Bronco Utah Operations LLC
PO Box 527
Emery Utah, 84522
801-286-2301

C/015/0015
Received 7/22/16
Task ID #5245

July 22, 2016

VIA E-MAIL

Mr. Daron Haddock
Utah Division of Oil, Gas and Mining
Coal Program
1594 West North Temple, Suite 1210
Box 145801
Salt Lake City, Utah 84114-5801

RE: Bronco Utah Operations LLC
Emery Mine
DOGM Permit No. C/015/0015
Phase II Additional Permit Boundary

Mr. Haddock:

Please consider this a minor revision to the above mentioned permit, which includes an executed C1 form, C2 form, revised pages and Plates.

This Phase II revision will add 29 acres to the existing Emery permit to provide access to a new portal area. The revision will allow access to the remaining approved Emery coal reserve. The revision includes revised MRP pages referring to standalone appendices that contain Emery 2 expansion information.

Bond calculations for the additional structures are included and have been modified in format with updated unit costs per the recently approved Phase I submittal.

If you have any questions concerning this request, please contact Kit Pappas at 435-286-2027.

Sincerely,

Kit Pappas
Environmental Manager

Attachments

JAG/jag EM UTDOGM C0150015 e2 Phase II.cover.docx

APPLICATION FOR COAL PERMIT PROCESSING

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

Permittee: Bronco Utah Operations LLC (BUOLLC)
Mine: Emery Mine **Permit Number:** 015/0015
Title: e2 Phase II Additional Permit Area
Description, Include reason for application and timing required to implement:
Permit 015/0015 e2 Phase II Additional Permit Area 7/16

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

☒ Yes ☐ No 1. Change in the size of the Permit Area? Acres: 29 Disturbed Area: 29 ☒ 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?

Please attach four (4) review copies of the application. If the mine is on or adjacent to Forest Service land please submit five (5) 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.

DAN R. BAKER
Print Name

Dan R. Baker PRES & CEO 7/22/2016
Sign Name, Position, Date

Subscribed and sworn to before me this 22 day of JULY, 2016

Notary Public

My commission Expires: 3-7, 2018

Attest: State of UTAH } } ss:
County of CARBON

JOHN CHRISTOPHER PAPPAS
Notary Public, State of Utah
Commission # 674103
My Commission Expires
March 07, 2018

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

Form DOGM- C1 (Revised March 12, 2002)

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

Permittee: Bronco Utah Operations LLC (BUOLLC)
Mine: Emery Mine **Permit Number:** 015/015
Title: e2 Phase II Additional Permit Area Page 1/2 07/16

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	CH I page 8
☐ Add	☒ Replace	☐ Remove	CH I Plate I-1(Surface and Coal Ownership)
☐ Add	☒ Replace	☐ Remove	CH II pgs 17d - 17f
☒ Add	☐ Replace	☐ Remove	CH II pgs 17g - 17h
☐ Add	☐ Replace	☐ Remove	
☐ Add	☒ Replace	☐ Remove	CH II pgs 20, 23, and 24
☐ Add	☒ Replace	☐ Remove	CH II Plate II-1, Structures and Facilities Main Portal Area
☐ Add	☒ Replace	☐ Remove	CH III pgs 2 & 3
☒ Add	☐ Replace	☐ Remove	CH III page 4a
☐ Add	☐ Replace	☐ Remove	
☐ Add	☒ Replace	☐ Remove	CH III page 8
☒ Add	☐ Replace	☐ Remove	CH III page 10b
☐ Add	☒ Replace	☐ Remove	CH III page 12
☐ Add	☒ Replace	☐ Remove	CH III Plate III-9 (Permit Boundaries and Bonding map- Exhibit D)
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☐ Add	☒ Replace	☐ Remove	CH IV Table of Contents page 3
☐ Add	☒ Replace	☐ Remove	CH IV pgs 7, 7a, & 7b
☒ Add	☐ Replace	☐ Remove	CH IV page 7c
☐ Add	☒ Replace	☐ Remove	CH IV, Page 12 (bond summary sheet)
☐ Add	☒ Replace	☐ Remove	CH IV, Part IV.B, Demo bond calc sheets
☐ Add	☒ Replace	☐ Remove	CH IV, Part IV.B, Earth bond calc sheets
☐ Add	☐ Replace	☐ Remove	CH IV, Part IV.B, Reveg bond calc sheets
☐ Add	☒ Replace	☐ Remove	CH IV Plate IV-8a (Emery 2 Phase I & II Expansion, Roads& Conveyor Plan view)
☐ Add	☒ Replace	☐ Remove	CH IV Plate IV-8b (Emery 2 Phase I & II Expansion, Roads& Conveyor Profile/x-sect)
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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**

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

Permittee: Bronco Utah Operations LLC (BUOLLC)
Mine: Emery Mine **Permit Number:** 015/015
Title: e2 Phase II Additional Permit Area Page 2/2 07/16

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	
☐ Add	☒ Replace	☐ Remove	CH VI Table of Contents pgs viii & x
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☒ Add	☐ Replace	☐ Remove	CH VI Appendix VI-20 (Emery 2 Expansion Drainage Control)
☐ Add	☐ Replace	☐ Remove	CH VI Plate HDR-1 (Hydrology Design)
☒ Add	☐ Replace	☐ Remove	CH VII Table of Contents
☒ Add	☐ Replace	☐ Remove	CH VII Appendix VII-5 (Order 2 Soil Survey of Emery 2 Mine Pernit Area
☐ Add	☒ Replace	☐ Remove	CH VIII Table of Contents page 1
☒ Add	☐ Replace	☐ Remove	CH VIII Table of Contents page 2
☐ Add	☐ Replace	☐ Remove	
☒ Add	☐ Replace	☐ Remove	CH VIII Appendix VIII-8 (Vegetation and Sensitive Species of the Emery 2 Area)
☐ 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**

UMC 782,17

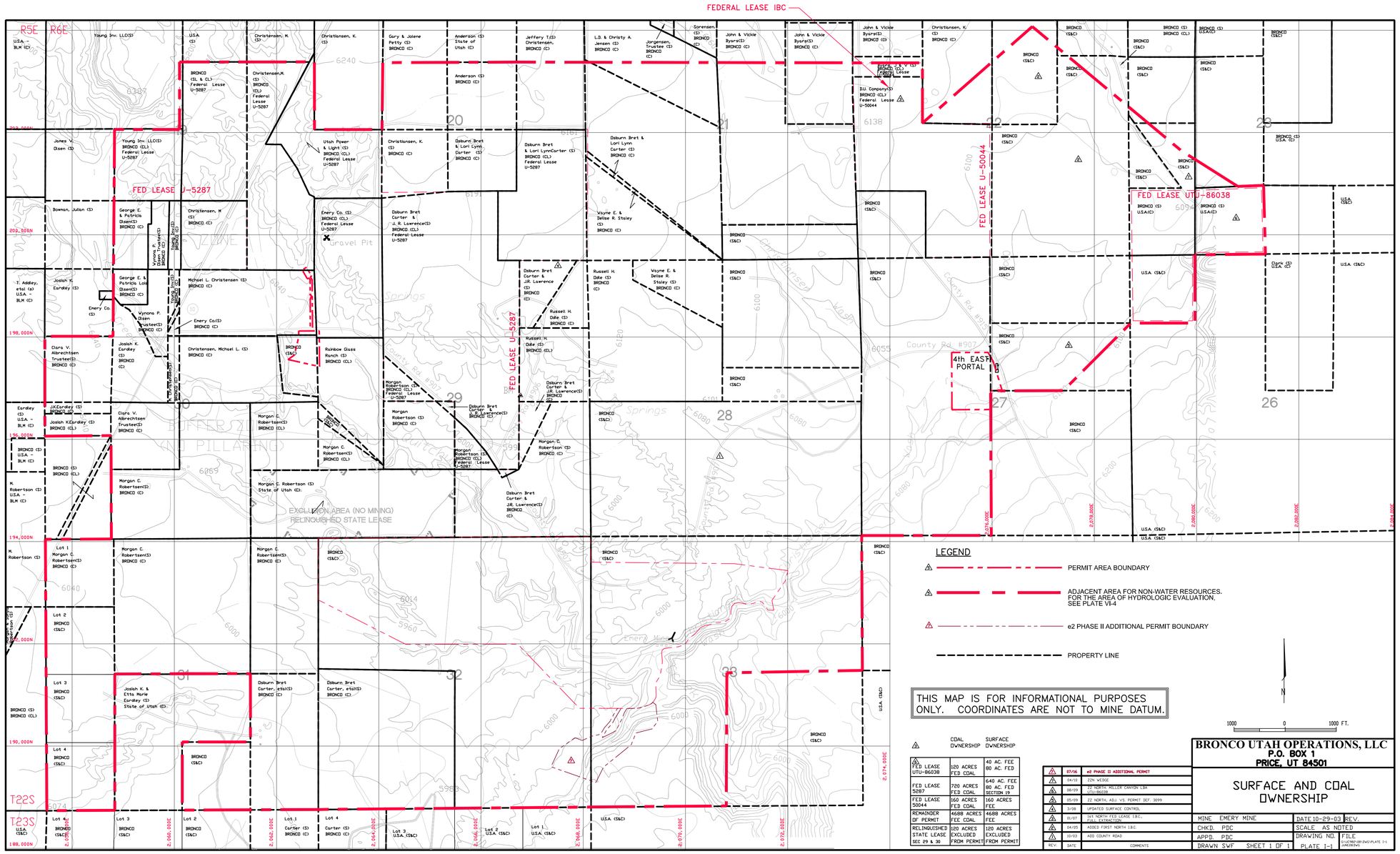
Underground operations at the Emery Mine is an ongoing situation which does not occur in phases. The extent of the underground workings over the life of the permit is shown on Plates IV-l and IV-2. The permit area encompasses approximately ~~442.5~~471.50 acres and the adjacent area encompasses approximately 5,776 acres.

It is anticipated that mining activities will continue considerably beyond the five (5) year permit term. This will require renewals at the end of each term.

UMC 782.18, UMC 800.60

Appendix I-5 contains a copy of the insurance certificate, for the Emery Mine, covering personal injury and property damage.

Revised 8-31-95
Revised 4/05
Revised 9/06
Revised 5/09
Revised 8/09
Revised 4/10
Revised 7/2016



	COAL OWNERSHIP	SURFACE OWNERSHIP
FED LEASE UTU-86038	120 ACRES FED COAL	40 AC. FEE 80 AC. FED
FED LEASE 5287	720 ACRES FED COAL	640 AC. FEE 80 AC. FED SECTION 19
FED LEASE 50044	160 ACRES FED COAL	160 ACRES FEE
REMAINDER OF PERMIT	4688 ACRES FEE COAL	4688 ACRES FEE
RELINQUISHED STATE LEASE SEE 29 & 30	120 ACRES EXCLUDED FROM PERMIT	120 ACRES EXCLUDED FROM PERMIT

REV.	DATE	COMMENTS
4	07/16	e2 PHASE II ADDITIONAL PERMIT
3	04/10	FIN WEDGE
2	08/09	1Z NORTH MILLER CANYON LBA UTU-86038
1	05/09	2Z NORTH, ADJ VS. PERMIT DEF 3099
0	3/08	UPDATED SURFACE CONTROL
3	01/07	1Y2 NORTH FED LEASE IBC, COAL EXTRACTION
2	04/05	ADDED FIRST NORTH IBC
1	10/03	ADD COUNTY ROAD

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 1
PRICE, UT 84501

SURFACE AND COAL OWNERSHIP

MINE EMERY MINE		DATE 10-29-03	REV.
CHKD. PDC		SCALE AS NOTED	
APPD. PDC		DRAWING NO.	FILE G:\ACAD\BRONCO\PLATE I-1 AMENDED
DRAWN SWF	SHEET 1 OF 1	PLATE I-1	

REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
NOT VALID WITHOUT A SIGNATURE
STATE OF UTAH

Roads Misc.

Road to Mine Substation
Map Code: Identified on Plate II-1
Status: Existing – prior to 1975

The road to the mine substation is on top of the canyon, north of the mine entrance and is used to access the substation.

This road will be used to access the proposed preparation plant facilities area. The design information to upgrade this structure for use as the plant access road is presented in Chapter IV.

Road to Borehole Pump Facility No. 1
Map Code: Shown on CH IV, Appendix IV-7 and Plate IV-8
Status: Existing – prior to 1975

The road to borehole pump no. 1 is located approximately 3/4 of a mile north of the mine entrance and branches off County Road 9-07. The road is used solely to access and maintain dewatering pump no. 1.

Road to Mine Discharge Sedimentation Pond No. 1
Map Code: Shown on Plate II-2
Status: Existing – 4th quarter 1976

This road (located about ½ mile north of the mine entrance) was used in the past to access Sedimentation Pond No. 1 but a culvert used for crossing Quitchupah Creek was washed out in a flood, thereby making the road impassable.

Upon construction of the preparation plant, the road will be constructed to access the plant waste disposal facilities. The design for rebuilding this road as a coal refuse haulage road is presented in Chapter IV.

Emery 2 Expansion Facilities

Mine Substation
Map Code: e1, Plate II-1
Status: Proposed 2016

Electric substation mounted on a concrete pad. The 20 MVA substation is located adjacent to the existing mine substation (Map Code 42). The pad contains 75 cubic yards of concrete. The substation area is within the approved surface drainage control area and disturbed area.

Conveyor 6/Truck Loadout
Map Code: e2, Plate II-1
Status: Proposed 2016

48-inch Conveyor from Screen/Crusher Building to Truck Loadout area. The conveyor is 217 feet long consisting of 122 feet of elevated structure and 95 feet on grade. Two concrete pads with dimensions 16'x12'x3' and 12'x9'x3' (33 cubic yards total) along with metal frame structure support the elevated portion of the belt. Suspended solids contributions will be minimized by utilizing covered conveyors (Plate II-I, photo log P5) and water sprays. The conveyor and loadout area is within the approved surface drainage control area and disturbed area.

Screening & Crushing Facility
Map Code: e3, Plate II-1
Status: Proposed 2016

Screening and crushing equipment with metal support structure mounted on a 46'x26'x3' concrete pad and 10 piers (143 cubic yards total). Equipment structure will have approximate dimensions of 40'x20'x55' high. The facility will receive coal from Conveyor 5 and discharge to Conveyor 6. The Screening & Crushing Facility is within the approved surface drainage control area and disturbed area.

Conveyor 5
Map Code: e4, Plate II-1
Status: Proposed 2016

54-inch conveyor partially elevated and supported by metal frame structure mounted on concrete pads with the remaining conveyor length constructed on grade and within a reclaim tunnel. Four concrete pads and piers with dimensions 20'x20'x3' pad with 8-foot diameter by 4.5-foot high pier, 34'x18'x3' pad with 10-foot diameter by 4.5-foot high pier, 36'x20'x3' pad with 10-foot diameter by 4.5-foot high pier, and 28'x8'x3' pad with 20'x3'x3' pad, for a total of 259 cubic yards.

Conveyor 5 will receive coal from feeders beneath the Conveyor 4/Radial Stacker stockpile and discharge to the Screening and Crushing Facility. Suspended solids contributions will be minimized by utilizing covered conveyors (Plate II-I, photo log P5) and water sprays. Conveyor 5 is within the approved surface drainage control area and disturbed area.

Emery 2 Expansion Facilities (cont.)

Reclaim Tunnel
Map Code: e5, Plate II-1
Status: Proposed 2016

Corrugated metal tunnel to house a portion of Conveyor 5. The tunnel will be 320 feet long and consist of a 12-foot diameter corrugated metal pipe buried in a backfilled trench. Concrete (141 cubic yards) will be poured to a thickness of 2.7 feet to form a floor surface within the pipe for mounting the conveyor structure. Approximately half the tunnel length will be utilized under the current mine plan. The full length will be utilized during future mine expansion. A 3-foot diameter, 120-foot long escape tunnel is also included with this structure. Coal from the Radial Stacker stockpile will fall through feeders onto Conveyor 5. The Reclaim Tunnel is located within the approved surface drainage control area and disturbed area. Reclamation of the tunnels will consist of excavating cover soil, removing the tunnels, and backfilling the trenches. The cross sectional area of the excavation required for tunnel demolition is 666 square feet for the main tunnel and 232 square feet for the escape tunnel, resulting in 7,893 cubic yards and 1,031 cubic yards of excavation/backfill, respectively. Final surface reclamation costs are included in bond calculations for the entire portal area grading costs.

Conveyor 4/Radial Stacker
Map Code: e6, Plate II-1
Status: Proposed 2016

48-inch radial stacking conveyor supported by metal frame structure. The conveyor will receive coal from the drop chute at the end of Conveyor 2 and discharge to a stockpile. The stacker will travel on a compacted rock surface. The conveyor will be anchored to a concrete pad supporting the drop chute (concrete included with Conveyor 2). Suspended solids contributions will be minimized by utilizing covered conveyors (Plate II-I, photo log P5) and water sprays. Conveyor 4/Radial Stacker is located within the approved surface drainage control area and disturbed area.

Conveyor 2, Phase I
Map Code: e7p1 Plate II-1
Status: Proposed 2016

60-inch conveyor supported by metal frame structure. ~~A~~The 260-foot portion of ~~the~~ Conveyor 2, Phase I will be located within the original~~current~~ permit area.~~ The remaining conveyor length will be included in an expanded permit boundary.~~

The conveyor is elevated and supported by metal framework anchored to 2 concrete pads with dimensions of 36'x20'x3'. A 10-foot diameter, 4.5-foot high concrete pier is mounted on each pad for a total concrete volume (includes the 2 pad/piers) of 186 cubic yards. The drop chute at the end of Conveyor 2 is supported by a 22'x16'x3' concrete pad (39 cubic yards) that also anchors the Radial Stacker. Suspended solids contributions will be minimized by utilizing covered conveyors (Plate II-I, photo log P5) and water sprays. Conveyor 2, Phase I is located within the approved surface drainage control area and disturbed area.

Replaced 7/2016
Revised 7/2016

Emery 2 Expansion Facilities (cont.)

Conveyor 2, Phase II
Map Code: e7p2 Plate II-1
Status: Proposed 2016

60-inch conveyor supported by metal frame structure. The remaining 365-foot portion of Conveyor 2, Phase II will be located within the expanded permit boundary.

The 365-foot portion of Conveyor 2, Phase II is elevated and supported by metal framework anchored to 2 concrete pads with dimensions of 34'x18'x3' and 36'x20'x3', respectively. A 10-foot diameter, 4.5-foot high concrete pier is mounted on each pad for a total concrete volume of 174 cubic yards (includes the 2 pad/piers). The transition pad (to Conveyor 1) dimensions are 23.5'x16'x3', with a volume of 42 cubic yards. Suspended solids contributions will be minimized by utilizing covered conveyors (Plate II-I, photo log P5) and water sprays. Conveyor 2, Phase II will be located within an approved surface drainage control and disturbed area.

Conveyor 1
Map Code: e8 Plate II-1
Status: Proposed 2016

60-inch conveyor supported by metal frame structure. The 215-foot conveyor system transports coal from the Emery 2 mine portal to Conveyor 2 (Map Code e8).

The conveyor is elevated and supported by metal framework anchored to 2 concrete pads with dimensions of 20'x20'x3' and 18'x18'x3, respectively. A 10-foot diameter, 4.5-foot high concrete pier is mounted on each pad for a total concrete volume of 102 cubic yards (includes the 2 pad/piers). The transition pad dimensions into the mine are 25'x16'x3', with a volume of 44 cubic yards Suspended solids contributions will be minimized by utilizing covered conveyors (Plate II-I, photo log P5) and water sprays. Conveyor 1 will be located within the approved surface drainage control area and disturbed area.

Portals
Identified on Plate II-1
Status: Proposed 2016

This 3-entry portal is designed to provide access to the Emery 2 Expansion operating sections of the mine and for future reserve development. The entries will be established at the bottom of an open box cut located at the southern edge of the permit area in Section 33. The majority of the excavated material will be used as fill to establish grade to support the conveyor system and mine access road. The excess material from the boxcut will be stockpiled and used in future reclamation. A ramp on a grade of approximately 10% will lead to the bottom of the portal box cut. Each entry will be approximately 8 feet high by 14 feet wide and will be driven on 45-foot centers. Once established, the portal will be utilized for two purposes: 1) to allow access of rubber-tired vehicles for the transportation of men and supplies into the mine and 2) to serve as a coal haulage portal.

Unaffected drainage will be diverted past the portal site to Quitchupah Creek. Affected drainage will collect in retention basin 1 and be pumped to Sediment Pond 3 (UPDES Outfall 005).

Inserted 7/2016

Emery 2 Expansion Facilities (cont.)

Culvert (UC-1)
Map Code: e10 Plate II-1
Status: Proposed 2016

Culvert (UC-1) is a 30-inch diameter CHDPE 800 feet in length. This culvert conveys unaffected drainage upstream of the portals to Quitchupah Creek.

Culvert (UC-2)
Map Code: e11 Plate II-1
Status: Proposed 2016

Culvert (UC-2) is 30-inch diameter CHDPE 760 feet in length. This culvert conveys unaffected drainage to Quitchupah Creek.

Topsoil Stockpile

Identified on Plate II-1 as existing topsoil stockpile T-2
Status: Existing

This existing stockpile is located south of the coal mine waste pile. Salvaged soil from the Emery 2 Expansion area will be stockpiled here. The stockpile will be fully bermed to contain a 100-yr/24-hr rainfall event.

Excess Boxcut Material

Identified on Plate II-1 as Coal Stockpile Area
Status: Existing

This existing coal stockpile area will be used to store excess boxcut material (89,000 cubic yards) not used for fill. The coal stockpile area reports to an approved drainage basin.

Inserted 7/2016

II.B DRAINAGE CONTROLS

UMC 784.14(a), (b)

A response to (a) and (b) of this regulation is provided in Chapter VI in conjunction with part (c).

UMC 784.16 (a) (1) (i-iii), (v), (a), (2),(i-iii),(a) (3) (i), (iii), (b)(1), (b) (2), (c), (d), (e)

The location and plan views of all ponds, impoundments, and coal processing waste embankments are shown on Plates II-1, II-1A, II-2, II-3, IV-3, and VI-18. This chapter (II), and Chapters IV and VI contain information to describe each structure, provide detailed design and operational criteria (including geotechnical information), and to assess hydrologic impacts. All designs are certified by a qualified, registered, professional engineer. This also applies to any structure which meets or exceeds MSHA requirements. Removal of structures is covered in the reclamation plan presented in Chapter III. As in other instances, this application attempts to consolidate information, where possible, for ease of location.

See Appendix VI-19 (Emery 2 Expansion Drainage Control) for a discussion and detailed drainage design.

UMC 784.22

Three (3) diversions have been designed for the permit area. Each intercepts overland flow from drainage areas of less than one (1) square mile. These diversions are shown on Plate VI-10 (500 scale) and individually on the following 100 scale maps:

Waste Disposal Site Diversion (constructed)	: Plate II-2
4 East Portal Diversion	: Plate II-3 & Plate VI-10a
Preparation Plant Area Diversion	: Plate II-1

Each diversion is designed to achieve compliance with UMC 817.43 and UMC 817.44. This design information is contained in Chapter VI.

UMC 817.41-,50

Mining activities will be conducted so as to minimize changes to the prevailing hydrologic balance in both the permit and adjacent areas. This is accomplished through mine plan considerations and through the implementation of a water management plan as described in Section VI.B.

The mine has the portals located up dip of the mining areas which will prevent gravity drainage from the mine.

Revised 10/2002
Revised 7/2016

UMC 785.13

During the term of this permit, alternative, experimental mining practices which would require a variance from the environmental protection performance standards of Subchapter K, are not proposed.

UMC 785.17(b)(2), (b)(4), UMC 817.21-.23

Prior to the construction of any surface facility, topsoil and subsoil will be removed and stockpiled separately. The site will be visually inspected prior to disturbance for cryptogamic soils. If cryptogam's are found, effort will be made to harvest these structures. The cryptogam material will be stored in a dry place until the material can be respread on the completed topsoil stockpile. Following removal of cryptogam's, effort will be made to segregate the top crust (up to 2-inch) of the topsoil from the site. The crust which contains many of the fine roots and nutrients for the cryptogamic material will be respread over the completed topsoil stockpile following roughening and seeding. The cryptogam's will then be selectively respread on the stockpile in areas protected from the effects of wind and water erosion Removal depths will vary according to the soil classifier's recommendations. Soils will normally be picked up by scrapers but may also be removed by back hoes and/or front end loaders. If vegetation is of sufficient size to potentially cause stockpile instability, it will be removed prior to soil recovery.

Stockpiles will be constructed with a maximum side slope of 2:1 (horiz:vert.) to prevent wind and water erosion. These piles will also be vegetated to assist erosion control. To minimize the effects of wind and water erosion, stockpiled material should utilize surface roughening techniques prior to seeding and mulching. Surface roughening should be performed by a backhoe or excavator to form random depressions from 1 ft to 2 ft in depth. The roughening is to be performed over the entire surface area of the stockpile including side slopes. Berm structures should also utilize some roughening methods to enhance protection from wind and water erosion.

Plates II-1, II-1A, II-2, II-3, IV-3 and VI-18 show the location of both existing and proposed topsoil and subsoil stockpiles

Chapter VII contains the details of the soils plan and Chapter VIII covers vegetation, including temporary, contemporaneous, and final reclamation methods.

It should be noted that a portion of existing subsoil stockpile S-I overlaps the proposed clean coal storage area of the proposed preparation plant area on the operations plan map. This conflict will be resolved prior to construction of the preparation plant facility by utilizing the stockpile in reclamation at the earliest possible time. The respread depth and respread location will be provided to the Division prior to initiating any reclamation If it is not possible to utilize the stockpile prior to construction of the preparation plant facility, final disposition of this stockpile will be determined in consultation with the Division.

UMC 817.61-.68

Surface blasting activities are not conducted by the applicant at the Emery Mine. Surface blasting was performed by contractors in the development of the 4th East Portal during excavation of the boxcut per the approved blasting plan (Refer to CH IV, Appendix IV -11). Surface blasting will be conducted by contractors in the development of the Emery 2 portals and access roads per an approved blasting plan. Once a contractor is chosen, a blasting plan will be submitted to DOGM as CH IV, Appendix IV-11a.

While use of explosives underground is very infrequent, a small amount is stored in an MSHA approved magazine (refer to Plate II-1) which is isolated from heavily traveled areas and is posted with warning signs. Explosives are used and handled as directed by MSHA.

UMC 817.81 - .85

The requirements of these regulations, concerning disposal construction, inspections, and drainage for coal processing waste banks are covered in chapter IV (part IV.C.1)

UMC 817,86 - .88

While no coal processing waste is produced at the present time, this renewal application proposes a preparation plant in the future. At that time a plan for fire suppression, burned waste utilization, and storage in mine workings will be prepared for approval by the Division and MSHA.

UMC 817.91 - .92

The requirements of these regulations for waste dam and embankment design and construction are covered in Chapter IV (part IV.C.2)

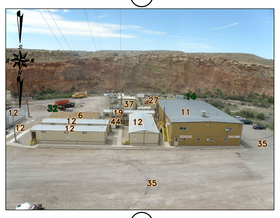
UMC 823.12 - .13

During the term of this permit, Consol does not plan to conduct any surface operations on prime farmland.

P1

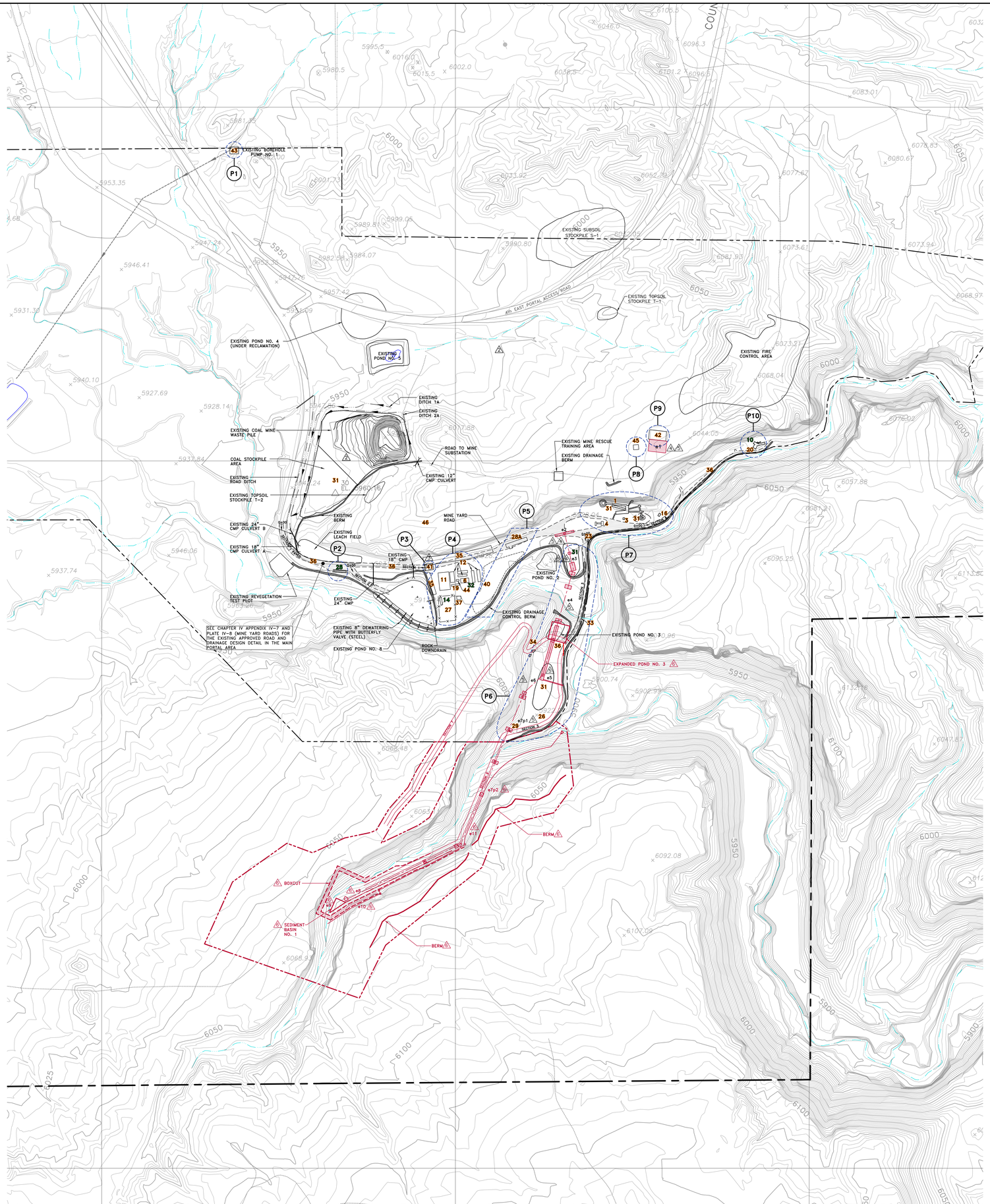
P2

P3

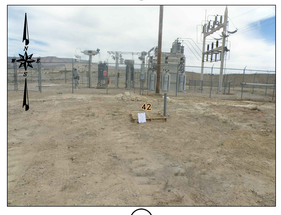


P4

P5



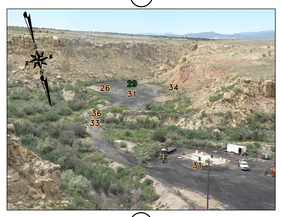
P10



P9

P8

P7



P6

LEGEND

- EXISTING FACILITIES
- PROPOSED FACILITIES
- EXISTING BOREHOLE PUMP WATER LINE
- PERMIT AREA BOUNDARY
- ADJACENT AREA FOR NON-WATER RESOURCES. FOR THE AREA OF HYDROLOGIC EVALUATION, SEE PLATE VI-4
- P11 PHOTOS TAKEN 9th-10th, JUNE 2016

EXISTING FACILITIES KEY

1	TIPPLE STACKER-RECLAIM SYSTEM
3	TIPPLE CONTROL STATION
4	SURFACE STORAGE TANK CONTAINMENT AREA
6	FOREMAN'S BATH HOUSE
10	RETURN AIR PORTAL
11	WAREHOUSE/OFFICE BUILDING
12	BATHHOUSES
14	STORAGE TRAILERS
16	TIPPLE TRANSFORMER BUILDING
19	FOREMAN'S/SHIFT CHANGE OFFICE
20	MINE FAN BUILDING
23	STEAM CLEANER BUILDING
26	SCRAP YARD
27	SUPPLY YARDS
28	OLD TRUCK SCALE FOUNDATION
28A	TRUCK SCALE
29	EXPLOSIVES STORAGE
31	COAL STOCKPILE AREA
32	SEWAGE TREATMENT SYSTEM
33	BRIDGE ON QUITCHUPAH CREEK
34	NON-COAL WASTE STORAGE AREA
35	PARKING AREA
36	MINE YARD ROADS
37	MINE RESCUE STORAGE AREA
40	MATERIAL STORAGE AREA
41	TRAINING SITE PAD
42	EXISTING MINE SUBSTATION
43	BOREHOLE PUMP FACILITY
44	SEWAGE PUMPING STATION
45	TRANSFORMER STORAGE PAD
46	POWER LINE

NOTE: FACILITIES SHOWN IN GREEN HAVE BEEN REMOVED.
FACILITIES SHOWN IN BLACK ARE EXISTING.

NEW FACILITIES KEY

e1	MINE SUBSTATION
e2	CONVEYOR 6/TRUCK LOADOUT
e3	SCREENING AND CRUSHING FACILITY
e4	CONVEYOR 5
e5	RECLAIM TUNNEL
e6	CONVEYOR 4/RADIAL STACKER
e7p1	CONVEYOR 2 P1
e7p2	CONVEYOR 2 P2
e8	CONVEYOR 1
e9	E2 PORTALS
e10	UC-1 CULVERT
e11	UC-2 CULVERT

REGISTERED PROFESSIONAL ENGINEER No. 168246 RICHARD B. WHITE STATE OF UTAH

BASE MAP:

EXTERNAL REFERENCE:

COORDINATE SYSTEM:
STATE PLANE COORDINATES
NAD 83 (CONUS)
UTAH CENTRAL ZONE, CENTRAL - US FEET
VERTICAL DATUM - NAVD 88-US FEET

REVISIONS NO.	DATE	BY	DESCRIPTION	NO.	DATE	BY	DESCRIPTION	NO.	DATE	BY	DESCRIPTION	NO.	DATE	BY	DESCRIPTION
1	09/07	JAG	UPDATED MAP	5	06/16	JAG	#2 PHASE I PERMITTED (TSK 5198)								
2	01/08	JAG	N.O.V. 10005	6	07/16	JAG	#2 PHASE II ADDITIONAL PERMIT								
3	07/08	JAG	TRAINING SITE PAD												
4	05/16	JAG	#2-CONCRETE PAD (TSK 5197)												

0' 200'
SCALE: 1" = 200'

DRAWN BY: SWF
CHECKED BY: JAG
ORIGINAL DATE: 8/90
RE-DRAWN DATE: 9/07
APPROVED BY: JAG
DWG DATA: G:\UC982\15\PLATE II-1-JULY08
DWG 07-23-08

EMERY MINE
EMERY COUNTY, UTAH
PERMIT NO.
ACT015/015

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 1
PRICE, UT 84501

PLATE II-1
STRUCTURES AND FACILITIES
MAIN PORTAL AREA

TABLE III-1

SURFACE OPERATIONS AREA
PRE- AND POST-MINING LAND USES

Land Use	Acres Pre-Mining	Acres Post-Mining
Grazing/Wildlife	417.2	436.7
Grazing Wildlife (Emery 2 Expansion)	29.0	29.0
Industrial (Coal Mining)	19.5	0
Roads	5.8	5.8
TOTAL	471~~42~~.5	471~~42~~.5

TABLE III-2

EXISTING AND FUTURE
SURFACE DISTURBANCE AREAS

	Acres	~~%~~
Prior to August 3, 1977 Area	19.5	~~4~~
August 3, 1977 to May 3, 1978 Area	4.7	~~1~~
May 3, 1978 to January 5, 1986 Area	17.9	~~4~~
Post January 5, 1986 Area	8.6	~~2~~
Post July 1, 2002 Area at 4th East Portal	16.0	~~3~~
Potential Surface Operations Area	375.8	~~86~~
Emery 2 Expansion Disturbance Area	29.0	
TOTAL	471~~42~~.5	~~100~~

Revised 10/2002
Revised 10/2003
Revised 1/2004
Revised 7/2016

III.A.2 TIMING, SEQUENCE AND BONDING

UMC 784.13(b)(1), UMC 784.16(a)(2)(iv), UMC 784.16(a)(3)(iv)

The following reclamation schedule forecasts the timing of reclamation activities at the Emery Mine. The schedule is based on the assumption that mining will continue through the ~~year 2015~~permit term.

Contemporaneous Reclamation

1st Half, 1982	Reclaimed sections of road to Pond No. 1 and Pump #1
1986	Reclaimed old abandoned mine portals and associated borrow area for backfill.
2006	Sealed and Reclaimed main portal entries
2016	Sealed 4th East Portals

Final Abandonment

12 months after cessation of use	Reclamation of development waste disposal site after wastes stored on the northwest coal stockpile area are buried.
12 months after cessation of use	Reclamation of development waste disposal site if newly generated wastes are disposed.
12 months after cessation of use	Reclamation of disposal site for excess cut material generated from initial development of the waste disposal site.
12 months after cessation of use	Reclamation of disposal site used for excess cut material.
From Construction –	Ongoing reclamation of proposed coarse refuse disposal site following construction of this facility as newly generatedwastes are disposed.
12 months after cessation of use	Removal of all non-earthen structures.
12 months after cessation of use	Surface debris removal, regrading, final covering of excess spoil and development waste disposal sites, final covering of coarse refuse disposal site. Dewater freshwater cell of slurry pond, removal of Ponds No. 1, No. 4, and No. 6 and embankments, sealing of mine openings, backfilling and regarding, removal of culverts and bridges, regarding roads and parking areas, topsoil respreading.

Revised 2/08
Revised 7/2016

The following reclamation schedule forecasts the timing of reclamation activities at the Emery Mine 2 Expansion area. Reclamation is anticipated to begin upon final removal of underground machinery.

Year	No. Work Days	Description of Reclamation Work
1	21	Seal Underground Entries and Backfill (3 Entries) – MSHA Approved Seals
1	30	Remove Surface Structures (conveyor, bins, scales, screens/crusher, fan)
1	5	Remove Footers and Foundation (concrete and/or steel)
1	5	Pick up coal stockpile and place in bottom of boxcut on opposite side of U/G entries.
1	2	Clean out Sediment Pond – place sediment in boxcut
1	60	Backfill boxcut. Backfill to be placed in no more than 3-foot lifts. Material to be compacted with traversing of heavy equipment.
1	5	Backfill Airshaft – Non-toxic material
1	2	Remove gravel from site – use as backfill material in airshaft
1	20	Restoration of Ephemeral Channel and culvert removal approximately 1200 feet
1	2	Respread Berm Material
1	2	Construct Silt Fences and/or other Alternate Sediment Control (temporary)
1	6	Respread and roughen topsoil
1	2	Seed and mulch affected surface
2 & 3	2	Refill Airshaft
2	3	Respread/roughen and seed/mulch topsoil of temporary diversion
4	5	Place Permanent Concrete Cap and Monument Marker
6	3	Remove Sediment Basin
6	2	Install silt fence at downstream toe of basin
6	2	Seed and mulch basin and topsoil pile locations
7	2	Remove Alternate Sediment Control (silt fence, straw bales, check dams)

Inserted 7/2016

III.B.1 STRUCTURE REMOVAL AND SITE CLEANUP

UMC 784.11(b), 817.132

All surface structures at the mine will be removed or razed upon either the completion of mining or after the useful life of these facilities has expired. The structure that are salvageable will be sold and removed; all other structures will be razed and disposed of in an environmentally sound manner. Please refer to Plates II-1, II-1A, II-2, II-3 and Chapter II.A for the location and description of existing and proposed facilities at the Emery mine.

Prior to regarding the affected surface areas, surface debris (coal fines, pavement material, etc.) will be removed. The material that is removed will be disposed in the permanent underground development waste disposal site, abandoned underground workings under a disposal plan developed at that time and approved by MSHA and DOGM, or sold as product. If the proposed coarse refuse disposal area has been constructed prior to completion of underground mining, the coal fines may be disposed of in that facility prior to commencing final reclamation of the disposal area.

UMC 784.23(b)13, 817.56

There are currently no existing facilities which will remain as permanent features upon cessation of underground mining activities. In addition, there are no existing facilities proposed as permanent. Therefore, no renovation of these structures will be required prior to final bond release. For details of the reclamation of these structures please refer to Chapter III.C.1 and III.D.1.

Revised 10/2002
Rrevised 2/08
Revised 7/2016

Emery 2 Expansion

There are three primary roads proposed for the Emery No. 2 Portal Site. Primary roads will be constructed to allow access to the site for construction. After portal construction is complete, primary roads will be used as a haul road, portal access road, and ventilation fan access road.

Identification	Classification	Reference MRP Section
Section 5	Primary	Plate IV-8a/b
Section 6	Primary	Plate IV-8 a/b
Section 7	Primary	Plate IV-8 a/b

Please note detailed drawings illustrating the plan view, profile, and cross sections for the above referenced roads are provided in above referenced permit sections of the MRP.

Inserted 7/2016

impoundment with the excavated dirt forming an embankment around the pond. Prior to reclamation, the accumulated sediment may be removed and disposed of in the same manner as the coal fines described in Chapter III.B.1. Reclamation grading will require the dozing of the embankment material back into the pond so that approximate original topography is replaced.

Pond No. 4 was also constructed prior to Aug 3, 1977. This structure is an evaporation lagoon for the waste produce of the reverse osmosis water treatment system. Reclamation of this site will include the removal of the embankment so that approximate original topography is achieved. Analysis of the soils in the bottom of this pond will be made to determine if evaporative salts have accumulated to a toxic level. Soils that are found to be toxic will be removed or covered with sufficient material to comply with UMC 817.103. This site is currently being used as a reclamation test site.

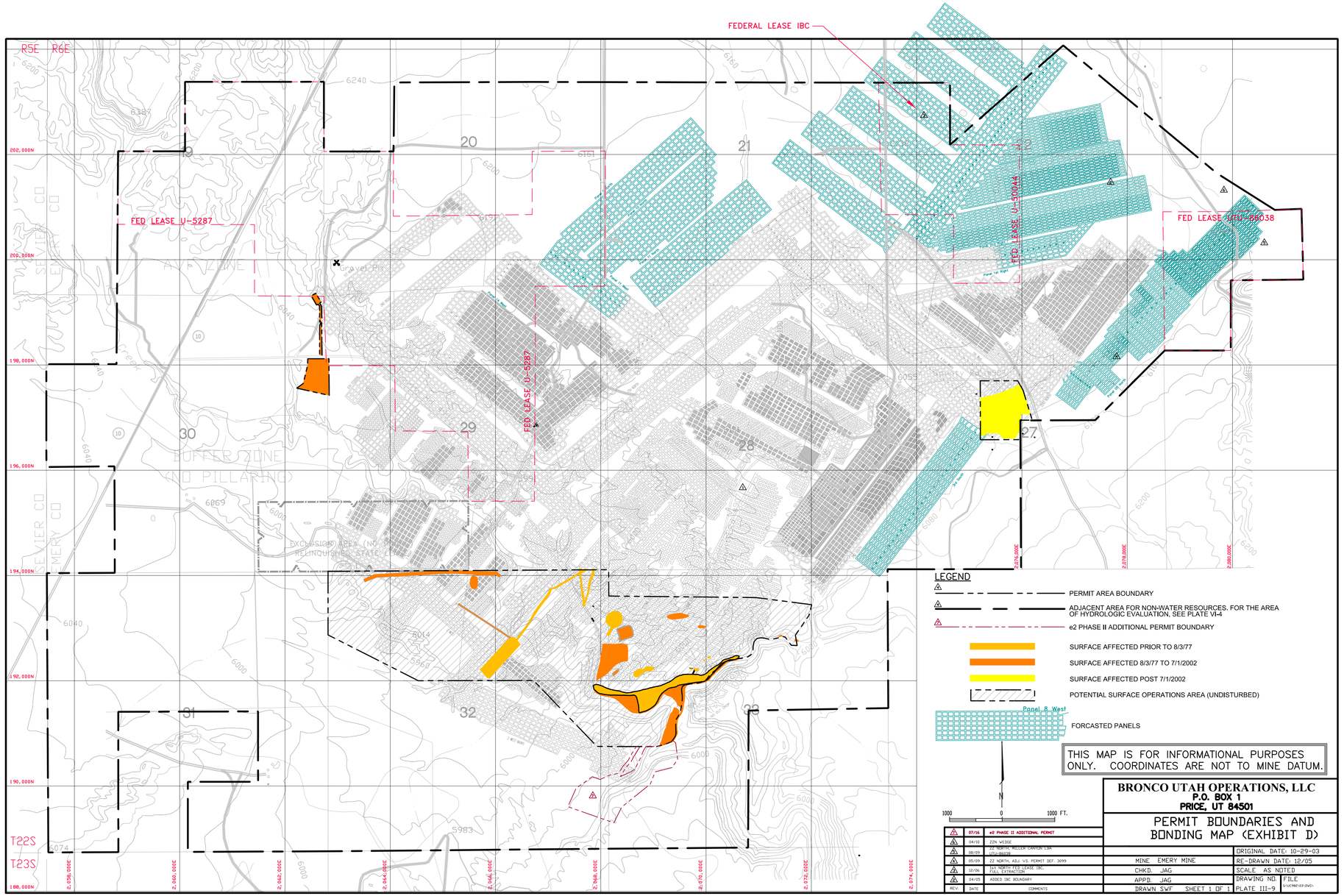
Existing ponds No. 5 (UPDES outfall 007) and No. 6 (UPDES outfall 004) and proposed pond No. 7 are all incised structures. Prior to reclamation, the accumulated sediment may be removed and disposed of in the same manner as the coal fines described in Chapter III.B.1. Reclamation grading will require the dozing of the embankment material back into the ponds so that approximate original topography is replaced. However, subsoil and topsoil which are removed and stockpiled from these sites will also be utilized in the reclamation of these ponds.

Existing sediment pond ~~n~~No.9 (UPDES outfall 009) collects and treats runoff from the 4 East Portal site. Reclamation of this site will include the removal of the embankment and filling the incised volume so that original topography is achieved. Analysis of the soils in the bottom of this pond will be made to determine if evaporative salts have accumulated to a toxic level. Soils that are found to be toxic will be removed or covered with sufficient material to comply with rules and regulations. However, subsoil and topsoil which are removed and stockpiled from this site will also be utilized in the reclamation of this pond.

Sediment pond No. 3 (UPDES outfall 005) currently collects affected runoff from the coal stockpile area. This pond will be enlarged to collect and treat runoff from the Emery 2 Portal site. Reclamation of this site will include removal of the embankment and filling the incised volume so the original topography is achieved.

For additional detail concerning the topsoil and revegetation of these sites, please refer to Chapter III.E.1 and Chapter III.F.1. Additional detail concerning the volume of material in the embankments and design information for Pond No. 1, 2, 3, 4, 5, 6 and 9 is contained in Chapter IV.B and Chapter VI.C respectively. The location of these structures may be found on Plates II-1, II-IA, II-2 and II-3 and on Plate VI-10. Refer to CH VI Appendix VI-19 (Emery 2 Expansion Drainage Control)

Revised 10/2002
Revised 10/2003
Revised 7/2016



REV	DATE	COMMENTS
1	07/16	e2 PHASE II ADDITIONAL PERMIT
1	04/10	ZZN WEDGE
1	08/09	22 NORTH MULLER CANYON LBA (UTU-86029)
1	05/09	22 NORTH ADJ VS PERMIT DEF. 3099
1	12/06	161 NORTH F/S LEASE IBC FULL EXTRACTION
1	04/06	ADDED IBC BOUNDARY

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 1
PRICE, UT 84501

PERMIT BOUNDARIES AND BONDING MAP (EXHIBIT D)

	ORIGINAL DATE: 10-29-03
MINE EMERY MINE	RE-DRAWN DATE: 12/05
CHKD. JAG	SCALE AS NOTED
APPD. JAG	DRAWING NO. / FILE
DRAWN SWF SHEET 1 OF 1	PLATE III-9

REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
STATE OF UTAH
NOT VALID WITHOUT A SIGNATURE

CHAPTER IV - ENGINEERING DESIGNS

PLATES (In Map Pockets)

PLATE IV-2	UG OPERATIONS PLAN (scale 1"=1000')
PLATE IV-3	4th EAST PORTAL DESIGN
PLATE IV-4	UNDERGROUND DEVELOPMENT WASTES DISPOSAL SITE CROSS SECTIONS
PLATE IV-5	EXCESS CUT MATERIAL SITE PROJECTED FINAL CONTOURS, PLAN VIEW & CROSS SECTIONS
PLATE IV-6	COARSE REFUSE DISPOSAL AREA PLAN VIEW TYPICAL SECTIONS
PLATE IV-7	SLURRY IMPOUNDMENT
PLATE IV-8	MINE YARD ROADS - ROAD SECTION
PLATE IV-8a	EMERY 2 EXPANSION PHASES I & II ~~EXPANSION~~ ROAD~~S~~ ~~AND CONVEYOR~~PLAN VIEW
PLATE IV-8b	EMERY 2 EXPANSION PHASES I & II ROAD PROFILE AND CROSS SECTION
PLATE IV-9	BOREHOLE PUMP ROAD - EXISTING PLAN, PROFILE & CROSS SECTION
PLATE IV-10	PLANT ACCESS & TANK EXTENSION ROADS, PLAN, PROFILE & TYPICAL CROSS SECTION
PLATE IV-11	MAIN ENTRANCE ROAD PREPARATION PLANT SITES, PROPOSED PLAN, PROFILE & SECTIONS
PLATE IV-12	COARSE REFUSE HAULAGE ROAD
FIGURE IV-13	4th EAST COAL LOADOUT ROAD
FIGURE IV-14	4th EAST VENTILATION FAN ROAD
FIGURE IV-15	4th EAST PORTAL TOPSOIL STOCKPILE

Revised 10/2002
Revised 9/2003
Revised 7/2016

Soils and Vegetation – 4th East Portal

Refer to Chapter VII, Appendix VII-3 & Appendix VII-4 for narrative of soil resources at the 4 East Portal Area. Prior to portal and diversion excavation, the area will be checked for topsoil thickness. Once the thickness is determined, depth stakes, thickness maps or similar measures will be used to ensure total recovery. All topsoil designated on Plate III-1 for topsoil removal shall be removed and stockpiled in the topsoil stockpile location refer to Plate II-3 and/or IV-3.

