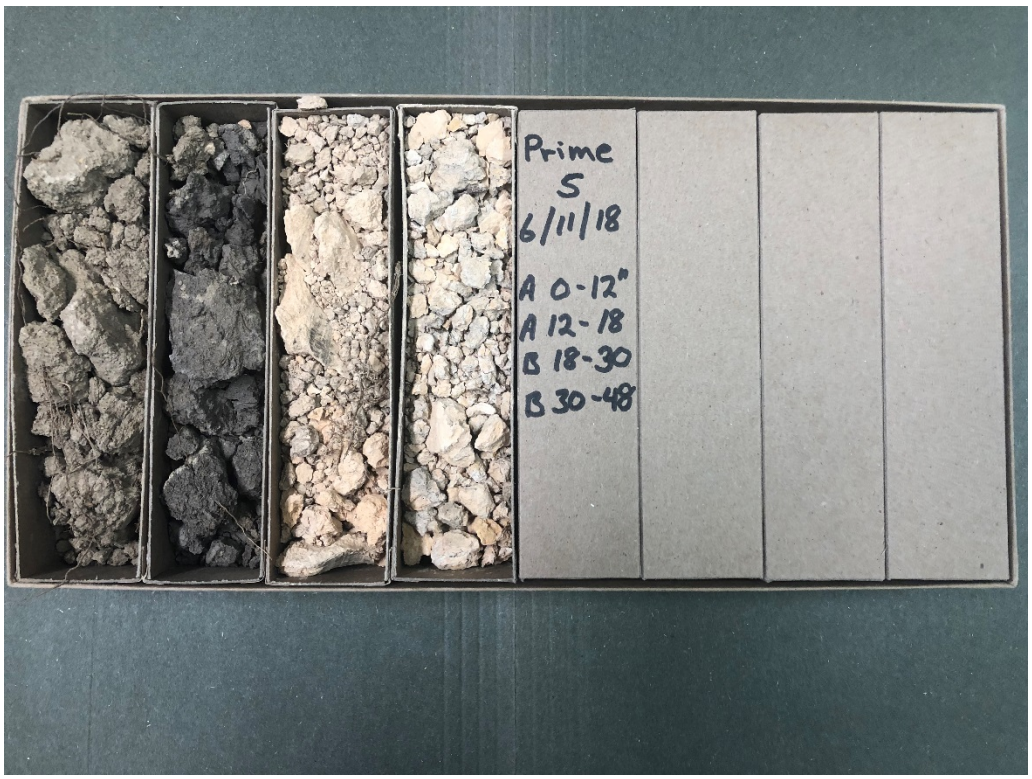


Profile Box - Prime 2



Profile Box - Prime 3

Profile Box - Prime 4



Profile Box - Prime 5

Profile Box - Prime 6

Profile Box - Prime 7

Profile Box - Prime 8

Profile Box - Prime 9

Profile Box - Prime 10

Profile Box - Prime 11

Profile Box - Prime 12

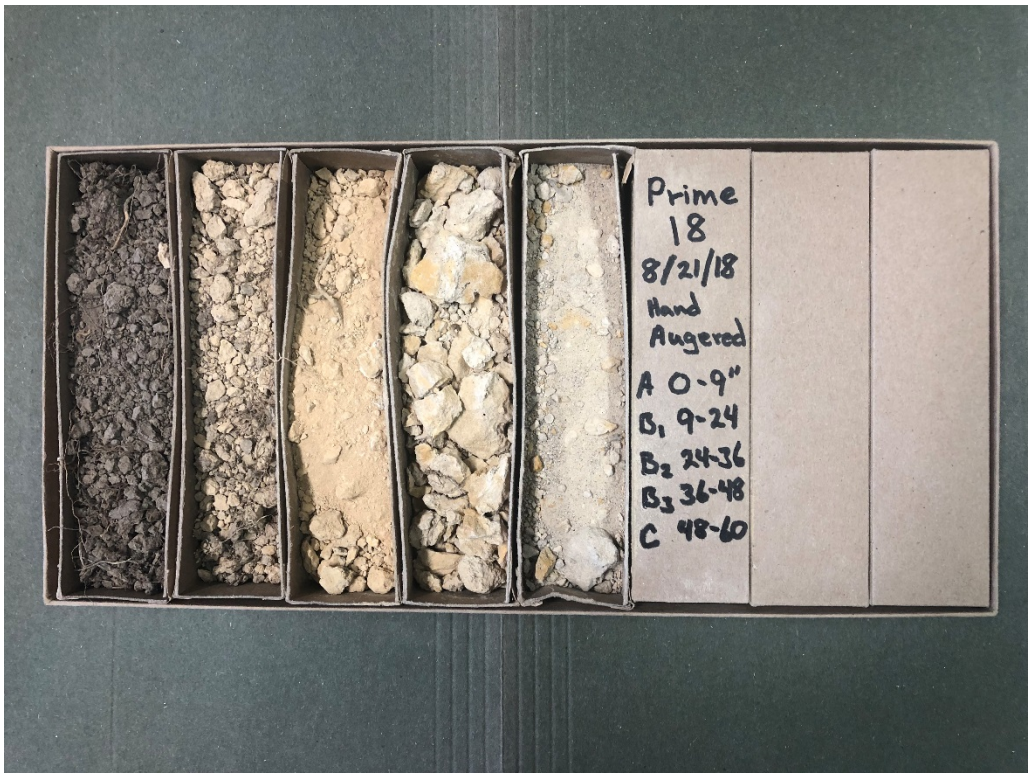
Profile Box - Prime 13

Profile Box - Prime 14

Profile Box - Prime 15

Profile Box - Prime 16

Profile Box - Prime 17



Profile Box - Prime 18

Profile Box - Prime 19

Profile Box - Prime 20

Profile Box - Prime 21

Profile Box - Prime 22

Profile Box - Prime 23

Appendix D

Gem Engineering, LLC
Field Density Test Summary Sheets