Salvage of topsoil material from the 4th East Portal area will involve the following deviation from the topsoil handling plan outlined in Chapter III.E.1.

1. The topsoil which lies within the interior of the excavation material stockpile and topsoil stockpile will be preserved in-place.

2. The interface of the in-place original topsoil and the place material will be marcated with a 4" yellow tape. The tape shall be placed in a 10 ft by 10 ft. grid. and shall remain in place until final reclamation.

3. The topsoil stockpile will be roughened by pocking the surface.

4. Following seeding of the topsoil pile it will be irrigated and records kept as to date and amount of water applied.

The topsoil material from the excavation material and the topsoil stockpile will remain preserved in-place. This practice deviates from normal topsoil handling practices. This deviation is requested in an attempt to preserve the soil structures and cryptogam's within the area. Prior to placement of excavated overburden material on top of the in-place topsoil, the interface was delineated in the field with 4-inch wide yellow tape. The tape was applied in a 10 ft by 10 ft grid pattern. Material from the excavation will be placed over top the in-place topsoil. No toxic material will be placed within this excavation pile.

The topsoil stockpile interface between the in-place and placed topsoil was marked with the grid pattern utilizing the yellow tape.

Salvaging of the topsoil with the initial disturbance of the 4th East Portal was conducted under the direction of Jim Nyenhuis a qualified soil specialist under a contract with Mt. Nebo Scientific of Springville, Utah. Soil salvage from the site progressed from the north (Persayo-Chipeta map unit) to the south (Castle Valley & Montwell soil units), with the Castle Valley soils being placed on top of the stockpile. The surface of the topsoil_stockpile was roughened with a backhoe leaving undulating (pocked) surface. The topsoil stockpile was hydro-seeded and tactified on July 10,2002, with non-native seed mixture defined in Chapter VIII.C.3. This seed mix involved Crested Wheatgrass, Fourwing Saltbush and Russian Wildrye. The southern edge of the topsoil berm was seeded with the native (interim) seed mix which included Shadscale, Fourwing Saltbush, Castle Valley Clover, Streambank Wheatgrass, Scarlet Globemallow, Winter Fat, Blue Grama, Indian Ricegrass and Alkali Sacaton.

The berm located along the northern half of the east fence line was removed in the spring of 2003. This material which consisted of topsoil was removed to protect it from fugitive coal fines. The relocated topsoil was placed on the western outside edge of the topsoil stockpile berm. This section of berm was hydro-seeded and tactified August 19, 2003. The seed mix utilized in the reseeding involved the native seed mix under Chapter VIII.C.3. Record of the applied seed mix was provided to DOGM at the time of reseeding for their records.

Revised 10/2002
Revised 10/2003
Revised 7/2016

Soils and Vegetation – 4th East Portal (cont.)

Irrigation of the south and west side of the topsoil berm (only) began on July 11,2002 by applying one-quarter inch of water. The following table represents the date and amount of water sprayed on the berm.

July 12 - 1/4"	July 18 - 3/4"	July 29 - 1/2"
July 15 - 1/2"	July 19 - 1/2"	Aug 1 - 1/2" Rain
July 16 - 1/4"	July 22 - 1/4"	Aug 2 - 1/2" Rain
July 17 - 1/4"	July 23 - 1/4"	Periodic Rains Have Continued No Further Manual Watering

The topsoil stockpile was not irrigated because of seeding with non-native mix.

Salvage of topsoil contaminated by wind blown coal fines at the 4th East Portal site will be handled in the following manner:

Prior to any topsoil salvage operation, coal fines will be vacuumed up to the best extent possible. This vacuuming operation will be done in a manner which attempts to minimize further disturbance of the topsoil and it's vegetation. On completion of the vacuuming operation, the one acre area of surface disturbance will be checked for cryptogamic matter prior to any topsoil removal. The Division of Oil, Gas and Mining will assist in determining the presence of cryptogams of this soil prior to removal. Should cryptogams be found within the area, the organic matter will be manually collected and immediately transplanted by hand on the topsoil stockpile. The location selected for transplanting of the cryptogams shall be a small confined area of the topsoil stockpile. The cryptogamic material shall be placed along the interior western edge of depressions (gouges) to protect it from prevailing winds. To prevent over saturation the material should be placed within the upper portion of the depression, not in the depression bottom. The depressions where transplanting of cryptogams took place shall be noted, staked and records kept of the area.

The existing west end of the topsoil stockpile berm will be crowded into the existing stockpile (see Figure IV-15). Topsoil currently in-place between the water tank and the topsoil stockpile will be picked up and placed in the topsoil stockpile. Topsoil from the additional 1 acre of disturbance associated with construction of the re-route road will be picked up under the direction of a qualified soil specialist. The excavated topsoil will be moved to the existing topsoil stockpile, where, it will be used to rebuild the berm. The stockpile and associated berm will be placed in a manner to allow for minimal side slope, but, still retains the runoff from the stockpile. The disturbed portions of the topsoil stockpile and berm will be randomly pocked and seeded with native seed mix defined in Chapter VIII.C.3. Seed tag will be saved and date of seeding recorded. Copy of seed tag will be forwarded to DOGM. The affected berm(s) and stockpile will be mulched with straw or hay applied at a rate of one to two tons per acre. The material used for mulching needs to be free of noxious weeds. All berms composted of topsoil will be clearly marked as topsoil storage area.

Soils and Vegetation – Emery 2 Expansion

Refer to CH VII Appendix VII-5 (Order 2 Soil Survey of Emery 2 Mine Permit Area, July 2016) for a discussion of topsoil/subsoil salvage quantity and quality as well as reclamation parameters.

Inserted 10/2002
Revised 10/2003
Revised 7/2016

Wildlife – Main Portal

The disturbance area was inspected on April 11, 1989 by Mr. L. B. Dalton of the Division of Wildlife Resources, Department of Natural Resources, State of Utah. Mr. Dalton finds that "the portal development will have minimal impacts on the wildlife resource." These findings, in letter form, are attached for reference.

Wildlife – 4th East Portal

The 4 East portal site was resurveyed in May 2002 by Mt. Nebo Scientific Consultants. The survey was performed by request from the Division of Oil Gas and Mining. The report in contained as Appendix VIII-3 in Chapter VII.

The vegetation map and T&E survey for the extension area of 1.5 acres at the 4th East Portal was modified by Patrick Collins, Ph.D. of Mt. Nebo Consultants. Mr. Collins letter is located in Chapter VII, Appendice VII-4.

Wildlife – Emery 2 Expansion

Vegetation and Wildlife information for the Emery 2 expansion area can be found at CH VIII Appendix VIII-8 (Vegetation & Sensitive Species of the Emery 2 Area, Mt. Nebo Scientific, Inc., June 2016).

Sampling of fish and macro invertebrates were conducted in September 2002 by JBR Environmental Consultants. The survey was conducted in Quitchupah Creek and Christiansen Wash. The sampling was performed to provide new baseline data for the reactivation of mining operations. Because of the minimal number of samples taken, a second sampling will be performed in September of 2003. The process methods and final report of the 2002 sampling is contained as Appendix IX-2. In accordance with DOGM requirements for perennial streams the micro invertebrate sampling will be performed every three years following the 2003 sampling. Results of these sampling's will be included as part of the annual report for that year.

Inserted 10/2002
Revised 10/2003
Revised 7/2016

Cultural Resources – Main Portal

The area of disturbance was surveyed in 1975, as part of an 880 acre area of investigation, by Mr. Michael S. Berry, Assistant Utah State Archaeologist. After traversing the entire area on 50 to 75 foot intervals, three (3) sites were located and recorded. The nearest of these sites is approximately 0.5 miles to the southwest of the proposed 4 East Portal Site. As a result, we do not anticipate any cultural resource impacts from this development. Mr. Berry's report on this investigation is contained in Chapter X.

Cultural Resources – 4th East Portal

The 4 East portal site was resurveyed in May 2002 by Montgomery Archaeological Consultants. The survey was performed by request from the Division of Oil Gas and Mining. The report is contained as Appendix 5-5 in Chapter X. In March 2003, Montgomery Archaeological Consultants extended the cultural resource survey of the 4th East Portal site. This report is "Confidential", Appendix 5-7 in Chapter X, Vol 2, and should be placed in DOGM's confidential files.

Cultural Resources – Emery 2 Expansion

The Emery 2 Expansion area was surveyed on September 25, 2009 by Montgomery Archeological Consultants, Inc. (Chapter X, Appendix 5-12 MOAC Report 09-152 Emery 2 Expansion. A mitigation plan (Chapter X, Appendix 5-13 MOAC 16-021 Emery 2 Expansion Monitoring and Discovery Plan site 42Em1314) was submitted on April 29, 2016 to address revised Emery 2 expansion plans.

Inserted 10/2002
Revised 10/2003
Inserted 7/2016

Bonding Calculations

Direct Costs		
Subtotal Demolition and Removal	$399,322.00	
Subtotal Backfilling and Grading	$2,843,347.00	
Subtotal Revegetation	$656,247.00	
Direct Costs	$3,898,916.00	
Indirect Costs		
Mob/Demob	$389,892.00	10.0%
Contingency	$194,946.00	5.0%
Engineering Redesign	$97,473.00	2.5%
Main Office Expense	$265,126.00	6.8%
Project Mainagement Fee	$97,473.00	2.5%
Subtotal Indirect Costs	$1,044,910.00	26.8%
Total Cost	$4,943,826.00	
Escalation factor		0.007
Number of years (Mid-Term Review 2018)		2
Escalation	$69,456.00	
Reclamation Cost Escalated	$5,013,282.00	
Bond Amount (rounded to nearest $1,000) 2016 Dollars	$5,013,000.00	
Bond Posted 2016 dollars	$3,808,000.00	
Difference Between Cost Estimate and Bond	-$1,205,000.00	
Percent Difference	-24.04%	

Map Ref.	Description	Cost
1	Tipple Stacker-Reclaim System 01	$ 26,725
3	Tipple Control Station 03	$ 314
4	Surface Storage Tank Containment Area 04	$ 1,429
6	Foreman's Bath House 06	$ 3,815
11	Warehouse/Office Building 11	$ 44,924
12	Bathhouses 12	$ 8,465
16	Tipple Transformer Building 16	$ 651
19	Foreman's/Shift Change Office 19	$ 1,922
20	Mine Fan Building 20	$ 5,123
23	Steam Cleaner Building 23	$ 464
27	Supply Yards 27	$ 2,219
28A	Truck Scale 28A	$ 3,751
33	Bridge On Quitchupah Creek 33	$ 1,837
37	Mine Rescue Storage Area 37	$ 2,107
41	Training Site Pad 41	$ 557
42	Existing Mine Substation 42	$ 5,549
43	Borehole Pump Facility 43	$ 24,699
44	Sewage Pumping Station 44	$ 384
45	Transformer Storage Pad 45	$ 512
46	Power Line 46	$ 3,739
4E01	Crusher/Screen Building 4E01	$ 1,808
4E05	Radial Stacker 4E05	$ 1,232
4E10	Sediment Basin #9_4E10	$ 493
4E13	Rock Dust Bin 4E13	$ 111
4E15	Truck Scale 4E14 & Truck Loadout 4E15	$ 7,870
4E16	Coal Feed Hopper_4E16	$ 1,604
4E17	Beltline Transfer Point_4E17	$ 1,069
4E18	Powerline_4E18	$ 5,299
4E19	Water Tank_4E19	$ 5,359
4E20	VentilationFan_4E20	$ 9,227
4E22	Corrugated Metal Pipe Culvert_4E22	$ 249
4E23	Corrugated Metal Pipe Culvert_4E23	$ 143
4E25	CattleGuard_4E25	$ 247
4E28	Oil Storage Building_4E28	$ 3,083
4E29	RecessedFeeder_4E29	$ 87
4E32	Wind Fence 4E32	$ 2,641
4E33	Perimeter Fence_4E33	$ 8,673
4E34	Substation Pad & Compressor Shed_4E34	$ 3,414
e1	e2 Mine Substation e1	$ 7,293
e2	e2 Conveyor6-Truck Loadout_e2	$ 4,449
e3	e2 Screening&CrushFacility_e3	$ 16,073
e4	e2 Conveyor 5_e4	$ 30,163
e5	e2 Reclaim Tunnel_e5	$ 34,875
e6	e2 Conveyor4-Radial Stacker_e6	$ 1,243
e7p1	e2 Conveyor2 P1_e7p1	$ 19,079
e7p2	e2 Conveyor2 P2_e7p2	$ 26,254
e8	e2 Conveyor1_e8	$ 18,661
e9	e2 SealPortals_e9	$ 34,900
e10	e2 Culvert_e10	$ 7,456
e11	e2 Culvert_e11	$ 7,081
	Total	$ 399,322

Ref. ORIG:	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Tipple Stacker Reclaim 01																			
	Tipple Stacker-Reclaim System 01																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF						996					CY		26892	CF	$ 4,894
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30%	%						697					CY		18824	CF	
	Rubble's Weight (exclude steel)															Ton/CY		0		
	Truck's Capacity															Ton				
	Haulage																			
	Transportation Cost Non Steel Truck															HR			Day	
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 2,531
	Steel's Weight															Ton/CY		0	Ton/CY	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 7,425
	Equipment 's Disposal Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	754	5	3			419							11310	CF	$ 2,941
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30%	%						293					CY		7917	CF	
	Equipment 's Vol. Demolished																			
	Loading Costs															HR			DAY	
	Transport Costs	Truck dump 16 ton payload	01 54 33 20 5300	$ 690.80	/day											TON		0	TON	
	Disposal Costs	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 1,064
	Subtotal																			$ 4,005
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						305					CY		305	CY	$ 3,050
	Concrete's Vol. Demolished																1.3	397	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													397	CY	$ 623
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													397	CY	$ 1,139
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													397	CY	$ 3,347
	Subtotal																			$ 8,159
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						150					CY		150	CY	$ 1,500
	Concrete's Vol. Demolished																1.3	195	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													195	CY	$ 306
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													195	CY	$ 560
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													195	CY	$ 1,644
	Subtotal																			$ 4,010
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						117					CY		117	CY	$ 1,170
	Concrete's Vol. Demolished																1.3	152	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													152	CY	$ 239
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													152	CY	$ 436
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													152	CY	$ 1,281
	Subtotal																			$ 3,126
	Total																			$ 26,725

Ref. ORIG:	Description Tipple Control Station 02	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Tipple Control Station 03																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF						23					CY		621	CF	$ 113
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30%	%						16					CY		435	CF	
	Rubble's Weight (exclude steel)												1.4			TON/CY				
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck															HR			Day	
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY											CY				$ 58
	Steel's Weight																	0	0	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 171
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						5.25					CY		5.25	CY	$ 53
	Concrete's Vol. Demolished																1.3	7	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													7	CY	$ 11
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													7	CY	$ 20
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													7	CY	$ 59
	Subtotal																			$ 143
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 314

Ref. ORIG:	Description Storage Tank Containment Area 21	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Surface Storage Tank Containment Area 04																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF						106					CY		2862	CF	$ 521
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30%	%						74					CY		2003	CF	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63																$ 269
	Steel's Weight															TON				
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 790
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						24					CY		24	CY	$ 240
	Concrete's Vol. Demolished																1.3	31	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													31	CY	$ 49
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													31	CY	$ 89
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													31	CY	$ 261
	Subtotal																			$ 639
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 1,429

Ref. ORIG:	Description No Spreadsheet	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Foreman's Bath House 06																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	48.375	24	9			387.0					CY		10449	CF	$ 1,902
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30%	%						271					CY		7314	CF	
	Rubble's Weight (exclude steel)															TON/CY		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck															HR			Day	
	Transportation Cost Non Steel Drive																	0	TON	$ -
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63																$ 983
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 2,885
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Light Floor's																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	48	28	0.33			16.4					CY		16.4	CY	$ 164
	Concrete's Vol. Demolished																1.3	21	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													21	CY	$ 33
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													21	CY	$ 60
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													21	CY	$ 177
	Subtotal																			$ 434
	Heavy Wall's																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	2.5	1.4	144			18.7					CY		18.7	CY	$ 187
	Concrete's Vol. Demolished																1.3	24	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													24	CY	$ 38
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													24	CY	$ 69
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													24	CY	$ 202
	Subtotal																			$ 496
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 3,815

Ref. ORIG:	Description Warehouse Office Bld 10	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Warehouse/Office Building 11																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	120	60	20			5333					CY		144000	CF	$ 26,208
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						3733					CY		100800	CF	
	Rubble's Weight (exclude steel)															TON/CY		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck													0		HR			Day	
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 13,552
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck													0		HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 39,760
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Light Floor's																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	120	60	0.5			133.3					CY		133.3	CY	$ 1,333
	Concrete's Vol. Demolished																1.3	173	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													173	CY	$ 272
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													173	CY	$ 497
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													173	CY	$ 1,458
	Subtotal																			$ 3,560
	Heavy Wall's																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	360	1.5	3			60					CY		60	CY	$ 600
	Concrete's Vol. Demolished																1.3	78	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													78	CY	$ 122
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													78	CY	$ 224
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													78	CY	$ 658
	Subtotal																			$ 1,604
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 44,924

Ref. ORIG:	Description Bathhouse 6 Trailers 13	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Bathhouses 12																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	50	12	10			222				5	CF		30000	CF	$ 5,460
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						156					CY		21000	CF	
	Rubble's Weight (exclude steel)															TON/CY		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck															HR			Day	
	Transportation Cost Non Steel Drive																	0	TON	$ -
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 2,823
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 8,283
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	60	9	0.33			6.6				1	CY		7	CY	$ 66
	Concrete's Vol. Demolished																1.3	9		
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													9	CY	$ 14
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													9	CY	$ 26
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													9	CY	$ 76
	Subtotal																			$ 182
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 8,465

Ref. ORIG:	Description Tipple Transformer Bld 03	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Tipple Transformer Building 16																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	20	10	8			59.3					CY		1600	CF	$ 291
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						41					CY		1120	CF	
	Rubble's Weight (exclude steel)												1.4			TON/CY				
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck															HR			Day	
	Transportation Cost Non Steel Drive																		TON	$ -
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 151
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 442
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						8					CY		8	CY	$ 80
	Concrete's Vol. Demolished																1.3	10	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													10	CY	$ 16
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													10	CY	$ 29
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													10	CY	$ 84
	Subtotal																			$ 209
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 651

Ref. ORIG:	Description Foreman Office Trailer 09	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Foreman's/Shift Change Office 19																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	58	12	10			258					CY		6960	CF	$ 1,267
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						180					CY		4872	CF	
	Rubble's Weight (exclude steel)															TON/CY			TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck															HR			Day	
	Transportation Cost Non Steel Drive																	0	TON	$ -
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 655
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 1,922
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 1,922

Ref. ORIG:	Description Mine Fan Bld 08	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Mine Fan Building 20																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF						525					CY		14175	CF	$ 2,580
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						368					CY		9923	CF	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 1,334
	Steel's Weight															TON				
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 3,914
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						45					CY		45	CY	$ 450
	Concrete's Vol. Demolished																1.3	59	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													59	CY	$ 93
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													59	CY	$ 169
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													59	CY	$ 497
	Subtotal																			$ 1,209
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 5,123

Ref. ORIG:	Description Steam Cleaner Bld 04	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Steam Cleaner Building 23																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	8	10	10			29.6					CY		800	CF	$ 146
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						21					CY		560	CF	
	Rubble's Weight (exclude steel)															TON/CY				
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck															HR				
	Transportation Cost Non Steel Drive																		TON	$ -
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 75
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 221
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	8	10	3			8.9					CY		8.9	CY	$ 89
	Concrete's Vol. Demolished																1.3	12	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													12	CY	$ 19
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													12	CY	$ 34
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													12	CY	$ 101
	Subtotal																			$ 243
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 464

Ref. ORIG:	Description Fence 26	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Supply Yards 27																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Silt Fence Disposal Cost																			
	Silt Fence	Silt fence	31 25 14 16 1000	$ 1.07	LF	575										FT		575	FT	$ 615
	Supply Yard Fence	Chain link remove 8'-10'	02 41 13 60 1700	$ 2.79	/LF	575										FT		575	FT	$ 1,604
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 2,219
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 2,219

Ref. ORIG:	Description Truck Scale New 15	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Truck Scale 28A																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	8	6	8			14.2					CY		384	CF	$ 70
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						10					CY		269	CF	
	Rubble's Weight (exclude steel)															TON/CY		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck															HR				
	Transportation Cost Non Steel Drive																	0	TON	$ -
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 36
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 106
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	130	12	0.67			38.5					CY		38.5	CY	$ 385
	Concrete's Vol. Demolished																1.3	50	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													50	CY	$ 79
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													50	CY	$ 144
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													50	CY	$ 422
	Subtotal																			$ 1,030
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	12	12	0.33			1.8					CY		1.8	CY	$ 18
	Concrete's Vol. Demolished																1.3	2	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													2	CY	$ 3
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													2	CY	$ 6
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													2	CY	$ 17
	Subtotal																			$ 44
	Footer's Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY						70					CY		70.0	CY	$ 1,400
	Footer's Vol. Demolished																1.3	91	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													91	CY	$ 143
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													91	CY	$ 261
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													91	CY	$ 767
	Subtotal																			$ 2,571
	Total																			$ 3,751

Ref. ORIG:	Description Bridge Quitchupah Creek 16	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Bridge On Quitchupah Creek 33																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY						50					CY		50	CY	$ 1,000
	Concrete's Vol. Demolished																1.3	65	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													65	CY	$ 102
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													65	CY	$ 187
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													65	CY	$ 548
	Subtotal																			$ 1,837
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 1,837

Ref. ORIG:	Description No Spreadsheet	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Mine Rescue Storage Area 37																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	24	20	12			213					CY		5760	CF	$ 1,048
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						149					CY		4032	CF	
	Rubble's Weight (exclude steel)															TON/CY		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck															HR				
	Transportation Cost Non Steel Drive																	0	TON	$ -
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 542
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 1,590
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Light Floor's																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	24	18	0.5			8.0					CY		8.0	CY	$ 80
	Concrete's Vol. Demolished																1.3	10	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													10	CY	$ 16
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													10	CY	$ 29
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													10	CY	$ 84
	Subtotal																			$ 209
	Heavy Wall's																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	64	1.5	2.33			8.3					CY		8.3	CY	$ 166
	Concrete's Vol. Demolished																1.3	11	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													11	CY	$ 17
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													11	CY	$ 32
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													11	CY	$ 93
	Subtotal																			$ 308
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 2,107

Ref. ORIG:	Description Rescue Training Pad 47	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Training Site Pad 41																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	37	47	0.33								ft		21	CY	$ 210
	Concrete's Vol. Demolished																1.3	27	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													27	CY	$ 42
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													27	CY	$ 77
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													27	CY	$ 228
	Subtotal																			$ 557
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 557

Ref. ORIG:	Description Mine Substation 06	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Existing Mine Substation 42																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Remove Substation																			
	Equipment 's Disposal Cost	300 H. P. (D8)	01 54 33 20 4310	$ 1,708.20	/day									2		HR		0.3	Day	$ 512
	Dismantling Cost	Mechanical equipment heavy	25 05 05 10 3600	$ 795.00	/ton							2			3	TON		6	TON	$ 4,770
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 5,282
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						10					CY		10	CY	$ 100
	Footer's Vol. Demolished																1.3	13	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													13	CY	$ 20
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													13	CY	$ 37
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													13	CY	$ 110
	Subtotal																			$ 267
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 5,549

Ref. ORIG:	Description Borehole Pump Facility 18	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Borehole Pump Facility 43																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost	Plug Well	Nevada Mine Cost E	$ 8,200	EA.										3	EA		3	EA	$ 24,600
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 24,600
	Footer's Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						3.5					CY		3.5	CY	$ 35
	Footer's Vol. Demolished																1.3	5	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													5	CY	$ 8
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													5	CY	$ 14
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													5	CY	$ 42
	Subtotal																			$ 99
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 24,699

Ref. ORIG:	Description Sewage Pumping Station 17	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Sewage Pumping Station 44																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	8	8	9			21.3					CY		576	CF	$ 105
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						15					CY		403	CF	
	Rubble's Weight (exclude steel)															TON/CY				
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck															HR				
	Transportation Cost Non Steel Drive																		TON	$ -
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 54
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 159
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	8	8	3.5			8.3					CY		8.3	CY	$ 83
	Concrete's Vol. Demolished																1.3	11	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													11	CY	$ 17
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													11	CY	$ 32
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													11	CY	$ 93
	Subtotal																			$ 225
	Wall's Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			$ -
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 384

Ref. ORIG:	Description Transformer Storage Pad 05	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Transformer Storage Pad 45																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	32	32	0.5			19.0					CY		18.96296	CY	$ 190
	Concrete's Vol. Demolished																1.3	25	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													25	CY	$ 39
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													25	CY	$ 72
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													25	CY	$ 211
	Subtotal																			$ 512
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 512

Ref. ORIG:	Description Power Line 19	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Power Line 46																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost	Powerpole	02 41 13 80 0100	$ 184.64	EA										17	EA		17	EA	$ 3,139
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 3,139
	Equipment 's Disposal Cost	Wire Removal	26 05 05 10 1900	$ 14.95	CLF	4012										feet		40.12	CLF	$ 600
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 600
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 3,739

Ref. ORIG:	Description Crusher Screen Building 28	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
28	Crusher/Screen Building 4E01																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	10	12	10			44.4					CY		1200	CF	$ 218
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						31					CY		840	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 113
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 331
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						55					CY		55	CY	$ 550
	Concrete's Vol. Demolished																1.3	72	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													72	CY	$ 113
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													72	CY	$ 207
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													72	CY	$ 607
	Subtotal																			$ 1,477
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 1,808

Ref. ORIG:	Description Radial Stacker 30	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Radial Stacker 4E05																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						46					CY		46	CY	$ 460
	Concrete's Vol. Demolished																1.3	60	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													60	CY	$ 94
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													60	CY	$ 172
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													60	CY	$ 506
	Subtotal																			$ 1,232
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 1,232

Ref. ORIG:	Description NPDES Outfalls 24	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Sediment Basin #9_4E10																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost	PVC Pipe 18 inch	33 31 13 25 2300	$ 21.68	/LF	20												20	LF	$ 434
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 434
	Footer's Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						2					CY		2	CY	$ 20
	Footer's Vol. Demolished																1.3	3	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													3	CY	$ 5
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													3	CY	$ 9
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													3	CY	$ 25
	Subtotal																			$ 59
	Wall's Demolition																			
	Demolition Cost																			
	Wall's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			$ -
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			$ -
	Total																			$ 493

Ref. ORIG:	Description Rock Dust Bin 32	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Rock Dust Bin 4E13																			
	Structure's Demolition Cost															CF		0	CF	$ -
	Structure's Vol. Demolished																	0	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR		0	Day	$ -
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ -
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY						3					CY		3	CY	$ 60
	Concrete's Vol. Demolished																1.3	4	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													4	CY	$ 6
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													4	CY	$ 11
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													4	CY	$ 34
	Subtotal																			$ 111
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 111

Ref. ORIG:	Description Loadout 35	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Truck Scale 4E14 & Truck Loadout 4E15																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF						23660					CF		23660	CF	$ 4,306
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						613					CY		16562	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 2,227
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 6,533
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						50					CY		50	CY	$ 500
	Concrete's Vol. Demolished																1.3	65	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													65	CY	$ 102
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													65	CY	$ 187
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													65	CY	$ 548
	Subtotal																			$ 1,337
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 7,870

Ref. ORIG:	Description Concrete Barriers 40	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Coal Feed Hopper_4E16																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ -
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						60.0					CY		60.0	CY	$ 600
	Concrete's Vol. Demolished																1.3	78	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													78	CY	$ 122
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													78	CY	$ 224
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													78	CY	$ 658
	Subtotal																			$ 1,604
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 1,604

Ref. ORIG:	Description No Spreadsheet	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Beltline Transfer Point_4E17																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ -
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	10	8	1.5			4.4				9	CY		40.0	CY	$ 400
	Concrete's Vol. Demolished																1.3	52	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													52	CY	$ 82
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													52	CY	$ 149
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													52	CY	$ 438
	Subtotal																			$ 1,069
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 1,069

Ref. ORIG:	Description Powerline 36	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Powerline_4E18																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost	Powerpole	02 41 13 80 0100	$ 184.64	EA										27	EA		27	EA	$ 4,985
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 4,985
	Equipment 's Disposal Cost																			
	Dismantling Cost	Wire Removal	26 05 05 10 1900	$ 14.95	CLF	2132										LF		21	CLF	$ 314
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 314
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 5,299

Ref. ORIG:	Description Water Tank 31	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Water Tank_4E19																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF						17177					CF		17177	CF	$ 3,126
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						445							12024	CF	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 1,617
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 4,743
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						23					CY		23	CY	$ 230
	Concrete's Vol. Demolished																1.3	30	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													30	CY	$ 47
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													30	CY	$ 86
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													30	CY	$ 253
	Subtotal																			$ 616
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 5,359

Ref. ORIG:	Description Ventilation Fan 33	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	VentilationFan_4E20																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF						29167					CF		29167	CF	$ 5,308
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						756							20417	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 2,745
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 8,053
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						44					CY		44	CY	$ 440
	Concrete's Vol. Demolished																1.3	57	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													57	CY	$ 89
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													57	CY	$ 164
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													57	CY	$ 481
	Subtotal																			$ 1,174
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 9,227

Ref. ORIG:	Description Corrugated Metal Pipe Culvert_4E22	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Corrugated Metal Pipe Culvert_4E22																			
	Structure's Demolition Cost	Machine Excavation 3/4 CY	31 23 16 16 6035	$ 14.02	/BCY	63	3	2			14					BCY		14	LF	$ 196
	Structure's Vol. Demolished																	0	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 196
	Equipment 's Disposal Cost	CMP - 12-inch	02 41 13 40 0150	$ 1.69	/LF	63										LF		63	LF	$ 106
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			$ -
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 249

Ref. ORIG:	Description Corrugated Metal Pipe Culvert_4E23	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Corrugated Metal Pipe Culvert_4E23																			
	Structure's Demolition Cost	Machine Excavation 3/4 CY	31 23 16 16 6035	$ 14.02	/BCY	36	3	2			8					BCY		8	LF	$ 112
	Structure's Vol. Demolished																	0	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 112
	Equipment 's Disposal Cost	CMP - 12-inch	02 41 13 40 0150	$ 1.69	/LF	36										LF		36	LF	$ 61
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			$ -
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 143

Ref. ORIG:	Description Cattle Guard 39	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	CattleGuard_4E25																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF						96					CF		96	CF	$ 17
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						67					CF		2.00	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 7
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 24
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY						6					CY		6	CY	$ 120
	Concrete's Vol. Demolished																1.3	8	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													8	CY	$ 13
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													8	CY	$ 23
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													8	CY	$ 67
	Subtotal																			$ 223
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 247

Ref. ORIG:	Description Oil Storage Building 42	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Oil Storage Building_4E28																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	60	18	8			320					CY		8640	CF	$ 1,572
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						224					CY		6048	CF	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 813
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 2,385
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	60	18	0.66								CY		26	CY	$ 260
	Concrete's Vol. Demolished																1.3	34	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													34	CY	$ 53
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													34	CY	$ 98
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													34	CY	$ 287
	Subtotal																			$ 698
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 3,083

Ref. ORIG:	Description Recessed Feeder 43	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	RecessedFeeder_4E29																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	8	1	8			2.4					CY		2.4	CY	$ 48
	Concrete's Vol. Demolished																1.3	3	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													3	CY	$ 5
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													3	CY	$ 9
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													3	CY	$ 25
	Subtotal																			$ 87
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 87

Ref. ORIG:	Description Wind Fence 38	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Wind Fence 4E32																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF						48					CY		1300	CF	$ 237
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						34					CY		910	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 122
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 359
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY						62					CY		62	CY	$ 1,240
	Concrete's Vol. Demolished																1.3	81	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													81	CY	$ 127
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													81	CY	$ 232
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													81	CY	$ 683
	Subtotal																			$ 2,282
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 2,641

Ref. ORIG:	Description Task2929 Forth East Fence 45	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Perimeter Fence_4E33																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost	Chain link remove 8'-10'	02 41 13 60 1700	$ 2.79	/LF	3068										FT		3068	FT	$ 8,560
	Dismantling Cost																			
	Equipment 's Vol. Demolished												100			FT/CY				
	Loading Costs																			
	Transport Costs																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY						31					CY		31	CY	$ 113
	Subtotal																			$ 8,673
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 8,673

Ref. ORIG:	Description Task3103 Substation concrete and compressor shed 48	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Substation Pad & Compressor Shed_4E34																			
	Structure's Demolition Cost	Wood Bldg Small	02 41 16 13 0700	$ 0.28	/CF	12	16	8			57					CY		1536	CF	$ 430
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 207
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 637
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						104					CY		104	CY	$ 1,040
	Concrete's Vol. Demolished																1.3	135	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													135	CY	$ 212
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													135	CY	$ 387
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													135	CY	$ 1,138
	Subtotal																			$ 2,777
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 3,414

Ref.	Description **e2 Mine Substation e1**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost	300 H. P. (D8)	01 54 33 20 4310	$ 1,708.20	/day									2		HR		0.3	Day	$ 512
	Dismantling Cost	Mechanical equipment heavy	25 05 05 10 3600	$ 795.00	/ton							2			3	TON		6	TON	$ 4,770
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 5,282
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						75					CY		75	CY	$ 750
	Concrete's Vol. Demolished																1.3	98	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													98	CY	$ 154
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													98	CY	$ 281
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													98	CY	$ 826
	Subtotal																			$ 2,011
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 7,293

Ref.	Description **e2 Conveyor6-Truck Loadout_e2**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	217	6	9			434.0					CY		11718	CF	$ 2,133
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						304							8203	CF	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 1,103
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 3,236
	Equipment 's Disposal Cost																	0	CF	$ -
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																		DY	
	Transport Costs																	0	0	$ -
	Disposal Costs																			
	Subtotal																			$ -
	Pier C6-1																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	16	12	3			21					CY		21	CY	$ 420
	Concrete's Vol. Demolished																1.3	27	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													27	CY	$ 42
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													27	CY	$ 77
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													27	CY	$ 228
	Subtotal																			$ 767
	Pier C6-2																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	12	9	3			12					CY		12	CY	$ 240
	Concrete's Vol. Demolished																1.3	16	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													16	CY	$ 25
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													16	CY	$ 46
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													16	CY	$ 135
	Subtotal																			$ 446
	Concrete Demolition																			
	Demolition Cost				/CY											CY		0	CY	$ -
	Concrete's Vol. Demolished																	0	CY	
	Loading Cost				/CY													0	CY	$ -
	Transportation Cost				/CY													0	CY	$ -
	Disposal Costs				/CF													0	CY	$ -
	Subtotal																			$ -
	Total																			$ 4,449

Ref.	Description **e2 Screening&CrushFacility_e3**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	40	20	55			1629.6					CY		44000	CF	$ 8,008
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						1141							30800		
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 4,141
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 12,149
	Equipment 's Disposal Cost																	0	CF	$ -
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																		DY	
	Transport Costs																	0	0	$ -
	Disposal Costs																			
	Subtotal																			$ -
	Pad																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	46	26	3			133					CY		133	CY	$ 1,330
	Concrete's Vol. Demolished																1.3	173	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													173	CY	$ 272
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													173	CY	$ 497
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													173	CY	$ 1,458
	Subtotal																			$ 3,557
	Piers - 10																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	3	3	3			10					CY		10	CY	$ 200
	Concrete's Vol. Demolished																1.3	13	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													13	CY	$ 20
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													13	CY	$ 37
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													13	CY	$ 110
	Subtotal																			$ 367
	Concrete Demolition																			
	Demolition Cost				/CY											CY		0	CY	$ -
	Concrete's Vol. Demolished																	0	CY	
	Loading Cost				/CY													0	CY	$ -
	Transportation Cost				/CY													0	CY	$ -
	Disposal Costs				/CF													0	CY	$ -
	Subtotal																			$ -
	Total																			$ 16,073

Ref.	Description **e2 Conveyor 5_e4**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Elevated Belt																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	420	14	12			2613.3					CY		70560	CF	$ 12,842
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						1829							49392		
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 6,640
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 19,482
	On-grade Belt																			
	Equipment 's Disposal Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	213	6	5			236.7					CY		6390	CF	$ 1,163
	Dismantling Cost	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						166							4473		
	Equipment 's Vol. Demolished																			
	Loading Costs															HR			DY	
	Transport Costs															TON		0	TON	$ -
	Disposal Costs																			
	Subtotal																			$ 1,163
	Pier C5-1																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	20	20	3			53					CY		53	CY	$ 1,060
	Concrete's Vol. Demolished							4.5	8								1.3	69	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													69	CY	$ 108
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													69	CY	$ 198
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													69	CY	$ 582
	Subtotal																			$ 1,948
	Piers C5-2, 5-3																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	35	19	3			174					CY		174	CY	$ 3,480
	Concrete's Vol. Demolished							4.5	10								1.3	226	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													226	CY	$ 355
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													226	CY	$ 649
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													226	CY	$ 1,905
	Subtotal																			$ 6,389
	Pier C5-4																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY						32					CY		32	CY	$ 640
	Concrete's Vol. Demolished																1.3	42	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													42	CY	$ 66
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													42	CY	$ 121
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													42	CY	$ 354
	Subtotal																			$ 1,181
	Total																			$ 30,163

Ref.	Description **e2 Reclaim Tunnel_e5**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Structure's Demolition Cost	Reclaim Tunnel Demolition	02 41 13 40 0200	$ 31.20	LF	440			12		1842.1					LF		440	LF	$ 13,728
	Structure's Vol. Demolished	Reduction in Volume	Estimate	10%	%						184					CY		4974	CF	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 669
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 14,397
	Tunnel																			
	Equipment 's Disposal Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF						0.0							0	CF	$ -
	Dismantling Cost	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						0									
	Equipment 's Vol. Demolished																			
	Loading Costs															HR			DY	
	Transport Costs															TON		0	TON	$ -
	Disposal Costs																			
	Subtotal																			$ -
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	320				19	225					CY		225	CY	$ 2,250
	Concrete's Vol. Demolished																1.3	293	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													293	CY	$ 460
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													293	CY	$ 841
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													293	CY	$ 2,470
	Subtotal																			$ 6,021
	Tunnel Cover Excavation																			
	Main Tunnel Excavation Cost	Machine Excavation 1.5 CY	31 23 16 42 0250	$ 1.62	/BCY	320				666	7893					CY		7893	CY	$ 12,787
	Escape Tunnel Excavation Cost	Machine Excavation 1.5 CY	31 23 16 42 0250	$ 1.62	/BCY	120				232	1031					CY		1031	CY	$ 1,670
	Loading Cost																		CY	$ -
	Transportation Cost																		CY	$ -
	Disposal Costs																		CY	$ -
	Subtotal																			$ 14,457
	Concrete Demolition																			
	Demolition Cost															CY		0	CY	$ -
	Concrete's Vol. Demolished																	0	CY	
	Loading Cost																	0	CY	$ -
	Transportation Cost																	0	CY	$ -
	Disposal Costs																	0	CY	$ -
	Subtotal																			$ -
	Total																			$ 34,875

Ref.	Description **e2 Conveyor4-Radial Stacker_e6**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	150	6	5			166.7					CY		4500	CF	$ 819
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						117							3150		
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 424
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 1,243
	Equipment 's Disposal Cost																	0	CF	$ -
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs															HR			DY	
	Transport Costs															TON		0	TON	$ -
	Disposal Costs																			
	Subtotal																			$ -
	Travel Pad																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY											CY		0	CY	$ -
	Concrete's Vol. Demolished																1.3	0	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													0	CY	$ -
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													0	CY	$ -
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													0	CY	$ -
	Subtotal																			$ -
	Concrete Demolition																			
	Demolition Cost				/CY											CY		0	CY	$ -
	Concrete's Vol. Demolished																	0	CY	
	Loading Cost				/CY													0	CY	$ -
	Transportation Cost				/CY													0	CY	$ -
	Disposal Costs				/CF													0	CY	$ -
	Subtotal																			$ -
	Concrete Demolition																			
	Demolition Cost				/CY											CY		0	CY	$ -
	Concrete's Vol. Demolished																	0	CY	
	Loading Cost				/CY													0	CY	$ -
	Transportation Cost				/CY													0	CY	$ -
	Disposal Costs				/CF													0	CY	$ -
	Subtotal																			$ -
	Total																			$ 1,243

Ref.	Description **e2 Conveyor2 P1_e7p1**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	260	13	12			1502.2					CY		40560	CF	$ 7,382
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						1052							28392		
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 3,817
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 11,199
	Equipment 's Disposal Cost																	0	CF	$ -
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs															HR			DY	
	Transport Costs															TON		0	TON	$ -
	Disposal Costs																			
	Subtotal																			$ -
	Pier C2-3																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	36	20	3			93					CY		93	CY	$ 1,860
	Concrete's Vol. Demolished							4.5	10								1.3	121	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													121	CY	$ 190
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													121	CY	$ 347
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													121	CY	$ 1,020
	Subtotal																			$ 3,417
	Pier C2-4																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	36	20	3			93					CY		93	CY	$ 1,860
	Concrete's Vol. Demolished							4.5	10								1.3	121	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													121	CY	$ 190
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													121	CY	$ 347
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													121	CY	$ 1,020
	Subtotal																			$ 3,417
	Drop Chute Pad																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	22	16	3			39					CY		39	CY	$ 390
	Concrete's Vol. Demolished																1.3	51	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													51	CY	$ 80
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													51	CY	$ 146
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													51	CY	$ 430
	Subtotal																			$ 1,046
	Total																			$ 19,079

Ref.	Description **e2 Conveyor2 P2_e7p2**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	13+80 to 10+15																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	365	13	12			2109					CY		56940	CF	$ 10,363
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						1476							39858		
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 5,359
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 15,722
	10+15 to 7+00																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	315	6	5			350					CY		9450	CF	$ 1,720
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						245							6615		
	Equipment 's Vol. Demolished																			
	Loading Costs															HR			DY	
	Transport Costs															TON		0	TON	$ -
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 889
	Subtotal																			$ 2,609
	Bent C2-2 (Pad and pier)																			
	Concrete Demolition																			
	Demolition Cost - Pad	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	34	18	3			68					CY		81	CY	$ 1,622
	Concrete's Vol. Demolished							4.5	10		13						1.3	105	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													105	CY	$ 165
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													105	CY	$ 301
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													105	CY	$ 885
	Subtotal																			$ 2,973
	Bent C2-1 (Pad and pier)																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	36	20	3			80					CY		93	CY	$ 1,862
	Concrete's Vol. Demolished							4.5	10		13						1.3	121	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													121	CY	$ 190
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													121	CY	$ 347
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													121	CY	$ 1,020
	Subtotal																			$ 3,419
	Conv 1 - Conv 2 Transition																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	23.5	16	3			42					CY		42	CY	$ 836
	Concrete's Vol. Demolished																1.3	54	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													54	CY	$ 85
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													54	CY	$ 155
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													54	CY	$ 455
	Subtotal																			$ 1,531
	Total																			$ 26,254

Ref.	Description **e2 Conveyor1_e8**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	4+85 to 7+00																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	215	13	12			1242					CY		33540	CF	$ 6,104
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						870							23478		
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 3,156
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 9,260
	0+00 to 4+85																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	485	6	5			539					CY		14550	CF	$ 2,648
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						377							10185		
	Equipment 's Vol. Demolished																			
	Loading Costs															HR			DY	
	Transport Costs															TON		0	TON	$ -
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 1,369
	Subtotal																			$ 4,017
	Bent C1-2 (Pad and pier)																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	20	20	3			44					CY		58	CY	$ 1,151
	Concrete's Vol. Demolished							4.5	10		13						1.3	75	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													75	CY	$ 118
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													75	CY	$ 215
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													75	CY	$ 632
	Subtotal																			$ 2,116
	Bent C1-1 (Pad and pier)																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	18	18	3			36					CY		44	CY	$ 887
	Concrete's Vol. Demolished							4.5	8		8						1.3	58	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													58	CY	$ 91
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													58	CY	$ 166
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													58	CY	$ 489
	Subtotal																			$ 1,633
	Mine Belt to Conveyor 1 Transition																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	25	16	3			44					CY		44	CY	$ 889
	Concrete's Vol. Demolished																1.3	58	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													58	CY	$ 91
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													58	CY	$ 166
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													58	CY	$ 489
	Subtotal																			$ 1,635
	Total																			$ 18,661

Ref.	Description **e2 SealPortals_e9**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Structure's Demolition Cost	Seal Portals	Strata Mine Services	$ 34,900	EA.						0				1	CY		1	CF	$ 34,900
	Structure's Vol. Demolished																	0		
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 34,900
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Cost, Non Steel & Steel																			
	Subtotal																			$ -
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			$ -
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			$ -
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			$ -
	Total																			$ 34,900

Ref. ORIG:	Description **e2 Culvert_e10**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Structure's Demolition Cost	Machine Excavation 3/4 CY	31 23 16 16 6035	$ 14.02	/BCY	800	3	2			178					BCY		178	LF	$ 2,496
	Structure's Vol. Demolished																	0	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 2,496
	Equipment 's Disposal Cost	Plasic Pipe - 30-inch	02 41 13 38 1900	$ 6.20	/LF	800										LF		800	LF	$ 4,960
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 4,960
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			$ -
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 7,456

Ref. ORIG:	Description **e2 Culvert_e11**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Structure's Demolition Cost	Machine Excavation 3/4 CY	31 23 16 16 6035	$ 14.02	/BCY	760	3	2			169					BCY		169	LF	$ 2,369
	Structure's Vol. Demolished																	0	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 2,369
	Equipment 's Disposal Cost	Plasic Pipe - 30-inch	02 41 13 38 1900	$ 6.20	/LF	760										LF		760	LF	$ 4,712
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 4,712
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			$ -
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 7,081

Map Ref.	Description	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
	Backfill and Grade Portal Area 01															$ 248,478
	Coal Fines Removal 02															$ 182,794
	Coal Mine Waste 03															$ 270,045
	Coal Mine Waste 03a															$ 459,141
	Roadside Berms 04															$ 10,947
	Dike Improvements 05															$ 21,232
	Pond No One 06															$ 125,734
	Pond No Two 07															$ 21,232
	Pond No Three 08															$ 2,324
	Pond No Four 09															$ 24,550
	Pond No Five 10															$ 10,284
	Pond No Six 11															$ 61,375
	Pond No 1 Road 12															$ 996
	Pump No 1 Road 13															$ 1,327
	Tank Road 14															$ 1,327
	MineYardRoads15															$ 12,606
	The 4th East Portal 16															$ 712,560
	Emery 2 Boxcut_17															$ 659,728
	Pond No 3_18															$ 10,616
	Berms UB1-UB2_19															$ 900
	Switchback Road_20															$ 5,151
	Total															$ 2,843,347

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	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Backfill and Grade Portal Area 01															
627G EROPS (9-49) (2nd2007)	$ 26,220	$ 164.55	10%	$ 51.10	$ 395.98	6	$ 2,375.88	$/HR	52600	CY	702	CY/HR	74.9	HR	$ 177,953
D7N DS XR Series II (9-51) (2nd 2007)	$ 12,455	$ 69.65	10%	$ 51.10	$ 205.56	1	$ 205.56	$/HR					74.9	HR	$ 15,396
D8T (9-52)(2nd2007)	$ 16,865	$ 89.55	10%	$ 51.10	$ 255.01	1	$ 255.01	$/HR					74.9	HR	$ 19,100
12H EROPS (9-11)(2H2007)	$ 13,110	$ 64.30	10%	$ 51.10	$ 203.77	1	$ 203.77	$/HR					74.9	HR	$ 15,262
5,000 gal H2O truck Diesel (20-17) (2nd2006)	$ 5,280	$ 45.80	10%	$ 43.20	$ 126.58	1	$ 126.58	$/HR					74.9	HR	$ 9,481
Pickup Crew 4x4 1 ton 340 hp (20-17) (2nd2007)	$ 1,080	$ 20.35	10%	$ 37.90	$ 67.04	1	$ 67.04	$/HR					74.9	HR	$ 5,021
CLAB				$ 37.90	$ 35.45	1	$ 35.45	$/HR					74.9	HR	$ 2,655
Foreman Average, Outside				$ 51.90	$ 48.20	1	$ 48.20	$/HR					74.9	HR	$ 3,610
Subtotal															$ 248,478

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Coal Fines Removal 02															
627G EROPS (9-49) (2nd2007)	$ 26,220	$ 164.55	10%	$ 51.10	$ 395.98	6	$ 2,375.88	$/HR	38700	CY	702	CY/HR	55.1	HR	$ 130,911
D7N DS XR Series II (9-51) (2nd 2007)	$ 12,455	$ 69.65	10%	$ 51.10	$ 205.56	1	$ 205.56	$/HR					55.1	HR	$ 11,326
D8T (9-52)(2nd2007)	$ 16,865	$ 89.55	10%	$ 51.10	$ 255.01	1	$ 255.01	$/HR					55.1	HR	$ 14,051
12H EROPS (9-11)(2H2007)	$ 13,110	$ 64.30	10%	$ 51.10	$ 203.77	1	$ 203.77	$/HR					55.1	HR	$ 11,228
5,000 gal H2O truck Diesel (20-17) (2nd2006)	$ 5,280	$ 45.80	10%	$ 43.20	$ 126.58	1	$ 126.58	$/HR					55.1	HR	$ 6,975
Pickup Crew 4x4 1 ton 340 hp (20-17) (2nd2007)	$ 1,080	$ 20.35	10%	$ 37.90	$ 67.04	1	$ 67.04	$/HR					55.1	HR	$ 3,694
CLAB				$ 37.90	$ 35.45	1	$ 35.45	$/HR					55.1	HR	$ 1,953
Foreman Average, Outside				$ 51.90	$ 48.20	1	$ 48.20	$/HR					55.1	HR	$ 2,656
Subtotal															$ 182,794

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Backfilling and Regrading															
Coal Mine Waste 03															
Task 2929															
627G EROPS (9-49) (2nd2007)	$ 26,220	$ 164.55	10%	$ 51.10	$ 395.98	6	$ 2,375.88	$/HR	57110	CY	702	CY/HR	81.4	HR	$ 193,397
D7N DS XR Series II (9-51) (2nd 2007)	$ 12,455	$ 69.65	10%	$ 51.10	$ 205.56	1	$ 205.56	$/HR					81.4	HR	$ 16,733
D8T (9-52)(2nd2007)	$ 16,865	$ 89.55	10%	$ 51.10	$ 255.01	1	$ 255.01	$/HR					81.4	HR	$ 20,758
12H EROPS (9-11)(2H2007)	$ 13,110	$ 64.30	10%	$ 51.10	$ 203.77	1	$ 203.77	$/HR					81.4	HR	$ 16,587
5,000 gal H2O truck Diesel (20-17) (2nd2006)	$ 5,280	$ 45.80	10%	$ 43.20	$ 126.58	1	$ 126.58	$/HR					81.4	HR	$ 10,304
Pickup Crew 4x4 1 ton 340 hp (20-17) (2nd2007)	$ 1,080	$ 20.35	10%	$ 37.90	$ 67.04	1	$ 67.04	$/HR					81.4	HR	$ 5,457
CLAB				$ 37.90	$ 35.45	1	$ 35.45	$/HR					81.4	HR	$ 2,886
Foreman Average, Outside				$ 51.90	$ 48.20	1	$ 48.20	$/HR					81.4	HR	$ 3,923
Subtotal															$ 270,045

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Excavate Coal Mine Waste Site															
Coal Mine Waste 03a															
Task 2929															
627G EROPS (9-49) (2nd2007)	$ 26,220	$ 164.55	10%	$ 51.10	$ 395.98	6	$ 2,375.88	$/HR	97130	CY	702	CY/HR	138.4	HR	$ 328,822
D7N DS XR Series II (9-51) (2nd 2007)	$ 12,455	$ 69.65	10%	$ 51.10	$ 205.56	1	$ 205.56	$/HR					138.4	HR	$ 28,450
D8T (9-52)(2nd2007)	$ 16,865	$ 89.55	10%	$ 51.10	$ 255.01	1	$ 255.01	$/HR					138.4	HR	$ 35,293
12H EROPS (9-11)(2H2007)	$ 13,110	$ 64.30	10%	$ 51.10	$ 203.77	1	$ 203.77	$/HR					138.4	HR	$ 28,202
5,000 gal H2O truck Diesel (20-17) (2nd2006)	$ 5,280	$ 45.80	10%	$ 43.20	$ 126.58	1	$ 126.58	$/HR					138.4	HR	$ 17,519
Pickup Crew 4x4 1 ton 340 hp (20-17) (2nd2007)	$ 1,080	$ 20.35	10%	$ 37.90	$ 67.04	1	$ 67.04	$/HR					138.4	HR	$ 9,278
CLAB				$ 37.90	$ 35.45	1	$ 35.45	$/HR					138.4	HR	$ 4,906
Foreman Average, Outside				$ 51.90	$ 48.20	1	$ 48.20	$/HR					138.4	HR	$ 6,671
Subtotal															$ 459,141

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Roadside Berms 04															
627G EROPS (9-49) (2nd2007)	$ 26,220	$ 164.55	10%	$ 51.10	$ 395.98	6	$ 2,375.88	$/HR	2300	CY	702	CY/HR	3.3	HR	$ 7,840
D7N DS XR Series II (9-51) (2nd 2007)	$ 12,455	$ 69.65	10%	$ 51.10	$ 205.56	1	$ 205.56	$/HR					3.3	HR	$ 678
D8T (9-52)(2nd2007)	$ 16,865	$ 89.55	10%	$ 51.10	$ 255.01	1	$ 255.01	$/HR					3.3	HR	$ 842
12H EROPS (9-11)(2H2007)	$ 13,110	$ 64.30	10%	$ 51.10	$ 203.77	1	$ 203.77	$/HR					3.3	HR	$ 672
5,000 gal H2O truck Diesel (20-17) (2nd2006)	$ 5,280	$ 45.80	10%	$ 43.20	$ 126.58	1	$ 126.58	$/HR					3.3	HR	$ 418
Pickup Crew 4x4 1 ton 340 hp (20-17) (2nd2007)	$ 1,080	$ 20.35	10%	$ 37.90	$ 67.04	1	$ 67.04	$/HR					3.3	HR	$ 221
CLAB				$ 37.90	$ 35.45	1	$ 35.45	$/HR					3.3	HR	$ 117
Foreman Average, Outside				$ 51.90	$ 48.20	1	$ 48.20	$/HR					3.3	HR	$ 159
Subtotal															$ 10,947

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Dike Improvements 05															
627G EROPS (9-49) (2nd2007)	$ 26,220	$ 164.55	10%	$ 51.10	$ 395.98	6	$ 2,375.88	$/HR	4500	CY	702	CY/HR	6.4	HR	$ 15,206
D7N DS XR Series II (9-51) (2nd 2007)	$ 12,455	$ 69.65	10%	$ 51.10	$ 205.56	1	$ 205.56	$/HR					6.4	HR	$ 1,316
D8T (9-52)(2nd2007)	$ 16,865	$ 89.55	10%	$ 51.10	$ 255.01	1	$ 255.01	$/HR					6.4	HR	$ 1,632
12H EROPS (9-11)(2H2007)	$ 13,110	$ 64.30	10%	$ 51.10	$ 203.77	1	$ 203.77	$/HR					6.4	HR	$ 1,304
5,000 gal H2O truck Diesel (20-17) (2nd2006)	$ 5,280	$ 45.80	10%	$ 43.20	$ 126.58	1	$ 126.58	$/HR					6.4	HR	$ 810
Pickup Crew 4x4 1 ton 340 hp (20-17) (2nd2007)	$ 1,080	$ 20.35	10%	$ 37.90	$ 67.04	1	$ 67.04	$/HR					6.4	HR	$ 429
CLAB				$ 37.90	$ 35.45	1	$ 35.45	$/HR					6.4	HR	$ 227
Foreman Average, Outside				$ 51.90	$ 48.20	1	$ 48.20	$/HR					6.4	HR	$ 308
Subtotal															$ 21,232

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Pond No One 06															
627G EROPS (9-49) (2nd2007)	$ 26,220	$ 164.55	10%	$ 51.10	$ 395.98	6	$ 2,375.88	$/HR	26600	CY	702	CY/HR	37.9	HR	$ 90,046
D7N DS XR Series II (9-51) (2nd 2007)	$ 12,455	$ 69.65	10%	$ 51.10	$ 205.56	1	$ 205.56	$/HR					37.9	HR	$ 7,791
D8T (9-52)(2nd2007)	$ 16,865	$ 89.55	10%	$ 51.10	$ 255.01	1	$ 255.01	$/HR					37.9	HR	$ 9,665
12H EROPS (9-11)(2H2007)	$ 13,110	$ 64.30	10%	$ 51.10	$ 203.77	1	$ 203.77	$/HR					37.9	HR	$ 7,723
5,000 gal H2O truck Diesel (20-17) (2nd2006)	$ 5,280	$ 45.80	10%	$ 43.20	$ 126.58	1	$ 126.58	$/HR					37.9	HR	$ 4,797
Pickup Crew 4x4 1 ton 340 hp (20-17) (2nd2007)	$ 1,080	$ 20.35	10%	$ 37.90	$ 67.04	1	$ 67.04	$/HR					37.9	HR	$ 2,541
CLAB				$ 37.90	$ 35.45	1	$ 35.45	$/HR					37.9	HR	$ 1,344
Foreman Average, Outside				$ 51.90	$ 48.20	1	$ 48.20	$/HR					37.9	HR	$ 1,827
Subtotal															$ 125,734

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Pond No Two 07															
627G EROPS (9-49) (2nd2007)	$ 26,220	$ 164.55	10%	$ 51.10	$ 395.98	6	$ 2,375.88	$/HR	4500	CY	702	CY/HR	6.4	HR	$ 15,206
D7N DS XR Series II (9-51) (2nd 2007)	$ 12,455	$ 69.65	10%	$ 51.10	$ 205.56	1	$ 205.56	$/HR					6.4	HR	$ 1,316
D8T (9-52)(2nd2007)	$ 16,865	$ 89.55	10%	$ 51.10	$ 255.01	1	$ 255.01	$/HR					6.4	HR	$ 1,632
12H EROPS (9-11)(2H2007)	$ 13,110	$ 64.30	10%	$ 51.10	$ 203.77	1	$ 203.77	$/HR					6.4	HR	$ 1,304
5,000 gal H2O truck Diesel (20-17) (2nd2006)	$ 5,280	$ 45.80	10%	$ 43.20	$ 126.58	1	$ 126.58	$/HR					6.4	HR	$ 810
Pickup Crew 4x4 1 ton 340 hp (20-17) (2nd2007)	$ 1,080	$ 20.35	10%	$ 37.90	$ 67.04	1	$ 67.04	$/HR					6.4	HR	$ 429
CLAB				$ 37.90	$ 35.45	1	$ 35.45	$/HR					6.4	HR	$ 227
Foreman Average, Outside				$ 51.90	$ 48.20	1	$ 48.20	$/HR					6.4	HR	$ 308
Subtotal															$ 21,232

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Pond No Three 08															
627G EROPS (9-49) (2nd2007)	$ 26,220	$ 164.55	10%	$ 51.10	$ 395.98	6	$ 2,375.88	$/HR	500	CY	702	CY/HR	0.7	HR	$ 1,663
D7N DS XR Series II (9-51) (2nd 2007)	$ 12,455	$ 69.65	10%	$ 51.10	$ 205.56	1	$ 205.56	$/HR					0.7	HR	$ 144
D8T (9-52)(2nd2007)	$ 16,865	$ 89.55	10%	$ 51.10	$ 255.01	1	$ 255.01	$/HR					0.7	HR	$ 179
12H EROPS (9-11)(2H2007)	$ 13,110	$ 64.30	10%	$ 51.10	$ 203.77	1	$ 203.77	$/HR					0.7	HR	$ 143
5,000 gal H2O truck Diesel (20-17) (2nd2006)	$ 5,280	$ 45.80	10%	$ 43.20	$ 126.58	1	$ 126.58	$/HR					0.7	HR	$ 89
Pickup Crew 4x4 1 ton 340 hp (20-17) (2nd2007)	$ 1,080	$ 20.35	10%	$ 37.90	$ 67.04	1	$ 67.04	$/HR					0.7	HR	$ 47
CLAB				$ 37.90	$ 35.45	1	$ 35.45	$/HR					0.7	HR	$ 25
Foreman Average, Outside				$ 51.90	$ 48.20	1	$ 48.20	$/HR					0.7	HR	$ 34
Subtotal															$ 2,324

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Pond No Four 09															
627G EROPS (9-49) (2nd2007)	$ 26,220	$ 164.55	10%	$ 51.10	$ 395.98	6	$ 2,375.88	$/HR	5200	CY	702	CY/HR	7.4	HR	$ 17,582
D7N DS XR Series II (9-51) (2nd 2007)	$ 12,455	$ 69.65	10%	$ 51.10	$ 205.56	1	$ 205.56	$/HR					7.4	HR	$ 1,521
D8T (9-52)(2nd2007)	$ 16,865	$ 89.55	10%	$ 51.10	$ 255.01	1	$ 255.01	$/HR					7.4	HR	$ 1,887
12H EROPS (9-11)(2H2007)	$ 13,110	$ 64.30	10%	$ 51.10	$ 203.77	1	$ 203.77	$/HR					7.4	HR	$ 1,508
5,000 gal H2O truck Diesel (20-17) (2nd2006)	$ 5,280	$ 45.80	10%	$ 43.20	$ 126.58	1	$ 126.58	$/HR					7.4	HR	$ 937
Pickup Crew 4x4 1 ton 340 hp (20-17) (2nd2007)	$ 1,080	$ 20.35	10%	$ 37.90	$ 67.04	1	$ 67.04	$/HR					7.4	HR	$ 496
CLAB				$ 37.90	$ 35.45	1	$ 35.45	$/HR					7.4	HR	$ 262
Foreman Average, Outside				$ 51.90	$ 48.20	1	$ 48.20	$/HR					7.4	HR	$ 357
Subtotal															$ 24,550

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Pond No Five 10															
627G EROPS (9-49) (2nd2007)	$ 26,220	$ 164.55	10%	$ 51.10	$ 395.98	6	$ 2,375.88	$/HR	2200	CY	702	CY/HR	3.1	HR	$ 7,365
D7N DS XR Series II (9-51) (2nd 2007)	$ 12,455	$ 69.65	10%	$ 51.10	$ 205.56	1	$ 205.56	$/HR					3.1	HR	$ 637
D8T (9-52)(2nd2007)	$ 16,865	$ 89.55	10%	$ 51.10	$ 255.01	1	$ 255.01	$/HR					3.1	HR	$ 791
12H EROPS (9-11)(2H2007)	$ 13,110	$ 64.30	10%	$ 51.10	$ 203.77	1	$ 203.77	$/HR					3.1	HR	$ 632
5,000 gal H2O truck Diesel (20-17) (2nd2006)	$ 5,280	$ 45.80	10%	$ 43.20	$ 126.58	1	$ 126.58	$/HR					3.1	HR	$ 392
Pickup Crew 4x4 1 ton 340 hp (20-17) (2nd2007)	$ 1,080	$ 20.35	10%	$ 37.90	$ 67.04	1	$ 67.04	$/HR					3.1	HR	$ 208
CLAB				$ 37.90	$ 35.45	1	$ 35.45	$/HR					3.1	HR	$ 110
Foreman Average, Outside				$ 51.90	$ 48.20	1	$ 48.20	$/HR					3.1	HR	$ 149
Subtotal															$ 10,284

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Pond No Six 11															
627G EROPS (9-49) (2nd2007)	$ 26,220	$ 164.55	10%	$ 51.10	$ 395.98	6	$ 2,375.88	$/HR	13000	CY	702	CY/HR	18.5	HR	$ 43,954
D7N DS XR Series II (9-51) (2nd 2007)	$ 12,455	$ 69.65	10%	$ 51.10	$ 205.56	1	$ 205.56	$/HR					18.5	HR	$ 3,803
D8T (9-52)(2nd2007)	$ 16,865	$ 89.55	10%	$ 51.10	$ 255.01	1	$ 255.01	$/HR					18.5	HR	$ 4,718
12H EROPS (9-11)(2H2007)	$ 13,110	$ 64.30	10%	$ 51.10	$ 203.77	1	$ 203.77	$/HR					18.5	HR	$ 3,770
5,000 gal H2O truck Diesel (20-17) (2nd2006)	$ 5,280	$ 45.80	10%	$ 43.20	$ 126.58	1	$ 126.58	$/HR					18.5	HR	$ 2,342
Pickup Crew 4x4 1 ton 340 hp (20-17) (2nd2007)	$ 1,080	$ 20.35	10%	$ 37.90	$ 67.04	1	$ 67.04	$/HR					18.5	HR	$ 1,240
CLAB				$ 37.90	$ 35.45	1	$ 35.45	$/HR					18.5	HR	$ 656
Foreman Average, Outside				$ 51.90	$ 48.20	1	$ 48.20	$/HR					18.5	HR	$ 892
Subtotal															$ 61,375

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Pond No 1 Road 12															
627G EROPS (9-49) (2nd2007)	$ 26,220	$ 164.55	10%	$ 51.10	$ 395.98	6	$ 2,375.88	$/HR	200	CY	702	CY/HR	0.3	HR	$ 713
D7N DS XR Series II (9-51) (2nd 2007)	$ 12,455	$ 69.65	10%	$ 51.10	$ 205.56	1	$ 205.56	$/HR					0.3	HR	$ 62
D8T (9-52)(2nd2007)	$ 16,865	$ 89.55	10%	$ 51.10	$ 255.01	1	$ 255.01	$/HR					0.3	HR	$ 77
12H EROPS (9-11)(2H2007)	$ 13,110	$ 64.30	10%	$ 51.10	$ 203.77	1	$ 203.77	$/HR					0.3	HR	$ 61
5,000 gal H2O truck Diesel (20-17) (2nd2006)	$ 5,280	$ 45.80	10%	$ 43.20	$ 126.58	1	$ 126.58	$/HR					0.3	HR	$ 38
Pickup Crew 4x4 1 ton 340 hp (20-17) (2nd2007)	$ 1,080	$ 20.35	10%	$ 37.90	$ 67.04	1	$ 67.04	$/HR					0.3	HR	$ 20
CLAB				$ 37.90	$ 35.45	1	$ 35.45	$/HR					0.3	HR	$ 11
Foreman Average, Outside				$ 51.90	$ 48.20	1	$ 48.20	$/HR					0.3	HR	$ 14
Subtotal															$ 996

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Pump No 1 Road 13															
627G EROPS (9-49) (2nd2007)	$ 26,220	$ 164.55	10%	$ 51.10	$ 395.98	6	$ 2,375.88	$/HR	300	CY	702	CY/HR	0.4	HR	$ 950
D7N DS XR Series II (9-51) (2nd 2007)	$ 12,455	$ 69.65	10%	$ 51.10	$ 205.56	1	$ 205.56	$/HR					0.4	HR	$ 82
D8T (9-52)(2nd2007)	$ 16,865	$ 89.55	10%	$ 51.10	$ 255.01	1	$ 255.01	$/HR					0.4	HR	$ 102
12H EROPS (9-11)(2H2007)	$ 13,110	$ 64.30	10%	$ 51.10	$ 203.77	1	$ 203.77	$/HR					0.4	HR	$ 82
5,000 gal H2O truck Diesel (20-17) (2nd2006)	$ 5,280	$ 45.80	10%	$ 43.20	$ 126.58	1	$ 126.58	$/HR					0.4	HR	$ 51
Pickup Crew 4x4 1 ton 340 hp (20-17) (2nd2007)	$ 1,080	$ 20.35	10%	$ 37.90	$ 67.04	1	$ 67.04	$/HR					0.4	HR	$ 27
CLAB				$ 37.90	$ 35.45	1	$ 35.45	$/HR					0.4	HR	$ 14
Foreman Average, Outside				$ 51.90	$ 48.20	1	$ 48.20	$/HR					0.4	HR	$ 19
Subtotal															$ 1,327

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Tank Road 14															
627G EROPS (9-49) (2nd2007)	$ 26,220	$ 164.55	10%	$ 51.10	$ 395.98	6	$ 2,375.88	$/HR	300	CY	702	CY/HR	0.4	HR	$ 950
D7N DS XR Series II (9-51) (2nd 2007)	$ 12,455	$ 69.65	10%	$ 51.10	$ 205.56	1	$ 205.56	$/HR					0.4	HR	$ 82
D8T (9-52)(2nd2007)	$ 16,865	$ 89.55	10%	$ 51.10	$ 255.01	1	$ 255.01	$/HR					0.4	HR	$ 102
12H EROPS (9-11)(2H2007)	$ 13,110	$ 64.30	10%	$ 51.10	$ 203.77	1	$ 203.77	$/HR					0.4	HR	$ 82
5,000 gal H2O truck Diesel (20-17) (2nd2006)	$ 5,280	$ 45.80	10%	$ 43.20	$ 126.58	1	$ 126.58	$/HR					0.4	HR	$ 51
Pickup Crew 4x4 1 ton 340 hp (20-17) (2nd2007)	$ 1,080	$ 20.35	10%	$ 37.90	$ 67.04	1	$ 67.04	$/HR					0.4	HR	$ 27
CLAB				$ 37.90	$ 35.45	1	$ 35.45	$/HR					0.4	HR	$ 14
Foreman Average, Outside				$ 51.90	$ 48.20	1	$ 48.20	$/HR					0.4	HR	$ 19
Subtotal															$ 1,327

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading MineYardRoads15															
627G EROPS (9-49) (2nd2007)	$ 26,220	$ 164.55	10%	$ 51.10	$ 395.98	6	$ 2,375.88	$/HR	2700	CY	702	CY/HR	3.8	HR	$ 9,028
D7N DS XR Series II (9-51) (2nd 2007)	$ 12,455	$ 69.65	10%	$ 51.10	$ 205.56	1	$ 205.56	$/HR					3.8	HR	$ 781
D8T (9-52)(2nd2007)	$ 16,865	$ 89.55	10%	$ 51.10	$ 255.01	1	$ 255.01	$/HR					3.8	HR	$ 969
12H EROPS (9-11)(2H2007)	$ 13,110	$ 64.30	10%	$ 51.10	$ 203.77	1	$ 203.77	$/HR					3.8	HR	$ 774
5,000 gal H2O truck Diesel (20-17) (2nd2006)	$ 5,280	$ 45.80	10%	$ 43.20	$ 126.58	1	$ 126.58	$/HR					3.8	HR	$ 481
Pickup Crew 4x4 1 ton 340 hp (20-17) (2nd2007)	$ 1,080	$ 20.35	10%	$ 37.90	$ 67.04	1	$ 67.04	$/HR					3.8	HR	$ 255
CLAB				$ 37.90	$ 35.45	1	$ 35.45	$/HR					3.8	HR	$ 135
Foreman Average, Outside				$ 51.90	$ 48.20	1	$ 48.20	$/HR					3.8	HR	$ 183
Subtotal															$ 12,606

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
The 4th East Portal 16															
Grade berm into surrounding area															
D6R XL Series III (9-51) (2nd 2007)	$ 7,570	$ 46.20	10%	$ 51.10	$ 149.23	1	$ 149.23	$/HR	3721	CY	189	CY/HR	19.7	HR	$ 2,940
Partial Backfilling of Portal Boxcut															
D8T (9-52)(2nd2007)	$ 16,865	$ 89.55	10%	$ 51.10	$ 255.01	1	$ 255.01	$/HR	34277	CY	287	CY/HR	119.4	HR	$ 30,448
Reclamation of In Place Topsoil															
D6R XL Series III (9-51) (2nd 2007)	$ 7,570	$ 46.20	10%	$ 51.10	$ 149.23	1	$ 149.23	$/HR	12100	CY	1455	CY/HR	8.3	HR	$ 1,239
Multi-Shank Ripper 190-259 P (9-58) (2nd2007)	$ 1,970	$ 6.90	10%	$ 51.10	$ 71.00	1	$ 71.00	$/HR					8.3	HR	$ 589
Material Stock Pile															
988H EROPS (9-35) (2nd2007)	$ 35,440	$ 154.85	10%	$ 51.10	$ 442.94	1	$ 442.94	$/HR	113711	CY	349	CY/HR	325.8	HR	$ 144,310
769D (20-11) (2nd2007)	$ 25,000	$ 162.65	10%	$ 51.10	$ 386.27	2	$ 772.53	$/HR					325.8	HR	$ 251,690
Topsoil															
988H EROPS (9-35) (2nd2007)	$ 35,440	$ 154.85	10%	$ 51.10	$ 442.94	1	$ 442.94	$/HR	100911	CY	465	CY/HR	217	HR	$ 96,118
6X4 40,000lbs 8-10 CY (20-11) (2nd2007)	$ 3,405	$ 46.10	10%	$ 37.90	$ 109.89	3	$ 329.67	$/HR					217	HR	$ 71,538
Pocking															
446D 4WD (9-27) (2nd 2007)	$ 6,850	$ 37.35	10%	$ 51.10	$ 135.00	1	$ 135.00	$/HR	8873	CY	192	CY/HR	46.2	HR	$ 6,237
Support Personel and Equipment															
Foreman Average, Outside				$ 51.90	$ 48.20	1	$ 48.20	$/HR					353	HR	$ 17,015
CLAB				$ 37.90	$ 35.45	2	$ 70.90	$/HR					353	HR	$ 25,028
Pickup Crew 4x4 1 ton 340 hp (20-17) (2nd2007)	$ 1,080	$ 20.35	10%	$ 37.90	$ 67.04	1	$ 67.04	$/HR					353	HR	$ 23,665
5,000 gal H2O truck Diesel (20-17) (2nd2006)	$ 5,280	$ 45.80	10%	$ 43.20	$ 126.58	1	$ 126.58	$/HR					353	HR	$ 44,683
Subtotal															$ 712,560

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery 2 Boxcut_17															
Trucked to Boxcut from Stockpile															
988H EROPS (9-35) (2nd2007)	$ 35,440	$ 154.85	10%	$ 51.10	$ 442.94	1	$ 442.94	$/HR	89000	CY	349	CY/HR	255	HR	$ 112,950
769D (20-11) (2nd2007)	$13,200.00	$ 73.70	10%	$ 47.35	$ 210.92	2	$ 421.84	$/HR					255	HR	$ 107,569
Trucked to Boxcut from Emery 2 Fill															
988H EROPS (9-35) (2nd2007)	$ 35,440	$ 154.85	10%	$ 51.10	$ 442.94	1	$ 442.94	$/HR	71000	CY	349	CY/HR	203.4	HR	$ 90,094
769D (20-11) (2nd2007)	$13,200.00	$ 73.70	10%	$ 47.35	$ 210.92	2	$ 421.84	$/HR					203.4	HR	$ 85,802
Truck 50% of Fill Balance to Emery for Cover															
988H EROPS (9-35) (2nd2007)	$ 35,440	$ 154.85	10%	$ 51.10	$ 442.94	1	$ 442.94	$/HR	16000	CY	349	CY/HR	45.8	HR	$ 20,287
769D (20-11) (2nd2007)	$13,200.00	$ 73.70	10%	$ 47.35	$ 210.92	2	$ 421.84	$/HR					45.8	HR	$ 19,320
Push 50% of Fill Balance to Finish Reclamation															
D8T (9-52)(2nd2007)	$16,000.00	$ 100.65	10%	$ 60.10	$ 270.82	1	$ 270.82	$/HR	16000	CY	287	CY/HR	55.7	HR	$ 15,085
Topsoil/Subsoil - Entire Permit															
988H EROPS (9-35) (2nd2007)	$19,200.00	$ 114.05	10%	$ 60.10	$ 305.56	1	$ 305.56	$/HR	55600	CY	465	CY/HR	119.6	HR	$ 36,545
6X4 40,000lbs 8-10 CY (20-11) (2nd2007)	$ 2,840.00	$ 48.45	10%	$ 47.35	$ 118.40	3	$ 355.19	$/HR					119.6	HR	$ 42,481
Pocking															
446D 4WD (9-27) (2nd 2007)	$ 3,680.00	$ 34.75	10%	$ 60.10	$ 121.33	1	$ 121.33	$/HR	17400	CY	192	CY/HR	90.6	HR	$ 10,992
Support Personel and Equipment															
Foreman Average, Outside					$ 64.40	1	$ 64.40	$/HR					384	HR	$ 24,730
CLAB					$ 47.05	2	$ 94.10	$/HR					384	HR	$ 36,134
Pickup Crew 4x4 1 ton 340 hp (20-17) (2nd2007)	$ 1,060.00	$ 17.75	10%	$ -	$ 26.15	1	$ 26.15	$/HR					384	HR	$ 10,042
5,000 gal H2O truck Diesel (20-17) (2nd2006)	$ 5,170.00	$ 40.50	10%	$ 47.35	$ 124.21	1	$ 124.21	$/HR					384	HR	$ 47,697
Subtotal															$ 659,728

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Pond No 3_18 Backfilling and Grading Pond 3 (Outfall 005)															
627G EROPS (9-49) (2nd2007)	$ 26,220	$ 164.55	10%	$ 51.10	$ 395.98	6	$ 2,375.88	$/HR	2250	CY	702	CY/HR	3.2	HR	$ 7,603
D7N DS XR Series II (9-51) (2nd 2007)	$ 12,455	$ 69.65	10%	$ 51.10	$ 205.56	1	$ 205.56	$/HR					3.2	HR	$ 658
D8T (9-52)(2nd2007)	$ 16,865	$ 89.55	10%	$ 51.10	$ 255.01	1	$ 255.01	$/HR					3.2	HR	$ 816
12H EROPS (9-11)(2H2007)	$ 13,110	$ 64.30	10%	$ 51.10	$ 203.77	1	$ 203.77	$/HR					3.2	HR	$ 652
5,000 gal H2O truck Diesel (20-17) (2nd2006)	$ 5,280	$ 45.80	10%	$ 43.20	$ 126.58	1	$ 126.58	$/HR					3.2	HR	$ 405
Pickup Crew 4x4 1 ton 340 hp (20-17) (2nd2007)	$ 1,080	$ 20.35	10%	$ 37.90	$ 67.04	1	$ 67.04	$/HR					3.2	HR	$ 215
CLAB				$ 37.90	$ 35.45	1	$ 35.45	$/HR					3.2	HR	$ 113
Foreman Average, Outside				$ 51.90	$ 48.20	1	$ 48.20	$/HR					3.2	HR	$ 154
Subtotal															$ 10,616

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Berms UB1-UB2_19 Backfilling and Grading Undisturbed Berms UB-1 & UB-2															
D6R XL Series III (9-51) (2nd 2007)	$ 7,570	$ 46.20	10%	$ 51.10	$ 149.23	1	$ 149.23	$/HR	563	CY	189	CY/HR	3	HR	$ 448
Pickup Crew 4x4 1 ton 340 hp (20-17) (2nd2007)	$ 1,080	$ 20.35	10%	$ 37.90	$ 67.04	1	$ 67.04	$/HR					3	HR	$ 201
CLAB				$ 37.90	$ 35.45	1	$ 35.45	$/HR					3	HR	$ 106
Foreman Average, Outside				$ 51.90	$ 48.20	1	$ 48.20	$/HR					3	HR	$ 145
Subtotal															$ 900

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Switchback Road_20 Backfilling and Grading Switchback Road															
D8T (9-52)(2nd2007)	$ 16,865	$ 89.55	10%	$ 51.10	$ 255.01	1	$ 255.01	$/HR	2000	CY	287	CY/HR	7	HR	$ 1,785
12H EROPS (9-11)(2H2007)	$ 13,110	$ 64.30	10%	$ 51.10	$ 203.77	1	$ 203.77	$/HR					7	HR	$ 1,426
5,000 gal H2O truck Diesel (20-17) (2nd2006)	$ 5,280	$ 45.80	10%	$ 43.20	$ 126.58	1	$ 126.58	$/HR					7	HR	$ 886
Pickup Crew 4x4 1 ton 340 hp (20-17) (2nd2007)	$ 1,080	$ 20.35	10%	$ 37.90	$ 67.04	1	$ 67.04	$/HR					7	HR	$ 469
CLAB				$ 37.90	$ 35.45	1	$ 35.45	$/HR					7	HR	$ 248
Foreman Average, Outside				$ 51.90	$ 48.20	1	$ 48.20	$/HR					7	HR	$ 337
Subtotal															$ 5,151

Ref.	Description	Cost
	Vegetation	
	Main Facilities 01	$ 400,260
	The 4th East Portals 02	$ 89,666
	Emery 2 03	$ 166,321
	Total	$ 656,247

Ref.	Description **Main Facilities 01**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Main Facilities 01																			
	Vegetation																			
	Spread Topsoil	Backfill structural 200 HP 300' Dirt	31 23 23 14 5420	$ 1.70	/CY						43300					CY		43300	CY	$ 73,610
	Till Soil	75 HP Dozerw/scarifiers	32 91 13 23 3100	$ 3.87	MSF						53.7					AC		2339	MSF	$ 9,052
	Seeding	Wildflower Seed Mix	32 92 19 14 5800	$ 28.81	MSF						53.7					AC		2339	MSF	$ 67,387
	Mulch	Hay 1 inch small power mulcher	32 91 13 16 0250	$ 54.33	/MSF						53.7					AC		2339	MSF	$ 127,078
	Fertilizer	Fetilizer Hydro Spread	32 01 90 13 0180	$ 3.96	/MSF						53.7					AC		2339	MSF	$ 9,262
	Erosion Control	Hay bale	31 25 14 16 1200	$ 626.27	/ton							53.7				Ton		54	TON	$ 33,819
	Subtotal																			$ 320,208
	Reseeding																			
	25% of Vegetation Cost																			$ 80,052
	Subtotal																			$ 80,052
	Total																			$ 400,260

Hay coverage based on Chapter III, page 4b.

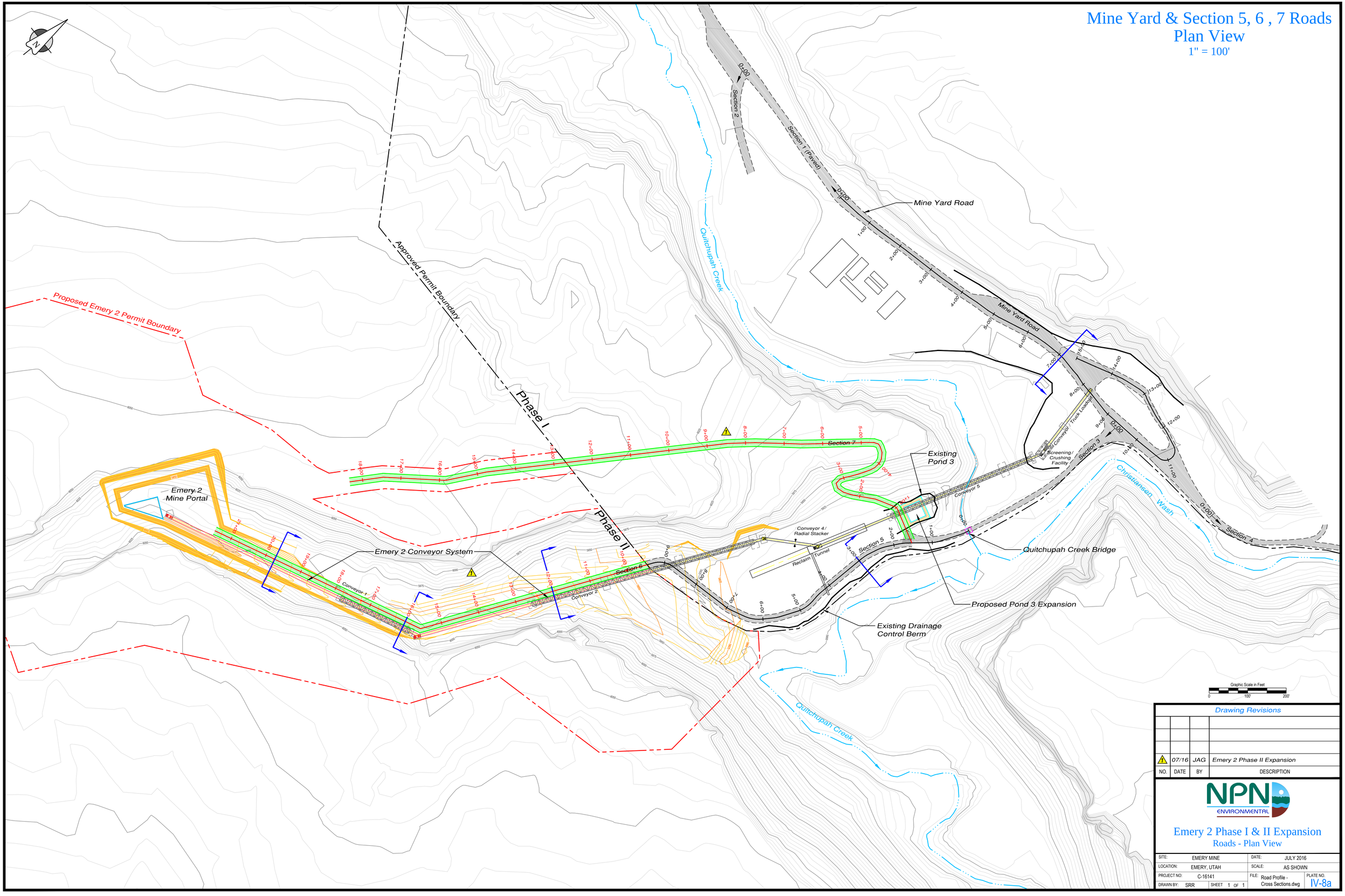
Ref.	Description **The 4th East Portals 02**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	The 4th East Portals 02																			
	Vegetation																			
	Seeding	Wildflower Seed Mix	32 92 19 14 5800	$ 28.81	MSF						16					AC		697	MSF	$ 20,081
	Mulch	Hay 1 inch small power mulcher	32 91 13 16 0250	$ 54.33	/MSF						16					AC		697	MSF	$ 37,868
	Fertilizer	Fetilizer Hydro Spread	32 01 90 13 0180	$ 3.96	/MSF						16					AC		697	MSF	$ 2,760
	Erosion Control	Hay bale	31 25 14 16 1200	$ 626.27	/ton							16				Ton		16	TON	$ 10,020
		Revegetation mat, webbed	31 25 14 16 0120	$ 2.15	SY	300	14									FT		467	SY	$ 1,004
	Subtotal																			$ 71,733
	Reseeding																			
	25% of Vegetation Cost																			$ 17,933
	Subtotal																			$ 17,933
	Total																			$ 89,666

Hay coverage based on Chapter III, page 4b.

Ref.	Description **Emery 2 03**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Main Facilities 01																			
	Vegetation																			
	Till Soil	75 HP Dozerw/scarifiers	32 91 13 23 3100	$ 3.87	MSF						29					AC		1263	MSF	$ 4,888
	Seeding	Wildflower Seed Mix	32 92 19 14 5800	$ 28.81	MSF						29					AC		1263	MSF	$ 36,387
	Mulch	Hay 1 inch small power mulcher	32 91 13 16 0250	$ 54.33	/MSF						29					AC		1263	MSF	$ 68,619
	Fertilizer	Fetilizer Hydro Spread	32 01 90 13 0180	$ 3.96	/MSF						29					AC		1263	MSF	$ 5,001
	Erosion Control	Hay bale	31 25 14 16 1200	$ 626.27	/ton							29				Ton		29	TON	$ 18,162
	Subtotal																			$ 133,057
	Reseeding																			
	25% of Vegetation Cost																			$ 33,264
	Subtotal																			$ 33,264
	Total																			$ 166,321

Hay coverage based on Chapter III, page 4b.

Mine Yard & Section 5, 6 , 7 Roads
Plan View
1" = 100'



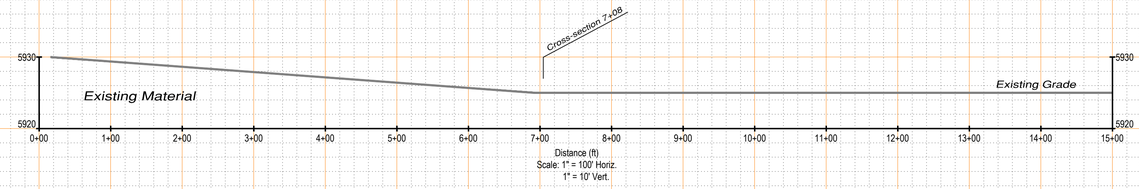
Drawing Revisions			
1	07/16	JAG	Emery 2 Phase II Expansion
NO.	DATE	BY	DESCRIPTION

NPN ENVIRONMENTAL

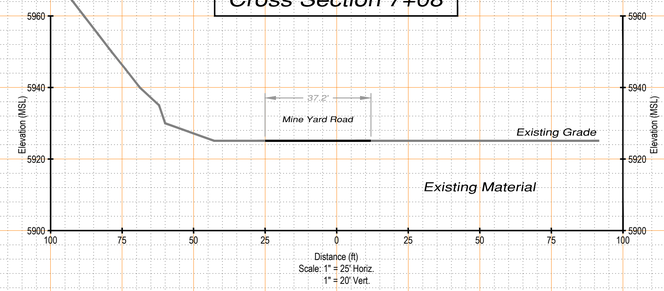
Emery 2 Phase I & II Expansion
Roads - Plan View

SITE:	EMERY MINE	DATE:	JULY 2016
LOCATION:	EMERY, UTAH	SCALE:	AS SHOWN
PROJECT NO:	C-16141	FILE:	Road Profile - Cross Sections.dwg
DRAWN BY:	SRR	SHEET	1 OF 1
PLATE NO.	IV-8a		

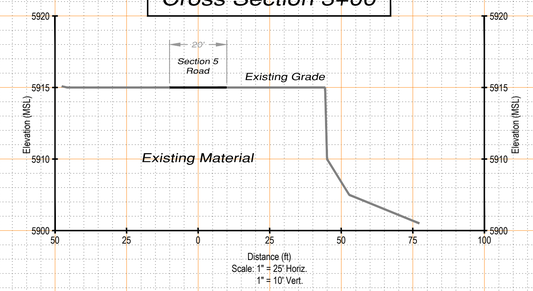
Mine Yard Road Profile Phase I



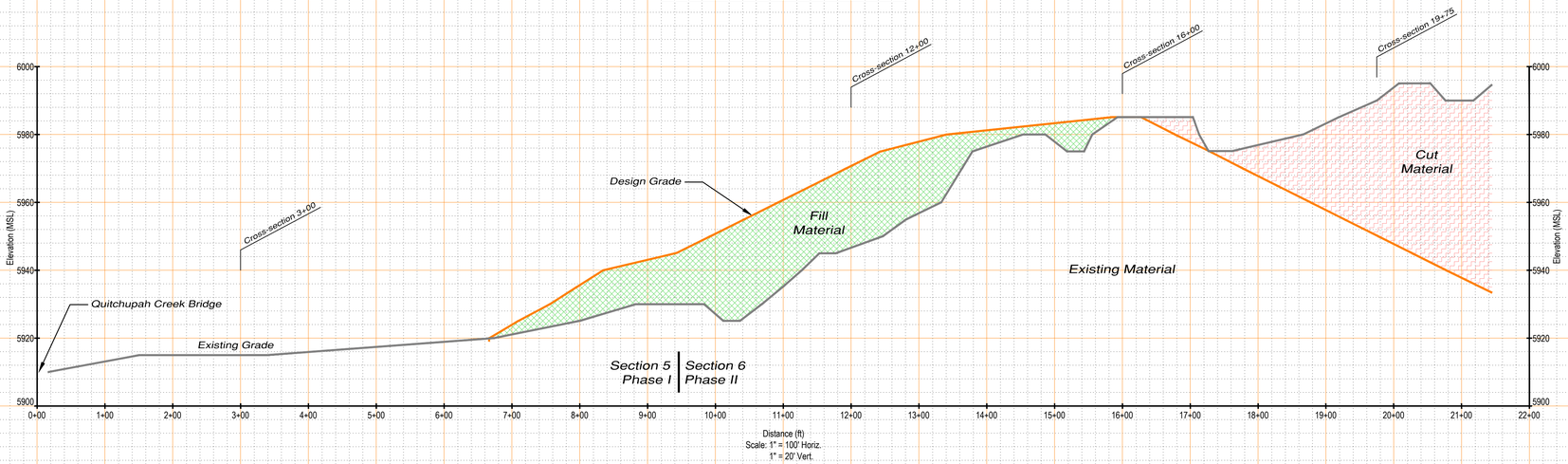
Mine Yard Road Cross Section 7+08



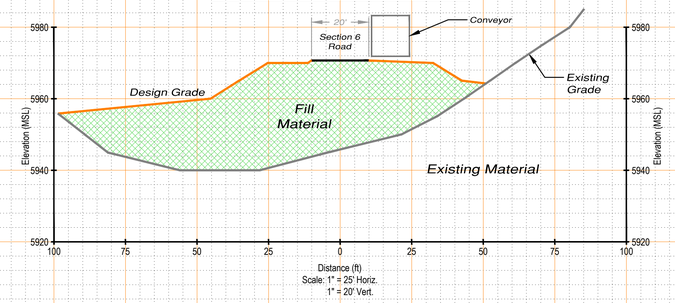
Section 5 Road Cross Section 3+00



Section 5 & Section 6 Road Profile



Section 6 Road Cross Section 12+00



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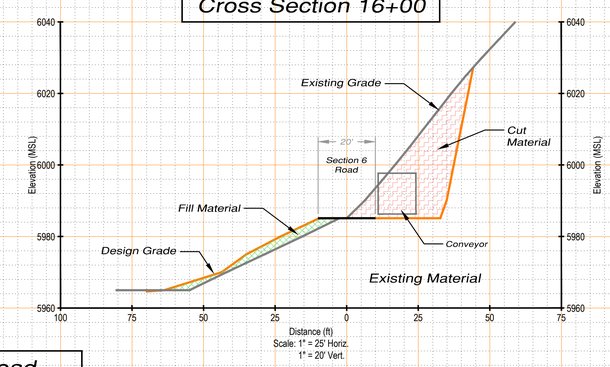
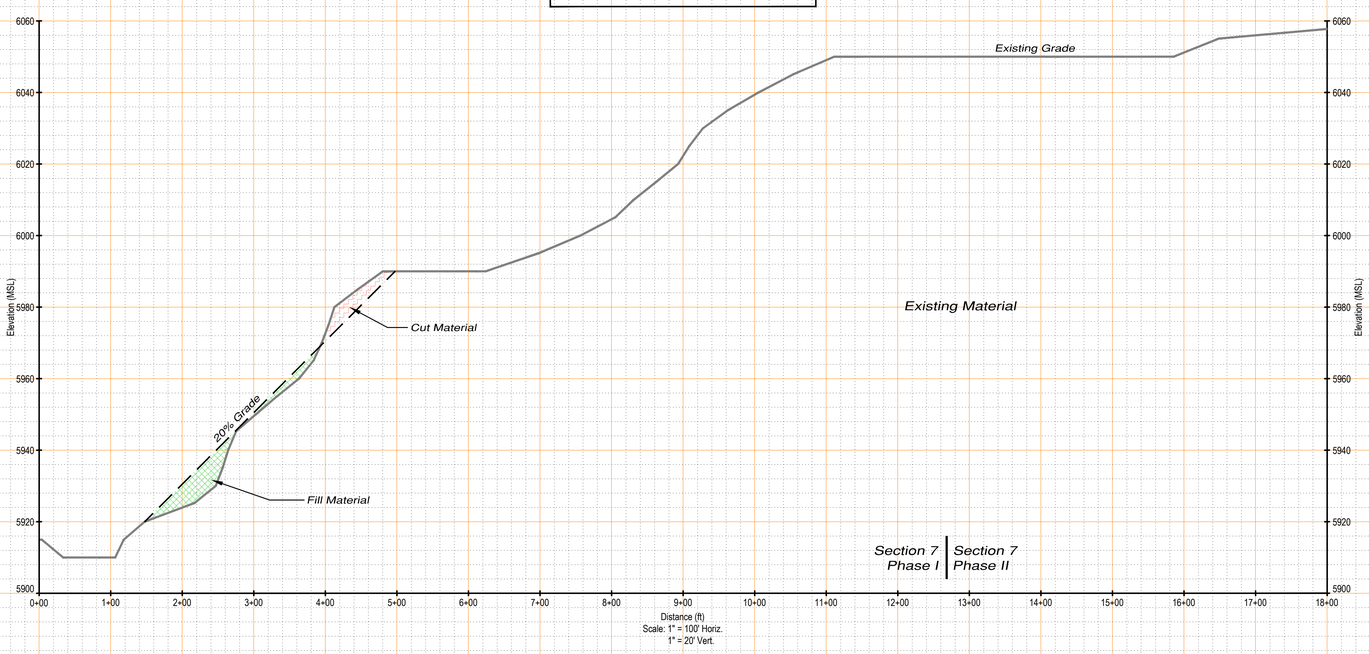
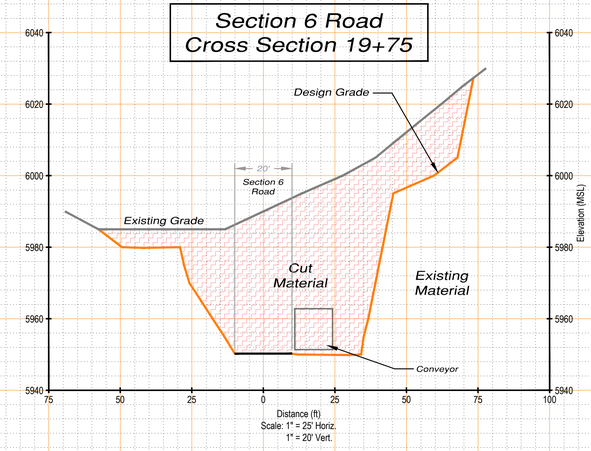


Section 7 Road Profile



Section 6 Road Cross Section 19+75



Drawing Revisions

NO.	DATE	BY	DESCRIPTION

NPN ENVIRONMENTAL

Emery 2 Phase I & II Expansion

Roads - Profiles/Cross-Sections

SITE: EMERY MINE		DATE: JULY 2016	
LOCATION: EMERY, UTAH		SCALE: AS SHOWN	
PROJECT NO: C-16141		FILE: Road Profile - Cross Sections.dwg	PLATE NO. IV-8b
DRAWN BY: SRR	SHEET 1 OF 1		

LIST OF APPENDICES

VI-1: Groundwater Monitoring – Water Quality Data

VI-2: Lithologic and Geophysical Data for Monitoring Wells

VI-3: Pump Test Reports and Plots

VI-4: Water Rights

VI-5: Surface Water Monitoring – Flow and Water Quality Data

VI-6: Drainage Ditch Designs

VI-7: Sedimentation Pond Designs

VI-8: Alternate Sediment Control Designs

VI-9: HEC-1 Computer Routings

VI-10: Groundwater Monitoring – Water Level Data

VI-11: USGS Streamflow Data

VI-12: UPDES Monitoring Data

VI-13: Data from Miscellaneous Surface Water Quality Studies

VI-14: Mass-Balance Estimates of Future Mine-Water Discharges

VI-15: MODFLOW Report

VI-16: Selected Text from Miller Canyon Tract EA

VI-17: Evaluation/Revision of Groundwater Monitoring Plan (08/2011)

VI-18: Evaluation of Oil in Emery Mine Monitoring Wells

VI-19: Groundwater Well Integrity Evaluation & Rehabilitation Report

VI-20: Emery 2 Expansion Drainage Design

Revised 09/15/2011
Revised 07/15/2016
Revised 07/22/2016

LIST OF PLATES (cont.)

VI-20: 4th East Portal Plan View & Cross Sections, Sediment Pond #9

VI-20A: Sediment Pond, Topsoil, and Bypass Ditch As-Builts

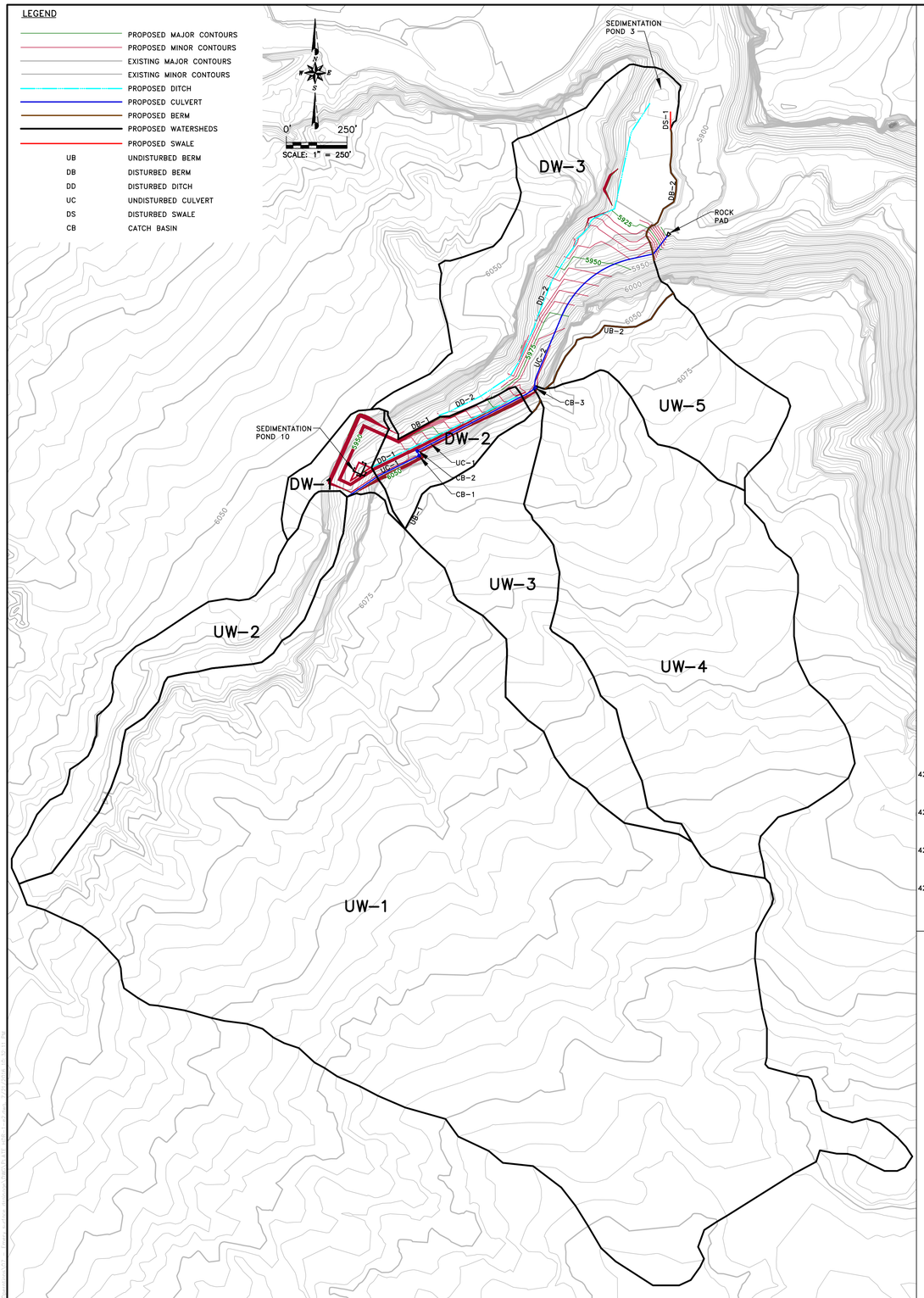
VI-21: 4th East Portal Profile & Cross Sections, Temporary Stream Diversion

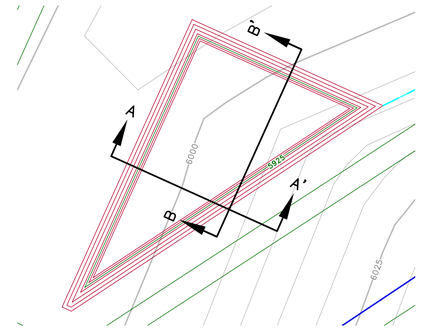
V-HDR-1: Hydrology Design

CHAPTER VI, APPENDIX VI-20
Emery 2 Expansion Drainage Design

Inserted 7/2016

Place holder for Drainage data sheets





SEDIMENTATION POND 10

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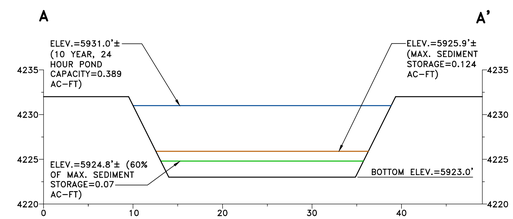

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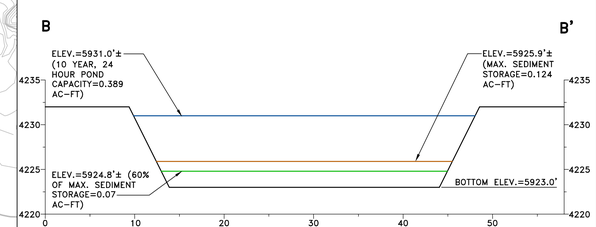

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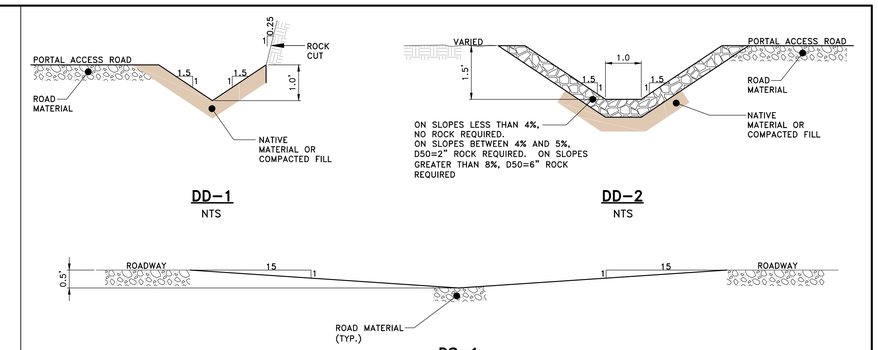
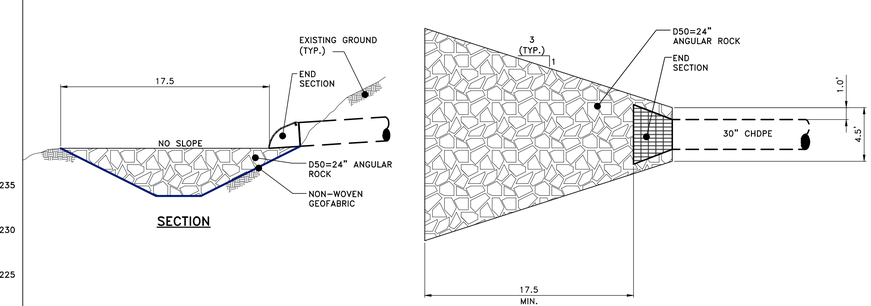
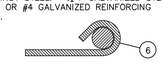




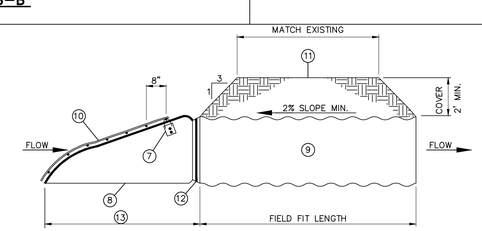
UC-2 OUTFALL DETAIL

NO SCALE

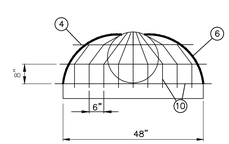
NOTE:
ROLL EDGE OF SIDEWALL SNUGLY AGAINST STEEL. ½"ø GALVANIZED STEEL ROD OR #4 GALVANIZED REINFORCING BAR.



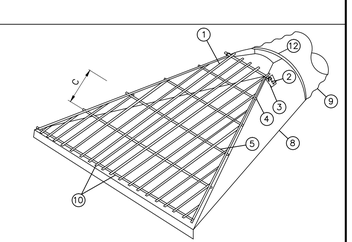
SECTION VIEW OF EDGE OF FLARED CMP ASSEMBLY



FRONT ELEVATION



SIDE ELEVATION



ISOMETRIC ELEVATION

MATERIALS LIST FOR CULVERT/END SECTION

1. #4 REBAR
2. ½"ø STAINLESS STEEL BOLT/NUT. (TYP).
3. 10 GAGE STEEL STRAPS (TYP).
4. OVERLAP BARS 4" PAST EDGE OF END SECTION (TYP).
5. WELD EACH CROSS JOINT (TYP).
6. REINFORCED EDGE ON END SECTION (TYP)
7. TRASH RACK HINGE.
8. FLARED STEEL CMP END SECTION, MINIMUM WALL THICKNESS 0.064" OR 16 GAGE
9. CMP, MINIMUM WALL THICKNESS PER TABLE.
10. HINGED TRASH RACK (TYP).
11. ACCESS ROAD OR OTHER COVER.
12. ½"ø, PLACE THREADED ROD OVER TOP OF END SECTION.
13. FOR SLOPES STEEPER THAN 4:1 THE LENGTH IS 32" FOR SLOPES SHALLOWER THAN 6:1 THE LENGTH IS 48"

NOTES:

1. PROVIDE HINGED SAFETY BARS (TRASH RACK) ON INFLOW SIDE OF CULVERT.
2. PROVIDE FLARED END SECTIONS ON BOTH ENDS OF CULVERT.
3. INSTALL CULVERT ASSEMBLY INTO EXISTING FLOW CHANNEL. REPAIR CHANNEL AS REQUIRED TO INSTALL CULVERT ASSEMBLY AS DIRECTED BY OWNER OR ENGINEER.
4. ALL SAFETY BARS (TRASH RACK) AND COMPONENTS SHALL HAVE A CORROSION PROTECTIVE FINISH.

CULVERT INLET/OUTLET TRASH RACK DETAIL

NO SCALE

PROFESSIONAL ENGINEER No. 9501032 TIMOTHY A. JIMENEZ STATE OF UTAH

EarthFax

BASE MAP:

COORDINATE SYSTEM:
STATE PLANE COORDINATES.
NAD 83 CONUS
ZONE: NAD83-UTAH, CENTRAL – US FEET
VERTICAL DATUM – NAVD 88-US FEET

EXTERNAL REFERENCE:

REVISIONS NO.	DATE	BY	DESCRIPTION	NO.	DATE	BY	DESCRIPTION
1	07/16	JAG	HYDROLOGY e2				

AS SHOWN

DRAWN BY: SWF
CHECKED BY: RBW
ORIGINAL DATE: 07/16
RE-DRAWN DATE:
APPROVED BY: TJ
DWG DATA: G:\UC1665-BRONCO UTAH OPERATIONS/07-EMERY SURFACE DRAINAGE/DWG/PLATE HDR-1-e2

EMERY MINE
EMERY COUNTY, UTAH
PERMIT NO. ACT015/015

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 1
PRICE, UT 84501

PLATE HDR-1
HYDROLOGY DESIGN

CHAPTER VII

SOILS

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VII-2 TOPSOIL SUBSTITUTION PLAN, PERMANENT UNDERGROUND DEVELOPMENT WASTE DISPOSAL SITE

VII-3 BIOLOGICAL & SOIL RESOURCES AT THE 4TH EAST PORTAL AREA

VII-4 LETTER FROM MT. NEBO CONSULTANTS – APPEND 1.5 AC. AREA TO 4TH EAST PORTAL AREA

VII-5 ORDER 2 SOIL SURVEY OF EMERY 2 MINE PERMIT AREA (LONG RESOURCE CONSULTANTS JULY 2016)

Inserted 7/2016

CHAPTER VII, APPENDIX VII-5
Order 2 Soil Survey of Emery 2 Mine Permit

Inserted 7/2016

Order 2 Soil Survey

of

Emery 2 Mine Permit Area

Located near Emery, Utah

Prepared for

Bronco Utah Operations, LLC

By

Long Resource Consultants, Inc.

Morgan, Utah

July 2016

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Introduction

Purpose of Soil Survey

The purpose of this report is to summarize the results of an order 2 soils inventory conducted for Bronco Utah Operations LLC (BUOLLC) in an area south and west of the existing Emery Mine in Emery County, Utah. The *Emery 2 Soil Survey* area is adjacent to the existing Emery Mine surface facilities.

BUOLLC is proposing to expand the underground operations of the Emery Mine to the southwest, which will require construction of new roads and surface facilities. This soil survey was prepared so that BUOLLC could: 1) identify suitable sources of topsoil and subsoil; 2) determine topsoil and subsoil salvage depths and quantities; and, 3) develop a post mining reclamation plan using salvaged soil materials. This soil survey covers 189.6 acres.

Project Area

The Emery 2 Soil Survey area is on Walker Flat, approximately 4.7 miles south of the town of Emery, Utah, Figure 1. It is bounded on the west by the Old Woman Plateau, on south by the San Rafael Swell, and on the north and east by Quitchapah Creek. The area is located in portions of the east half of section 32 and the west half of section 33, Township 27 South, Range 6 East, Salt Lake Base Meridian.

The Emery 2 Soil Survey area drains north to Quitchapah Creek which crosses the north portion of the survey area and forms part of the boundary along the northeast part of the area. Quitchapah Creek flows into Ivie Creek about 4 miles south of the soil survey area. Ivie Creek flows into Muddy Creek about 4.5 miles southeast of the soil survey area. Then Muddy Creek flows southeast approximately 50 miles to its confluence with the Fremont River which forms the Dirty Devil River that flows into the Colorado River near Hite Crossing, Utah.

The soil survey area is accessed from the north by following State Route (SR) 10 south 5.5 miles from Emery, Utah to a dirt surface road. It is accessed from the south by following SR 10 Fremont Junction on Interstate 70 (exit 89) north 6.75 miles to the dirt surface road. The distance along the dirt surface road to the southwest corner of the *Emery 2 Soil Survey Area* is approximately 2.4 miles. The survey area can be accessed on foot through the canyon from a parking area south of the Emery mine office.

Native vegetation in the Emery 2 Soil Survey Area consists of shadscale, black greasewood, black sage in the northwest portion; and Utah juniper, pinyon pine, big sagebrush, and black greasewood in the southeast portion.

Climate

An official U.S. Weather Bureau station is located in Emery, Utah. The period of available records for this station is January 1, 1901 through April 30, 2006 (Western Regional Climate Center, May 2016). Average annual precipitation at Emery is 7.33 inches and is evenly distributed throughout the year. The average annual air temperature is 46.0 ^{o}F.

The precipitation pattern is aridic and the soil temperature regime is mesic (USDA-NRCS 2009). Table 1 contains a summary of weather data for Emery, Utah. Summers are warm with cool nights.

Table 1. Summary of weather data for Emery, Utah (1901-1970). Summary of Emery, Utah weather records for 1971 to 2000 have similar values.

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
Ave Max Temp ^{o}F	37.1	42.0	50.0	59.3	68.8	77.6	83.4	81.3	74.4	63.4	50.1	39.6	60.6
Ave Min Temp ^{o}F	10.9	16.1	22.8	30.0	37.8	45.5	52.2	50.7	42.0	32.3	21.7	13.5	31.3
Ave Total Precip. Inches	0.47	0.50	0.43	0.39	0.60	0.51	0.83	1.12	0.90	0.81	0.33	0.44	7.33
Average Total Snowfall (Inches)	5.3	5.0	2.8	0.6	0.4	0.0	0.1	0.0	0.0	0.6	1.7	4.4	20.9
Average Total Snow Depth (Inches)	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: Western Regional Climate Center, May 2016.

The Emery Area soil survey identified the area as transitioning from Typic aridic (Desert 5 to 9 inches) to Ustic aridic (Semi-Desert 10 to 16 inches) precipitation patterns (USDA-NRCS 2016). The NRCS precipitation break is along the southeast rim of the canyon that cuts through the soil survey area. This transition is identified in the field with dominantly shadscale vegetation northwest of the canyon and Utah juniper, pinyon pine, and big sagebrush on the plateau southeast of the canyon. Tamarisk and black greasewood are present in the alluvial areas along Quitchapah Creek.

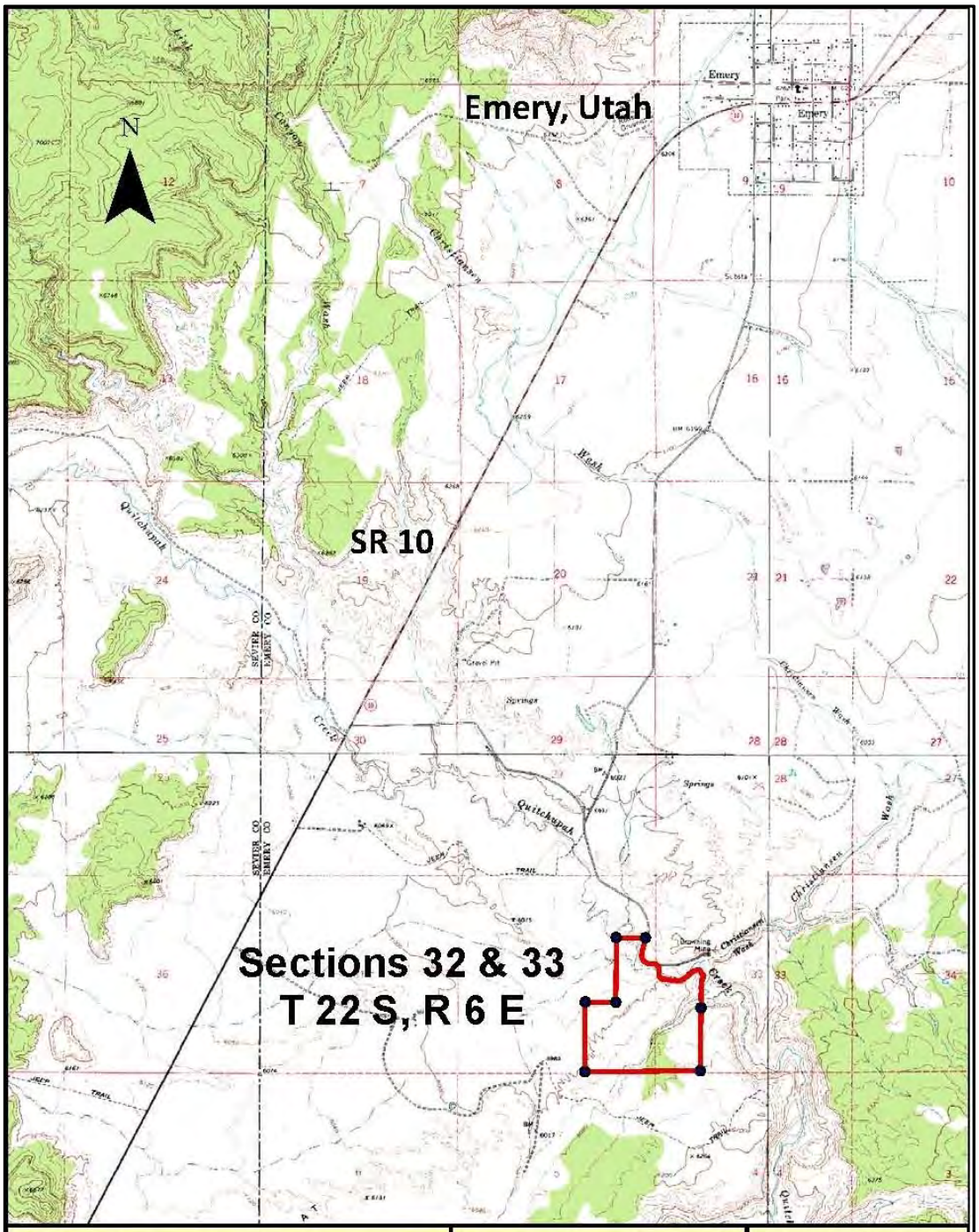


Fig. 1. Location of Emery 2 Soil Survey Area	USGS Quads: Emery East, Utah Emery West, Utah Walker Flat, Utah Messa Butte , Utah	1:48,000

Figure 1. General location of Emery 2 soil survey area. Scale is approximate.

How This Soil Survey was Conducted

This soil survey was made in accordance with the guidelines for an order 2 soil survey as detailed in the Soil Survey Manual (USDA 1993). Soils were classified using the *Keys to Soil Taxonomy*, Twelfth Edition (USDA 2014). The dominant soil sub-groups identified in the Emery 2 Soil Survey area are Lithic Ustic Torriorthents, shallow Ustic Torriorthents, Lithic Torriorthents, and Typic Torriorthents. Tables of the taxonomic classification and field descriptions of the soil profiles are contained in appendix B.

Field Evaluation of Soils

Soil pedon descriptions were completed for representative hand pits dug in September, October, and November 2009. Two soil profiles were examined and described in June 2016. Pits in very deep soils were dug or augured to a minimum 150 cm (60 inches), unless bedrock was encountered. Sandstone or shale bedrock was encountered in most of the pits between 25 to 100 cm (10 and 40 inches). Shallow and moderately deep pits were hand dug. A hand soil auger was used to examine soils deeper than 100 cm (60 inches) Soil pedon log sheets were completed for each soil pit using the methods detailed in the *Field Book for Describing and Sampling Soils*, version 3.0 (Schoeneberger et. al., 2012). Soil colors were determined using Munsell Soil Color Charts (Munsell 2000 and 2013). Soil pits were described by Robert Long, Certified Professional Soil Scientist. Field description sheets are in Appendix B. Taxonomic classification of soil profiles was completed by using *Keys to Soil Taxonomy*, Twelfth Edition (USDA 2014). Soils were correlated to established soil series used in Emery County, Utah (USDA 2016a).

Aerial photographs (NAIP 2006 and 2014, 1 meter) and U.S.G.S. topographic maps were used to delineate soil map unit boundaries based on slope gradient, geomorphic features, and vegetation. The aerial photography was taken in 2014 (Utah AGRC 2016). Samples of soil horizons were collected in gallon size plastic bags and in micromonolith boxes. The box samples were used for further determination of soil profile characteristics. Soil lines and sample locations were delineated on the aerial photography using ARC-Map software, version 10.2, in NAD 1983.

Analysis of Soil Samples

Soil samples (32) collected during September 29-30, 2009 from eight soil profiles were shipped to Intermountain Labs in Sheridan, Wyoming for analysis on September 24, 2009. Each of the soil samples were analyzed for the topsoil suitability parameters outlined by the Utah Division of Oil Gas and Mining's (DOGM) *Guidelines for Management of Topsoil and Overburden* (DOGM, 2008), Table 2.

Soil samples (19) collected on October 8, 2009 from five soil profiles were shipped to Intermountain Labs in Sheridan, Wyoming for analysis on 20, 2009. Each of the soil samples were analyzed for the topsoil suitability parameters outlined by the Utah Division of Oil Gas and Mining's (DOGM) *Guidelines for Management of Topsoil and Overburden* (DOGM 2008), Table 2.

Soil samples (6) collected November12, 2009 from one soil profile were shipped to Intermountain Labs in Sheridan, Wyoming for analysis on December 3, 2006. Each of the soil samples were analyzed for the topsoil suitability parameters outlined by the Utah Division of Oil Gas and Mining's (DOGM) *Guidelines for Management of Topsoil and Overburden* (DOGM 2008), Table 2.

Laboratory data reports of the soil sample analyses are in Appendix C.

Table 2. Soil analysis parameters for topsoil and overburden (Utah DOGM, 2008).

Topsoil Suitability Parameters	
Paste pH	Available Phosphorus
Saturation percent	Particle Size Analysis (% very fine sand, sand, silt, and clay)
Electrical Conductivity (ECe)	Organic Matter Percent
Soluble Na, K, Mg, and Ca	CaCo3 Percent
Sodium Adsorption Ratio	Extractable Potassium
Additional Analyses for Topsoil and Overburden	
Soluble Selenium	Soluble Boron
Alkalinity	

Geology and Setting

Ferron sandstone (Kmf), Blue Gate shale (Kmb), Quaternary stream and wash alluvium (Qa), and Quaternary mixed wind-blown sand and alluvium are the primary sources of parent material in the soil survey area. Ferron sandstone and Blue Gate shale are members of the Upper Cretaceous Mancos formation (Utah Geological Survey 2004).

Ferron sandstone (Kmf) is a member of the Upper Cretaceous Mancos formation. It is alternating yellow-gray, light-brown, and white sandstone, sandy gray shale, gray and carbonaceous shale, and coal; mostly fine to medium grained sandstone, commonly calcareous (Utah Geological Survey 2004). Shallow and moderately deep soils have developed in the Ferron sandstone area.

Blue Gate (Kmb) shale is a member of the Upper Cretaceous Mancos formation that occurs above the Ferron sandstone. It is a "pale blue-gray marine shale, nodular and irregularly bedded mudstone and siltstone…" that "weathers into low rolling hills and badlands (Utah Geological Survey, 2004). Shallow sodic saline soils have developed in Blue Gate shale in the southwest portion of the soil survey area. Blue Gate shale is also present on the upper slopes in the canyon area.

Quaternary alluvium (Qa) consists of unconsolidated clay, silt, sand, and gravel deposits along more active streams and washes of Holocene age (Utah Geological Survey, 2004). Very deep soils have developed in the Quaternary alluvium along Quitchapah Creek.

Quaternary mixed wind-blown sand and alluvium (shown as Qed on geology map, but Qea is closest symbol in geology report) "consists of sand and silt of eolian origin interspersed with silt, sand, and gravel of fluvial origin; generally dominated by eolian deposits (Utah Geological Survey, 2004)". Moderately deep coarse-loamy soils have developed in these wind-blown deposits.

NRCS Soil Survey

The Emery 2 soil survey is within the Emery Area, Utah, Parts of Emery, Carbon, and Sevier Counties soil survey published by the Natural Resource Conservation (USDA – NRCS June 2016b), Figure 2. Table 3 lists the NRCS soil map units that occur within the Emery 2 soil survey area.

The only significant differences between soils mapped by the NRCS and those identified by the Emery 2 soil survey were:

- Soils on the plateau east of the canyon are dominated by coarse-loamy textures, while NRCS map unit 103 is dominated by fine-loamy soils. The other soil characteristics in the survey area are similar.
- The very deep soils in the bottom of the canyon and along Quitchapah Creek are coarse-loamy and have horizons with SAR values ranging from less than 1.0 to 48.7.

Table 3. NRCS soil map units occurring within the Emery 2 soil survey area.

NRCS Map Unit	Map Unit Name	Acres Within Emery 2 Soil Survey Area
005	Badland-Persayo-Rock Outcrop Complex, 35 to 80 percent slopes	10.2
008	Beebe loamy fine sand, 1 to 3 percent slopes	4.9
015	Braf -Persayo-Casmos complex, 3 to 20 percent slopes	82.8
017	Briny silty clay loam, 0 to 3 percent slopes	4.3
041	Ferron peaty silt loam, 0 to 3 percent slopes	1.6
073	Hunting-Gullied land-Libbings complex, 0 to 5 percent slopes	8.4
083	Lazear-Gerst-Pacon complex, 3 to 35 percent slopes	18.0
103	Molen-Lazear-Gerst complex, 2 to 8 percent slopes	45.3
127	Persayo-Chipeta association, 3 to 20 percent	13.9
144	Ravola-Homko complex, 1 to 3 percent slopes	0.2
	Total	189.6

Source: Soil Survey of the Emery Area, Parts of Emery, Carbon, and Sevier Counties (USDA 2016b).

Prime Farmland

The Natural Resource Conservation Service (NRCS) conducted an evaluation of potential Prime Farmlands within the Emery 2 soil survey area and determined that the it “contains no Prime or Unique farmlands of farmlands of Statewide importance (Sasser 2010)." The NRCS letter detailing this assessment is in Appendix A.

NRCS soil map unit 144 is designated as *Prime Farmland if Irrigated*. This soil map unit is of very limited extent in the Emery 2 soil survey area and no evidence of irrigation is present in the survey area. The surface area of 144 soil map unit is 0.2 acres within the Emery 2 soil survey area and it is not located within the proposed permit area.

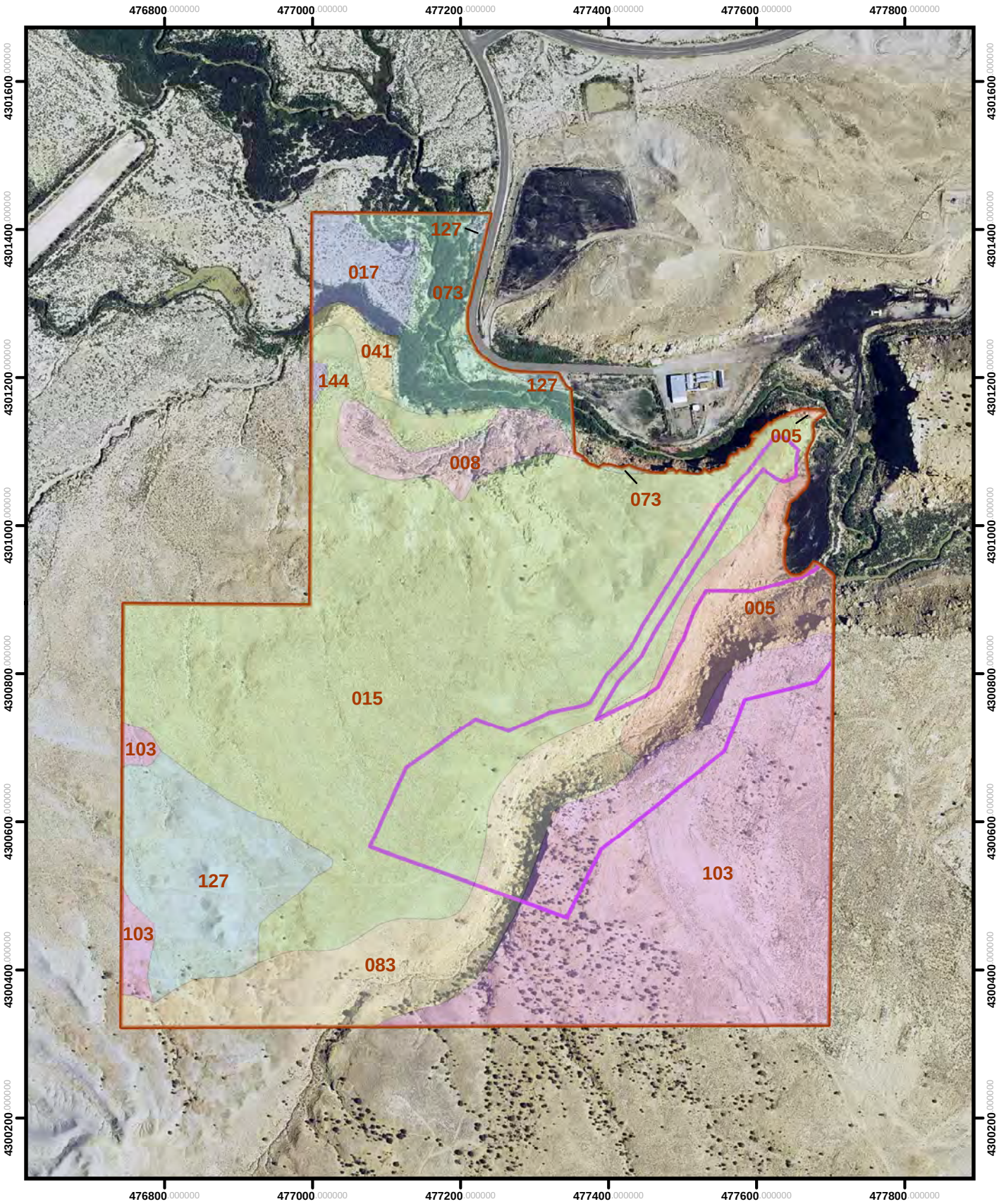


Figure 2.
NRCS - Emery Area Soil Survey

Legend

Emery 2 Soil Survey Area

Emery 2 Permit area

July 19, 2016
Base map NAIP 2014
UTM NAD 83

0 300 600 900 1,200 Feet

Soil Survey Map Units

Soil Survey Legend

Native soils in the Emery 2 Soil Survey area were identified with nine map units based on the taxonomic classification (USDA – NRCS, 2010) of the soils and slope. One additional soil map units is included to identify a previously disturbed area. The composition of these map units is described in Table 4. Detailed descriptions of each soil map unit are included in this section. Topsoil and subsoil suitability classifications of *Good*, *Fair*, *Poor*, and *Unacceptable* are based on *Guidelines for Management of Topsoil and Overburden* (Utah DOGM 2008).

Soil map unit delineations are shown in Figure 3. Map unit boundaries are based on:

- Field traverses and transects within the soil survey area;
- Interpretation of GIS slope maps, and;
- Interpretation of vegetation patterns on aerial photography using GIS software.

In some cases, site specific evaluation of the soils and vegetation will be necessary for delineation of map unit boundaries in the field.

Table 4. Soil map unit composition for the Emery 2 Soil Survey area.

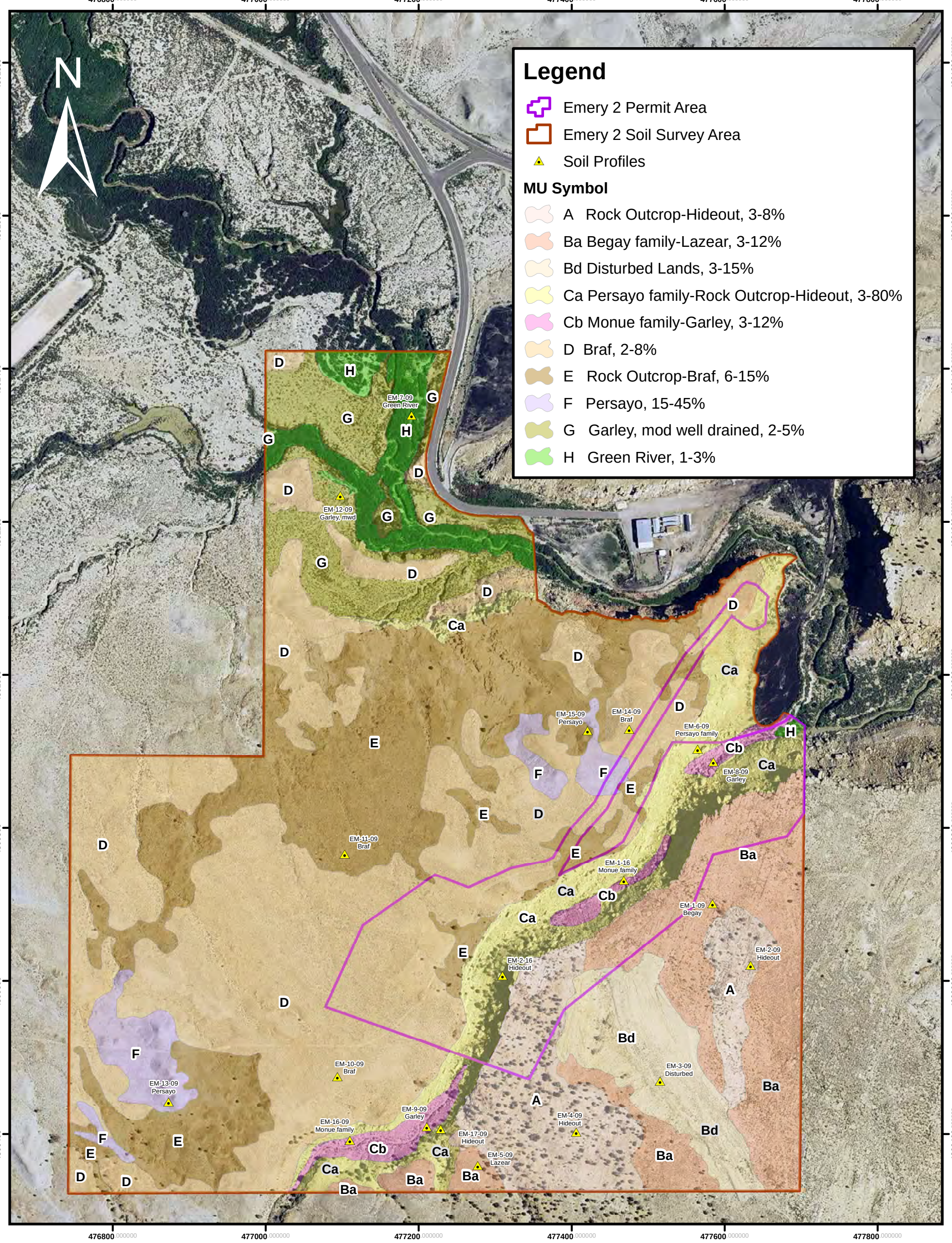
Map Unit	Percent	Soil Series or Taxonomic Family	Modal Pedon
A	**Rock Outcrop – Hideout complex, 3 to 8 percent slopes**		
	50	Sandstone Outcrop	
	40	Hideout	EM-4-09
	10	Begay family	
Ba	**Begay family – Lazear complex, 3 to 12 percent slopes**		
	50	Begay family	EM-1-09
	35	Lazear	EM-5-09
	10	Hideout	
	5	Sandstone Outcrop	

Table 4. Soil map unit composition for the Emery 2 Soil Survey area.

Map Unit	Percent	Soil Series or Taxonomic Family	Modal Pedon
Bd	**Disturbed Lands, 3 to 15 percent slopes**		
	85	Previously disturbed soils	EM-3-09
	10	Begay family	
	5	Hideout	
Ca	**Persayo family – Rock Outcrop - Hideout complex, 3 to 80 percent slopes**		
	50	Persayo family	EM-6-09
	20	Sandstone Outcrop	
	15	Hideout	EM-17-09
	8	Garley	EM-8-09
	7	Monue family	
Cb	**Monue Family – Garley complex, 3 to 12 percent slopes**		
	60	Monue Family	EM-16-09
	30	Garley	EM-9-09
	10	Begay family	
D	**Braf sandy loam, 2 to 8 percent slopes**		
	85	Braf	EM-10-09
	10	Sandstone Outcrop	
	5	Persayo family	

Table 4. Soil map unit composition for the Emery 2 Soil Survey area.

Map Unit	Percent	Soil Series or Taxonomic Family	Modal Pedon
E	**Rock Outcrop –Braf complex, 6 to 15 percent slopes**		
	50	Sandstone Outcrop	
	45	Braf	EM-11-09
	5	Persayo family	
F	**Persayo very gravelly clay loam, 15 to 45 percent slopes**		
	85	Persayo	EM-13-09
	10	Braf	
	5	Sandstone Outcrop	
G	**Garley loam, moderately well drained, 2 to 5 percent slopes**		
	85	Garley, moderately well drained	EM-12-09
	10	Green river	
	5	Braf	
H	**Green River sandy clay loam, 1 to 3 percent slopes**		
	90	Green River	EM-7-09
	10	Garley, moderately well drained	



Bronco UTAH OPERATIONS, LLC

Figure 3. Emery 2 Mine
Order 2 Soil Survey Map

Rev. July 19, 2016
June 30, 2016 Base map NAIP 2014 UTM NAD 83 1 inch = 400 feet

Prepared By:
Long Resource Consultants, Inc.
Morgan, Utah

0 200 400 600 800 Feet

A Rock Outcrop — Hideout complex, 3 to 8 percent slopes

General

Map unit A is characterized by Ferron sandstone outcrops and shallow soils on a plateau in the southeast portion of the soil survey area. Inclusions of moderately deep Begay family soils also occur in this soil map unit. Component distribution is based on a 10 point transect (Appendix B). Hideout soils are dominated by Utah juniper and pinyon pine. Big sagebrush and black greasewood are on the Begay family soils. Grasses are of very limited extent in this map unit. Table 5 lists the taxonomic classification of the soil components in map unit A.

Table 5. Taxonomic classification of soil components in map unit A.

Percent of Map Unit	Soil Series or Family	Taxonomic Classification
50		Sandstone outcrop
40	Hideout	Lithic Ustic Torriorthents, loamy, mixed, superactive, calcareous, mesic
10	Begay family	Ustic Haplocambids, coarse-loamy, mixed, superactive, mesic

Typifying Soil Pedon Descriptions

Soils colors are for dry soil unless specified otherwise.

The typifying soil pedon for Hideout soils in map unit A is EM-4-09, The surface 4 cm (2 inches) is very pale brown loamy sand. The lower surface is pale brown sandy loam to 20 cm (8 inches). Ferron sandstone is at 20 cm (8 inches).

Limiting Features

The large amount of Ferron sandstone outcrop and shallow depth to sandstone will be limiting to excavation and topsoil salvage in this map unit.

Available water capacity is *Fair* (DOGM 2008) in these coarse textured soils.

Reclamation of this map unit will be limited by the amount of topsoil salvage from shallow soils.

Ba Begay family — Lazear complex, 3 to 12 percent slopes

General

Map unit Ba is dominated by moderately deep, Begay family, and shallow, Lazear, soils over Ferron sandstone. Minor inclusions of shallow Hideout soils also occur in this map unit. Wyoming big sagebrush, black greasewood, and shadscale dominate the Begay family soils. Shadscale is the dominant vegetation on Lazear soils. Grasses are of very limited extent in this map unit. Table 6 lists the taxonomic classification of the soil components in map unit Ba.

Table 6. Taxonomic classification of soil components in map unit Ba.

Percent of Map Unit	Soil Series or Family	Taxonomic Classification
50	Begay family	Ustic Haplocambids, coarse-loamy, mixed, superactive, mesic
35	Lazear	Lithic Ustic Torriorthents, loamy, mixed, superactive, calcareous, mesic
10	Hideout	Lithic Ustic Torriorthents, loamy, mixed, superactive, calcareous, mesic
5		Sandstone outcrop

Typifying Soil Pedon Descriptions

The typifying pedon for Begay family soils in map unit Ba is EM-1-09. The surface is pale yellow sandy loam to 8 cm (3 inches). The sub-surface is light yellowish brown sandy loam to 50 cm (20 inches). The subsoil is pale yellow channery sandy loam to 80 cm (32 inches). Ferron sandstone is at 80 cm (32 inches).

The typifying pedon for Lazear soils in map unit Ba is EM-5-09. The surface is pale brown channery sandy loam to 7 cm (3 inches). The sub-surface is light yellowish brown channery sandy clay loam to 20 cm (8 inches). Ferron sandstone is at 20 cm (8 inches).

Hideout soils are similar to Lazear soils, but textures are coarse-loamy (5 to 18 percent clay).

Limiting Features

The moderately deep (50 to 100 cm) and shallow (less than 50 cm) depths to Ferron sandstone will be limiting to excavations.

Available water capacity is *Fair* (DOGM 2008) in these coarse textured soils.

Calcium carbonates in the Lazear subsoil will be limiting (*Fair*) to reclamation success. Topsoil salvage will be limited by the depth to Ferron sandstone.

Reclamation potential in this map unit ranges from fair to good depending on depth to sandstone.

Bd Disturbed Lands, 3 to 15 percent slopes

General

Map unit Bd is characterized by soils which have been previously disturbed for construction of roads and drill locations. The specific date and origin of this disturbance could not be determined. This disturbance did not appear to be recent when field work was conducted in the fall of 2009. Shadscale and black greasewood had become established in the area by the time the soil survey field work was conducted in 2009.

Disturbed soils are shallow to hard shale and sandstone with characteristics similar to Lazear soils. Minor inclusions of Begay family and Hideout soils are present in non- disturbed areas. Black greasewood and shadscale are the dominant vegetation on the disturbed soils. Big sagebrush and black greasewood characterize the Begay family soils, while the small areas of Hideout soils are dominated by pinyon pine and Utah juniper. Table 7 lists the taxonomic classification of the soil components in map unit Bd.

Table 7. Taxonomic classification of soil components in map unit Bd.

Percent of Map Unit	Soil Series or Family	Taxonomic Classification
85		Previously disturbed Lands
10	Begay family	Ustic Haplocambids, coarse-loamy, mixed, superactive, mesic
5	Hideout	Lithic Ustic Torriorthents, loamy, mixed, superactive, calcareous, mesic

Typifying Soil Pedon Descriptions

Soils colors are for dry soil unless specified otherwise.

The typifying soil pedon for disturbed soils in map unit Bd is EM-3-09. The surface is very pale brown channery loam to 18 cm (7 inches). The subsoil is pale brown channery sandy clay loam to 46 cm (18 inches). Hard shale is at 46 cm (18 inches).

Limiting Features

The shallow depth to hard shale and sandstone will be limiting to excavations in this map unit.

Topsoil salvage in this map unit will be limited by the previous soil disturbance.

Available water capacity is *Fair* (DOGM 2008) in these coarse textured soils.

Reclamation potential in this map unit is fair due to the previous disturbance.

Ca Persayo family - Rock Outcrop - Hideout complex, 3 to 80 percent slopes

General

Map unit Ca is located in the narrow canyon that separates the soil survey area from south to northeast. Soils are shallow to either Mancos shale (Persayo family) or Ferron sandstone (Hideout). There is a significant amount of sandstone outcrop with large car to house sized boulders on the steep canyon sideslopes and bottom. Alluvium in the bottom of the canyon is coarse-loamy with *Unacceptable* saline and sodic conditions in localized areas. Shadscale and Gardner's saltbush dominate the Persayo family soils. Utah juniper and pinyon pine occur on Hideout soils. Black greasewood and shadscale are the dominant vegetation on the Garley and Monue Family soils. Table 8 lists the taxonomic classification of the soil components in map unit Ca.

Table 8. Taxonomic classification of soil components in map unit Ca.

Percent of Map Unit	Soil Series or Family	Taxonomic Classification
50	Persayo family	Typic Torriorthents, loamy, mixed, active, calcareous, mesic, shallow
20		Sandstone Outcrop
15	Hideout	Lithic Ustic Torriorthents, loamy, mixed, superactive, calcareous, mesic
8	Garley	Typic Torrifluvents, coarse-loamy, mixed, active, calcareous, mesic
7	Monue Family	Typic Haplocambids, coarse-loamy, mixed, superactive, calcareous, mesic

Typifying Soil Pedon Descriptions

Soils colors are for dry soil unless specified otherwise.

The typifying soil pedon for Persayo family soils in map unit Ca is EM-6-09. The surface is very pale brown channery loamy sand to 7 cm (3 inches). The subsoil is very pale brown channery sandy loam to 18 cm (7 inches). Decomposing shale with a few fine and very fine roots is from 18 to 34 cm (7 to 13 inches). Soft shale that restricts plant root development is at 38 cm (13

inches). Persayo family soils have less that 18 percent clay in the control section (Persayo soil series has 18 to 35 percent clay). These soils are on very steep slopes ranging from 45 to 80 percent.

The typifying soil pedon for Hideout soils in map unit Ca is EM-17-09. The surface is pale brown very channery loamy sand to 4 cm (2 inches). The subsoil is brown channery sandy loam to 19 cm (8 inches). These soils are on structural benches on the canyon sideslopes.

Limiting Features

Persayo family and Hideout soils in this map unit are limited by the shallow depth to shale and sandstone, respectively.

Available water capacity is *Fair* to *Poor* (DOGM 2008) in these coarse textured soils.

The large (car to house size) sandstone boulders will make topsoil salvage difficult in some areas.

The very steep canyon sideslopes will make topsoil salvage difficult.

Garley soils have *Poor* to *Unacceptable* (DOGM 2008) saline and sodic conditions.

Monue family soils have *Poor* (DOGM 2008) saline and sodic conditions in the bottom of the soil profile.

Reclamation potential in this map unit ranges from fair to poor depending on slope, depth, soil chemistry, and other localized conditions.

Cb Monue Family — Garley complex, 3 to 12 percent slopes

General

Map unit Cb is characterized by very deep coarse-loamy soils in the upper portion of the canyon bottom. Minor inclusions of moderately deep Begay family soils occur on the footslopes of the adjacent canyon sideslopes. Black greasewood is the dominant vegetation on the Monue Family and Garley soils. Small clumps of Indian ricegrass occur on the Monue Family soils. Shadscale is found on the Garley soils. Utah juniper and pinyon pine grow on the Hideout soils. Table 9 lists the taxonomic classification of the soil components in map unit Cb.

Map unit Cb is the best source of topsoil and subsoil in the Emery 2 soil survey area. However, this map unit comprises less than 5 percent of the Emery 2 permit area.

Soil profiles in map unit were evaluated from 43 to 67 inches. Monue family soils are a good to fair source of topsoil, but limited by Poor conductivity and SAR in the lower subsoil. Garley soils are limited by *Poor* salinity (conductivity) levels and *Unacceptable* sodium (SAR) levels. *Unacceptable* and *Poor* materials will need to be salvaged and stockpiled separately from the *Good* and *Fair* materials. This segregation of materials will require monitoring by a Certified Professional Soil Scientist. Additional laboratory analysis of soil samples may be required for site specific determination of material quality.

Table 9. Taxonomic classification of soil components in map unit Cb.

Percent of Map Unit	Soil Series or Family	Taxonomic Classification
60	Monue Family	Typic Haplocambids, coarse-loamy, mixed, superactive, mesic
30	Garley	Typic Torrifluvents, coarse-loamy, mixed, active, calcareous, mesic
10	Begay family	Ustic Haplocambids, coarse-loamy, mixed, superactive, mesic

Typifying Soil Pedon Descriptions

Soils colors are for dry soil unless specified otherwise.

The typifying soil pedon for Monue Family soils in map unit Cb is EM-16-09. The surface is light yellowish brown gravelly sandy loam to 8 cm (3 inches). The subsurface is pale yellow sandy

loam to 46 cm (18 inches). The upper subsoil is light yellowish brown sandy loam to 80 cm (32 inches). The lower subsoil is light yellowish brown sandy loam with *Fair* to *Poor* salinity and SAR levels (DOGM 2008) to 170 cm (67 inches).

The typifying soil pedon for Garley soils in map unit Cb is EM-~~9~~8-09. The surface is pale brown loamy sand to 9 cm (3 inches). The lower surface is light yellowish brown loamy sand to 46 cm (18 inches). The upper subsoil is light yellowish brown sandy loam to 60 cm (24 inches). The lower subsoil is light yellowish brown very layers of sandy loam and very bouldery sandy loam to 150 cm (59 inches), SAR levels are unacceptable in all soil below 9 cm (3 inches). Salinity is *Poor* (DOGM 2008) in all 46 to 88 cm (18 to 35 inches).

Limiting Features

Poor to *Unacceptable* salinity and SAR levels (DOGM 2008) will be limiting to topsoil and subsoil salvage. Soil salinity and pH should be monitored during topsoil and subsoil salvage in order to minimize the amount of soils with *Poor* salinity and *Unacceptable* SAR that are salvaged.

Available water capacity is *Fair* to *Poor* in these coarse textured soils (DOGM 2008).

Reclamation potential ranges from fair to good depending on the amount of non-saline and non-sodic topsoil that is salvaged.

D Braf sandy loam, 2 to 8 percent slopes

General

Map unit D is characterized by shallow coarse-loamy soils. Ferron sandstone outcrop inclusions occur on convex summits and shoulders. Minor inclusions of shallow Persayo family soils occur on hillslopes. Shadscale and black sage with Indian ricegrass are the dominant vegetation on Braf soils. Table 10 lists the taxonomic classification of the soil components in map unit D.

Table 10. Taxonomic classification of soil components in map unit D.

Percent of Map Unit	Soil Series or Family	Taxonomic Classification
85	Braf	Lithic Torriorthents, loamy, mixed, superactive, calcareous, mesic
10		Sandstone outcrop
5	Persayo family	Typic Torriorthents, loamy, mixed, active, calcareous, mesic, shallow

Typifying Soil Pedon Descriptions

Soils colors are for dry soil unless specified otherwise.

The typifying soil pedon for Braf soils in map unit D is EM-10-09. The surface is pale brown loamy sand to 7 cm (3 inches). The upper subsoil is light yellowish brown sandy loam to 27 cm (11 inches). The lower subsoil is pale yellow flaggy sandy loam to 45 cm (18 inches). Ferron sandstone is at 45 cm (18 inches). Calcium carbonate levels are *Fair* in the subsoil (DOGM 2008).

Limiting Features

The shallow depth to Ferron sandstone will be limiting to excavations and topsoil salvage.

Fair calcium carbonate levels (DOGM 2008) in the subsoil will be limiting to topsoil salvage.

Available water capacity is *Fair* (DOGM 2008).

Reclamation potential is fair based on the shallow depth to sandstone.

E Rock Outcrop — Braf complex, 6 to 15 percent slopes

General

Map unit E is characterized by Ferron sandstone outcrops and shallow soils. The sandstone outcrops are on convex ridges and hillslopes. The shallow Braf soils are in swales on the hillslopes and on leeward hillslopes. Persayo family soils occur on the steeper shale outcrop areas. Shadscale, black sage, Indian ricegrass, and prickly pear are the dominate vegetation on the Braf soils. Widely scattered Utah juniper and pinyon pine are growing in the swales. Table 11 lists the taxonomic classification of the soil components in map unit E.

Table 11. Taxonomic classification of soil components in map unit E.

Percent of Map Unit	Soil Series or Family	Taxonomic Classification
50		Sandstone outcrop
40	Braf	Lithic Torriorthents, loamy, mixed, superactive, calcareous, mesic
10	Persayo family	Typic Torriorthents, loamy, mixed, active, calcareous, mesic, shallow

Typifying Soil Pedon Descriptions

Soils colors are for dry soil unless specified otherwise.

The typifying soil pedon for Braf soils in map unit E is EM-11-09. The surface is pale brown channery sandy loam to 3 cm (1 inch), The subsoil is pale brown sandy loam to 8 cm (3 inches). Ferron sandstone is at 8 cm (3 inches). The surface and subsoil horizons were sampled and analyzed together due to the limited thickness of each.

Limiting Features

The sandstone outcrops and shallow soils will be limiting to topsoil salvage.

Available water capacity is *Fair* (DOGM 2008).

Reclamation potential is fair to poor due to the very limited potential for topsoil salvage.

F Persayo very gravelly clay loam, 15 to 45 percent slopes

General

Map unit F is characterized by soils which are shallow to Mancos shale on steep to very steep slopes. There are minor inclusions of shallow coarse-loamy Braf soils over sandstone and sandstone outcrops. Shadscale is the dominant vegetation on the Persayo soils. Table 12 lists the taxonomic classification of the soil components in map unit F.

Table 12. Taxonomic classification of soil components in map unit F.

Percent of Map Unit	Soil Series or Family	Taxonomic Classification
85	Persayo	Typic Torriorthents, loamy, mixed, active, calcareous, mesic, shallow
10	Braf	Lithic Torriorthents, loamy, mixed, superactive, calcareous, mesic
5		Sandstone Outcrop

Typifying Soil Pedon Descriptions

Soils colors are for dry soil unless specified otherwise.

The typifying soil pedon for Persayo soils in map unit F is EM-13-09. The surface is light yellowish brown very gravelly clay loam to 10 cm (4 inches). The subsoil is light brownish gray silty clay loam to 40 cm (16 inches). Soft shale is at 40 cm (16 inches). Salinity levels are *Poor* and SAR levels are *Unacceptable* in the subsoil. Calcium carbonate levels are *Fair* to *Poor* (DOGM 2008).

Limiting Features

The shallow depth to shale and steep slopes will be limiting to topsoil salvage.

Poor salinity and *Unacceptable* SAR levels in the subsoil will limit topsoil salvage (DOGM 2008).

Reclamation potential will be limited by the shallow depths to shale and sandstone.

G Garley loam, moderately well drained, 2 to 5 percent slopes

General

Map unit G is characterized by very deep coarse-loamy saline and sodic soils. This map unit occurs on the stream terrace along Quitchapah Creek. Minor inclusions of Green River soils with aquic soil conditions occur on the floodplain. Also included are small areas of shallow Braf soils on the footslopes adjacent to the stream terrace. Black greasewood is the dominant vegetation on the Garley soils. Grasses are very limited in this map unit. Table 13 lists the taxonomic classification of the soil components in map unit G.

This map unit does not occur within the Emery 2 Mine Permit area.

Table 13. Taxonomic classification of soil components in map unit G.

Percent of Map Unit	Soil Series or Family	Taxonomic Classification
85	Garley, moderately well drained	Typic Torrifluvents, coarse-loamy, mixed, active, calcareous, mesic
10	Green River	Oxyaquic Torrifluvents, coarse-loamy, mixed, calcareous, superactive, mesic
5	Braf	Lithic Torriorthents, loamy, mixed, superactive, calcareous, mesic

Typifying Soil Pedon Descriptions

Soils colors are for dry soil unless specified otherwise.

The typifying soil pedon for Garley, moderately well drained, soils in map unit G is EM-12-09. The surface is light gray loam to 15 cm (3 inches). The upper subsoil is light yellowish brown sandy loam and loam to 72 cm (28 inches). A buried surface of light yellowish brown sandy loam is from 72 to 102 cm. The lower subsoil is light yellowish brown sandy loam to 164 cm (65 inches). SAR levels are *Unacceptable*. Salinity levels are *Fair* in the surface and *Poor* below 15 cm (3 inches). Calcium carbonate and available water capacity range from *Good* to *Fair* in the soil profile. Soil pH is *Fair* below the surface horizon (DOGM 2008).

Limiting Features

The *Unacceptable* SAR levels will limit the amount of topsoil that can be salvaged (DOGM 2008). The topsoil salvaged from Garley soils should be stockpiled separately from the better quality topsoil salvaged from other map units.

Reclamation potential is poor due to the poor salinity and unacceptable SAR levels.

H Green River sandy clay loam, 1 to 3 percent slopes

General

Map unit H soils are coarse-loamy and very deep on the floodplain along Quitchapah Creek (perennial stream). These soils are subject to flooding and high groundwater during periods of high stream flows in Quitchapah Creek. Minor inclusions of Garley soils occur on the stream terraces. Tamarisk is the dominant vegetation on Green River soils with small clumps of coyote willow along the stream channel. Black greasewood dominates the Garley soils. Table 14 lists the taxonomic classification of the soil components in map unit H.

This map unit is of very limited extent within the Emery 2 permit area. It occurs at the confluence of the canyon drainage and Quitchapah Creek in the permit area.

Table 14. Taxonomic classification of soil components in map unit H.

Percent of Map Unit	Soil Series or Family	Taxonomic Classification
90	Green River	Oxyaquic Torrifluvents, coarse-loamy, mixed, calcareous, superactive, mesic
10	Garley, moderately well drained	Typic Torrifluvents, coarse-loamy, mixed, active, calcareous, mesic

Typifying Soil Pedon Descriptions

Soils colors are for dry soil unless specified otherwise.

The typifying soil pedon for Green River soils in map unit H is EM-7-09. The surface is light yellowish brown sandy clay loam to 15 cm (6 inches). A buried surface is pale yellow silty loam and barns to 28 cm (11 inches). The underlying subsoil is light gray loam and silt loam to 56 cm (22 inches). The lower subsoil is light yellowish brown sandy loam and loam to 130 cm (51 inches). The lower subsoil is light gray sandy loam to 150 cm. Fine, medium and coarse soil mottles were observed between 28 and 56 cm (11 and 22 inches). The surface 15 cm (6 inches) appeared to have been deposited when the area was flooded on September 16, 2009. The stream channel was incised ten to fifteen feet within this soil map unit at the location of the representative pedon for Green River soils.

Limiting Features

Calcium carbonate levels are *Fair* (DOGM 2008) from 15 to 102 cm (6 to 40 inches).

Flooding could be limiting to reclamation, if the stream flows are too high.

This soil map unit is a good source of topsoil for reclamation.

Map Unit Areas

The cumulative surface area for each soil map unit was calculated with ARC-Map software on the horizontal plane. Cumulative surface areas are listed for each soil map unit in Table 15.

Table 15. Cumulative surface area for soil map units in the Emery 2 soil survey area.

	Soil Map Units										
	A	Ba	Bd	Ca	Cb	D	E	F	G	H	Total
Acres	13.8	20.2	8.4	18.1	3.2	64.6	37.4	5.5	12.0	6.4	189.6
Percent	7.3	10.6	4.5	9.5	1.7	34.1	19.7	2.9	6.3	3.4	

Major Soil Types

Representative soil profiles for each of the major soil types are described in this section. Major soil types are those which comprise at least 15 percent of a soil map unit. Field description sheets are in Appendix B. Laboratory analysis data for these profiles are in Appendix C.

Soil horizon depths were measured in centimeters in the field. Depths in inches have been rounded to the nearest inch.

Major soil types were correlated to established soil series (USDA 2016a). Soils that did meet specific soil series criteria were correlated to soil families with the name of a locally used soil series in the same family (USDA 2016a and 2016b).

Begay family

Begay family soils are moderately deep (50 to 100 cm, 20 to 40 inches) to Ferron sandstone. They have developed in stabilized eolian deposits on the plateau southeast of the canyon.

Soil profile EM-1-09 is representative of Begay family soil in the Emery 2 soil survey area. Dominant vegetation on the Begay family soils is big sage, black greasewood, and shadscale.

Ustic Haplocambids, coarse-loamy, mixed, superactive, mesic

A --- 0 to 8 cm (0 to 3 inches); pale yellow (2.5Y 7/3) dry, sandy loam; light yellowish brown (2.5Y 6/4) moist; 63 percent sand; 20 percent silt; 17 percent clay; weak medium platy parting to moderate fine granular structure; very friable, slightly hard, slightly sticky, slightly plastic; common very fine roots throughout and common fine roots throughout; common very fine tubular pores; 2 percent (common) fine irregular moderately cemented carbonate concretions on bottom of rock fragments; 3 percent subangular calcareous sandstone gravels; electrical conductivity of 2.25 dS/m by EC meter, saturated paste; violently effervescent by HCl, 1 normal; neutral, pH 7.3; clear smooth boundary; CaCO3 9.1 percent.

Bw1 --- 8 to 23 cm (3 to 9 inches); light yellowish brown (2.5Y 6/4) dry, sandy loam; light olive brown (2.5Y 5/4) moist; 57 percent sand; 29 percent silt; 14 percent clay; structure; very friable, slightly hard, slightly sticky, slightly plastic; many very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 2 percent (common) fine irregular moderately cemented carbonate concretions on bottom of rock fragments; 5 percent calcareous sandstone gravels; electrical conductivity of 2.32 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.4; clear smooth boundary; CaCO3 7.2 percent.

Bw2 --- 23 to 50 cm (9 to 20 inches); light yellowish brown (10YR 6/4) dry, sandy loam; yellowish brown (10YR 5/4) moist; 73 percent sand; 14 percent silt; 13 percent clay; moderate medium subangular blocky structure; very friable, slightly hard, nonsticky, nonplastic; many very fine roots throughout, common fine roots throughout, common medium roots throughout and common coarse roots throughout; common very fine tubular pores; 3 percent (common) fine masses of carbonate on vertical faces of peds and 4 percent (common) fine irregular carbonate concretions around rock fragments; 8 percent subangular calcareous sandstone gravels; electrical conductivity of 3.94 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; clear smooth boundary; $CaCO_3$ 7.2 percent.

Bk --- 50 to 80 cm (20 to 32 inches); very pale brown (10YR 7/4) dry, channery sandy loam; yellowish brown (10YR 5/4) moist; 65 percent sand; 23 percent silt; 12 percent clay; weak medium subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; common very fine roots throughout, common fine roots throughout, common medium roots throughout and common coarse roots throughout; common very fine tubular pores; 2 percent (common) fine masses of carbonate on vertical faces of peds and 7 percent (common) medium carbonate concretions around rock fragments; 6 percent subangular calcareous sandstone gravels and 12 percent subangular calcareous sandstone channers; electrical conductivity of 3.07 dS/m by EC meter, saturated paste; violently effervescent by HCl, 1 normal; slightly alkaline, pH 7.6 ; abrupt smooth boundary; $CaCO_3$ 7.8 percent.

R --- 80 cm (32 inches); Ferron sandstone.

Braf

Braf soils are shallow, less than 50 cm (20 inches) to sandstone bedrock. In some areas, especially map unit F, Braf soils are less than 25 cm (10 inches) deep. These soils are well drained. Braf soils have a typic aridic moisture regime and are drier than Hideout and Lazear soils which have aridic moisture regimes bordering on ustic. Braf soils have 5 to 18 percent clay in the control section. These soils are in Wind Erodibility Groups 2 and 3. Braf soils were delineated as the dominant soil (map unit 015) on the bench west of the canyon by the NRCS in the Emery Area soil survey (USDA 2016b).

Soil profile EM-10-09 is representative of Braf soils in the Emery 2 soil survey area. Shadscale, black sage, Indian ricegrass, and prickly pear cactus are the dominant vegetation on Braf soils.

Lithic Torriorthents, loamy, mixed superactive, calcareous, mesic

A --- 0 to 7 cm (0 to 3 inches); pale yellow (2.5Y 7/3) dry, loamy sand; light yellowish brown (2.5Y 6/3) moist; 84 percent sand; 8 percent silt; 8 percent clay; weak medium platy parting to single grain structure; very friable, slightly hard, nonsticky, nonplastic; many very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 10 percent subangular calcareous sandstone gravels; electrical conductivity of 0.64 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 7.9; clear smooth boundary; CaCO3 13.5 percent.

C1 --- 7 to 27 cm (3 to 11 inches); light yellowish brown (2.5Y 6/4) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 70 percent sand; 20 percent silt; 10 percent clay; structure; very friable, moderately hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 2 percent fine calcium carbonate coats on bottom of rock fragments; 10 percent subangular calcareous sandstone gravels; electrical conductivity of 0.50 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.8; clear smooth boundary; CaCO3 22.2 percent.

C2 --- 27 to 45 cm (11 to 18 inches); pale yellow (2.5Y 7/4) dry, flaggy sandy loam; light yellowish brown (2.5Y 6/4) moist; 76 percent sand; 16 percent silt; 8 percent clay; single grain; loose, loose, nonsticky, nonplastic; common very fine roots throughout and common fine roots throughout; common very fine tubular pores; 2 percent fine calcium carbonate coats on bottom of rock fragments; 20 percent subangular calcareous sandstone flags and 10 percent subangular calcareous sandstone channers; electrical conductivity of 1.97 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6; abrupt smooth boundary; CaCO3 18.7 percent.

R --- 45 cm (18 inches); Ferron sandstone.

Disturbed Soils

The soil surfaces in map unit Bd were previously disturbed for the construction of drill holes and access roads. The area appeared to have been similar to map unit Ba prior to the disturbance. The specific date and origin of this disturbance could not be determined. This disturbance did not appear to be recent when field work was done in the fall of 2009. Shadscale and black greasewood had become established in the area by the time the soil survey field work was conducted in 2009.

The dominant soil in the disturbed areas is shallow to sandstone or hard shale. These soils are similar to Lazear with the native A horizon removed or disturbed.

Soil profile EM-3-09 is representative of the disturbed soils in map unit Bd. Black greasewood and shadscale have partially re-vegetated these areas.

Loamy, mixed, superactive, calcareous, mesic Lithic Ustic Torriorthents

A --- 0 to 18 cm (0 to 7 inches); very pale brown (10YR 7/3) dry, channery loam; pale brown (10YR 6/3) moist; 47 percent sand; 33 percent silt; 20 percent clay; structure; friable, hard, slightly sticky, slightly plastic; common very fine roots throughout; common very fine tubular pores; 2 percent (common) fine irregular moderately cemented carbonate concretions around rock fragments; 15 percent subangular calcareous sandstone channers; electrical conductivity of 1.40 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; clear smooth boundary;: CaCO3 13.9 percent.

C --- 18 to 46 cm (7 to 18 inches); pale brown (10YR 6/3) dry, channery sandy clay loam; brown (10YR 5/3) moist; 53 percent sand; 25 percent silt; 22 percent clay; medium structure; friable, hard, nonsticky, slightly plastic; common fine roots throughout and common very fine roots throughout; common very fine tubular pores; 2 percent (common) medium irregular moderately cemented carbonate concretions around rock fragments; 5 percent subangular calcareous sandstone flags and 15 percent subangular 2 calcareous sandstone channers; electrical conductivity of 4.39 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.4; abrupt smooth boundary; CaCO3 13.4 percent.

R --- 46 cm (18 inches); hard shale.

Garley

Garley soils are very deep, greater than 150 cm (60 inches) and are in the bottom of the canyon that crosses the Emery 2 soil survey from south to northeast. They are coarse-textured and are saline and have *Unacceptable* SAR levels (Utah DOGM 2008).

Soil profile EM-8-09 is representative of Garley soils in the Emery 2 soil survey area. Black greasewood, shadscale, and scattered clumps of Indian ricegrass are the dominant vegetation.

Typic Torrifluvents, coarse-loamy, mixed, active, calcareous, mesic

A --- 0 to 9 cm (0 to 4 inches); pale yellow (2.5Y 7/3) dry, loamy sand; light yellowish brown (2.5Y 6/3) moist; 79 percent sand; 13 percent silt; 8 percent clay; moderate medium platy structure; friable, hard, slightly sticky, slightly plastic; many very fine roots throughout, few fine roots throughout; common very fine tubular pores; electrical conductivity of 2.25 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; strongly alkaline, pH 8.7; clear smooth boundary; $CaCO_3$ 8.8 percent.

C1--- 9 to 32 cm (4 to 13 inches); pale yellow (10YR 7/4) dry, loamy sand; light yellowish brown (10YR 6/4) moist; 85 percent sand; 10 percent silt; 5 percent clay; moderate medium subangular blocky structure; friable, hard, nonsticky, nonplastic; common very fine roots throughout, few fine roots throughout, and few medium roots throughout; common very fine tubular pores; electrical conductivity of 3.82 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; very strongly alkaline, pH 9.3; abrupt smooth boundary; $CaCO_3$ 8.9 percent.

C2 --- 32 to 46 cm (13 to 18 inches); pale yellow (10YR 7/4) dry, very gravelly loamy sand; light yellowish brown (10YR 6/4) moist; 85 percent sand; 9 percent silt; 6 percent clay; single grain; loose, loose, nonsticky, nonplastic; common very fine roots throughout; many very fine interstitial pores; 40 percent fine calcareous sandstone gravels; 2 percent thin calcium carbonate coatings on bottom of rock fragments; electrical conductivity of 3.91 dS/m by EC meter, saturated paste; very slightly effervescent by HCl, 1 normal; strongly alkaline, pH 8.8; abrupt wavy boundary; $CaCO_3$ 8.9 percent.

Ab1 --- 46 to 60 cm (18 to 24 inches); pale yellow (10YR 7/4) dry, loamy sand; light yellowish brown (10YR 6/4) moist; 85 percent sand; 9 percent silt; 6 percent clay; moderate medium subangular blocky structure; friable, very hard, nonsticky, nonplastic; common very fine roots throughout; common very fine tubular pores; electrical conductivity of 8.29 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; very strongly alkaline, pH 9.3; clear smooth boundary; $CaCO_3$ 5.3 percent.

C3 --- 60 to 70 cm (24 to 28 inches); light yellowish brown (10YR 6/4) dry, very gravelly loam; light olive brown (10YR 5/4) moist; 50 percent sand; 40 percent silt; 10 percent clay; single grain; loose, loose, nonsticky, nonplastic; common very fine roots throughout,

common fine roots throughout, few medium roots throughout and few coarse roots throughout; many very fine interstitial pores; 40 percent fine calcareous sandstone gravels; 2 percent thin calcium carbonate coatings on bottom of rock fragments; electrical conductivity of 9.77 dS/m by EC meter, saturated paste; very slightly effervescent by HCl, 1 normal; strongly alkaline, pH 8.6; abrupt wavy boundary; $CaCO_3$ 8.4 percent.

C4 --- 70 to 88 cm (28 to 35 inches); pale yellow (10YR 7/4) dry, sandy loam; light yellowish brown (10YR 6/4) moist; 79 percent sand; 10 percent silt; 11 percent clay; massive; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout, and few fine roots throughout,; common very fine tubular pores; 2 percent fine masses of carbonate on faces of peds; electrical conductivity of 9.38 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; moderately alkaline, pH 7.9; abrupt wavy boundary; $CaCO_3$ 6.3 percent.

AB2 --- 88 to 98 cm (~~47~~ 35 to 66 inches); light yellowish brown (10YR 6/4) dry, very gravelly loam; light olive brown (10YR 5/4) moist; 80 percent sand; 8 percent silt; 12 percent clay; single grain; loose, loose, nonsticky, nonplastic; common very fine roots throughout; many very fine interstitial pores; 50 percent calcareous sandstone boulders; electrical conductivity of 4.35 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; slightly alkaline, pH 7.4; abrupt wavy boundary; $CaCO_3$ 5.5 percent.

C5 --- 98 to 108 cm (35 to 43 inches); light yellowish brown (10YR 6/4) dry, very bouldery sandy loam; light olive brown (10YR 5/4) moist; 77 percent sand; 14 percent silt; 9 percent clay; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout; few very fine tubular pores; 50 percent calcareous sandstone boulders; electrical conductivity of 5.54 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; slightly alkaline pH 7.7; abrupt smooth boundary; $CaCO_3$ 6.8 percent.

C6 --- 108 to 120 cm (43 to 47 inches); light yellowish brown (10YR 6/3) dry, extremely bouldery sandy loam; light olive brown (10YR 5/4) moist; 75 percent sand; 13 percent silt; 12 percent clay; very friable, slightly hard, slightly sticky, slightly plastic; many very fine and common fine roots throughout; few very fine tubular pores; 70 percent calcareous sandstone boulders; electrical conductivity of 5.59 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline pH 7.5; clear smooth boundary; $CaCO_3$ 3.2 percent.

C7 --- 120 to 150 cm (59 inches); light yellowish brown (10YR 6/3) dry, extremely bouldery sandy loam; olive brown (10YR 4/4) moist; 77 percent sand; 11 percent silt; 12 percent clay; very friable, slightly hard, slightly sticky, slightly plastic; common very fine roots throughout; few very fine tubular pores; 70 percent calcareous sandstone boulders; electrical conductivity of 6.17 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline pH 7.5; clear smooth boundary; $CaCO_3$ 6.0 percent.

Garley, moderately well drained phase

Garley, moderately well drained, soils in map unit G are on low stream terraces along Quitchapah Creek. These soils have the same unacceptable SAR levels discussed previously in the Garley soils section.

Soil profile EM-12-09 is representative of Garley, moderately well drained soils in the Emery 2 soil survey area. Black greasewood is the dominant vegetation on Garley, moderately well drained soils. Black greasewood is the dominant vegetation.

Typic Torrifluvents, coarse-loamy, mixed, active, mesic

A --- 0 to 15 cm (0 to 6 inches); light gray (2.5Y 7/2) dry, loam; light olive brown (2.5Y 5/3) moist; 48 percent sand; 38 percent silt; 14 percent clay; moderate coarse platy structure; friable, very hard, slightly sticky, nonplastic; common very fine roots throughout; common very fine tubular pores; electrical conductivity of 6.54 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.1; clear smooth boundary; CaCO3 17.5 percent.

C1 --- 15 to 35 cm (6 to 14 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 54 percent sand; 30 percent silt; 16 percent clay; moderate medium subangular blocky structure; friable, very hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; electrical conductivity of 8.97 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.1; unable to dig with shovel; clear smooth boundary; CaCO3 18.7 percent.

C2 --- 35 to 46 cm (14to 18 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 64 percent sand; 25 percent silt; 11 percent clay; weak fine and medium subangular blocky structure; friable, hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; electrical conductivity of 8.60 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.2; gradual smooth boundary; CaCO3 14.3 percent.

C3 --- 46 to 72 cm (18 to 28 inches); light yellowish brown (2.5Y 6/3) dry, loam; light olive brown (2.5Y 5/3) moist; 46 percent sand; 38 percent silt; 16 percent clay; weak medium subangular blocky structure; friable, hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 5 percent (common) fine masses of carbonate on vertical faces of peds; electrical conductivity of 8.88 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.3; gradual smooth boundary; CaCO3 16.1 percent.

Ab --- 72 to 102 cm (28 to 40 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; grayish brown (2.5Y 5/2) moist; 54 percent sand; 34 percent silt; 12 percent clay; weak medium subangular blocky structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 2 percent (common) fine masses of carbonate on vertical faces of peds; electrical conductivity of 12.1 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.4; clear smooth boundary; CaCO3 14.6 percent.

C4 --- 102 to 130 cm (40 to 52 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; grayish brown (2.5Y 5/2) moist; 54 percent sand; 34 percent silt; 12 percent clay; weak medium subangular blocky structure; very friable, hard, nonsticky, nonplastic; common very fine roots throughout; common very fine tubular pores; 1 percent (few) fine masses of carbonate on vertical faces of peds; electrical conductivity of 5.55 dS/m by EC meter, saturated paste; electrical conductivity of 12.6 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.4; clear smooth boundary; CaCO3 15.2 percent.

C5 --- 130 to 164 cm (52 to 65 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; grayish brown (2.5Y 5/2) moist; 54 percent sand; 30 percent silt; 16 percent clay; 2 percent fine prominent brownish yellow (10YR 6/6) mottles; moderate medium subangular blocky structure; friable, very hard, nonsticky, nonplastic; common very fine roots throughout; common very fine tubular pores; 2 percent (common) fine prominent spherical very weakly cemented masses of oxidized iron clear in matrix; 1 percent (few) fine masses of carbonate on vertical faces of peds; electrical conductivity of 9.64 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.3; CaCO3 14.8 percent.

Green River

Green River soils are very deep and are located in the floodplain along Quitchapah Creek. These soils are susceptible to flooding and a water table may be present in locations near the stream.

Soil profile EM-7-09 is representative of Green River soils in the Emery 2 soil survey area. Tamarisk is the dominant vegetation with coyote willows along streambanks.

Oxyaquic Torrifluvents, coarse-loamy, mixed, superactive, calcareous, mesic

A --- 0 to 15 cm (0 to 6 inches); light yellowish brown (2.5Y 6/3) dry, sandy clay loam; light olive brown (2.5Y 5/3) moist; 57 percent sand; 15 percent silt; 28 percent clay; medium platy structure; very friable, slightly hard, nonsticky, nonplastic; electrical conductivity of 2.43 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; abrupt smooth boundary; CaCO3 14.4 percent.

2A --- 15 to 28 cm (6 to 11 inches); pale yellow (2.5Y 7/3) dry, silt loam; grayish brown (2.5Y 5/2) moist; 37 percent sand; 52 percent silt; 11 percent clay; moderate medium subangular blocky structure; very friable, hard, nonsticky, nonplastic; common very fine roots throughout and common fine roots throughout; common very fine tubular pores; electrical conductivity of 1.55 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6; clear smooth boundary; CaCO3 18.3 percent.

2C --- 28 to 43 cm (11 to 17 inches); light gray (2.5Y 7/2) dry, loam; light yellowish brown (2.5Y 6/3) moist; 43 percent sand; 48 percent silt; 9 percent clay; 2 percent medium distinct olive yellow (2.5Y 6/6) and 2 percent fine distinct olive yellow (2.5Y 6/6) mottles; moderate medium subangular blocky structure; very friable, hard, slightly sticky, nonplastic; many very fine roots throughout and common fine roots throughout; common very fine tubular pores; electrical conductivity of 1.36 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; clear smooth boundary; CaCO3 15.9 percent.

3A --- 43 to 56 cm (17 to 22 inches); light gray (2.5Y 7/2) dry, silt loam; light olive brown (2.5Y 5/3) moist; 23 percent sand; 56 percent silt; 21 percent clay; 6 percent coarse prominent strong brown (7.5YR 5/8) and 6 percent medium prominent strong brown (7.5YR 5/8) mottles; strong coarse platy structure; very friable, hard, slightly sticky, slightly plastic; common very fine roots throughout and common fine roots throughout; common very fine tubular pores; electrical conductivity of 3.46 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; abrupt smooth boundary; CaCO3 19.2 percent.

3C1 --- 56 to 78 cm (22 to 31 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 61 percent sand; 26 percent silt; 13 percent clay; single grain; loose, loose, nonsticky, nonplastic; many very fine interstitial pores; electrical conductivity of 3.67 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6; clear smooth boundary; CaCO3 15.2 percent.

3C2 --- 78 to 102 cm (31to 40 inches); light yellowish brown (2.5Y 6/3) dry, loam; dark grayish brown (2.5Y 4/2) moist; 46 percent sand; 37 percent silt; 17 percent clay; massive parting to single grain; very friable, slightly hard, slightly sticky, slightly plastic; many very fine interstitial pores; electrical conductivity of 3.93 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; gradual smooth boundary; CaCO3 16.5 percent.

3C3 --- 102 to 130 cm (40 to 51 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 58 percent sand; 33 percent silt; 9 percent clay; single grain and medium structure; very friable, slightly hard, slightly sticky, slightly plastic; many very fine interstitial pores; electrical conductivity of 2.21 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6; clear smooth boundary; CaCO3 14.5 percent.

3C4 --- 130 to 150 cm (51 to 59 inches); light gray (2.5Y 7/2) dry, sandy loam; light yellowish brown (2.5Y 6/3) moist; 69 percent sand; 25 percent silt; 6 percent clay; single grain; loose, loose, nonsticky, nonplastic; many very fine interstitial pores; electrical conductivity of 1.6 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; CaCO3 14.3 percent.

Hideout

Hideout soils are shallow and located on the plateau southeast of the canyon and on structural benches in the canyon. These soils have 5 to 18 percent clay in the control section while Lazear soils have 18 to 27 percent clay. Hideout soils have an aridic moisture regime that borders on ustic. Hideout soils are similar to Braf soils, but Braf soils are typic aridic (drier).

Soil profile EM-4-09 is representative of Hideout soils in the Emery 2 soil survey area. Utah juniper, pinyon pine, Birchleaf mahogany, Utah serviceberry, Wyoming big sage, black sage, broom snakeweed, and prickly pear cactus are the dominant vegetation.

Lithic Ustic Torriorthents, loamy, mixed, superactive, calcareous, mesic

A --- 0 to 6 cm (0 to 2 inches); very pale brown (10YR 7/3) dry, loamy sand; pale brown (10YR 6/3) moist; 79 percent sand; 14 percent silt; 7 percent clay; weak medium platy parting to single grain structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout and common fine roots throughout; many very fine interstitial pores; electrical conductivity of 0.69 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; abrupt smooth boundary; CaCO3 6.1 percent.

C --- 6 to 20 cm (2 to 8 inches); pale brown (10YR 6/3) dry, sandy loam; brown (10YR 5/3) moist; 69 percent sand; 21 percent silt; 10 percent clay; weak medium subangular blocky structure; very friable, hard, nonsticky, nonplastic; many very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; electrical conductivity of 0.95 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; abrupt smooth boundary; CaCO3 6.4 percent.

R --- 20 cm (8 inches); Ferron sandstone.

Lazear

Lazear soils are shallow and located on the plateau southeast of the canyon. These soils are similar to Hideout soils, but Lazear soils have 18 to 27 percent clay in the control section while Hideout soils have 5 to 18 percent clay.

Soil profile EM-5-09 is representative of Lazear soils in the Emery 2 soil survey area. Shadscale, black sage, broom snakeweed, and bluegrass are the dominant vegetation.

Lithic Ustic Torriorthents, loamy, mixed, superactive, calcareous, mesic

A --- 0 to 7 cm (0 to 3 inches); pale brown (10YR 6/3) dry, channery sandy loam; brown (10YR 5/3) moist; 65 percent sand; 22 percent silt; 13 percent clay; moderate medium platy structure; very friable, slightly hard, slightly sticky, slightly plastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 10 percent subangular calcareous sandstone channers and 10 percent subangular calcareous sandstone gravels; electrical conductivity of 0.65 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.8; clear smooth boundary; $CaCO_3$ 22.5 percent.

C --- 7 to 20 cm (23 to 8 inches); light yellowish brown (10YR 6/4) dry, channery sandy clay loam; pale brown (10YR 6/3) moist; 63 percent sand; 16 percent silt; 21 percent clay; weak medium subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; many very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 10 percent subangular calcareous sandstone gravels and 15 percent subangular calcareous sandstone channers; electrical conductivity of 0.57 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6; abrupt smooth boundary; $CaCO_3$ 25.4 percent.

R --- 20 cm (8 inches); Ferron sandstone.

Monue Family

Monue family soils are very deep and are located on alluvial fans in the upper third of the canyon. These soils are on the same landforms in the canyon as Garley soils. Monue family soils generally have slightly more grass cover than Garley soils. These soils have *Fair* conductivity and SAR levels below 80 cm (31 inches) and poor levels below 122 cm (48 inches). Monue family soils are a good source of topsoil and subsoil within the Emery 2 permit area.

Soil profile EM-16-09 is representative of Monue family soils in the Emery 2 soil survey area. Black greasewood and Indian rice grass are the dominant vegetation.

Typic Haplocambids, coarse-loamy, mixed, superactive, mesic

A1 --- 0 to 8 cm (0 to 3 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam gravel; light olive brown (2.5Y 5/3) moist; 64 percent sand; 28 percent silt; 8 percent clay; weak medium subangular blocky parting to single grain structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout and common fine roots throughout; many very fine interstitial pores; 1 percent subangular calcareous sandstone gravels; electrical conductivity of 1.01 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; clear smooth boundary; CaCO3 13.4 percent.

Bw1 --- 8 to 21 cm (3 to 8 inches); pale yellow (2.5Y 7/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 68 percent sand; 24 percent silt; 8 percent clay; structure; very friable, hard, nonsticky, nonplastic; common very fine roots throughout and common fine roots throughout; many very fine interstitial pores; electrical conductivity of 0.43 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6; clear smooth boundary; CaCO3 (Exists in NASIS Horizon) 11.4 percent.

Bw2 --- 21 to 46 cm (8 to 18 inches); pale yellow (2.5Y 7/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 58 percent sand; 33 percent silt; 9 percent clay; moderate medium subangular blocky structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout and common fine roots throughout; many very fine interstitial pores; electrical conductivity of 0.43 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; clear smooth boundary; CaCO3 11.6 percent.

C2 --- 46 to 80 cm (18 to 31 inches); light yellowish brown (2.5Y 6/4) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 60 percent sand; 28 percent silt; 12 percent clay; single grain; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout; many very fine interstitial pores; 1 percent (few) carbonate concretions on bottom of rock fragments; 2 percent subangular calcareous sandstone gravels; electrical conductivity of 0.45 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; gradual smooth boundary; CaCO3 13 percent.

C3 --- 80 to 122 cm (31 to 48 inches); light yellowish brown (2.5Y 6/4) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 70 percent sand; 22 percent silt; 8 percent clay; single grain; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout; many very coarse interstitial pores; electrical conductivity of 5.89 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; gradual smooth boundary; CaCO3 12.9 percent.

2C --- 122 to 170 cm (48 to 67 inches); light yellowish brown (10YR 6/4) dry, sandy loam; yellowish brown (10YR 5/4) moist; 68 percent sand; 24 percent silt; 8 percent clay; single grain; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout; many very fine interstitial pores; 1 percent (few) salt masses in matrix and 1 percent (few) carbonate concretions on bottom of rock fragments; 4 percent subangular calcareous sandstone channers; electrical conductivity of 9.6 dS/m by EC meter, saturated paste; violently effervescent by HCl, 1 normal; moderately alkaline, pH 8; CaCO3 12.3 percent.

Persayo

Persayo soils are shallow to Blue Gate shale member of the Mancos formation on very steep to extremely steep hillslopes, referred to locally as the "Blue Hills". Persayo soils are medium textured and have 18 to 35 percent clay in the control section, while Persayo Family soils have less than 18 percent clay in the control section.

Soil profile EM-13-09 is representative of Persayo soils in the Emery 2 soil survey area. Widely scattered shadscale was the only vegetation observed.

Typic Torriorthents, loamy, mixed, active, calcareous, mesic, shallow

A --- 0 to 10 cm (0 to 4 inches); light yellowish brown (2.5Y 6/3) dry, very gravelly clay loam; dark grayish brown (2.5Y 4/2) moist; 32 percent sand; 41 percent silt; 27 percent clay; weak fine subangular blocky parting to moderate fine granular structure; friable, hard, slightly sticky, slightly plastic; common very fine roots throughout; common very fine tubular pores; 20 percent angular strongly cemented calcareous shale channers and 40 percent angular strongly cemented calcareous shale gravels; electrical conductivity of 2.44 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 7.9; clear smooth boundary; $CaCO_3$ 33.6 percent.

C --- 10 to 40 cm (4 to 16 inches); light brownish gray (2.5Y 6/2) dry, silty clay loam; grayish brown (2.5Y 5/2) moist; 18 percent sand; 50 percent silt; 32 percent clay; moderate medium subangular blocky structure; friable, hard, slightly sticky, slightly plastic; common very fine roots throughout; common very fine tubular pores; 10 percent angular very weakly cemented calcareous shale parachanners; electrical conductivity of 8.64 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.2; clear smooth boundary; $CaCO_3$ 16.5 percent.

Cr --- 40 cm (16 inches); Blue Gate member of the Mancos shale.

Persayo Family

Persayo family soils are shallow to Blue Gate shale member of the Mancos formation and located on extremely steep sideslopes in the canyon. These soils have less than 18 percent clay in the control, while Persayo soils have 18 to 27 percent clay in the control section.

Soil profile EM-6-09 is representative of Persayo Family soils in the Emery 2 soil survey area. Gardners saltbush and shadscale are the dominant vegetation. Depth to the Blue Gate member of the Mancos shale is 18 cm (7 inches). Very fine and fine roots penetrate the shale to 34 cm (13 inches). Soil textures are influenced by slope wash from the Ferron sandstone cliffs.

Typic Torriorthents, loamy, mixed, active, calcareous, mesic, shallow

A --- 0 to 7 cm (0 to 3 inches); very pale brown (10YR 7/3) dry, channery loamy sand; pale brown (10YR 6/3) moist; 79 percent sand; 12 percent silt; 9 percent clay; weak medium platy structure parting to single grain; very friable, slightly hard, non-sticky, non-plastic; common very fine and few fine roots; common very fine and few fine tubular pores; 10 percent angular strongly cemented 2 to 76 millimeters (0.1 to 3 inches) sandstone channers, 5 percent angular strongly cemented sandstone gravels, 5 percent angular strongly cemented sandstone flags, and 1 percent angular strongly cemented sandstone boulders; electrical conductivity of 2.32 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; clear smooth boundary; CaCO3 6.4 percent.

2C --- 7 to 18 cm (3 to 7 inches); very pale brown (10YR 7/4) dry, para-channery sandy loam; light yellowish brown (10YR 6/4) moist; 71 percent sand; 15 percent silt; 14 percent clay; weak fine and medium subangular blocky structure; very friable, slightly hard, slightly sticky, non-plastic; many very fine, few fine, few medium roots; common very fine tubular pores; 20 percent angular weakly cemented shale parachanners; electrical conductivity of 2.71 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; abrupt smooth boundary; CaCO3 7.5 percent.

2Cr1 --- 18 to 34 cm (7 to 13 inches); decomposing Blue Gate member of the Mancos shale; common very fine and few fine roots; clear smooth boundary.

2Cr2 --- 34 to 38 cm (13 to 15 inches); Blue Gate member of the Mancos shale.

Topsoil Salvage

Soil Limiting Features

Topsoil and subsoil salvage depths were determined by the depth to carbonates, soil pH (greater than 8.5), salinity (EC), sodicity (SAR), texture and depth to parent material (based on DOGM 2008). Clayey soils, carbonate accumulations and corresponding poor pH are the primary limiting soil features in the Emery 2 soil survey area. The depth to each of these limiting soil features varies by soil type and map unit.

The determination of *Good*, *Fair*, *Poor*, or *Unacceptable* qualities of the topsoil and subsoil is based on the soil suitability criteria established by the Utah Division of Oil Gas and Mining in *Guidelines for Management of Topsoil and Overburden* (Utah DOGM 2008). The Utah DOGM suitability guidelines are summarized in Table 16.

Table 16. Soil suitability and unsuitability criteria (Utah DOGM, 2005).

Criteria	Good	Fair	Poor	Unacceptable
Saturation %	25 to 55	≥56 to 80	<25 or >80	
pH	6.5 to 8.2	6.0 to 6.4 8.2 to 8.5	5.5 to 6.0 8.6 to 9.0	< 5.5 > 9.0
EC (mS/cm 25°C)	0 to 4	4 to 8	8 to 15	> 15
SAR [1]	0 to 4	5 to 10	10 to 14	> 14 [1]
$CaCO_3$ %	<15	15 to 30	>30	
Texture	sl, l, sil, scl, vfsl, fsl	cl, c, sicl, sc, ls, lfs	sic, s, sc, c, cos, fs, vfs	g, vcos

Criteria	Good	Fair	Poor	Unacceptable
Total Organic Carbon	< 10%			≥ 10%
Available Water Capacity	> 0.10 moderate	0.05 to 0.10 low	< 0.05 very low	
K factor	< 0.37	0.37	> 0.37	
<u>Overburden</u>				
Selenium, soluble, mg/kg				≥ 0.15 [2] ≥ 0.10 [3, 4]
Boron, available, mg/kg				≥ 5.0
Acid/Base Potential, tons $CaCO_3$/1000 tons				≤ 0

1. For clay textured soils *Unacceptable* is SAR > 14. For sandy textured soils *Unacceptable* is > 20.
2. Unacceptable level for the rooting zone (top four feet of fill) and/or ephemeral drainages with 100 year flood plains, top 4 feet fill.
3. Unacceptable level for the top 4 feet of fill in surface-water impoundments.
4. Unacceptable level for intermittent/perennial drainages including 100 year flood plains.

Topsoil Salvage by Major Soil Types

Estimated Topsoil and subsoil salvage depths are based on field examination of soil profiles and laboratory analysis of representative soil samples. Actual salvage depths will vary within soil types and map units. These estimates are provided as a guideline for determining potential salvage volumes and to determine post-mining reclamation soil profile composition. Topsoil and subsoil salvage operations should be monitored in consultation with a Certified Professional Soil Scientist. A summary of estimated average topsoil and subsoil salvage depths for each major soil type in Table 17. Salvage depth estimates listed in Table 17 for topsoil and subsoil are based on the representative soil profile previously listed in the *Major Soil Types* section.

Estimations of *Good*, *Fair*, *Poor*, and *Unacceptable* sources of topsoil and subsoil are based on the Guidelines for Management of Topsoil and Overburden (DOGM 2008).

Begay family

Begay family soils are a fair source of topsoil. These soils have low available water capacities due to the sandy loam textures. These soils are in Wind Erodibility Group 3. Begay family soils are limited by the moderate depth to sandstone (less than 40 inches) and low water holding capacity.

The estimated topsoil salvage depth for Begay family soils is 23 cm (9 inches) and 57 cm (22 inches) of subsoil. Salvage depths are limited by the depth to Ferron sandstone, which is 80 cm (32 inches) in the representative soil profile (EM-1-09). The separation between topsoil and subsoil is based on decreased organic matter and increased salinity.

Braf

Limiting features of Braf soils are: 1) the low available water capacity (AWC), due to the loamy sand textures; and 2) the calcium carbonate equivalents (CCE) range from 18 to 22 in the C horizon. Both the AWC and CCE for Braf soils are in the *Fair* range (Utah DOGM 2008). Braf soils are a fair source of topsoil, but are limited by the shallow depth to Ferron sandstone.

The estimated topsoil salvage depth is 27 cm (11 inches) and 18 cm (7 inches) of subsoil in the representative soil profile (EM-10-09). Limiting soil features are increased salinity at 27 cm and Ferron sandstone at 45 cm.

Total salvage depths in the Braf soils evaluated in this survey range from as little as 8 cm (1.2 inches) in EM-11-09 to as much as 48 cm (18.9 inches) in EM-14-09.

Disturbed Soils

Overburden analysis (Utah DOGM 2008) was conducted on the representative soil profile in addition to standard topsoil analyses, because of the previous disturbance. This analysis suite

consists of acid-base potential, selenium, boron, and total organic carbon. None of the results for the overburden parameters exceeded the Utah DOGM suitability guidelines (Utah DOGM 2008).

The only limiting feature identified in these soils was an electrical conductivity of 4.39 in the C horizon, 18 to 46 cm (7-18 inches). This conductivity level is in the *Fair* range (Utah DOGM 2008). These soils are in Wind Erodibility Group 3. These previously disturbed lands are a fair source of topsoil due to the shallow depth to sandstone and shale, and potential for horizons with fair salinity levels. Salvage of previously disturbed materials should be monitored. The estimated salvage depths for disturbed soils in map Bd are 18 cm (7 inches) of topsoil and 28 cm (18 inches) of subsoil based on the representative soil profile (EM-3-09). Separation between topsoil and subsoil is based on increased salinity at 18 cm.

Garley

Garley soils are well drained. The main limiting features of Garley soils, based on *Utah DOGM Topsoil and Overburden Guidelines* (Utah DOGM 2008), are: 1) *Unacceptable* SAR values that range from 15 to 49 (ESP 25 to 52 percent); 2) *Poor* electrical conductivity values ranging from 8.29 to 15.9 dS/m; 3) *Poor* pH values that correspond directly with the *Unacceptable* SAR levels; 4) loamy sand textures (*Poor*); and 5) *Poor* available water capacity due to the loamy sand textures. These soils are in Wind Erodibility Group 3.

Garley soils are a *Poor* source of topsoil and *Unacceptable* source of subsoil due to the SAR levels. The representative soil profile (EM-08-09) has 9 cm (~~3~~ 4 inches) of topsoil with *Poor* SAR value in map unit Cb based on the loamy sand texture. The *Unacceptable* SAR level for sandy textured soils is 20 (DOGM 2008). These soils have developed from numerous fluventic depositions, so the chemical and physical characteristics may vary between locations.

SAR levels in the subsoil range from 32.2 to 48.7 in the 9 to 88 cm zone of the representative soil profile. These SAR levels are in excess of the *Unacceptable* level. Garley subsoil should not be stockpiled with other salvaged subsoil materials.

It will be difficult to salvage 9 cm of topsoil and not have some mixing with *Unacceptable* SAR soils. Salvage from areas with Garley soils should be closely monitored in the field by a Certified Professional Soil Scientist. Salvaged Garley soils should be stockpiled separately from other topsoil sources. Placement of Garley topsoil and subsoil in reclamation areas should be limited to depths below four feet, whenever possible.

Garley, moderately well drained

The moderately well drained Garley soils have *Unacceptable* SAR levels (greater than 20) throughout the representative soil profile EM-12-09 (Utah DOGM 2008). These soils have *Poor* electrical conductivities, and *Poor* available water capacity due to the coarse soil texture. In addition, they are only moderately well drained due to the close proximity to Quitchapah Creek. Garley soils are described as well drained in the official series description (USDA – NRCS

2016). These soils are in Wind Erodibility Groups 3 and 4L. The Garley, moderately well drained soils are an unacceptable source of topsoil and subsoil due to the SAR levels, based on the representative soil profile (EM-12-09).

The estimated topsoil and subsoil salvage depths are both 0 cm (0 inches).

Disturbance of Garley, moderately well drained, soils should be avoided or minimized. If disturbance of these soils is not avoidable, then the topsoil and subsoil from this soil type should be stockpiled separately from other sources. Placement of Garley, moderately well drained, topsoil and subsoil in reclamation areas should be limited to depths below four feet, whenever possible.

Green River

These soils are limited by *Fair* calcium carbonate levels (15.2 to 19.2 tons $CaCO_3$ per 1,000 tons) in soil horizons between 15 and 102 cm (6 and 40 inches). Occasional flooding and aquic soil conditions from 28 to 56 cm (11 to 22 inches) are also limiting features. SAR is *Fair* in the 56 to 78 cm (22 to 31 inches) horizon of the representative soil profile (EM-7-09). The calculated K factor is *Poor* (greater than 0.37) between 28 and 56 cm in the representative soil profile. These soils are in Wind Erodibility Groups 3 and 4L. Green River soils are a poor source of topsoil due to the flooding potential and *Poor* K Factor.

The estimated topsoil salvage depth for Green River soils is 15 cm (6 inches), based on an increase of carbonates below this depth. An estimated 135 cm (53 inches) of subsoil can be salvaged from Green River soils to a depth of 150 cm (60 inches), if deep disturbance of the soil is required. Green River soils are geographically associated with Garley, moderately well drained soils and their locations should be monitored (*Unacceptable* SAR levels).

Disturbance of Green River soils should be avoided due to their close proximity to Quitchapah Creek. Additional permitting may be required, if these soils are impacted.

Hideout

These soils are in Wind Erodibility Groups 2 and 3. Hideout soils are a fair source of topsoil due to the shallow depth to sandstone and low available water capacities. These soils are geographically associated with large areas of Ferron sandstone outcrops. The estimated topsoil salvage depth is limited to approximately 20 cm (8 inches) based on the representative soil profile (EM-4-09).

Physical and chemical characteristics of Hideout topsoil and subsoil are similar. They should be salvaged and stockpiled together as topsoil due to the thinness of each.

Lazear

Lazear soils are a fair source of topsoil due to the calcium carbonate levels and the shallow depth. Calcium carbonate concentrations in the representative profile range from 22.5 to 25.4 tons $CaCO_3$ per 1,000 tons, which are in the *Fair* range (Utah DOGM 2008). These soils are in Wind Erodibility Groups 3 and 4L.

The estimated topsoil salvage depth for Lazear soils is limited by the shallow depth to Ferron sandstone, which is 20 cm (8 inches) in the representative soil profile (EM-5-09).

Physical and chemical characteristics of Lazear topsoil and subsoil are similar. They should be salvaged and stockpiled together as topsoil due to the thinness of each.

Monue Family

Monue family soils are a good source of topsoil and good to fair source of subsoil. SAR and salinity levels are *Fair* from 80 cm 122 cm and *Poor* below 122 cm in the representative soil profile. These soils have low available water capacities due to the sandy loam textures. Monue family soils are in Wind Erodibility Group 3.

The estimated topsoil salvage depth for Monue Family soils is 46 cm (18 inches) in the representative soil profile (EM-16-09). Subsoil salvage of 76 cm (48 inches) may occur in the Monue Family soils based on the representative soil profile, if deep disturbance is required. Monue Family soils are subject to wind erosion, so the actual topsoil salvage depth should be limited to the amount required to successfully revegetate the disturbance. The separation between topsoil and subsoil is based on the transition from the B to the C horizons in the representative soil profile.

Monue family soils are a good source of topsoil and subsoil within the Emery 2 permit area. The lower subsoil that is poor quality due to increased conductivity and SAR should not be stockpiled with the better quality topsoil and upper subsoil. Salvage of these soils should be monitored by a Certified Professional Soil Scientist.

Persayo

Persayo soils are a fair source of topsoil and an *Unacceptable* source of subsoil. These soils are limited by low water holding capacity in the upper 10 cm (4 inches) and *Unacceptable* SAR (15.9) below 10 cm (4 inches). Persayo soils are in Wind Erodibility Group 4L. These soils are limited by the shallow depth to shale.

The estimated topsoil salvage depth for Persayo soils is 10 cm (4 inches) in the representative soil profile (EM-13-09). The *Unacceptable* subsoil (SAR) below 10 cm to depth of 30 cm (28 inches) should only be disturbed, if deeper excavation is required. Persayo subsoil should be stockpiled separately from other subsoil materials. Disturbance of Persayo soils should be minimized.

Persayo Family

Persayo family soils are a good source of topsoil and subsoil, but limited by the shallow depth to shale in the representative soil profile (EM-6-09). These soils are limited by low available water capacities. Persayo family soils are in Wind Erodibility Groups 2 and 3. SAR levels were *Good* in the representative soil profile, but *Poor* to *Unacceptable* values are possible due to the shallow depth to Mancos shale. These soils are on very steep to extremely steep (45 to 80 percent) slopes which will be limiting to topsoil salvage operations.

The estimated topsoil salvage depth for Persayo family soils is limited by the depth to Mancos shale, which is 18 cm (7 inches) in the representative soil profile.

Physical and chemical characteristics of Persayo family topsoil and subsoil are similar. They should be salvaged and stockpiled together as topsoil due to the thinness of each.

Table 17. Estimated topsoil and subsoil salvage depths for each major soil type in the Emery 2 soil survey area based on the typifying or representative soil profiles. Salvage depth estimates are based on the representative soil profile listed in the *Major Soil Types* section.

Soil Series/Family	Typifying Profile	Topsoil Salvage	Subsoil Salvage	Topsoil Salvage	Subsoil Salvage	Total Salvage	Limitations
		cm	cm	inches	inches	inches	
Begay family	EM-1-09	23	57	9	22	31	Increased carbonate concentrations, increased salinity, and sandstone at 80 cm. Topsoil subsoil split based on decreased organic matter and increased soil pH and salinity.
Braf	EM-10-09	27	18	11	7	18	Increased salinity at 27 cm and sandstone at 45 cm.
Disturbed Soils	EM-3-09	18	28	7	11	18	Increased salinity at 18 cm and hard shale at 46 cm.
Garley	EM-8-09	9	0	4	0	4	Increase of SAR from 20.4 to 32.2 at 9 cm (SAR of 20 used for Unacceptable limit based on loamy sand texture).
Garley, mod well drained	EM-12-09	0	0	0	0	0	*Unacceptable* SAR levels to the surface. Topsoil and subsoil should be salvaged and stockpiled separately from other soil map units due to the *Unacceptable* qualities, if disturbance is necessary. Topsoil salvage depth (15 cm) based on depth of A horizon.

Topsoil Salvage

Soil Series/Family	Typifying Profile	Topsoil Salvage	Subsoil Salvage	Topsoil Salvage	Subsoil Salvage	Total Salvage	Limitations
		cm	cm	inches	inches	inches	
Green River	EM-7-09	15	135	6	53	59	Carbonates increase below 15 cm; redox mottles observed from 28 to 56 cm.
Hideout	EM-4-09	20	0	8	0	8	Sandstone at 20 cm; topsoil and subsoil should be salvaged as topsoil due to thin topsoil.
Lazear	EM-5-09	20	0	8	0	8	Sandstone at 20 cm; topsoil and subsoil should be salvaged as topsoil due to thin topsoil.
Monue Family	EM-16-09	46	76	18	30	48	A and B horizons comprise topsoil depth. Single grain alluvial parent material(C horizons) below 46 cm. Poor salinity below 122 cm.
Persayo	EM-13-09	10	30	4	12	16	*Poor* salinity and *Unacceptable* SAR below 10 cm. Thin topsoil layer should be salvaged and stockpiled separately from subsoil.
Persayo family	EM-6-09	18	0	7	0	7	Shale at 18 cm; topsoil and subsoil should be salvaged as topsoil. Large stones and boulders should be separated from salvaged topsoil.

Map Unit Salvage Depths

Table 18 identifies the weighted average depth of topsoil and subsoil that may be available for salvage based on field evaluations of soil pits and laboratory analysis of soil samples. Salvage depths may include some *Poor* quality materials. Field data sheets are in appendix B. Results of the laboratory analysis of soil samples are contained in appendix C.

Salvage depths will be limited by the depth to Ferron sandstone and presence of sandstone outcrops in portions of the Emery 2 permit area.

Table 18. Summary of weighted average topsoil and subsoil salvage depths for soil map units in the Emery 2 soil survey area. Actual salvage depths will vary from these estimates. Salvage operations should be monitored by a Certified Professional Soil Scientist.

Map Unit	Weighted Average Topsoil Salvage Depth[1]	Weighted Average Subsoil Salvage Depth[2]	Total Weighted Average Salvage Depth[3]
	feet	feet	feet
A	0.3	0.2	0.5
Ba	0.7	0.9	1.6
Bd	0.6	1.0	1.6
Ca	0.6	0.2	0.8
Cb	1.1	1.6	2.7
D	0.8	0.5	1.3
E	0.4	0.3	0.7
F	0.3	0.9	1.2
G	0.1	0.5	0.6
H	0.4	4.0	4.4

1. Weighted topsoil salvage depth for map unit is sum of products of map unit component percents and representative salvage depths from Table 17 (see Table F-1 for details).
2. Weighted subsoil salvage depth for map unit is sum of products of map unit component percents and representative salvage depth from Table 17 (see Table F-1 for details).
3. Sum of weighted topsoil and subsoil depths.

The estimated topsoil and subsoil salvage depths listed in Table 18 are for planning purposes. Actual depths will vary and should be monitored by a Certified Professional Soil Scientist. Salvage depth estimates are detailed in Appendix F.

Salvage of topsoil and subsoil from map unit Cb should be closely monitored due to presence of both *Good* and *Unacceptable* materials. Additional laboratory analysis may be necessary in order to identify specific topsoil and subsoil salvage depths within the Emery 2 permit area.

Potential salvage depths are listed for map unit H. However, soils in this map unit are on the floodplain of Quitchapah Creek and disturbance should be avoided. Additional studies and permitting may be necessary, if disturbance of soils in map unit H is necessary.

Disturbance Impacts

Soil map unit delineations within the proposed Emery 2 permit area are shown in Figure 3. Order 2 soil survey of Emery 2 area.. The map unit areas within the Emery 2 permit area are listed in Table 19. Map units Ca (40%) on the canyon sideslopes and D (32%) on the bench west of the canyon are the two most dominant within the Emery 2 permit area. Map units F (1%) and H (1%) are of very limited extent, while map unit G does not occur within the Emery 2 permit area.

Table 19. Map unit acres within the proposed Emery 2 permit area.

	Soil Map Units										
	A	Ba	Bd	Ca	Cb	D	E	F	G	H	Total
Acres	2.9	4.4	0.3	10.8	1.4	8.7	1.6	0.2	0.0	0.1	30.4
Percent	9.4	14.5	0.9	35.4	4.5	28.8	5.1	0.8	0.0	0.5	

Estimated salvage volumes are detailed in Table 20. These estimated volumes are based on the weighted average topsoil and subsoil salvage depths listed in Table 18 and the map unit acres listed in Table 19. These volumes would be the potential amounts of topsoil and subsoil that would need to be stockpiled, if all soils within the disturbance area were disturbed.

Table 20. Estimated salvage volumes for map units within the Emery 2 permit area.

Map Unit	Area[1]	Weighted Topsoil Salvage Depth[2]	Weighted Subsoil Salvage Depth[3]	Estimated Topsoil Salvage Volume[4]	Estimated Subsoil Salvage Volume[5]
	acres	feet	feet	cubic yards	cubic yards
A	2.9	0.3	0.2	1,404	936
Ba	4.4	0.7	0.9	4,969	6,389
Bd	0.3	0.6	1.0	290	484
Ca	10.8	0.6	0.2	10,454	3,485
Cb	1.4	1.1	1.6	2,485	3,614
D	8.7	0.8	0.5	11,229	7,018
E	1.6	0.4	0.3	1,033	774
F	0.2	0.3	0.9	97	290
G	0	0.1	0.5	0	0
H	0.1	0.4	4.0	65	645
TOTAL				32,025	23,635

1. Map unit area from Table 19.
2. Estimated weighted topsoil salvage depths from Table 18.
3. Estimated weighted subsoil salvage depths from Table 18.
4. Estimated total topsoil salvage depth, if salvaged from entire permit area.
5. Estimated total subsoil salvage depth, if salvaged from entire permit area.

Topsoil and Subsoil Stockpiles

The coarse-loamy soil textures that dominate the Emery 2 soil survey are susceptible to wind erosion. Topsoil and subsoil stockpiles should be protected from wind erosion.

Topsoil and subsoil that is salvaged from the Garley, Garley, moderately well drained, and other soils with *Unacceptable* properties (DOGM 2008) should be placed in stockpiles that are separate from the other topsoil or subsoil stockpiles. These soils with SAR levels in excess of 20 will require special treatment in order to establish vegetation.

Native Soil Profile Features

The combined depth of topsoil and subsoil varies in native soil profiles within the Emery 2 permit area depending on physiographic setting, depth to sandstone or shale, salinity, and sodicity (SAR).

Ferron sandstone outcrops are the dominant feature in map units A and E and a major component in Ca. It is also a minor component in map units Ba, D, and F.

Stockpile and Placement of Topsoil and Subsoil

Topsoil and subsoil should be salvaged and placed directly into stockpiles. Stockpiles should be identified with signs and protected from other mining activities. Stockpile locations should protect the topsoil from wind erosion, flooding, and stockpiled coal. A mixture of native grasses and shrubs should be seeded on the stockpile(s) to protect them from wind and water erosion.

Topsoil placement depths will range from a minimum of 9 cm (6 inches) up to approximately 30 cm (12 inches). Topsoil will not be available reclamation in areas which were sandstone outcrops prior to disturbance.

Reclamation of Sodic Subsoil Areas

Unacceptable sodium adsorption ratios (SAR) in the Garley soils may be limiting to the establishment of grasses and shrubs during post-mining reclamation. These soils are naturally sodic within a few inches of the native surface. Black greasewood and shadscale are presently growing on these soils with scattered clumps of Indian ricegrass in localized areas. The reclamation seed mix should include grasses and shrubs that are tolerant of these SAR levels.

It is recommended that sodic subsoil be stockpiled separately to avoid mixing with other subsoil sources.

Reclamation

The primary keys to successful reclamation of disturbed within the Emery 2 permit area will be:

- Identification of sodic subsoil materials and stockpiling them separately from other subsoil sources;
- Replacement of sodic subsoil materials in areas less susceptible to erosion;
- Incorporation of rock outcrop areas into the final surface reclamation plan in proportions similar to native conditions prior to disturbance;
- Seeding the final surface with a mixture of native grasses and shrubs that are tolerant of the coarse-loamy, droughty, saline, and sodic conditions in the Emery 2 permit area .

Substitute Soil Materials

No sources of substitute soil material sources were identified during the Emery 2 soil survey.

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Appendix A

NRCS - Prime Farmland Assessment

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
540 West Price River Drive
Price, Utah 84501

January 8, 2010

Mr. John Gefferth
Consolidated Coal Company
P.O. Box 566
Sesser, IL 62884

Dear: Mr. Gefferth

The area south and west of the coal mine south of Emery, Utah as outlined by Robert Long CPSS in sections 32 and 33 T22S. R6E. contains no Prime or Unique farmlands or farmlands of Statewide importance because there is no developed irrigation system on these arid soils. Most of this area has soils with other limitations also, such as being shallow to bedrock or steep slopes.

If we can be of further assistance please let us know.

Leland Sasser

Leland Sasser NRCS Soil Scientist

Appendix B

Soil Profile Descriptions

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EM-1-09

Site ID: EM-1-09
Description Date: 9/29/2009
Describer: Robert Long
Soil Name As Correlated: Begay Family
Classification: Coarse-loamy, mixed, superactive, mesic Ustic Haplocambids
Pedon Type: Modal pedon for map unit
Pedon Purpose: Full pedon description
Taxon Kind: Family

County or Parish: UT015 - Emery
State or Territory: UT - Utah
7.5' Quad: Walker Flat, Utah
UTM: 422584E, 4300701N -- Datum NAD83, Zone 12
Location Description:
Legal Description: Section 33, Township 22 S, Range 6 E

Landscape: plateau
Landform: hill
Geomorphic Component: Side Slope
Profile Pos: Footslope

Slope: 7 percent
Elevation: 1847 meters (6060 feet)
Aspect: 314°
Shape: up/down: Concave; **across:** Concave
Drainage: Well drained
Runoff: Medium
Permeability: Moderate
Erosion: Class 2 - Gully erosion

Primary Earth Cover: Grass/herbaceous cover; **Secondary Earth Cover:** Grassland rangeland
Existing Vegetation: ARTRW8 - Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*); SAVE4 - greasewood (*Sarcobatus vermiculatus*); ATCO - shadscale (*Atriplex confertifolia*)

Parent Materials: Alluvium over Sandstone
Bedrock: Calcareous sandstone at 80 centimeters (32 inches)
Particle Size Control Section: 25 to 80 centimeters (10 to 32 inches)
Diagnostic Features: Lithic contact: 80 centimeters (Restrictive layer) and Cambic horizon: 8 to 50 centimeters (3 to 20 inches)
Restrictions: Lithic bedrock: 80 centimeters

A --- 0 to 8 cm (0 to 3 inches); pale yellow (2.5Y 7/3) dry, sandy loam; light yellowish brown (2.5Y 6/4) moist; 63 percent sand; 20 percent silt; 17 percent clay; weak medium platy parting to moderate fine granular structure; very friable, slightly hard, slightly sticky, slightly plastic; common very fine roots throughout and common fine roots throughout; common very fine tubular pores; 2 percent (common) fine irregular moderately cemented carbonate concretions on bottom of rock fragments; 3 percent subangular calcareous sandstone gravels; electrical conductivity of 2.25 dS/m by EC meter, saturated paste; violently effervescent by HCl, 1 normal; neutral, pH 7.3; clear smooth boundary; $CaCO_3$ 9.1 percent.

Bw1 --- 8 to 23 cm (3 to 9 inches); light yellowish brown (2.5Y 6/4) dry, sandy loam; light olive brown (2.5Y 5/4) moist; 57 percent sand; 29 percent silt; 14 percent clay; structure; very friable, slightly hard, slightly sticky, slightly plastic; many very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 2 percent (common) fine irregular moderately cemented carbonate concretions on bottom of rock fragments; 5 percent calcareous sandstone gravels; electrical conductivity of 2.32 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.4; clear smooth boundary; $CaCO_3$ 7.2 percent.

Bw2 --- 23 to 50 cm (9 to 20 inches); light yellowish brown (10YR 6/4) dry, sandy loam; yellowish brown (10YR 5/4) moist; 73 percent sand; 14 percent silt; 13 percent clay; moderate medium subangular blocky structure; very friable, slightly hard, nonsticky, nonplastic; many very fine roots throughout, common fine roots throughout, common medium roots throughout and common coarse roots throughout; common very fine tubular pores; 3 percent (common) fine masses of carbonate on vertical faces of peds and 4 percent (common) fine irregular carbonate concretions around rock fragments; 8 percent subangular calcareous sandstone gravels; electrical conductivity of 3.94 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; clear smooth boundary; $CaCO_3$ 7.2 percent.

Bk --- 50 to 80 cm (20 to 32 inches); very pale brown (10YR 7/4) dry, channery sandy loam; yellowish brown (10YR 5/4) moist; 65 percent sand; 23 percent silt; 12 percent clay; weak medium subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; common very fine roots throughout, common fine roots throughout, common medium roots throughout and common coarse roots throughout; common very fine tubular pores; 2 percent (common) fine masses of carbonate on vertical faces of peds and 7 percent (common) medium carbonate concretions around rock fragments; 6 percent subangular calcareous sandstone gravels and 12 percent subangular calcareous

sandstone channers; electrical conductivity of 3.07 dS/m by EC meter, saturated paste; violently effervescent by HCl, 1 normal; slightly alkaline, pH 7.6 ; abrupt smooth boundary; $CaCO_3$ 7.8 percent.

R --- 80 cm (32 inches); Ferron sandstone.

EM-2-09

Pedon ID: EM-2-09
Description Date: 9/29/2009
Describer: Robert Long

Soil Name As Correlated: Hideout
Current Taxonomic Class: Loamy, mixed, superactive, calcareous, mesic Lithic Ustic Torriorthents
Current Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
UTM: 477634E, 4300621N -- Datum NAD83, Zone 12
Legal Description: Section 33, Township 22 South, Range 6 East of the 29 Meridian

Landscape: plateaus or tablelands
Landform: hill
Geomorphic Component: Side Slope
Profile Pos: Backslope: on middle third
Slope: 6 percent
Elevation: 1851 meters (6070 feet)
Aspect: 10°
Shape: up/down: ; across:
Complexity: Simple

Drainage: Well drained
Runoff: Medium
Erosion: Class 1 - Sheet erosion

Primary Earth Cover: Shrub cover; **Secondary Earth Cover:** Shrubby rangeland
Existing Vegetation: ARTRW8 - Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*); ATCO - shadscale (*Atriplex confertifolia*); SAVE4 - black greasewood (*Sarcobatus vermiculatus*); JUOS - Utah juniper (*Juniperus osteosperma*); GUSA2 - broom snakeweed (*Gutierrezia sarothrae*); EPHED - Mormon tea (*Ephedra*); AMUT - Utah serviceberry (*Amelanchier utahensis*); PIED - twoneedle pinyon (*Pinus edulis*)

Parent Materials: slightly weathered, residuum weathered from calcareous sandstone
Bedrock: Strongly cemented calcareous sandstone at 19 centimeters (7.5 inches)
Particle Size Control Section: 0 to 19 centimeters (0 to 7.5 inches)
Diagnostic Features: Lithic contact: 19 centimeters (7.5 inches)
Restrictions: Lithic bedrock: 19 centimeters (7.5 inches)

A --- 0 to 5 centimeters (0 to 2 inches); pale brown (10YR 6/3) dry, sandy loam; brown (10YR 4/3) moist; 69 percent sand; 20 percent silt; 11 percent clay; moderate fine granular and weak medium platy structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout; common very fine tubular pores; 5 percent subangular calcareous sandstone gravels; electrical conductivity of 0.89 mmhos/cm by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7, pH meter; abrupt smooth boundary; $CaCO_3$ 5.5 Percent.

C --- 5 to 19 centimeters (2 to 7.5 inches); brown (10YR 5/3) dry, sandy loam; brown (10YR 4/3) moist; 71 percent sand; 17 percent silt; 12 percent clay; weak medium subangular blocky structure; friable, hard, slightly sticky, slightly plastic; common fine roots throughout and common very fine roots throughout; common very fine tubular pores; electrical conductivity of 0.78 mmhos/cm by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7, pH meter; abrupt smooth boundary; CaCO3 4.4 Percent.

R --- 19 centimeters (7.5 inches).

EM-3-09

Pedon ID: EM-3-09
Description Date: 9/29/2009
Describer: Robert Long

Soil Name As Correlated: Disturbed Land
Classification: Loamy, mixed, superactive, calcareous, mesic Lithic Ustic torrio Torriorthents
Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
7.5' Quad: Walker Flat, Utah
UTM: 477516E, 4300469N -- Datum NAD83, Zone 12
Legal Description: Section 33, Township 22 S, Range 6 E

Landscape: plateau
Landform: hillslope
Geomorphic Component: Side Slope
Profile Pos: Backslope
Slope: 11 percent
Elevation: 1861 meters (6105 feet)
Aspect: 350°
Shape: up/down: Linear; **across:** Linear

Drainage: Well drained
Runoff: Medium
Permeability: Moderately slow
Erosion: Class 2 - Sheet erosion

Primary Earth Cover: Grass/herbaceous cover; **Secondary Earth Cover:** Grassland rangeland
Existing Vegetation: ATCO - shadscale (*Atriplex confertifolia*); SAVE4 - greasewood (*Sarcobatus vermiculatus*)

Parent Materials: Residuum
Bedrock: Calcareous shale at 46 centimeters (18 inches)
Particle Size Control Section: 36 to 46 centimeters (7 to18 inches)
Diagnostic Features: Lithic contact: 46 centimeters (18 inches)
Restrictions: Lithic bedrock: 46 centimeters (18 inches)

A --- 0 to 18 cm (0 to 7 inches); very pale brown (10YR 7/3) dry, channery loam; pale brown (10YR 6/3) moist; 47 percent sand; 33 percent silt; 20 percent clay; structure; friable, hard, slightly sticky, slightly plastic; common very fine roots throughout; common very fine tubular pores; 2 percent (common) fine irregular moderately cemented carbonate concretions around rock fragments; 15 percent subangular calcareous sandstone channers; electrical conductivity of 1.40 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; clear smooth boundary;: CaCO3 13.9 percent.

C --- 18 to 46 cm (7 to 18 inches); pale brown (10YR 6/3) dry, channery sandy clay loam; brown (10YR 5/3) moist; 53 percent sand; 25 percent silt; 22 percent clay; medium structure; friable, hard, nonsticky, slightly plastic; common fine roots throughout and common very fine roots throughout; common very fine tubular pores; 2 percent (common) medium irregular moderately cemented carbonate concretions around rock fragments; 5 percent subangular calcareous sandstone flags and 15 percent subangular calcareous sandstone channers; electrical conductivity of 4.39 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.4; abrupt smooth boundary; CaCO3 13.4 percent.

R --- 46 cm (18 inches); hard shale.

EM-4-09

Pedon ID: EM-4-09
Description Date: 9/29/2009
Describer: Robert Long

Soil Name as Correlated: Hideout
Classification: Loamy, mixed, superactive, calcareous, mesic Lithic Ustic Torriorthents
Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
7.5' Quad: Walker Flat, Utah
UTM: 477406E, 4300402N -- Datum NAD83, Zone 12
Legal Description: Section 33, Township 22 S, Range 6 E of the Salt Lake Meridian

Landscape: plateau
Landform: structural bench and plateau
Geomorphic Component: Tread
Profile Pos: Summit

Slope: 6 percent
Elevation: 1852 meters (6076.1 feet)
Aspect: 327°
Shape: up/down: Convex; **across:** Convex
Drainage: Well drained **Runoff:** Medium **Permeability:** Moderate
Erosion: Class 2 - Sheet erosion

Primary Earth Cover: Tree cover; **Secondary Earth Cover:** Conifers
Existing Vegetation: PIED - twoneedle pinyon (*Pinus edulis*); JUOS - Utah juniper (*Juniperus osteosperma*); CEMOG - birchleaf mountain mahogany (*Cercocarpus montanus var. glaber*); ARTRW8 - Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*); ARNO4 - black sagebrush (*Artemisia nova*); OPUNT - pricklypear (*Opuntia*); GUSA2 - broom snakeweed (*Gutierrezia sarothrae*)

Parent Materials: Eolian

Bedrock: Calcareous sandstone at 20 centimeters (7.9 inches)
Particle Size Control Section: 0 to 20 centimeters (0 to 7.9 inches)
Diagnostic Features: Lithic contact: 20 centimeters (7.9 inches) (Restrictive layer)
Restrictions: Lithic bedrock: 20 centimeters (7.9 inches)

A --- 0 to 6 centimeters (0 to 2.4 inches); very pale brown (10YR 7/3) dry, loamy sand; pale brown (10YR 6/3) moist; 79 percent sand; 14 percent silt; 7 percent clay; weak medium platy parting to single grain structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout and common fine roots throughout; many very fine interstitial pores; electrical conductivity of 0.69 mmhos/cm by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; abrupt smooth boundary; $CaCO_3$ 6.1 Percent.

C --- 6 to 20 centimeters (2.4 to 7.9 inches); pale brown (10YR 6/3) dry, sandy loam; brown (10YR 5/3) moist; 69 percent sand; 21 percent silt; 10 percent clay; weak medium subangular blocky structure; very friable, hard, nonsticky, nonplastic; many very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; electrical conductivity of 0.95 mmhos/cm by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; abrupt smooth boundary; $CaCO_3$ 6.4 Percent.

R --- 20 centimeters (7.9 inches); Ferron sandstone.

EM-5-09

Pedon ID: EM-5-2009
Description Date: 9/29/2009
Describer: Robert Long

Soil Name As Correlated: Lazear
Classification: Loamy, mixed, superactive, calcareous, mesic Lithic Ustic torrio Torriorthents
Pedon Type: Modal pedon for map unit
Pedon Purpose: Full pedon description
Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
7.5' Quad: Walker Flat, Utah
UTM: 477277E, 4300359N -- Datum NAD83, Zone 12
Legal Description: Section 33, Township 22 S, Range 6 E

Landscape: plateau
Landform: hillslope
Geomorphic Component: Side Slope
Slope: 8 percent
Elevation: 1859 meters (6100 feet)
Aspect: 0°
Shape: up/down: Linear; **across:** Convex

Drainage: Well drained
Runoff: Medium
Permeability: Moderate
Erosion: Class 2 - Sheet erosion

Primary Earth Cover: Grass/herbaceous cover; **Secondary Earth Cover:** Grassland rangeland
Existing Vegetation: ATCO - shadscale (*Atriplex confertifolia*); ARNO4 - black sagebrush (*Artemisia nova*); GUSA2 - broom snakeweed (*Gutierrezia sarothrae*); POA - bluegrass (*Poa*)

Parent Materials: Residuum
Bedrock: Calcareous sandstone at 20 centimeters (8 inches)
Particle Size Control Section: 0 to 20 centimeters (0 to 8 inches)
Diagnostic Features: Lithic contact: 20 centimeters (Restrictive layer)
Restrictions: Lithic bedrock: 20 centimeters (8 inches)

A --- 0 to 7 cm (0 to 3 inches); pale brown (10YR 6/3) dry, channery sandy loam; brown (10YR 5/3) moist; 65 percent sand; 22 percent silt; 13 percent clay; moderate medium platy structure; very friable, slightly hard, slightly sticky, slightly plastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 10 percent subangular calcareous sandstone channers and 10 percent subangular calcareous sandstone gravels; electrical conductivity of 0.65 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.8; clear smooth boundary; $CaCO_3$ 22.5 percent.

C --- 7 to 20 cm (23 to 8 inches); light yellowish brown (10YR 6/4) dry, channery sandy clay loam; pale brown (10YR 6/3) moist; 63 percent sand; 16 percent silt; 21 percent clay; weak medium subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; many very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 10 percent subangular calcareous sandstone gravels and 15 percent subangular calcareous sandstone channers; electrical conductivity of 0.57 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6; abrupt smooth boundary; $CaCO_3$ 25.4 percent.

R --- 20 cm (8 inches); Ferron sandstone.

EM-6-09

Pedon ID: EM-6-09
Description Date: 9/30/2009
Describer: Robert Long

Soil Name As Correlated: Persayo family
Current Taxonomic Class: Loamy, mixed, superactive, calcareous, mesic, shallow Typic Torriorthents
Pedon Type: Representative pedon for component
Current Taxon Kind: family

County or Parish: UT015 - Emery
State or Territory: UT - Utah
7.5' Quad: 38111-G3 - Walker Flat, Utah
UTM: 477565E, 4300903N -- Datum NAD83, Zone 12
Legal Description: Section 33, Township 22 S, Range 6 E of the Salt Lake Meridian

Landscape: plateaus or tablelands
Landform: canyon
Geomorphic Component: Side Slope
Profile Pos: Backslope
Slope: 78 percent
Elevation: 1811 meters (5940 feet)
Aspect: 90°
Shape: up/down: ; across:
Complexity: Simple

Drainage: Well drained
Runoff: High
Erosion: Class 2 - Sheet erosion

Primary Earth Cover: Shrub cover; **Secondary Earth Cover:** Shrubby rangeland
Existing Vegetation: ATCO - shadscale (*Atriplex confertifolia*); ATGA - Gardner's saltbush (*Atriplex gardneri*)

Parent Materials: moderately weathered, residuum weathered from calcareous shale
Bedrock: Very weakly cemented calcareous shale at 18 centimeters (7.1 inches)
Particle Size Control Section: 0 to 18 centimeters (0 to 7.1 inches)
Diagnostic Features: Paralithic contact: 18 centimeters (7.1 inches)
Restrictions: Paralithic bedrock: 18 to 34 centimeters (7.1 to 13.4 inches) and Paralithic bedrock: 34 centimeters (13.4 inches)

A --- 0 to 7 cm (0 to 3 inches); very pale brown (10YR 7/3) dry, channery loamy sand; pale brown (10YR 6/3) moist; 79 percent sand; 12 percent silt; 9 percent clay; weak medium platy structure parting to single grain; very friable, slightly hard, non-sticky, non-plastic; common very fine and few fine roots; common very fine and few fine tubular pores; 10 percent angular sandstone channers, 5 percent angular strongly cemented sandstone gravels, 5 percent angular sandstone flags, and 1 percent angular sandstone boulders; electrical conductivity of 2.32 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; clear smooth boundary; CaCO3 6.4 percent.

2C --- 7 to 18 cm (3 to 7 inches); very pale brown (10YR 7/4) dry, para-channery sandy loam; light yellowish brown (10YR 6/4) moist; 71 percent sand; 15 percent silt; 14 percent clay; weak fine and medium subangular blocky structure; very friable, slightly hard, slightly sticky, non-plastic; many very fine, few fine, few medium roots; common very fine tubular pores; 20 percent angular weakly cemented shale parachanners; electrical conductivity of 2.71 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; abrupt smooth boundary; CaCO3 7.5 percent.

2Cr1 --- 18 to 34 cm (7 to 13 inches); decomposing Blue Gate member of the Mancos shale; common very fine and few fine roots; clear smooth boundary.

2Cr2 --- 34 to 38 cm (13 to 15 inches); Blue Gate member of the Mancos shale.

EM-7-09

Pedon ID: EM-7-09
Description Date: 9/30/2009
Describer: Robert Long

Soil Name As Correlated: Green River
Classification: Coarse-loamy, mixed, calcareous, mesic Oxyaquic Torrifluvents
Pedon Type: Modal pedon for map unit
Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
7.5' Quad: 38111-G3 - Walker Flat, Utah
UTM: 477190E, 4301339N -- Datum NAD83, Zone 12
Legal Description: Section 32, Township 22 S, Range 6 E of the Salt Lake Meridian

Landscape: valley
Landform: valley floor and stream terrace
Geomorphic Component: Base Slope
Profile Pos: Toeslope
Slope: 2 percent
Elevation: 1797 meters (5895 feet)
Aspect: 152°
Shape: up/down: Convex; **across:** Linear
Complexity: Simple

Flooding: Occasional; very brief **Ponding:** Rare; very brief **Drainage:** Moderately well drained
Runoff: Low
Permeability: Moderate
Erosion:
Primary Earth Cover: Grass/herbaceous cover; **Secondary Earth Cover:** Grassland rangeland
Existing Vegetation: TAMAR2 - tamarisk (*Tamarix*); SALIX - willow (*Salix*)

Parent Materials: Alluvium
Particle Size Control Section: 25 to 100 centimeters (9.8 to 39.4 inches)

A --- 0 to 15 cm (0 to 6 inches); light yellowish brown (2.5Y 6/3) dry, sandy clay loam; light olive brown (2.5Y 5/3) moist; 57 percent sand; 15 percent silt; 28 percent clay; medium platy structure; very friable, slightly hard, nonsticky, nonplastic; electrical conductivity of 2.43 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; abrupt smooth boundary; $CaCO_3$ 14.4 percent.

2A --- 15 to 28 cm (6 to 11 inches); pale yellow (2.5Y 7/3) dry, silt loam; grayish brown (2.5Y 5/2) moist; 37 percent sand; 52 percent silt; 11 percent clay; moderate medium subangular blocky structure; very friable, hard, nonsticky, nonplastic; common very fine roots throughout and common fine roots throughout; common very fine tubular pores; electrical conductivity of 1.55 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6; clear smooth boundary; CaCO3 18.3 percent.

2C --- 28 to 43 cm (11 to 17 inches); light gray (2.5Y 7/2) dry, loam; light yellowish brown (2.5Y 6/3) moist; 43 percent sand; 48 percent silt; 9 percent clay; 2 percent medium distinct olive yellow (2.5Y 6/6) and 2 percent fine distinct olive yellow (2.5Y 6/6) mottles; moderate medium subangular blocky structure; very friable, hard, slightly sticky, nonplastic; many very fine roots throughout and common fine roots throughout; common very fine tubular pores; electrical conductivity of 1.36 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; clear smooth boundary; CaCO3 15.9 percent.

3A --- 43 to 56 cm (17 to 22 inches); light gray (2.5Y 7/2) dry, silt loam; light olive brown (2.5Y 5/3) moist; 23 percent sand; 56 percent silt; 21 percent clay; 6 percent coarse prominent strong brown (7.5YR 5/8) and 6 percent medium prominent strong brown (7.5YR 5/8) mottles; strong coarse platy structure; very friable, hard, slightly sticky, slightly plastic; common very fine roots throughout and common fine roots throughout; common very fine tubular pores; electrical conductivity of 3.46 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; abrupt smooth boundary; CaCO3 19.2 percent.

3C1 --- 56 to 78 cm (22 to 31 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 61 percent sand; 26 percent silt; 13 percent clay; single grain; loose, loose, nonsticky, nonplastic; many very fine interstitial pores; electrical conductivity of 3.67 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6; clear smooth boundary; CaCO3 15.2 percent.

3C2 --- 78 to 102 cm (31to 40 inches); light yellowish brown (2.5Y 6/3) dry, loam; dark grayish brown (2.5Y 4/2) moist; 46 percent sand; 37 percent silt; 17 percent clay; massive parting to single grain; very friable, slightly hard, slightly sticky, slightly plastic; many very fine interstitial pores; electrical conductivity of 3.93 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; gradual smooth boundary; CaCO3 16.5 percent.

3C3 --- 102 to 130 cm (40 to 51 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 58 percent sand; 33 percent silt; 9 percent clay; single grain and medium structure; very friable, slightly hard, slightly sticky, slightly plastic; many very fine interstitial pores; electrical conductivity of 2.21 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6; clear smooth boundary; CaCO3 14.5 percent.

3C4 --- 130 to 150 cm (51 to 59 inches); light gray (2.5Y 7/2) dry, sandy loam; light yellowish brown (2.5Y 6/3) moist; 69 percent sand; 25 percent silt; 6 percent clay; single grain; loose, loose, nonsticky, nonplastic; many very fine interstitial pores; electrical conductivity of 1.6 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; CaCO3 14.3 percent.

EM-8-09

Pedon ID: EM-8-09
Description Date: 9/30/2009
Describer: Robert Long

Soil Name As Correlated: Garley
Current Taxonomic Class: Coarse-loamy, mixed, superactive, calcareous, mesic Typic Torrifluvents
Pedon Type: Representative pedon for component
Current Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
UTM: 477585E, 4300886N -- Datum NAD83, Zone 12
Legal Description: Section 33, Township 22 South, Range 6 East of the 29 Meridian

Landscape: plateau canyon
Landform: stream terrace
Geomorphic Component: Base Slope
Profile Pos: Toeslope
Slope: 5 percent
Elevation: 1809 meters (5934 feet)
Aspect: 45°
Shape: up/down: Concave; **across:** Linear
Complexity: simple

Drainage: Well drained
Runoff: Medium
Erosion: Class 2 - Gully erosion

Primary Earth Cover: Shrub cover; **Secondary Earth Cover:**
Existing Vegetation: SAVE4 - black greasewood (*Sarcobatus vermiculatus*); ATCO - shadscale (*Atriplex confertifolia*); CHRYS9 - rabbitbrush (*Chrysothamnus*); ARNO4 - black sagebrush (*Artemisia nova*); ACHY - Indian ricegrass (*Achnatherum hymenoides*)

Parent Materials: alluvium
Particle Size Control Section: 25 to 100 centimeters (9.8 to 39.4 inches)
Diagnostic Features: Secondary carbonates: 32 to 88 centimeters (12.6 to 34.6 inches)

A --- 0 to 9 cm (0 to 4 inches); pale yellow (2.5Y 7/3) dry, loamy sand; light yellowish brown (2.5Y 6/3) moist; 79 percent sand; 13 percent silt; 8 percent clay; moderate medium platy structure; friable, hard, slightly sticky, slightly plastic; many very fine roots throughout, few fine roots throughout; common very fine tubular pores; electrical conductivity of 2.25 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; strongly alkaline, pH 8.7; clear smooth boundary; $CaCO_3$ 8.8 percent.

C1--- 9 to 32 cm (4 to 13 inches); pale yellow (10YR 7/4) dry, loamy sand; light yellowish brown (10YR 6/4) moist; 85 percent sand; 10 percent silt; 5 percent clay; moderate medium subangular blocky structure; friable, hard, nonsticky, nonplastic; common very fine roots throughout, few fine roots throughout, and few medium roots throughout; common very fine tubular pores; electrical conductivity of 3.82 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; very strongly alkaline, pH 9.3; abrupt smooth boundary; $CaCO_3$ 8.9 percent.

C2 --- 32 to 46 cm (13 to 18 inches); pale yellow (10YR 7/4) dry, very gravelly loamy sand; light yellowish brown (10YR 6/4) moist; 85 percent sand; 9 percent silt; 6 percent clay; single grain; loose, loose, nonsticky, nonplastic; common very fine roots throughout; many very fine interstitial pores; 40 percent fine calcareous sandstone gravels; 2 percent thin calcium carbonate coatings on bottom of rock fragments; electrical conductivity of 3.91 dS/m by EC meter, saturated paste; very slightly effervescent by HCl, 1 normal; strongly alkaline, pH 8.8; abrupt wavy boundary; $CaCO_3$ 8.9 percent.

Ab1 --- 46 to 60 cm (18 to 24 inches); pale yellow (10YR 7/4) dry, loamy sand; light yellowish brown (10YR 6/4) moist; 85 percent sand; 9 percent silt; 6 percent clay; moderate medium subangular blocky structure; friable, very hard, nonsticky, nonplastic; common very fine roots throughout; common very fine tubular pores; electrical conductivity of 8.29 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; very strongly alkaline, pH 9.3; clear smooth boundary; $CaCO_3$ 5.3 percent.

C3 --- 60 to 70 cm (24 to 28 inches); light yellowish brown (10YR 6/4) dry, very gravelly loam; light olive brown (10YR 5/4) moist; 50 percent sand; 40 percent silt; 10 percent clay; single grain; loose, loose, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout, few medium roots throughout and few coarse roots throughout; many very fine interstitial pores; 50 percent fine calcareous sandstone gravels; 2 percent thin calcium carbonate coatings on bottom of rock fragments; electrical conductivity of 9.77 dS/m by EC meter, saturated paste; very slightly effervescent by HCl, 1 normal; strongly alkaline, pH 8.6; abrupt wavy boundary; $CaCO_3$ 8.4 percent.

C4 --- 70 to 88 cm (28 to 35 inches); pale yellow (10YR 7/4) dry, sandy loam; light yellowish brown (10YR 6/4) moist; 79 percent sand; 10 percent silt; 11 percent clay; massive; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout, and few fine roots throughout,; common very fine tubular pores; 2 percent fine masses of carbonate on faces of peds; electrical conductivity of 9.38 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; moderately alkaline, pH 7.9; abrupt wavy boundary; $CaCO_3$ 6.3 percent.

AB2 --- 88 to 98 cm (35 to 66 inches); light yellowish brown (10YR 6/4) dry, very bouldery sandy loam; light olive brown (10YR 5/4) moist; 80 percent sand; 8 percent silt; 12 percent clay; single grain; loose, loose, nonsticky, nonplastic; common very fine roots throughout; many very fine interstitial pores; 50 percent calcareous sandstone boulders; electrical conductivity of 4.35 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; slightly alkaline, pH 7.4; abrupt wavy boundary; $CaCO_3$ 5.5 percent.

C5 --- 98 to 108 cm (35 to 43 inches); light yellowish brown (10YR 6/4) dry, very bouldery sandy loam; light olive brown (10YR 5/4) moist; 77 percent sand; 14 percent silt; 9 percent clay; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout; few very fine tubular pores; 50 percent calcareous sandstone boulders; electrical conductivity of 5.54 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; slightly alkaline pH 7.7; abrupt smooth boundary; $CaCO_3$ 6.8 percent.

C6 --- 108 to 120 cm (43 to 47 inches); light yellowish brown (10YR 6/3) dry, extremely bouldery sandy loam; light olive brown (10YR 5/4) moist; 75 percent sand; 13 percent silt; 12 percent clay; very friable, slightly hard, slightly sticky, slightly plastic; many very fine and common fine roots throughout; few very fine tubular pores; 70 percent calcareous sandstone boulders; electrical conductivity of 5.59 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline pH 7.5; clear smooth boundary; $CaCO_3$ 3.2 percent.

C7 --- 120 to 150 cm (59 inches); light yellowish brown (10YR 6/3) dry, extremely bouldery sandy loam; olive brown (10YR 4/4) moist; 77 percent sand; 11 percent silt; 12 percent clay; very friable, slightly hard, slightly sticky, slightly plastic; common very fine roots throughout; few very fine tubular pores; 70 percent calcareous sandstone boulders; electrical conductivity of 6.17 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline pH 7.5; clear smooth boundary; $CaCO_3$ 6.0 percent.

EM-9-09

Pedon ID: EM-9-09
Description Date: 10/8/2009
Describer: Robert Long
Soil Name As Correlated: Garley
Classification: Coarse-loamy, mixed, superactive, mesic Typic Torrifluvents
Pedon Type: Modal pedon for map unit
Pedon Purpose: Full pedon description
Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
7.5' Quad: 38111-G3 - Walker Flat, Utah
UTM: 477210E, 4300409N -- Datum NAD83, Zone 12
Location Description:
Legal Description: Section 32, Township 22 S, Range 6 E of the Uintah Meridian

Landscape: canyon
Landform: alluvial fan
Geomorphic Component: Base Slope
Profile Pos: Toeslope
Slope: 5 percent
Elevation: 1827 meters (5994 feet)
Aspect: 21°
Shape: up/down: Linear; **across:** Concave

Drainage: Well drained
Runoff: Medium
Permeability: Moderate
Erosion: Class 2 - Gully erosion

Primary Earth Cover: Grass/herbaceous cover; **Secondary Earth Cover:** Grassland rangeland
Existing Vegetation: SAVE4 - greasewood (*Sarcobatus vermiculatus*); ATCO - shadscale (*Atriplex confertifolia*); ACHY - Indian ricegrass (*Achnatherum hymenoides*); JUOS - Utah juniper (*Juniperus osteosperma*)

Parent Materials: Alluvium/ Colluvium
Particle Size Control Section: 25 to 100 centimeters (9.8 to 39.3 inches)

A --- 0 to 9 centimeters (0 to 3.5 inches); pale yellow (2.5Y 7/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; null percent sand; null percent silt; 6 percent clay; moderate medium platy structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores finely disseminated salts throughout; electrical conductivity of 1.01 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; moderately alkaline, pH 8.4; clear smooth boundary; $CaCO_3$ 12.6 Percent.

Ac --- 9 to 25 centimeters (3.5 to 9.8 inches); light yellowish brown (10YR 6/4) dry, sandy loam; yellowish brown (10YR 5/4) moist; null percent sand; null percent silt; 9 percent clay; moderate medium subangular blocky structure; friable, hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout, common medium roots throughout and common coarse roots throughout; common very fine tubular pores finely disseminated salts throughout; electrical conductivity of 2.03 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; strongly alkaline, pH 8.6; clear smooth boundary; $CaCO_3$ 12 Percent.

C2 --- 25 to 49 centimeters (9.8 to 19.3 inches); light yellowish brown (10YR 6/4) dry, sandy loam; yellowish brown (10YR 5/4) moist; null percent sand; null percent silt; 8 percent clay; structure; friable, very hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout, common medium roots throughout and common coarse roots throughout; common very fine tubular pores finely disseminated salts throughout; electrical conductivity of 13.5 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.4; clear smooth boundary; $CaCO_3$ 12.9 Percent.

C2 --- 49 to 75 centimeters (19.3 to 29.5 inches); light yellowish brown (10YR 6/4) dry, sandy loam; yellowish brown (10YR 5/4) moist; null percent sand; null percent silt; 10 percent clay; weak medium subangular blocky structure; very friable, moderately hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout, common medium roots throughout and common coarse roots throughout; common very fine tubular pores; medium distinct strongly cemented masses of carbonate on vertical faces of peds; electrical conductivity of 15.9 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; strongly alkaline, pH 8.6; gradual smooth boundary; $CaCO_3$ 11.7 Percent.

C3 --- 75 to 120 centimeters (29.5 to 47.2 inches); light yellowish brown (2.5Y 6/4) dry, sandy loam; light olive brown (2.5Y 5/4) moist; null percent sand; null percent silt; 10 percent clay; weak medium subangular blocky structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout, common medium roots throughout and common coarse roots throughout; common very fine tubular pores; 5 percent (common) fine faint masses of carbonate on vertical faces of peds; strongly effervescent by HCl, 1 normal; electrical conductivity of 11.3 dS/m

by EC meter, saturated paste; strongly alkaline, pH 8.5; clear smooth boundary; $CaCO_3$ 12.2 Percent.

2Bk --- 120 to 168 centimeters (47.2 to 66.1 inches); very pale brown (10YR 7/4) dry, very channery sandy loam; yellowish brown (10YR 5/4) moist; null percent sand; null percent silt; 8 percent clay; subangular blocky and medium structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; many very fine interstitial pores; 4 percent (common) faint carbonate concretions on bottom of rock fragments; 10 percent shale cobbles and 35 percent calcareous sandstone channers; electrical conductivity of 8.55 dS/m by EC meter, saturated paste; violently effervescent by HCl, 1 normal; strongly alkaline, pH 8.6; $CaCO_3$ 23.2 Percent.

EM-10-09

Pedon ID: EM-10-09
Description Date: 10/8/2009
Describer: Robert Long

Soil Name As Correlated: Braf
Classification: Coarse-loamy, mixed, superactive, calcareous, mesic Lithic Torriorthents
Pedon Type: Modal pedon for map unit
Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
7.5' Quad: 38111-G3 - Walker Flat, Utah
UTM: 477094E, 4300475N -- Datum NAD83, Zone 12
Location Description:
Legal Description: Section 32, Township 22 S, Range 6 E

Landscape: plateau
Landform: hillslope
Tread **Profile Pos:** Summit
Slope: 7 percent
Elevation: 1840 meters (6036 feet)
Aspect: 343°
Shape: up/down: Convex; **across:** Convex

Drainage: Well drained
Runoff: Medium
Permeability: Moderately rapid
Erosion: Class 2 - Sheet erosion

Primary Earth Cover: Shrub cover
Existing Vegetation: ATCO - shadscale (*Atriplex confertifolia*); SAME3 - black sage (*Salvia mellifera*); ACHY - Indian ricegrass (*Achnatherum hymenoides*); OPUNT - pricklypear (*Opuntia*)

Parent Materials: Residuum
Bedrock: Calcareous sandstone at 45 centimeters (18 inches)
Particle Size Control Section: 25 to 47 centimeters (9.8 to 18 inches)
Diagnostic Features: Lithic contact: 45 centimeters (Restrictive layer)
Restrictions: Lithic bedrock: 45 centimeters (18 inches)

Notes: this profile does not meet requirements of a calcic horizon due to less than 5 percent identifiable secondary carbonates.

A --- 0 to 7 cm (0 to 3 inches); pale yellow (2.5Y 7/3) dry, loamy sand; light yellowish brown (2.5Y 6/3) moist; 84 percent sand; 8 percent silt; 8 percent clay; weak medium platy parting to single grain structure; very friable, slightly hard, nonsticky, nonplastic; many very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 10 percent subangular calcareous sandstone gravels; electrical conductivity of 0.64 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 7.9; clear smooth boundary; $CaCO_3$ 13.5 percent.

C1 --- 7 to 27 cm (3 to 11 inches); light yellowish brown (2.5Y 6/4) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 70 percent sand; 20 percent silt; 10 percent clay; structure; very friable, moderately hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 2 percent (very few) fine calcium carbonate coats on bottom of rock fragments; 10 percent subangular calcareous sandstone gravels; electrical conductivity of 0.50 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.8; clear smooth boundary; $CaCO_3$ 22.2 percent.

C2 --- 27 to 45 cm (11 to 18 inches); pale yellow (2.5Y 7/4) dry, flaggy sandy loam; light yellowish brown (2.5Y 6/4) moist; 76 percent sand; 16 percent silt; 8 percent clay; single grain; loose, loose, nonsticky, nonplastic; common very fine roots throughout and common fine roots throughout; common very fine tubular pores; 2 percent (very few) fine calcium carbonate coats on bottom of rock fragments; 20 percent subangular calcareous sandstone flags and 10 percent subangular calcareous sandstone channers; electrical conductivity of 1.97 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6; abrupt smooth boundary; $CaCO_3$ 18.7 percent.

R --- 45 cm (18 inches); Ferron sandstone.

EM-11-09

Pedon ID: EM-11-09
Description Date: 10/8/2009
Describer: Robert Long

Soil Name As Correlated: Braf
Current Taxonomic Name: Braf
Current Taxonomic Class: Loamy, mixed, superactive, calcareous, mesic Lithic Torriorthents
Pedon Type: Confirmation description
Current Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
UTM: 477103E, 4300766N -- Datum NAD83, Zone 12
Legal Description: Section 32, Township 22 South, Range 6 East of the 29 Meridian

Landscape: plateau
Landform: hillslope
Geomorphic Component: Side Slope
Profile Pos: Backslope
Slope: 10 percent
Elevation: 1828 meters (5997 feet)
Aspect: 330°
Shape: up/down: Linear; **across:** Convex
Complexity: simple

Drainage: Well drained
Runoff: Medium
Erosion: Class 3 - Sheet erosion

Primary Earth Cover: Shrub cover;
Existing Vegetation: ATCO - shadscale (*Atriplex confertifolia*); ACHY - Indian ricegrass (*Achnatherum hymenoides*); ARNO4 - black sagebrush (*Artemisia nova*); OPPO - plains pricklypear (*Opuntia polyacantha*)

Parent Materials: residuum
Bedrock: Strongly cemented calcareous sandstone at 8 centimeters (3.1 inches)
Particle Size Control Section: 0 to 18 centimeters (0 to 7.1 inches)
Diagnostic Features: Lithic contact: 8 centimeters (3.1 inches)
Restrictions: Lithic bedrock: 8 centimeters (3.1 inches)

A --- 0 to 3 centimeters (0 to 1.2 inches); very pale brown (10YR 7/3) dry, channery sandy loam; light yellowish brown (10YR 6/4) moist; 70 percent sand; 14 percent silt; 16 percent clay; moderate medium platy structure; very friable, slightly hard, nonsticky, nonplastic; common fine roots throughout and common very fine roots throughout; common very fine tubular pores; 5 percent subangular calcareous sandstone gravels and 10 percent subangular calcareous sandstone channers; electrical conductivity of 1.55 mmhos/cm by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6, pH meter; abrupt smooth boundary; $CaCO_3$ 20.5 Percent.

C --- 3 to 8 centimeters (1.2 to 3.1 inches); very pale brown (10YR 7/4) dry, sandy loam; brownish yellow (10YR 6/6) moist; 70 percent sand; 14 percent silt; 16 percent clay; moderate fine subangular blocky structure; very friable, slightly hard, slightly sticky, nonplastic; common fine roots throughout and common very fine roots throughout; common very fine tubular pores; 5 percent subangular calcareous sandstone gravels; electrical conductivity of 1.55 mmhos/cm by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6, pH meter; abrupt smooth boundary; $CaCO_3$ 20.5 Percent.

R --- 8 centimeters (3.1 inches); Ferron sandstone.

EM-12-09

Pedon ID: EM-12-09
Description Date: 10/8/2009
Describer: Robert Long

Soil Name As Correlated: Garley, moderately well drained
Classification: Coarse-loamy, mixed, active, calcareous, mesic Typic Torrifluvents
Pedon Type: Modal pedon for map unit
Pedon Purpose: Full pedon description
Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
7.5' Quad: 38111-G3 - Walker Flat, Utah
UTM: 477106E, 4301242N -- Datum NAD83, Zone 12
Legal Description: Section 32, Township 22 South, Range 6 East

Landscape: valley
Landform: stream terrace
Geomorphic Component: Base Slope
Profile Pos: Toeslope
Slope: 3 percent
Elevation: 1802 meters (5912.1 feet)
Aspect: 56°
Shape: up/down: Linear; **across:** Linear
Complexity: Simple

Flooding: Rare; extremely brief **Ponding:** Rare; very brief **Drainage:** Moderately well drained
Runoff: Low
Permeability: Moderately rapid
Erosion: Class 3 - Tunnel erosion

Primary Earth Cover: Shrub cover; **Secondary Earth Cover:** Shrubby rangeland
Existing Vegetation: SAVE4 - greasewood (*Sarcobatus vermiculatus*)

Parent Materials: Alluvium
Particle Size Control Section: 25 to 100 centimeters (9.8 to 39.4 inches)

A --- 0 to 15 cm (0 to 6 inches); light gray (2.5Y 7/2) dry, loam; light olive brown (2.5Y 5/3) moist; 48 percent sand; 38 percent silt; 14 percent clay; moderate coarse platy structure; friable, very hard, slightly sticky, nonplastic; common very fine roots throughout; common very fine tubular pores; electrical conductivity of 6.54 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.1; clear smooth boundary; CaCO3 17.5 percent.

C1 --- 15 to 35 cm (6 to 14 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 54 percent sand; 30 percent silt; 16 percent clay; moderate medium subangular blocky structure; friable, very hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; electrical conductivity of 8.97 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.1; unable to dig with shovel; clear smooth boundary; CaCO3 18.7 percent.

C2 --- 35 to 46 cm (14to 18 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 64 percent sand; 25 percent silt; 11 percent clay; weak fine and medium subangular blocky structure; friable, hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; electrical conductivity of 8.60 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.2; gradual smooth boundary; CaCO3 14.3 percent.

C3 --- 46 to 72 cm (18 to 28 inches); light yellowish brown (2.5Y 6/3) dry, loam; light olive brown (2.5Y 5/3) moist; 46 percent sand; 38 percent silt; 16 percent clay; weak medium subangular blocky structure; friable, hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 5 percent (common) fine masses of carbonate on vertical faces of peds; electrical conductivity of 8.88 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.3; gradual smooth boundary; CaCO3 16.1 percent.

Ab --- 72 to 102 cm (28 to 40 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; grayish brown (2.5Y 5/2) moist; 54 percent sand; 34 percent silt; 12 percent clay; weak medium subangular blocky structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 2 percent (common) fine masses of carbonate on vertical faces of peds; electrical conductivity of 12.1 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.4; clear smooth boundary; CaCO3 14.6 percent.

C4 --- 102 to 130 cm (40 to 52 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; grayish brown (2.5Y 5/2) moist; 54 percent sand; 34 percent silt; 12 percent clay; weak medium subangular blocky structure; very friable, hard, nonsticky, nonplastic; common very fine roots throughout; common very fine tubular pores; 1 percent (few) fine masses of carbonate on vertical faces of peds; electrical conductivity of 5.55 dS/m by EC meter, saturated paste; electrical conductivity of 12.6 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.4; clear smooth boundary; $CaCO_3$ 15.2 percent.

C5 --- 130 to 164 cm (52 to 65 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; grayish brown (2.5Y 5/2) moist; 54 percent sand; 30 percent silt; 16 percent clay; 2 percent fine prominent brownish yellow (10YR 6/6) mottles; moderate medium subangular blocky structure; friable, very hard, nonsticky, nonplastic; common very fine roots throughout; common very fine tubular pores; 2 percent (common) fine prominent spherical very weakly cemented masses of oxidized iron clear in matrix; 1 percent (few) fine masses of carbonate on vertical faces of peds; electrical conductivity of 9.64 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.3; $CaCO_3$ 14.8 percent.

EM-13-09

Pedon ID: EM-13-09
Description Date: 10/8/2009
Describer: Robert Long

Soil Name As Correlated: Persayo
Classification: Loamy, mixed, superactive, calcareous, mesic, shallow Typic Torriorthents
Pedon Type: Modal pedon for map unit
Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
7.5' Quad: 38111-G3 - Walker Flat, Utah
UTM: 476873E, 4300442N -- Datum NAD83, Zone 12
Legal Description: Section 32, Township 22 S, Range 6 E

Landscape: plateau
Landform: hillslope
Geomorphic Component: Side Slope
Profile Pos: Backslope
Slope: 42 percent
Elevation: 1832 meters (6012 feet)
Aspect: 230°
Shape: up/down: Linear; **across:** Convex

Drainage: Well drained
Runoff: High
Permeability: Moderately slow
Erosion: Class 3 - Sheet erosion

Primary Earth Cover: Grass/herbaceous cover;
Existing Vegetation: ATCO - shadscale (*Atriplex confertifolia*)

Parent Materials: Residuum
Bedrock: Calcareous shale at 40 centimeters
Particle Size Control Section: 25 to 40 centimeters
Diagnostic Features: Paralithic contact: 40 centimeters (Restrictive layer)

Restrictions: Paralithic bedrock: 40 centimeters (15.8 inches)

A --- 0 to 10 centimeters (0 to 3.9 inches); light yellowish brown (2.5Y 6/3) dry, very gravelly clay loam; dark grayish brown (2.5Y 4/2) moist; 33 percent sand; 40 percent silt; 27 percent clay; weak fine subangular blocky structure; friable, hard, slightly sticky, slightly plastic; common very fine roots throughout; common very fine tubular pores; 20 percent angular calcareous shale channers and 40 percent angular calcareous shale gravels; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.4; clear smooth boundary.

C --- 10 to 40 centimeters (3.9 to 15.8 inches); light brownish gray (2.5Y 6/2) dry, silty clay loam; grayish brown (2.5Y 5/2) moist; 10 percent sand; 68 percent silt; 32 percent clay; moderate medium subangular blocky structure; friable, hard, slightly sticky, slightly plastic; common very fine roots throughout; common very fine tubular pores; 10 percent flat angular very weakly cemented calcareous shale parachanners; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.4; clear smooth boundary.

Cr --- 40 centimeters (15.8 inches); weathered Mancos shale.

EM-14-09

Pedon ID: EM-14-09
Description Date: 11/12/2009
Describer: Robert Long

Soil Name As Correlated: Braf
Current Taxonomic Name: Braf
Current Taxonomic Class: Loamy, mixed, superactive, calcareous, mesic Lithic Torriorthents
Pedon Type: Confirmation description
Current Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
UTM: 477475E, 4300929N -- Datum NAD83, Zone 12
Legal Description: Section 33, Township 22 South, Range 6 East of the 29 Meridian

Landscape: plateaus or tablelands
Landform: hillslope
Geomorphic Component: Tread
Profile Pos: Shoulder
Slope: 8 percent
Elevation: 1855 meters (6086 feet)
Aspect: 340°
Shape: up/down: Convex; **across:** Linear
Complexity: Simple

Drainage: Well drained
Runoff: Medium
Erosion: Class 2 - Wind erosion

Primary Earth Cover: Shrub cover;
Existing Vegetation: ATCO - shadscale (*Atriplex confertifolia*); BOGR2 - blue grama (*Bouteloua gracilis*)

Parent Materials: residuum weathered from calcareous sandstone
Bedrock: Strongly cemented calcareous sandstone at 48 centimeters (18.9 inches)
Particle Size Control Section: 25 to 48 centimeters (9.8 to 18.9 inches)
Diagnostic Features: Lithic contact: 48 centimeters (18.9 inches)
Restrictions: Lithic bedrock: 48 centimeters (18.9 inches)

A --- 0 to 12 centimeters (0 to 4.7 inches); pale brown (10YR 6/3) dry, channery sandy loam; brown (10YR 5/3) moist; null percent sand; null percent silt; 6 percent clay; weak medium subangular blocky structure; very friable, slightly hard, moderately sticky, nonplastic; common medium roots throughout, common fine roots throughout and many very fine roots throughout; common very fine dendritic tubular and many very fine interstitial pores; 3 percent (very few) carbonate coats on bottom surfaces of rock fragments; 15 percent subangular calcareous sandstone channers and 10 percent subangular calcareous sandstone gravels; strongly effervescent by HCl, 1 normal; neutral, pH 7.3, pH meter; clear smooth boundary.

C1 --- 12 to 38 centimeters (4.7 to 15 inches); light yellowish brown (10YR 6/4) dry, gravelly sandy loam; yellowish brown (10YR 5/4) moist; null percent sand; null percent silt; 6 percent clay; moderate medium subangular blocky structure; very friable, slightly hard, nonsticky, nonplastic; common fine roots throughout and common very fine roots throughout; many very fine interstitial pores; 4 percent (very few) carbonate coats on bottom surfaces of rock fragments; 5 percent subangular calcareous sandstone channers and 15 percent subangular calcareous sandstone gravelly; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5, pH meter; clear smooth boundary.

C2 --- 38 to 48 centimeters (15 to 18.9 inches); very pale brown (10YR 7/3) dry, gravelly loamy sand; pale brown (10YR 6/3) moist; null percent sand; null percent silt; 4 percent clay; weak medium subangular blocky structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout; many very coarse interstitial pores; 2 percent (very few) carbonate coats on bottom surfaces of rock fragments; 15 percent subangular calcareous sandstone gravels; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.4, pH meter; abrupt smooth boundary.

R --- 48 centimeters (18.9 inches); Ferron sandstone.

EM-15-09

Pedon ID: EM-15-09
Description Date: 11/12/2009
Describer: Robert Long

Soil Name As Correlated: Persayo
Current Taxonomic Name: Persayo
Current Taxonomic Class: Loamy, mixed, superactive, calcareous, mesic, shallow Typic Torriorthents
Pedon Type: Confirmation description
Current Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
Lat/Long:
UTM: 477421E, 4300927N -- Datum NAD83, Zone 12
Legal Description: Section 33, Township 22 South, Range 6 East of the 29 Meridian

Landscape: plateau
Landform: hillslope
Geomorphic Component: Side Slope
Profile Pos: Backslope
Slope: 12 percent
Elevation: 1852 meters (6076.1 feet)
Aspect: 40°
Shape: up/down: Convex; **across:** Convex

Drainage: Well drained
Runoff: High
Erosion: Class 2 - Sheet erosion

Primary Earth Cover: Shrub cover;
Existing Vegetation: ATCO - shadscale (*Atriplex confertifolia*)

Parent Materials: Residuum
Bedrock: Calcareous shale at 48 centimeters (18.9 inches)
Particle Size Control Section: 25 to 48 centimeters (9.8 to 18.9 inches)
Diagnostic Features: Paralithic contact: 48 centimeters (18.9 inches)
Restrictions: Paralithic bedrock: 48 centimeters (18.9 inches)

A --- 0 to 17 centimeters (0 to 6.7 inches); light yellowish brown (2.5Y 6/3) dry, channery loam; light olive brown (2.5Y 5/3) moist; null percent sand; null percent silt; 22 percent clay; moderate medium subangular blocky structure; friable, hard, slightly sticky, slightly plastic; common fine roots throughout and common very fine roots throughout; common fine dendritic tubular and common very fine dendritic tubular pores; 5 percent subangular calcareous sandstone gravels and 15 percent angular calcareous shale channers; strongly effervescent by HCl, 1 normal; clear smooth boundary.

Cr --- 17 to 48 centimeters (6.7 to 18.9 inches); light yellowish brown (2.5Y 6/4) dry, loam; light olive brown (2.5Y 5/3) moist; null percent sand; null percent silt; 23 percent clay; weak fine subangular blocky structure; friable, hard, slightly sticky, slightly plastic; common very fine roots throughout; common very fine dendritic tubular pores; strongly effervescent by HCl, 1 normal; gradual smooth boundary.

A --- 48 centimeters (18.9 inches); weathered Mancos shale.

EM-16-09

Pedon ID: EM-16
Site ID: EM-16
Description Date: 11/12/2009
Print Date: 1/8/2010
Describer: Robert Long
Soil Name As Described/Sampled: Monue family
Soil Name As Correlated:
Classification: Coarse-loamy, mixed, superactive, mesic Typic Haplocambids
Pedon Type: Modal pedon for map unit
Pedon Purpose: Full pedon description
Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
7.5' Quad: 38111-G3 - Walker Flat, Utah
UTM: 477110E, 4300392N -- Datum NAD83, Zone 12
Location Description:
Legal Description: Section 32, Township 22 S, Range 6 E of the Salt Lake Meridian

Landscape: canyon
Landform: alluvial fan and stream terrace
Geomorphic Component: Base Slope
Profile Pos: Toeslope
Slope: 7 percent
Elevation: 1844 meters (6050 feet)
Aspect: 120°
Shape: up/down: Concave; **across:** Linear
Complexity: Simple

Drainage: Well drained
Runoff: Medium
Permeability: Moderately rapid
Erosion: Class 2 - Gully erosion

Primary Earth Cover: Shrub cover; **Secondary Earth Cover:** Shrubby rangeland
Existing Vegetation: SAVE4 - greasewood (*Sarcobatus vermiculatus*); ACHY - Indian ricegrass (*Achnatherum hymenoides*)

Parent Materials: Alluvium
Particle Size Control Section: 25 to 100 centimeters (9.8 to 39.4 inches)
Diagnostic Features: Cambic horizon: 8 to 21 centimeters (3.1 to 8.3 inches)

A1 --- 0 to 8 cm (0 to 3 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam gravel; light olive brown (2.5Y 5/3) moist; 64 percent sand; 28 percent silt; 8 percent clay; weak medium subangular blocky parting to single grain structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout and common fine roots throughout; many very fine interstitial pores; 1 percent subangular calcareous sandstone gravels; electrical conductivity of 1.01 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; clear smooth boundary; CaCO3 13.4 percent.

Bw1 --- 8 to 21 cm (3 to 8 inches); pale yellow (2.5Y 7/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 68 percent sand; 24 percent silt; 8 percent clay; structure; very friable, hard, nonsticky, nonplastic; common very fine roots throughout and common fine roots throughout; many very fine interstitial pores; electrical conductivity of 0.43 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6; clear smooth boundary; CaCO3 (Exists in NASIS Horizon) 11.4 percent.

Bw2 --- 21 to 46 cm (8 to 18 inches); pale yellow (2.5Y 7/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 58 percent sand; 33 percent silt; 9 percent clay; moderate medium subangular blocky structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout and common fine roots throughout; many very fine interstitial pores; electrical conductivity of 0.43 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; clear smooth boundary; CaCO3 11.6 percent.

C2 --- 46 to 80 cm (18 to 31 inches); light yellowish brown (2.5Y 6/4) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 60 percent sand; 28 percent silt; 12 percent clay; single grain; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout; many very fine interstitial pores; 1 percent (few) carbonate concretions on bottom of rock fragments; 2 percent subangular calcareous sandstone gravels; electrical conductivity of 0.45 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; gradual smooth boundary; CaCO3 13 percent.

C3 --- 80 to 122 cm (31 to 48 inches); light yellowish brown (2.5Y 6/4) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 70 percent sand; 22 percent silt; 8 percent clay; single grain; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout; many very coarse interstitial pores; electrical conductivity of 5.89 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; gradual smooth boundary; CaCO3 12.9 percent.

2C --- 122 to 170 cm (48 to 67 inches); light yellowish brown (10YR 6/4) dry, sandy loam; yellowish brown (10YR 5/4) moist; 68 percent sand; 24 percent silt; 8 percent clay; single grain; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout; many very fine interstitial pores; 1 percent (few) salt masses in matrix and 1 percent (few) carbonate concretions on bottom of rock fragments; 4 percent subangular calcareous sandstone channers; electrical conductivity of 9.6 dS/m by EC meter, saturated paste; violently effervescent by HCl, 1 normal; moderately alkaline, pH 8; $CaCO_3$ 12.3 percent.

EM-17-09

Pedon ID: EM-17-09
Description Date: 11/12/2009
Describer: Robert Long

Soil Name As Correlated: Hideout
Current Taxonomic Class: Loamy, mixed, superactive, calcareous, mesic Lithic Ustic Torriorthents
Pedon Type: Confirmation description
Current Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
UTM: 477229E, 4300406N -- Datum NAD83, Zone 12
Legal Description: Section 32, Township 22 South, Range 6 East of the 29 Meridian
Landscape: plateau

Landform: structural bench and canyon
Geomorphic Component: Free face
Profile Pos: Footslope
Slope: 10 percent
Elevation: 1843 meters (6045 feet)
Aspect: 345°
Shape: up/down: Convex; **across:** Linear

Drainage: Well drained
Runoff: Medium
Erosion: Class 2 - Sheet erosion

Primary Earth Cover: Tree cover; **Secondary Earth Cover:** Shrubby rangeland
Existing Vegetation: PIED - twoneedle pinyon (*Pinus edulis*); JUOS - Utah juniper (*Juniperus osteosperma*); AMUT - Utah serviceberry (*Amelanchier utahensis*); ARTRW8 - Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*)

Parent Materials: residuum weathered from calcareous sandstone
Bedrock: Moderately cemented calcareous sandstone
Particle Size Control Section: 0 to 19 centimeters (0 to 7.5 inches)
Diagnostic Features: Lithic contact: 19 centimeters (7.5 inches)
Restrictions: Lithic bedrock: 19 centimeters (7.5 inches)

A --- 0 to 4 centimeters (0 to 1.6 inches); pale brown (10YR 6/3) dry, very channery loamy sand; brown (10YR 4/3) moist; null percent sand; null percent silt; 6 percent clay; moderate fine platy structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout; many very fine interstitial pores; 15 percent subangular calcareous sandstone flags and 30 percent subangular calcareous sandstone channers; strongly effervescent; abrupt smooth boundary.

C --- 4 to 19 centimeters (1.6 to 7.5 inches); brown (10YR 5/3) dry, channery sandy loam; brown (10YR 4/3) moist; null percent sand; null percent silt; 8 percent clay; weak medium subangular blocky and weak fine subangular blocky structure; very friable, slightly hard, nonsticky, nonplastic; common fine roots throughout and common very fine roots throughout; many very fine interstitial pores; 5 percent flat subangular calcareous sandstone flags and 20 percent subangular calcareous sandstone channers; strongly effervescent; abrupt smooth boundary.

R --- 19 centimeters (7.5 inches); Ferron sandstone.

EM-1-16

Pedon ID: EM-1-16
Description Date: 6/9/2016
Describer: Robert Long

Soil Name As Correlated: Monue family
Current Taxonomic Name: Monue family
Current Taxonomic Class: Coarse-loamy, mixed, superactive, mesic Typic Haplocambids
Pedon Type: Confirmation description
Current Taxon Kind: Family

County or Parish: UT015 - Emery
State or Territory: UT - Utah
UTM: 477468E, 4300731N -- Datum NAD83, Zone 12
Legal Description: Section 33, Township 22 South, Range 6 East of the 29 Meridian

Landscape: plateau
Landform: alluvial fan and canyon
Geomorphic Component: Base Slope
Profile Pos: Toeslope
Slope: 5 percent
Elevation: 1818 meters (5965 feet)
Aspect: 40°
Shape: up/down: Linear; **across:** Concave
Complexity: Simple

Drainage: Well drained
Runoff: Low
Erosion: Class 2 - Gully erosion

Primary Earth Cover: Shrub cover;
Existing Vegetation: SAVE4 - black greasewood (*Sarcobatus vermiculatus*); ATCA2 - fourwing saltbush (*Atriplex canescens*); ATCO - shadscale (*Atriplex confertifolia*); BRTE - cheatgrass (*Bromus tectorum*)

Parent Materials: slightly weathered, alluvium derived from sandstone and shale
Particle Size Control Section: 25 to 100 centimeters (9.8 to 39.4 inches)
Diagnostic Features: Cambic horizon: 12 to 75 centimeters (4.7 to 29.5 inches) and Secondary carbonates: 40 to 75 centimeters (15.7 to 29.5 inches)

A --- 0 to 12 centimeters (0 to 4.7 inches); pale yellow (2.5Y 7/4) dry, sandy loam; light olive brown (2.5Y 5/4) moist; null percent sand; null percent silt; 8 percent clay; weak medium platy parting to single grain structure; very friable, hard, nonsticky, nonplastic; electrical conductivity of 0.3 mmhos/cm by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; neutral, pH 7.2, pH meter; clear smooth boundary.

Bk1 --- 12 to 40 centimeters (4.7 to 15.7 inches); light yellowish brown (2.5Y 6/4) dry, sandy loam; light olive brown (2.5Y 5/4) moist; null percent sand; null percent silt; 10 percent clay; weak medium subangular blocky parting to single grain structure; very friable, slightly hard, nonsticky, nonplastic; electrical conductivity of 0.4 mmhos/cm by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.4, pH meter; gradual smooth boundary.

Bk2 --- 40 to 75 centimeters (15.7 to 29.5 inches); pale yellow (2.5Y 7/4) dry, loamy sand; light yellowish brown (2.5Y 6/4) moist; null percent sand; null percent silt; 6 percent clay; weak medium subangular blocky parting to single grain structure; very friable, slightly hard, nonsticky, nonplastic; 2 percent (very few) discontinuous carbonate coats on bottom surfaces of rock fragments; 5 percent subangular calcareous sandstone gravels; electrical conductivity of 1.4 mmhos/cm by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; neutral, pH 7.3, pH meter; clear smooth boundary.

C --- 75 to 110 centimeters (29.5 to 43.3 inches); light yellowish brown (2.5Y 6/4) dry, sandy loam; light olive brown (2.5Y 5/4) moist; null percent sand; null percent silt; 8 percent clay; single grain; loose, loose, nonsticky, nonplastic; 2 percent subangular calcareous sandstone gravels; electrical conductivity of 2 mmhos/cm by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; neutral, pH 7.3, pH meter.

EM-2-16

Pedon ID: EM-2-16
Description Date: 6/9/2016
Describer: Robert Long

Soil Name As Described/Sampled:
Current Taxonomic Name: Hideout
Current Taxonomic Class: Loamy, mixed, superactive, calcareous, mesic Lithic Ustic Torriorthents
Pedon Type: Confirmation description
Current Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
UTM: 477309E, 4300606N -- Datum NAD83, Zone 12
Legal Description: Section 32, Township 22 South, Range 6 East of the 29 Meridian

Landscape: plateau
Landform: structural bench and canyon
Geomorphic Component: Free face
Profile Pos: Backslope
Slope: 8 percent
Elevation: 1833 meters (6014 feet)
Aspect: 265°
Shape: up/down: Linear; **across:** Linear
Complexity: complex

Drainage: Well drained
Runoff: High
Erosion: Class 2 - Sheet erosion

Primary Earth Cover: Tree cover;
Existing Vegetation: PIED - twoneedle pinyon (*Pinus edulis*); JUOS - Utah juniper (*Juniperus osteosperma*); CEMOG - birchleaf mountain mahogany (*Cercocarpus montanus var. glaber*)

Parent Materials: slightly weathered, residuum weathered from calcareous sandstone
Particle Size Control Section: 0 to 18 centimeters (0 to 7.1 inches)
Diagnostic Features: Lithic contact: 18 centimeters (7.1 inches)
Restrictions: Lithic bedrock: 18 centimeters (7.1 inches)

A --- 0 to 18 centimeters (0 to 7.1 inches); pale brown (10YR 6/3) dry, channery sandy loam; brown (10YR 5/3) moist; null percent sand; null percent silt; 14 percent clay; weak medium subangular blocky parting to single grain structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout; 10 percent subangular calcareous sandstone channers and 5 percent subangular calcareous sandstone gravels; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8, pH meter; abrupt smooth boundary.

R --- 18 centimeters (7.1 inches); Ferron sandstone.

Map Unit A Transect

Transect Stop	Soil Type	Soil Depth
		cm
1	Hideout (EM-4-09)	20
2	Hideout	7
3	Sandstone Outcrop	
4	Sandstone Outcrop	
5	Sandstone Outcrop	
6	Begay family	54
7	Hideout	2
8	Sandstone Outcrop	
9	Hideout	20
10	Sandstone Outcrop	
	Average Soil Depth	10

Sandstone outcrop comprises 50 percent of map unit A based on this transect.

Appendix C

Laboratory Analysis

Appendix C - Table of Contents

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C-1	Laboratory analysis results for Emery 2 soil samples with topsoil suitability highlights (DOGM 2008).	C-1
C-2	Available water capacity, K factor, and wind erodibility group by soil horizon.	C-3

Laboratory Analysis Reports

Lab Report ID	Soil Profiles	Page
S0910098001	EM-1-09, EM-2-09, EM-4-09, EM-5-09, EM-6-09, EM-7-09, EM-8-09	C-5
S0910099001	EM-3-09	C-11
S0910332003	EM-9-09, EM-10-09, EM-12-09, EM-13-09	C-15
S0912073001	EM-16-09	C-18

Table C-1. Laboratory analysis results for Emery 2 soil samples with topsoil suitability highlights (Utah DOGM 2008).

SampleID	Begin Depth	End Depth	pH	Saturation	Electrical Conductivity	Organic Matter	SAR	Clay	Texture	Very Fine Sand	CO3	Nitrogen Nitrate	Available Phosphorus	CEC	Available Potassium	ESP	TOC	T.S. ABP	Selenium	Boron
	cm	cm	s.u.	%	dS/m	%		%		%	%	ppm	ppm	meq/100g	meq/100g	%	%	t/1000t	ppm	ppm
EM-1-09	0	8	7.3	31.1	2.25	1.4	0.56	17.0	Sandy Loam	18.9	9.1	5.4	10.7		0.33		0.1			
EM-1-09	8	23	7.4	32.5	2.32	1.7	0.45	14.0	Sandy Loam	20.5	7.2	<0.1	6.20		0.28		0.3			
EM-1-09	23	50	7.7	31.3	3.94	1.1	2.36	13.0	Sandy Loam	24.1	7.2	<0.1	4.60		0.23		<0.1			
EM-1-09	50	80	7.6	30.2	3.07	1.0	2.11	12.0	Sandy Loam	25.4	7.8	<0.1	5.33		0.18		<0.1			
EM-2-09	0	5	7.7	27.6	0.89	1.3	1.52	11.0	Sandy Loam	24.2	5.5	1.9	11.7		0.31		0.3			
EM-2-09	5	19	7.7	29.1	0.78	1.2	2.81	12.0	Sandy Loam	30.4	4.4	0.7	5.39		0.19		0.3			
EM-3-09	0	18	7.5	34.8	1.40	1.3	1.99	20.0	Loam	6.6	13.9	10.4	11.7	0.68	2.0			131	<0.02	0.35
EM-3-09	18	46	7.4	35.7	4.39	1.4	3.68	22.0	Sandy Clay Loam	6.3	13.4	2.1	4.40	0.31	1.8			111	<0.02	0.91
EM-4-09	0	6	7.7	30.3	0.69	1.4	0.28	7.0	Loamy Sand	25.0	6.1	6.8	9.72		0.35		0.4			
EM-4-09	6	20	7.5	33.3	0.95	1.9	1.48	10.0	Sandy Loam	23.6	6.4	<0.1	5.21		0.43		0.8			
EM-5-09	0	7	7.8	28.6	0.65	1.6	0.88	13.0	Sandy Loam	21.4	22.5	3.5	12.5		0.41		0.3			
EM-5-09	7	20	7.6	36.6	0.57	1.5	0.82	21.0	Sandy Clay Loam	18.2	25.4	1.5	5.94		0.60		<0.1			
EM-6-09	0	7	7.7	26.7	2.32	1.1	0.24	9.0	Loamy Sand	33.0	6.4	<0.1	8.44		0.13		0.2			
EM-6-09	7	18	7.7	30.3	2.71	1.2	0.27	14.0	Sandy Loam	32.2	7.5	3.4	5.44		0.17		<0.1			
EM-7-09	0	15	7.5	34.4	2.43	1.2	0.90	28.0	Sandy Clay Loam	5.6	14.4	1.8	5.20		0.16		<0.1			
EM-7-09	15	28	7.6	45.8	1.55	3.3	1.09	11.0	Silty Loam	2.7	18.3	3.9	16.2		0.44		1.1			
EM-7-09	28	43	7.7	35.6	1.36	1.6	1.09	9.0	Loam	2.7	15.9	<0.1	4.67		0.20		0.4			
EM-7-09	43	56	7.5	45.5	3.46	3.0	2.96	21.0	Silty Loam	2.3	19.2	32.0	5.89		0.31		0.7			
EM-7-09	56	78	7.6	31.6	3.67	1.3	4.25	13.0	Sandy Loam	14.2	15.2	8.3	4.26		0.13		0.1			
EM-7-09	78	102	7.5	36.6	3.93	1.5	3.08	17.0	Loam	6.6	16.5	8.6	4.84		0.20		0.1			
EM-7-09	102	130	7.6	33.8	2.21	1.0	1.64	9.0	Sandy Loam	5.4	14.5	1.6	4.71		0.13		<0.1			
EM-7-09	130	150	7.7	34.8	1.60	0.6	1.30	6.0	Sandy Loam	10.9	14.3	<0.1	3.98		0.10		<0.1			
EM-8-09	0	9	8.7	36.2	2.25	2.3	20.4	8.0	Loamy Sand	18.4	8.8	9.0	13.3	6.08	0.71	25.3	0.6			
EM-8-09	9	32	9.3	27.6	3.82	1.1	32.2	5.0	Loamy Sand	31.0	8.9	11.1	10.3	3.12	0.40	52.1	0.2			
EM-8-09	32	46	8.8	25.7	3.91	1.2	28.5	6.0	Loamy Sand	36.7	8.9	8.2	7.63	3.62	0.26	26.9	0.3			
EM-8-09	46	60	9.3	29.7	8.29	0.9	46.7	7.0	Loamy Sand	33.8	5.3	31.4	9.16	6.22	0.16	47.2	0.2			
EM-8-09	60	70	8.6	25.5	9.77	1.3	48.7	10.0	Loam	36.1	8.4	16.5	7.96	4.10	0.10	46.2	<0.1			
EM-8-09	70	88	7.9	29.5	9.38	1.0	29.5	11.0	Sandy Loam	26.6	6.3	25.4	7.98	5.14	0.14	30.1	0.2			
EM-8-09	88	98	7.4	31.7	4.35	4.3	8.81	12.0	Sandy Loam	30.2	5.5	4.9	9.83		0.13		2.6			
EM-8-09	98	108	7.7	32.5	5.54	1.2	15.7	9.0	Sandy Loam	23.6	6.8	<0.1	9.08		0.13		0.4			
EM-8-09	108	120	7.5	29.6	5.59	1.8	7.21	12.0	Sandy Loam	32.0	3.2	<0.1	12.6		0.09		0.3			
EM-8-09	120	150	7.5	32.4	6.17	2.1	8.71	12.0	Sandy Loam	27.4	6.0	<0.1	11.6		0.12		0.3			
EM-9-09	0	9	8.4	32.1	1.01	2.0	9.66	6.0	Sandy Loam	13.3	12.6	5.5	18.8	5.86	0.74	7.41	0.4			
EM-9-09	9	25	8.6	29.9	2.03	1.0	22.3	9.0	Sandy Loam	16.8	12.0	13.7	6.70	6.06	0.75	21.6	0.1			
EM-9-09	25	49	8.4	30.8	13.5	0.7	43.7	8.0	Sandy Loam	19.4	12.9	7.3	6.34	6.04	0.23	26.7	<0.1			
EM-9-09	49	75	8.6	31.4	15.9	1.3	47.2	10.0	Sandy Loam	16.3	11.7	1.4	6.78	5.30	0.17	33.3	0.1			
EM-9-09	75	120	8.5	29.5	11.3	1.4	32.3	10.0	Sandy Loam	18.3	12.2	1.5	4.51	5.14	0.10	38.8	<0.1			
EM-9-09	120	168	8.6	27.4	8.55	1.9	25.2	8.0	Sandy Loam	16.2	23.2	1.4	4.57	4.86	0.09	29.1	<0.1			
EM-10-09	0	7	7.9	32.3	0.64	1.6	1.28	8.0	Loamy Sand	32.2	13.5	6.2	10.8		0.29		0.4			
EM-10-09	7	27	7.8	32.7	0.50	1.7	0.91	10.0	Sandy Loam	18.2	22.2	3.2	5.06		0.23		0.4			
EM-10-09	27	45	7.6	32.3	1.97	1.4	0.25	8.0	Sandy Loam	18.7	18.7	8.3	8.72		0.26		0.4			
EM-11-09	0	8	7.6	29.9	1.55	2.0	2.78	16.0	Sandy Loam	18.0	20.5	12.4	7.28		0.57		0.3			
EM-12-09	0	15	8.1	34.6	6.54	2.7	35.2	14.0	Loam	4.0	17.5	83.8	13.1	14.1	1.19	18.9	0.6			
EM-12-09	15	35	8.1	33.0	8.97	1.9	34.9	16.0	Sandy Loam	12.9	18.7	49.1	4.88	10.2	0.44	20.3	0.3			
EM-12-09	35	46	8.2	36.2	8.60	1.2	28.5	11.0	Sandy Loam	7.4	14.3	43.6	4.16	6.50	0.26	24.8	0.3			
EM-12-09	46	72	8.3	36.2	8.88	1.2	25.8	16.0	Loam	4.5	16.1	52.9	4.34	8.78	0.36	59.9	0.4			
EM-12-09	72	102	8.4	36.4	12.1	1.0	35.5	12.0	Sandy Loam	3.0	14.6	37.6	3.86	8.58	0.35	40.0	0.2			
EM-12-09	102	130	8.4	35.2	12.6	1.2	32.7	12.0	Sandy Loam	6.0	15.2	24.1	3.51	8.66	0.30	18.1	0.1			
EM-12-09	130	164	8.3	36.5	9.64	1.3	24.3	16.0	Sandy Loam	5.5	14.8	23.1	3.73	10.3	0.31	24.9	<0.1			

Table C-1. Laboratory analysis results for Emery 2 soil samples with topsoil suitability highlights (Utah DOGM 2008).

SampleID	Begin Depth	End Depth	pH	Saturation	Electrical Conductivity	Organic Matter	SAR	Clay	Texture	Very Fine Sand	CO3	Nitrogen Nitrate	Available Phosphorus	CEC	Available Potassium	ESP	TOC	T.S. ABP	Selenium	Boron
	cm	cm	s.u.	%	dS/m	%		%		%	%	ppm	ppm	meq/100g	meq/100g	%	%	t/1000t	ppm	ppm
EM-13-09	0	10	7.9	34.2	2.44	3.2	0.90	27.0	Clay Loam	12.3	33.6	14.9	4.74	12.5	0.61	0.87	0.1			
EM-13-09	10	40	8.2	41.7	8.64	4.3	15.9	32.0	Silty Clay Loam	3.1	16.5	57.7	2.33	19.2	0.89	15.2	0.2			
EM-16-09	0	8	7.7	28.4	1.01	1.5	1.74	8.0	Sandy Loam	11.6	13.4	14.4	9.89	6.04	0.49	1.55	<0.1			
EM-16-09	8	21	7.6	34.4	0.43	1.1	0.84	8.0	Sandy Loam	10.3	11.4	<0.1	6.18	6.30	0.36	0.98	0.1			
EM-16-09	21	46	7.5	29.9	0.43	1.2	0.34	9.0	Sandy Loam	12.9	11.6	1.0	3.60	6.16	0.37	0.33	<0.1			
EM-16-09	46	80	7.5	32.1	0.45	1.2	0.30	12.0	Sandy Loam	13.8	13.0	0.3	4.40	6.52	0.27	0.34	0.1			
EM-16-09	80	122	7.7	30.2	5.89	1.0	5.44	8.0	Sandy Loam	17.2	12.9	0.6	3.43	6.24	0.11	5.46	<0.1			
EM-16-09	122	170	8.0	28.3	9.60	0.8	10.6	8.0	Sandy Loam	23.7	12.3	7.6	3.54	6.24	0.12	16.2	<0.1			

Topsoil suitability (Utah DOGM 2008): *Good* | *Fair* | *Poor* | *Unacceptable*

Table C-2. Available water capacity, K factor, and wind erodibility group by soil horizon

SampleID	Begin Depth	End Depth	Capacity (Saxton 2006) Estimate	K Factor Estimate (Renard 1997)	Wind Erodibility Group (USDA - NRCS 1993)
	cm	cm	inch/inch		
EM-1-09	0	8	0.09	0.27	3
EM-1-09	8	23	0.10	0.35	3
EM-1-09	23	50	0.06	0.27	3
EM-1-09	50	80	0.07	0.37	3
EM-2-09	0	5	0.08	0.37	3
EM-2-09	5	19	0.08	0.34	3
EM-3-09	0	18	0.10	0.25	4L
EM-3-09	18	46	0.08	0.20	4L
EM-4-09	0	6	0.06	0.34	2
EM-4-09	6	20	0.08	0.33	3
EM-5-09	0	7	0.07	0.31	3
EM-5-09	7	20	0.07	0.28	4L
EM-6-09	0	7	0.05	0.30	2
EM-6-09	7	18	0.06	0.35	3
EM-7-09	0	15	0.10	0.14	4L
EM-7-09	15	28	0.16	0.30	4L
EM-7-09	28	43	0.14	0.40	4L
EM-7-09	43	56	0.17	0.39	4L
EM-7-09	56	78	0.10	0.20	3
EM-7-09	78	102	0.12	0.27	4L
EM-7-09	102	130	0.10	0.29	3
EM-7-09	130	150	0.08	0.18	3
EM-8-09	0	9	0.06	0.25	2
EM-8-09	9	32	0.04	0.25	2
EM-8-09	32	46	0.02	0.36	2
EM-8-09	46	60	0.01	0.14	2
EM-8-09	60	70	0.04	0.57	6
EM-8-09	70	88	0.03	0.26	3
EM-8-09	88	98	0.03	0.26	3
EM-8-09	98	108	0.03	0.26	3
EM-8-09	108	120	0.03	0.33	3
EM-8-09	120	150	0.03	0.29	3
EM-9-09	0	9	0.10	0.33	3
EM-9-09	9	25	0.08	0.28	3
EM-9-09	25	49	<0.01	0.25	3
EM-9-09	49	75	<0.01	0.28	3
EM-9-09	75	120	0.02	0.23	3
EM-9-09	120	168	0.02	0.16	3
EM-10-09	0	7	0.05	0.29	2
EM-10-09	7	27	0.07	0.27	3
EM-10-09	27	45	0.05	0.25	3
EM-11-09	0	8	0.07	0.22	3

Table C-2. Available water capacity, K factor, and wind erodibility group by soil horizon

SampleID	Begin Depth	End Depth	Capacity (Saxton 2006) Estimate	K Factor Estimate (Renard 1997)	Wind Erodibility Group (USDA - NRCS 1993)
EM-12-09	0	15	0.11	0.32	4L
EM-12-09	15	35	0.09	0.30	3
EM-12-09	35	46	0.06	0.24	3
EM-12-09	46	72	0.10	0.29	4L
EM-12-09	72	102	0.06	0.28	3
EM-12-09	102	130	0.06	0.29	3
EM-12-09	130	164	0.08	0.09	3
EM-13-09	0	10	0.07	0.17	4L
EM-13-09	10	40	0.13	0.15	4L
EM-16-09	0	8	0.09	0.15	3
EM-16-09	8	21	0.09	0.11	3
EM-16-09	21	46	0.11	0.20	3
EM-16-09	46	80	0.10	0.15	3
EM-16-09	80	122	0.06	0.15	3
EM-16-09	122	170	0.04	0.22	3
Topsoil suitability (Utah DOGM 2008)				Fair	Poor

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Lab ID	Sample ID	Depths cm	pH s.u.	Saturation %	Electrical Conductivity dS/m	Organic Matter %	PE Calcium meq/L	PE Magnesium meq/L	PE Potassium meq/L	PE Sodium meq/L	SAR
S0910098-001	EM-1-09	0-8	7.3	31.1	2.25	1.4	26.9	4.78	0.68	2.21	0.56
S0910098-002	EM-1-09	8-23	7.4	32.5	2.32	1.7	30.1	3.20	0.70	1.83	0.45
S0910098-003	EM-1-09	23-50	7.7	31.3	3.94	1.1	26.2	28.4	0.67	12.3	2.36
S0910098-004	EM-1-09	50-80	7.6	30.2	3.07	1.0	28.2	10.3	0.41	9.27	2.11
S0910098-005	EM-2-09	0-5	7.7	27.6	0.89	1.3	5.10	1.32	0.49	2.72	1.52
S0910098-006	EM-2-09	5-19	7.7	29.1	0.78	1.2	3.05	0.86	0.22	3.93	2.81
S0910098-007	EM-4-09	0-6	7.7	30.3	0.69	1.4	4.35	1.37	1.01	0.47	0.28
S0910098-008	EM-4-09	6-20	7.5	33.3	0.95	1.9	4.68	2.83	1.30	2.88	1.48
S0910098-009	EM-5-09	0-7	7.8	28.6	0.65	1.6	3.08	1.31	0.44	1.30	0.88
S0910098-010	EM-5-09	7-20	7.6	36.6	0.57	1.5	2.78	1.58	0.32	1.22	0.82
S0910098-011	EM-6-09	0-7	7.7	26.7	2.32	1.1	32.0	3.01	0.59	1.02	0.24
S0910098-012	EM-6-09	7-18	7.7	30.3	2.71	1.2	31.4	9.77	0.97	1.20	0.27
S0910098-013	EM-7-09	0-15	7.5	34.4	2.43	1.2	29.6	4.55	0.62	3.73	0.90
S0910098-014	EM-7-09	15-28	7.6	45.8	1.55	3.3	11.7	3.73	1.12	3.02	1.09
S0910098-015	EM-7-09	28-43	7.7	35.6	1.36	1.6	10.0	2.64	0.42	2.75	1.09
S0910098-016	EM-7-09	43-56	7.5	45.5	3.46	3.0	25.3	14.0	0.49	13.1	2.96
S0910098-017	EM-7-09	56-78	7.6	31.6	3.67	1.3	23.8	15.3	0.35	18.8	4.25
S0910098-018	EM-7-09	78-102	7.5	36.6	3.93	1.5	27.8	20.3	0.53	15.1	3.08
S0910098-019	EM-7-09	102-130	7.6	33.8	2.21	1.0	15.5	10.2	0.37	5.88	1.64
S0910098-020	EM-7-09	130-150	7.7	34.8	1.60	0.6	10.3	6.54	0.30	3.78	1.30

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
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Karen Secor, Soil Lab Supervisor

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Report ID: S0910098001

Project: Emery 2 Topsoil
Date Received: 10/7/2009

Date Reported: 11/11/2009
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Lab ID	Sample ID	Depths cm	Sand %	Silt %	Clay %	Texture	Very Fine Sand %	CO3 %	Nitrogen Nitrate ppm	Phosphorus ppm	Available Potassium meq/100g
S0910098-001	EM-1-09	0-8	63.0	20.0	17.0	Sandy Loam	18.9	9.1	5.4	10.7	0.33
S0910098-002	EM-1-09	8-23	57.0	29.0	14.0	Sandy Loam	20.5	7.2	<0.1	6.20	0.28
S0910098-003	EM-1-09	23-50	73.0	14.0	13.0	Sandy Loam	24.1	7.2	<0.1	4.60	0.23
S0910098-004	EM-1-09	50-80	65.0	23.0	12.0	Sandy Loam	25.4	7.8	<0.1	5.33	0.18
S0910098-005	EM-2-09	0-5	69.0	20.0	11.0	Sandy Loam	24.2	5.5	1.9	11.7	0.31
S0910098-006	EM-2-09	5-19	71.0	17.0	12.0	Sandy Loam	30.4	4.4	0.7	5.39	0.19
S0910098-007	EM-4-09	0-6	79.0	14.0	7.0	Loamy Sand	25.0	6.1	6.8	9.72	0.35
S0910098-008	EM-4-09	6-20	69.0	21.0	10.0	Sandy Loam	23.6	6.4	<0.1	5.21	0.43
S0910098-009	EM-5-09	0-7	65.0	22.0	13.0	Sandy Loam	21.4	22.5	3.5	12.5	0.41
S0910098-010	EM-5-09	7-20	63.0	16.0	21.0	Sandy Clay Loam	18.2	25.4	1.5	5.94	0.60
S0910098-011	EM-6-09	0-7	79.0	12.0	9.0	Loamy Sand	33.0	6.4	<0.1	8.44	0.13
S0910098-012	EM-6-09	7-18	71.0	15.0	14.0	Sandy Loam	32.2	7.5	3.4	5.44	0.17
S0910098-013	EM-7-09	0-15	57.0	15.0	28.0	Sandy Clay Loam	5.6	14.4	1.8	5.20	0.16
S0910098-014	EM-7-09	15-28	37.0	52.0	11.0	Silty Loam	2.7	18.3	3.9	16.2	0.44
S0910098-015	EM-7-09	28-43	43.0	48.0	9.0	Loam	2.7	15.9	<0.1	4.67	0.20
S0910098-016	EM-7-09	43-56	23.0	56.0	21.0	Silty Loam	2.3	19.2	32.0	5.89	0.31
S0910098-017	EM-7-09	56-78	61.0	26.0	13.0	Sandy Loam	14.2	15.2	8.3	4.26	0.13
S0910098-018	EM-7-09	78-102	46.0	37.0	17.0	Loam	6.6	16.5	8.6	4.84	0.20
S0910098-019	EM-7-09	102-130	58.0	33.0	9.0	Sandy Loam	5.4	14.5	1.6	4.71	0.13
S0910098-020	EM-7-09	130-150	69.0	25.0	6.0	Sandy Loam	10.9	14.3	<0.1	3.98	0.10

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
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Lab ID	Sample ID	Depths cm	Total Carbon %	TOC %	Neutral. Potential t/1000t
S0910098-001	EM-1-09	0-8	1.2	0.1	91.4
S0910098-002	EM-1-09	8-23	1.1	0.3	71.6
S0910098-003	EM-1-09	23-50	0.9	<0.1	72.2
S0910098-004	EM-1-09	50-80	0.9	<0.1	78.2
S0910098-005	EM-2-09	0-5	1.0	0.3	55.4
S0910098-006	EM-2-09	5-19	0.8	0.3	44.5
S0910098-007	EM-4-09	0-6	1.1	0.4	61.0
S0910098-008	EM-4-09	6-20	1.6	0.8	64.5
S0910098-009	EM-5-09	0-7	3.0	0.3	225
S0910098-010	EM-5-09	7-20	3.1	<0.1	254
S0910098-011	EM-6-09	0-7	1.0	0.2	63.9
S0910098-012	EM-6-09	7-18	0.7	<0.1	75.2
S0910098-013	EM-7-09	0-15	1.7	<0.1	144
S0910098-014	EM-7-09	15-28	3.3	1.1	183
S0910098-015	EM-7-09	28-43	2.3	0.4	159
S0910098-016	EM-7-09	43-56	3.0	0.7	192
S0910098-017	EM-7-09	56-78	2.0	0.1	152
S0910098-018	EM-7-09	78-102	2.1	0.1	165
S0910098-019	EM-7-09	102-130	1.8	<0.1	145
S0910098-020	EM-7-09	130-150	1.7	<0.1	143

These results apply only to the samples tested.

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Lab ID	Sample ID	Depths cm	pH s.u.	Saturation %	Electrical Conductivity dS/m	Organic Matter %	PE Calcium meq/L	PE Magnesium meq/L	PE Potassium meq/L	PE Sodium meq/L	SAR
S0910098-021	EM-8-09	0-9	8.7	36.2	2.25	2.3	1.32	0.96	1.56	21.8	20.4
S0910098-022	EM-8-09	9-32	9.3	27.6	3.82	1.1	3.33	1.23	1.42	40.2	26.6
S0910098-023	EM-8-09	32-46	8.8	25.7	3.91	1.2	2.76	0.99	1.10	39.0	28.5
S0910098-024	EM-8-09	46-60	9.3	29.7	8.29	0.9	8.78	2.87	0.72	113	46.7
S0910098-025	EM-8-09	60-70	8.6	25.5	9.77	1.3	8.99	3.18	0.60	129	52.4
S0910098-026	EM-8-09	70-88	7.9	29.5	9.38	1.0	20.3	6.66	0.61	108	29.5
S0910098-027	EM-8-09	88-98	7.4	31.7	4.35	4.3	17.4	4.93	0.43	29.5	8.81
S0910098-028	EM-8-09	98-108	7.7	32.5	5.54	1.2	15.6	3.99	0.34	49.0	15.7
S0910098-029	EM-8-09	108-120	7.5	29.6	5.59	1.8	35.4	8.36	0.44	33.7	7.21
S0910098-030	EM-8-09	120-150	7.5	32.4	6.17	2.1	39.4	11.6	0.48	44.0	8.71

These results apply only to the samples tested.

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Lab ID	Sample ID	Depths cm	Sand %	Silt %	Clay %	Texture	Very Fine Sand %	CO3 %	Nitrogen Nitrate ppm	Phosphorus ppm	Available Potassium meq/100g
S0910098-021	EM-8-09	0-9	79.0	13.0	8.0	Loamy Sand	18.4	8.8	9.0	13.3	0.71
S0910098-022	EM-8-09	9-32	85.0	10.0	5.0	Loamy Sand	31.0	8.9	11.1	10.3	0.40
S0910098-023	EM-8-09	32-46	85.0	9.0	6.0	Loamy Sand	36.7	8.9	8.2	7.63	0.26
S0910098-024	EM-8-09	46-60	85.0	8.0	7.0	Loamy Sand	33.8	5.3	31.4	9.16	0.16
S0910098-025	EM-8-09	60-70	50.0	40.0	10.0	Loam	36.1	8.4	16.5	7.96	0.10
S0910098-026	EM-8-09	70-88	79.0	10.0	11.0	Sandy Loam	26.6	6.3	25.4	7.98	0.14
S0910098-027	EM-8-09	88-98	80.0	8.0	12.0	Sandy Loam	30.2	5.5	4.9	9.83	0.13
S0910098-028	EM-8-09	98-108	77.0	14.0	9.0	Sandy Loam	23.6	6.8	<0.1	9.08	0.13
S0910098-029	EM-8-09	108-120	75.0	13.0	12.0	Sandy Loam	32.0	3.2	<0.1	12.6	0.09
S0910098-030	EM-8-09	120-150	77.0	11.0	12.0	Sandy Loam	27.4	6.0	<0.1	11.6	0.12

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Lab ID	Sample ID	Depths cm	Total Carbon %	TOC %	Neutral. Potential t/1000t
S0910098-021	EM-8-09	0-9	1.6	0.6	88.3
S0910098-022	EM-8-09	9-32	1.2	0.2	89.3
S0910098-023	EM-8-09	32-46	1.4	0.3	89.3
S0910098-024	EM-8-09	46-60	0.8	0.2	52.5
S0910098-025	EM-8-09	60-70	1.1	<0.1	84.0
S0910098-026	EM-8-09	70-88	0.9	0.2	62.9
S0910098-027	EM-8-09	88-98	3.2	2.6	55.0
S0910098-028	EM-8-09	98-108	1.2	0.4	68.0
S0910098-029	EM-8-09	108-120	0.7	0.3	32.4
S0910098-030	EM-8-09	120-150	1.1	0.3	60.4

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
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Report ID: S0910099001

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Date Received: 10/7/2009

Date Reported: 11/10/2009
Work Order: S0910099

Lab ID	Sample ID	Depths cm	pH s.u.	Saturation %	Electrical Conductivity dS/m	Organic Matter %	PE Calcium meq/L	PE Magnesium meq/L	PE Potassium meq/L	PE Sodium meq/L	SAR
S0910099-001	EM-3-09	0-18	7.5	34.8	1.40	1.3	8.26	1.71	1.19	4.45	1.99
S0910099-002	EM-3-09	18-46	7.4	35.7	4.39	1.4	31.9	15.7	0.38	17.9	3.68

These results apply only to the samples tested.

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Lab ID	Sample ID	Depths cm	Sand %	Silt %	Clay %	Texture	Very Fine Sand %	CO3 %
S0910099-001	EM-3-09	0-18	47.0	33.0	20.0	Loam	6.6	13.9
S0910099-002	EM-3-09	18-46	53.0	25.0	22.0	Sandy Clay Loam	6.3	13.4

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Work Order: S0910099

Lab ID	Sample ID	Depths cm	Nitrogen Nitrate ppm	Selenium ppm	Boron ppm	Phosphorus ppm	Available Potassium meq/100g	Total Carbon %	TOC %
S0910099-001	EM-3-09	0-18	10.4	<0.02	0.35	11.7	0.68	2.0	0.4
S0910099-002	EM-3-09	18-46	2.1	<0.02	0.91	4.40	0.31	1.8	0.3

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
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Soil Analysis Report

Long Resource Consultants, Inc.
1960 West Deep Creek Road
Morgan, UT 84050

Report ID: S0910099001

Project: Emery 2 Overburden
Date Received: 10/7/2009

Date Reported: 11/10/2009
Work Order: S0910099

Lab ID	Sample ID	Depths cm	Total Sulfur %	T.S. AB t/1000t	Neutral. Potential t/1000t	T.S. ABP t/1000t
S0910099-001	EM-3-09	0-18	<0.01	<0.01	131	131
S0910099-002	EM-3-09	18-46	0.53	16.4	127	111

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

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Soil Analysis Report

Long Resource Consultants, Inc.
1960 West Deep Creek Road
Morgan, UT 84050

Report ID: S0910332003
(Replaces S0910332002)
Date Reported: 12/17/2009
Work Order: S0910332

Project: Emery 2 Topsoil
Date Received: 10/22/2009

Lab ID	Sample ID	Depths cm	pH s.u.	Saturation %	Electrical Conductivity dS/m	Organic Matter %	PE Calcium meq/L	PE Magnesium meq/L	PE Potassium meq/L	PE Sodium meq/L	SAR
S0910332-001	EM-9-09	0-9	8.4	32.1	1.01	2.0	1.18	0.78	1.46	9.54	9.66
S0910332-002	EM-9-09	9-25	8.6	29.9	2.03	1.0	1.19	0.74	0.93	21.9	22.3
S0910332-003	EM-9-09	25-49	8.4	30.8	13.5	0.7	24.7	19.5	1.04	206	43.7
S0910332-004	EM-9-09	49-75	8.6	31.4	15.9	1.3	24.7	42.4	0.72	273	47.2
S0910332-005	EM-9-09	75-120	8.5	29.5	11.3	1.4	20.6	37.8	0.22	175	32.3
S0910332-006	EM-9-09	120-168	8.6	27.4	8.55	1.9	21.0	24.0	0.17	120	25.2
S0910332-007	EM-10-09	0-7	7.9	32.3	0.64	1.6	4.15	1.44	0.45	2.14	1.28
S0910332-008	EM-10-09	7-27	7.8	32.7	0.50	1.7	2.96	1.23	0.32	1.32	0.91
S0910332-009	EM-10-09	27-45	7.6	32.3	1.97	1.4	27.9	4.97	0.85	1.02	0.25
S0910332-010	EM-11-09	0-8	7.6	29.9	1.55	2.0	7.24	5.01	0.77	6.88	2.78
S0910332-011	EM-12-09	0-15	8.1	34.6	6.54	2.7	7.12	3.02	3.60	79.3	35.2
S0910332-012	EM-12-09	15-35	8.1	33.0	8.97	1.9	24.0	7.67	1.90	139	34.9
S0910332-013	EM-12-09	35-46	8.2	36.2	8.60	1.2	24.8	14.4	1.29	126	28.5
S0910332-014	EM-12-09	46-72	8.3	36.2	8.88	1.2	21.7	27.7	0.84	128	25.8
S0910332-015	EM-12-09	72-102	8.4	36.4	12.1	1.0	16.0	23.3	1.24	157	35.5
S0910332-016	EM-12-09	102-130	8.4	35.2	12.6	1.2	21.0	31.3	1.42	167	32.7
S0910332-017	EM-12-09	130-164	8.3	36.5	9.64	1.3	18.7	24.5	0.76	113	24.3
S0910332-018	EM-13-09	0-10	7.9	34.2	2.44	3.2	27.1	6.37	1.90	3.69	0.90
S0910332-019	EM-13-09	10-40	8.2	41.7	8.64	4.3	20.1	33.8	2.24	82.6	15.9

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate

Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential

Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

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Soil Analysis Report

Long Resource Consultants, Inc.
1960 West Deep Creek Road
Morgan, UT 84050

Report ID: S0910332003
(Replaces S0910332002)
Date Reported: 12/17/2009
Work Order: S0910332

Project: Emery 2 Topsoil
Date Received: 10/22/2009

Lab ID	Sample ID	Depths cm	Sand %	Silt %	Clay %	Texture	Very Fine Sand %	CO3 %	Nitrogen Nitrate ppm	Available Phosphorus ppm
S0910332-001	EM-9-09	0-9	64.0	30.0	6.0	Sandy Loam	13.3	12.6	5.5	18.8
S0910332-002	EM-9-09	9-25	70.0	21.0	9.0	Sandy Loam	16.8	12.0	13.7	6.70
S0910332-003	EM-9-09	25-49	76.0	16.0	8.0	Sandy Loam	19.4	12.9	7.3	6.34
S0910332-004	EM-9-09	49-75	68.0	22.0	10.0	Sandy Loam	16.3	11.7	1.4	6.78
S0910332-005	EM-9-09	75-120	76.0	14.0	10.0	Sandy Loam	18.3	12.2	1.5	4.51
S0910332-006	EM-9-09	120-168	74.0	18.0	8.0	Sandy Loam	16.2	23.2	1.4	4.57
S0910332-007	EM-10-09	0-7	84.0	8.0	8.0	Loamy Sand	32.2	13.5	6.2	10.8
S0910332-008	EM-10-09	7-27	70.0	20.0	10.0	Sandy Loam	18.2	22.2	3.2	5.06
S0910332-009	EM-10-09	27-45	76.0	16.0	8.0	Sandy Loam	18.7	18.7	8.3	8.72
S0910332-010	EM-11-09	0-8	70.0	14.0	16.0	Sandy Loam	18.0	20.5	12.4	7.28
S0910332-011	EM-12-09	0-15	48.0	38.0	14.0	Loam	4.0	17.5	83.8	13.1
S0910332-012	EM-12-09	15-35	54.0	30.0	16.0	Sandy Loam	12.9	18.7	49.1	4.88
S0910332-013	EM-12-09	35-46	64.0	25.0	11.0	Sandy Loam	7.4	14.3	43.6	4.16
S0910332-014	EM-12-09	46-72	46.0	38.0	16.0	Loam	4.5	16.1	52.9	4.34
S0910332-015	EM-12-09	72-102	54.0	34.0	12.0	Sandy Loam	3.0	14.6	37.6	3.86
S0910332-016	EM-12-09	102-130	54.0	34.0	12.0	Sandy Loam	6.0	15.2	24.1	3.51
S0910332-017	EM-12-09	130-164	54.0	30.0	16.0	Sandy Loam	5.5	14.8	23.1	3.73
S0910332-018	EM-13-09	0-10	32.0	41.0	27.0	Clay Loam	12.3	33.6	14.9	4.74
S0910332-019	EM-13-09	10-40	18.0	50.0	32.0	Silty Clay Loam	3.1	16.5	57.7	2.33

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

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Soil Analysis Report

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1960 West Deep Creek Road
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Report ID: S0910332003
(Replaces S0910332002)
Date Reported: 12/17/2009
Work Order: S0910332

Project: Emery 2 Topsoil
Date Received: 10/22/2009

Lab ID	Sample ID	Depths cm	CEC meq/100g	Available Potassium meq/100g	Available Sodium meq/100g	Exchangeable Sodium meq/100g	ESP %	Total Carbon %	TOC %	Neutral. Potential t/1000t
S0910332-001	EM-9-09	0-9	5.86	0.74	0.74	0.43	7.41	1.9	0.4	123
S0910332-002	EM-9-09	9-25	6.06	0.75	1.97	1.31	21.6	1.5	0.1	116
S0910332-003	EM-9-09	25-49	6.04	0.23	7.94	1.61	26.7	1.5	<0.1	119
S0910332-004	EM-9-09	49-75	5.30	0.17	10.4	1.76	33.3	1.4	0.1	106
S0910332-005	EM-9-09	75-120	5.14	0.10	7.16	2.00	38.8	1.6	<0.1	125
S0910332-006	EM-9-09	120-168	4.86	0.09	4.69	1.41	29.1	3.2	<0.1	257
S0910332-007	EM-10-09	0-7		0.29				2.2	0.4	148
S0910332-008	EM-10-09	7-27		0.23				3.1	0.4	221
S0910332-009	EM-10-09	27-45		0.26				2.6	0.4	181
S0910332-010	EM-11-09	0-8		0.57				2.8	0.3	205
S0910332-011	EM-12-09	0-15	14.1	1.19	5.41	2.67	18.9	2.5	0.6	160
S0910332-012	EM-12-09	15-35	10.2	0.44	6.66	2.07	20.3	2.4	0.3	178
S0910332-013	EM-12-09	35-46	6.50	0.26	6.19	1.61	24.8	2.0	0.3	140
S0910332-014	EM-12-09	46-72	8.78	0.36	9.90	5.26	59.9	2.3	0.4	160
S0910332-015	EM-12-09	72-102	8.58	0.35	9.14	3.78	40.0	2.0	0.2	145
S0910332-016	EM-12-09	102-130	8.66	0.30	7.45	0.49	18.1	2.0	0.1	155
S0910332-017	EM-12-09	130-164	10.3	0.31	6.68	2.55	24.9	1.9	<0.1	156
S0910332-018	EM-13-09	0-10	12.5	0.61	0.24	0.10	0.87	4.0	0.1	326
S0910332-019	EM-13-09	10-40	19.2	0.89	6.36	3.45	15.2	2.1	0.2	164

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate

Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential

Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
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Soil Analysis Report

Long Resource Consultants, Inc.
1960 West Deep Creek Road
Morgan, UT 84050

Report ID: S0912073001

Project: Emery 2 Topsoil
Date Received: 12/4/2009

Date Reported: 12/17/2009
Work Order: S0912073

Lab ID	Sample ID	Depths cm	pH s.u.	Saturation %	Electrical Conductivity dS/m	Organic Matter %	PE Calcium meq/L	PE Magnesium meq/L	PE Potassium meq/L	PE Sodium meq/L	SAR
S0912073-001	EM-16-09	0-8	7.7	28.4	1.01	1.5	4.67	1.02	0.82	2.93	1.74
S0912073-002	EM-16-09	8-21	7.6	34.4	0.43	1.1	2.98	1.05	0.50	1.20	0.84
S0912073-003	EM-16-09	21-46	7.5	29.9	0.43	1.2	2.33	0.75	0.37	0.42	0.34
S0912073-004	EM-16-09	46-80	7.5	32.1	0.45	1.2	2.63	0.98	0.20	0.41	0.30
S0912073-005	EM-16-09	80-122	7.7	30.2	5.89	1.0	32.6	26.4	0.14	29.6	5.44
S0912073-006	EM-16-09	122-170	8.0	28.3	9.60	0.8	31.7	45.0	0.18	65.5	10.6

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

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Soil Analysis Report

Long Resource Consultants, Inc.
1960 West Deep Creek Road
Morgan, UT 84050

Report ID: S0912073001

Project: Emery 2 Topsoil
Date Received: 12/4/2009

Date Reported: 12/17/2009
Work Order: S0912073

Lab ID	Sample ID	Depths cm	Sand %	Silt %	Clay %	Texture	Very Fine Sand %	CO3 %	Nitrogen Nitrate ppm	Available Phosphorus ppm
S0912073-001	EM-16-09	0-8	64.0	28.0	8.0	Sandy Loam	11.6	13.4	14.4	9.89
S0912073-002	EM-16-09	8-21	68.0	24.0	8.0	Sandy Loam	10.3	11.4	<0.1	6.18
S0912073-003	EM-16-09	21-46	58.0	33.0	9.0	Sandy Loam	12.9	11.6	1.0	3.60
S0912073-004	EM-16-09	46-80	60.0	28.0	12.0	Sandy Loam	13.8	13.0	0.3	4.40
S0912073-005	EM-16-09	80-122	70.0	22.0	8.0	Sandy Loam	17.2	12.9	0.6	3.43
S0912073-006	EM-16-09	122-170	68.0	24.0	8.0	Sandy Loam	23.7	12.3	7.6	3.54

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

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Soil Analysis Report

Long Resource Consultants, Inc.
1960 West Deep Creek Road
Morgan, UT 84050

Report ID: S0912073001

Project: Emery 2 Topsoil
Date Received: 12/4/2009

Date Reported: 12/17/2009
Work Order: S0912073

Lab ID	Sample ID	Depths cm	CEC meq/100g	Available Potassium meq/100g	Available Sodium meq/100g	Exchangeable Sodium meq/100g	ESP %	Total Carbon %	TOC %	Neutral. Potential t/1000t
S0912073-001	EM-16-09	0-8	6.04	0.49	0.18	0.09	1.55	1.5	<0.1	134
S0912073-002	EM-16-09	8-21	6.30	0.36	0.10	0.06	0.98	1.5	0.1	114
S0912073-003	EM-16-09	21-46	6.16	0.37	0.03	0.02	0.33	1.3	<0.1	108
S0912073-004	EM-16-09	46-80	6.52	0.27	0.04	0.02	0.34	1.6	0.1	122
S0912073-005	EM-16-09	80-122	6.24	0.11	1.23	0.34	5.46	1.7	<0.1	130
S0912073-006	EM-16-09	122-170	6.24	0.12	2.87	1.01	16.2	1.4	<0.1	120

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

Appendix D

Site and Profile Photos

Photo D - 1. EM-1-09 soil profile of Begay family soils in map unit Ba with Wyoming big sage, black greasewood, and shadscale vegetation. Soil is moderately deep (Ferron sandstone at 80 cm) with coarse-loamy textural family. 1

Photo D - 2. EM-2-09 soil profile location of Hideout soils in map unit A. Vegetation includes scattered pinyon pine, Utah juniper, Utah Mormon tea, and Utah serviceberry. Depth to Ferron sandstone is 19 cm. 2

Photo D - 3. EM-3-09 soil profile location of Disturbed Land in map unit Bd. Depth to hard Mancos shale is 46 cm. Vegetation is limited to shadscale and black greasewood..... 3

Photo D - 4. EM-4-09 soil profile location of Hideout soil in map unit A. hideout soils are coarse-loamy. The surface is covered with 5 percent channers. Depth to Ferron sandstone is 20 cm. Vegetation is Utah juniper, pinyon pine, Birchleaf mahogany, and Utah serviceberry. 4

Photo D - 5. EM-5-09 soil profile location of Lazear soil on plateau in map unit Ba. Lazear soils are fine-loamy. Surface is covered with 10 percent gravels and 5 percent channers. Depth to Ferron sandstone is 20 cm. Vegetation is shadscale and black sage. Map unit A is in background with pinyon pine and Utah juniper. 5

Photo D - 6. EM-6-09 soil profile location of Persayo family soil on a very steep canyon sideslope (78 percent) in map unit Ca. The Persayo family soils in this map unit are coarse-loamy, compared to fine-loamy for the Persayo series. Depth to Mancos shale is 34 cm. Dominant vegetation is shadscale and Gardners saltbush. 6

Photo D - 7. EM-7-09 soil profile location of Green River soil in coarse-loamy alluvium in floodplain along Quitchapah Creek. This soil profile showed three distinct periods of deposition. The most recent deposition appeared to have been deposited during flooding on September 16, 2009. Distinct and prominent soil mottles were observed from 28 to 56 cm below the new surface. Dominant vegetation is tamarisk. 7

Photo D - 8. EM-8-09 soil profile location of Garley soil on cutbank in map unit Ca near northeast end of canyon. Surface is covered with 3 percent cobbles, 2 percent channers, and a few very large boulders (car to house size). SAR levels are unacceptable for use as topsoil from 0 to 88 cm and from 98 to 108 cm based on Utah DOGM Topsoil Guidelines (Utah DOGM 2005). Vegetation is dominated by black greasewood, shadscale, with small inclusions of rabbitbrush, black sage, and Indian ricegrass. 8

Photo D - 9. EM-9-09 soil profile of Garley soil in alluvial toeslope in map unit Cb. Soil is coarse-loamy with unacceptable SAR levels from 8 to 168 cm (Utah DOGM 2005). Surface is covered with 3 percent gravels, 2 percent channers, 1 percent flagstones, and a few very large boulders (car to house size). Dominant vegetation is black greasewood and shadscale with scattered clumps of Indian ricegrass. 9

Photo D - 10. EM-10-09 soil profile location of Braf soil in map unit D. Surface is covered with 6 percent gravel, 4 percent channers, 1 percent stones, and 1 percent flagstones. Ferron sandstone is at 45 cm. Vegetation is dominated by shadscale, black sage, Indian ricegrass, and prickly pear cactus. Area slopes to the northwest at 2 to 8 percent. 10

Photo D - 11. EM-11-09 soil profile location of Braf soil in map unit E. Area slopes to the northwest on broken slopes of 6 to 15 percent. Surface is covered with 10 percent channers and 5 percent gravels. This map unit is dominated by Ferron sandstone outcrops, visible in lower right corner of photo. Dominant vegetation is shadscale, black sage, Indian ricegrass, and prickly pear cactus. 11

Photo D - 12. EM-12-09 soil profile location of Garley, moderately well drained, soil on stream terrace above Quitchapah Creek in map unit G. Garley, moderately well drained, soils are coarse-loamy. SAR levels are unacceptable (SAR greater than 24) for use as topsoil from 0 to 164 cm (Utah DOGM 2005). This area is dominated by black greasewood and bare soils. 12

Photo D - 13. EM-13-09 soil profile location of Persayo soils on a very steep south facing slope in map unit F. Surface is covered with 40 percent gravels and 20 percent channers. Mancos shale is at 40 cm. Vegetation is limited to widely scattered shadscale. 13

Photo D - 14. EM-14-09 soil profile location of Braf soil in map unit D. Surface is covered with 15 percent channers and 10 percent gravels. Depth to Ferron sandstone is 48 cm. Vegetation is dominated by shadscale and scattered grasses. Dozer push piles in map unit Bd are visible (center left) on plateau southeast side of canyon (sandstone outcrop is upper portion of canyon sideslope). 14

Photo D - 15. EM-15-09 soil profile location of Persayo soil in map unit F. Surface is covered with 30 percent channers and 5 percent gravels. Depth to Mancos shale is 48 cm. This ridge slopes to the northeast at 12 percent. Vegetation is dominated by shadscale. Garley (map unit G) and Green River (map unit H) soils can be seen in the alluvial stream terrace and floodplain along Quitchapah Creek. 15

Photo D - 16. EM-16-09 soil profile location of Monue family soil in map unit Cb. Soil has developed from eolian deposits derived from the nearby Ferron sandstone. Surface is covered with 8 percent gravels and 3 percent channers. Vegetation is dominated by black greasewood and Indian ricegrass. The setting and vegetation for the Monue family soil is similar to the Garley soil in map unit Cb, but SAR and salinity do not become limiting in the Monue family soil until 80 cm. Monue family soils appear to have more Indian ricegrass cover than Garley soils (EM-8 and EM-9). The break between map units Ca (rock outcrop and steep shale slopes) and Cb is at the base of the Ferron sandstone outcrop. Map unit D (Farb soils) is located on the plateau above the canyon rim. 16

Photo D - 17. EM-17-09 soil profile location of Hideout soil on northwest facing structural bench in map unit Ca. Surface is covered with 35 percent channers, 10 percent flags, and 1 percent boulders. Soil is corase-loamy with Ferron sandstone is at 19 cm. Pinyon pine and Utah juniper dominate this area with scattered Wyoming big sage and utah serviceberry. 17

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Photo D - 3. EM-3-09 soil profile location of Disturbed Land in map unit Bd. Depth to hard Mancos shale is 46 cm. Vegetation is limited to shadscale and black greasewood.

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Photo D - 6. EM-6-09 soil profile location of Persayo family soil on a very steep canyon sideslope (78 percent) in map unit Ca. The Persayo family soils in this map unit are coarse-loamy, compared to fine-loamy for the Persayo series. Depth to Mancos shale is 34 cm. Dominant vegetation is shadscale and Gardners saltbush.

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Photo D - 8. EM-8-09 soil profile location of Garley soil on cutbank in map unit Ca near northeast end of canyon. Surface is covered with 3 percent cobbles, 2 percent channers, and a few very large boulders (car to house size). SAR levels are unacceptable for use as topsoil from 0 to 88 cm and from 98 to 108 cm based on Utah DOGM Topsoil Guidelines (Utah DOGM 2005). Vegetation is dominated by black greasewood, shadscale, with small inclusions of rabbitbrush, black sage, and Indian ricegrass.

Photo D - 9. EM-9-09 soil profile of Garley soil in alluvial toeslope in map unit Cb. Soil is coarse-loamy with unacceptable SAR levels from 8 to 168 cm (Utah DOGM 2005). Surface is covered with 3 percent gravels, 2 percent channers, 1 percent flagstones, and a few very large boulders (car to house size). Dominant vegetation is black greasewood and shadscale with scattered clumps of Indian ricegrass.

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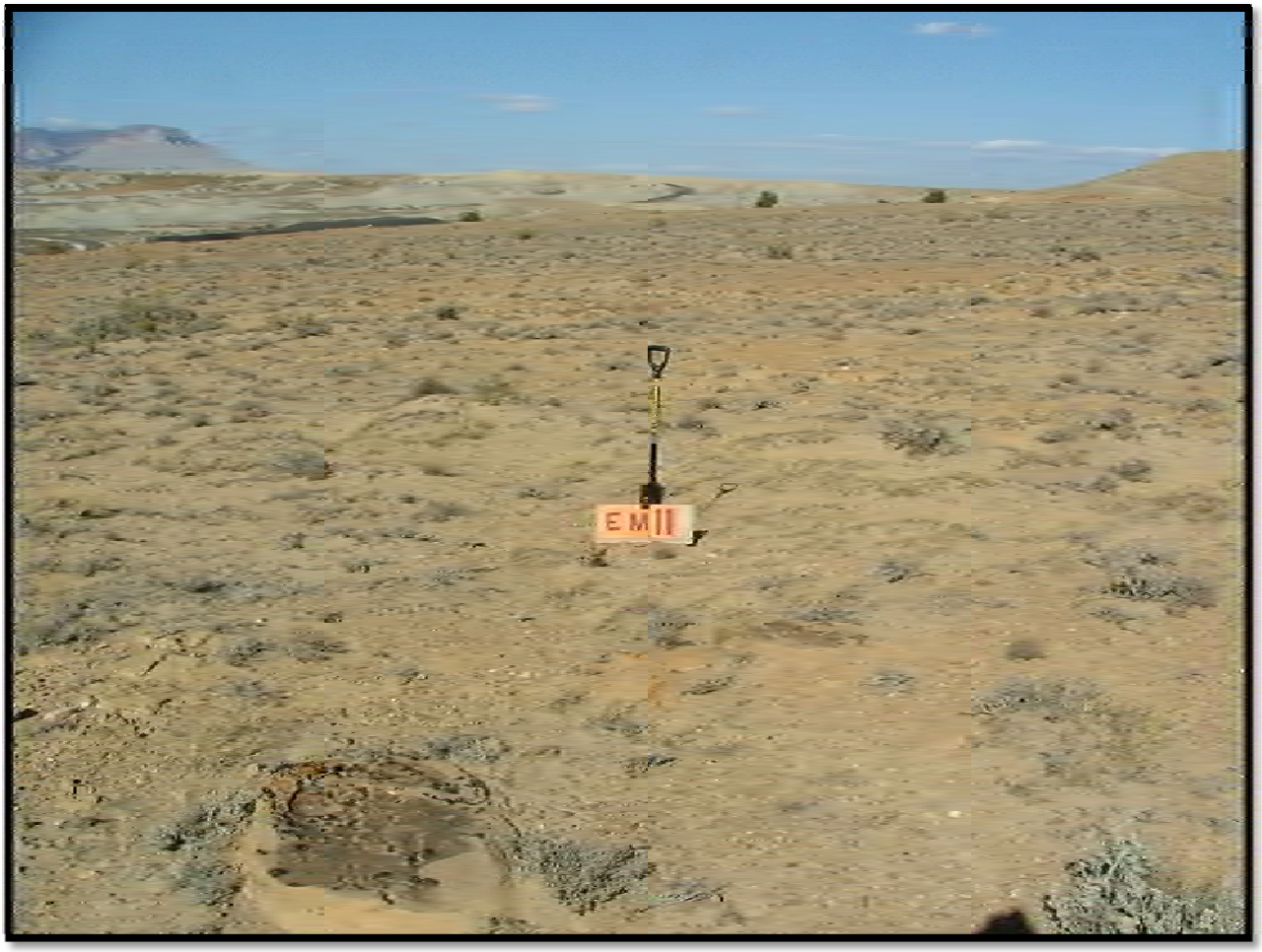

Photo D - 11. EM-11-09 soil profile location of Braf soil in map unit E. Area slopes to the northwest on broken slopes of 6 to 15 percent. Surface is covered with 10 percent channers and 5 percent gravels. This map unit is dominated by Ferron sandstone outcrops, visible in lower right corner of photo. Dominant vegetation is shadscale, black sage, Indian ricegrass, and prickly pear cactus.

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Photo D - 15. EM-15-09 soil profile location of Persayo soil in map unit F. Surface is covered with 30 percent channers and 5 percent gravels. Depth to Mancos shale is 48 cm. This ridge slopes to the northeast at 12 percent. Vegetation is dominated by shadscale. Garley (map unit G) and Green River (map unit H) soils can be seen in the alluvial stream terrace and floodplain along Quitchapah Creek.

Photo D - 16. EM-16-09 soil profile location of Monue family soil in map unit Cb. Soil has developed from eolian deposits derived from the nearby Ferron sandstone. Surface is covered with 8 percent gravels and 3 percent channers. Vegetation is dominated by black greasewood and Indian ricegrass. The setting and vegetation for the Monue family soil is similar to the Garley soil in map unit Cb, but SAR and salinity do not become limiting in the Monue family soil until 80 cm. Monue family soils appear to have more Indian ricegrass cover than Garley soils (EM-8 and EM-9). The break between map units Ca (rock outcrop and steep shale slopes) and Cb is at the base of the Ferron sandstone outcrop. Map unit D (Farb soils) is located on the plateau above the canyon rim.

Photo D - 17. EM-17-09 soil profile location of Hideout soil on northwest facing structural bench in map unit Ca. Surface is covered with 35 percent channers, 10 percent flags, and 1 percent boulders. Soil is corase-loamy with Ferron sandstone is at 19 cm. Pinyon pine and Utah juniper dominate this area with scattered Wyoming big sage and utah serviceberry.

Photo D - 18. EM-01-16 soil profile location of Monue family soil in map unit Cb. Black greasewood is the dominant vegetation in the bottom of the canyon.

Photo D - 19. EM-02-16 soil profile location of Hideout soil on structural bench in canyon, map unit Ca. Pinyon pine and Utah juniper are the dominant vegetation. Surface is covered with channers and flags. Large boulders have fallen from the cliffs above the bench.

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EM-1-09 - Begay family

Ustic Haplocambids, coarse-loamy, mixed, superactive, mesic

A 0-8 cm (0-3 inches)

Bw1 8-23 cm (3-9 inches)

Bw2 23-50 cm (9-20 inches)

Bk 50-80 cm (20-32 inches)

R 80 cm (32 inches)

EM-2-09 - Hideout

Lithic Ustic Torriorthents, loamy, mixed, superactive, calcareous, mesic

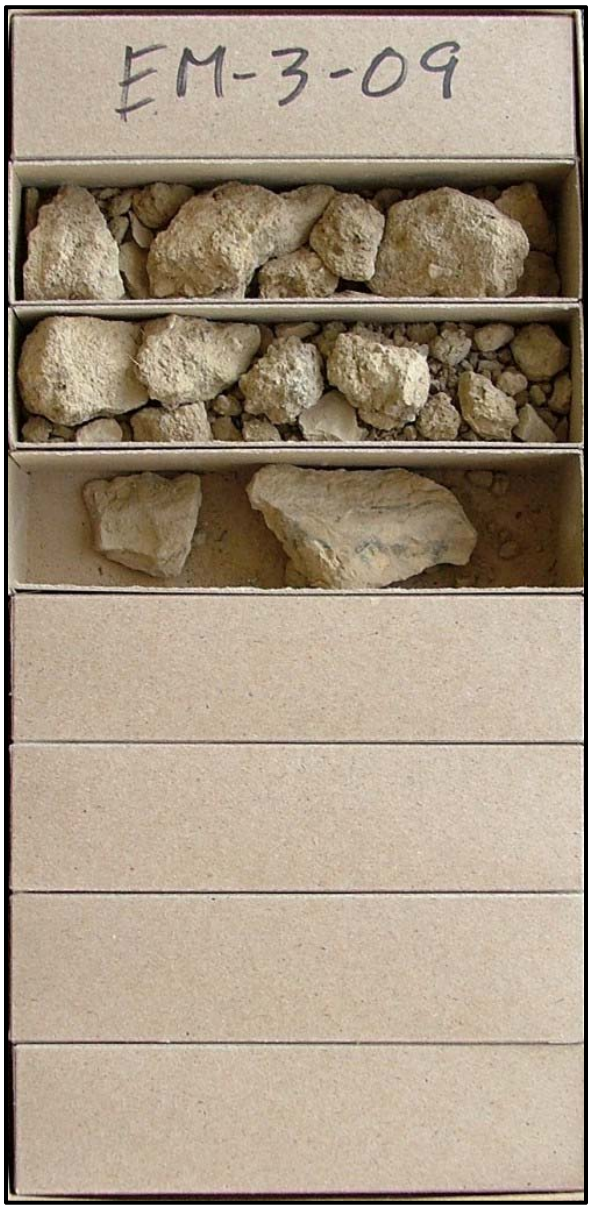
A 0-5 cm (0-2 inches)

C 5-19 cm (2-7 inches)

R 19 cm (7 inches)

EM-3-09 - Disturbed Land

Lithic Ustic Torriorthents, loamy, mixed, superactive, calcareous, mesic



A 0-18 cm (0-7 inches)

C 18-46 cm (7-18 inches)

R 46 cm (18 inches)

EM-4-09 - Hideout

Lithic Ustic torriorthents, loamy, mixed, superactive, calcareous, mesic

A 0-6 cm (0-2 inches)

C 6-20 cm (2-8 inches)

R 20 cm (8 inches)

EM-5-09 - Lazear

Lithic Ustic Torriorthents, loamy, mixed, superactive, calcareous, mesic

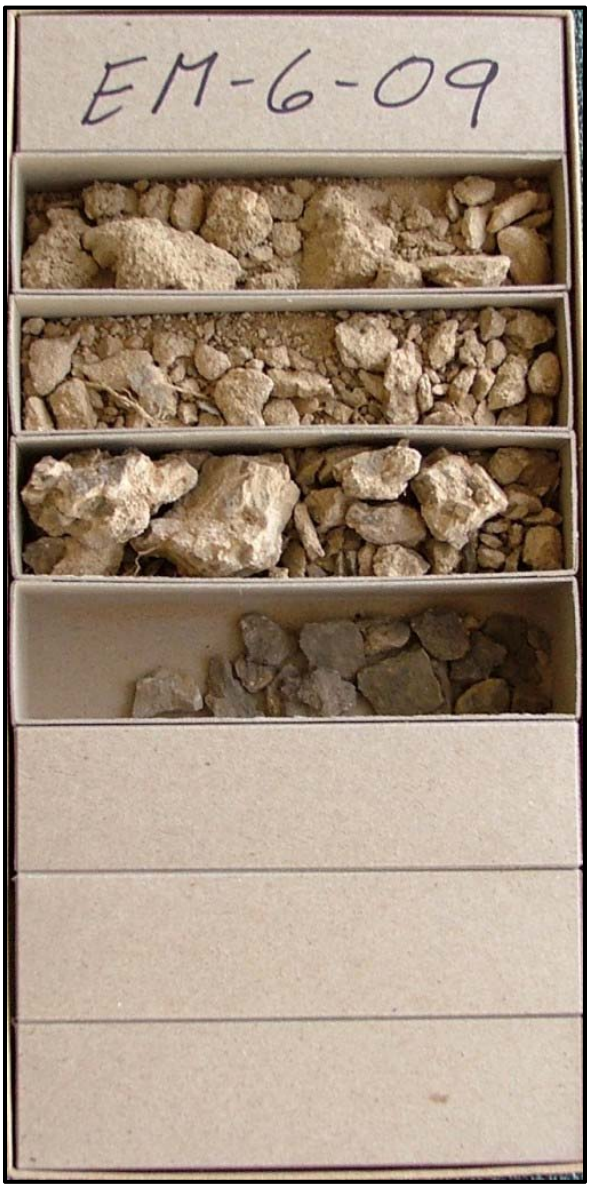
A 0-7 cm (0-3 inches)

C 7-20 cm (3-8 inches)

R 20 cm (8 inches)

EM-6-09 - Persayo family

Typic Torriorthents, loamy, mixed active, calcareous, shallow, mesic



A 0-7 cm (0-3 inches)

2C 7-18 cm (3-7 inches)

Cr1 18-34 cm (7-13 inches)

Cr2 34-38+ cm (13-15+ inches)

EM-7-09 - Green River

Oxyaquic Torrifluvents, coarse-loamy, mixed, calcareous, superactive, mesic

A 0-15 cm (0-6 inches)

2A 15-28 cm (6-11 inches)

2C 28-43 cm (11-17 inches)

3A 43-56 cm (17-22 inches)

3C1 56-78 cm (22-31 inches)

3C2 78-102 cm (31-40 inches)

3C3 102-130 cm (40-51 inches)

3C4 130-150 cm (51-59 inches)

EM-8-09 - Garley

Typic Torrifluvents, coarse-loamy, mixed, calcareous, active, mesic

A 0-9 cm (0-4 inches)

C1 9-32 cm (4-13 inches)

C2 32-46 cm (13-18 inches)

Ab1 46-60 cm (18-24 inches)

C3 60-70 cm (24-28 inches)

C4 70-88 cm (28-35 inches)

Ab2 88-98 cm (35-39 inches)

C5 98-108 cm (39-43 inches)

C6 108-120 cm (43-47 inches)

C7 120-150 (47-59 inches)

EM-9-09 - Garley

Typic Torrifluvents, coarse-loamy, mixed, calcareous, active, mesic

A 0-9 cm (0-4 inches)

AC 9-25 cm (4-10 inches)

C1 25-49 cm (10-19 inches)

C2 49-75 cm (19-30 inches)

C3 75-120 cm (30-47 inches)

2Bk 120-168 cm (47-66 inches)

EM-10-09 - Braf

Lithic Torriorthents, loamy, mixed, superactive, calcareous, mesic

A 0-7 cm (0-3 inches0

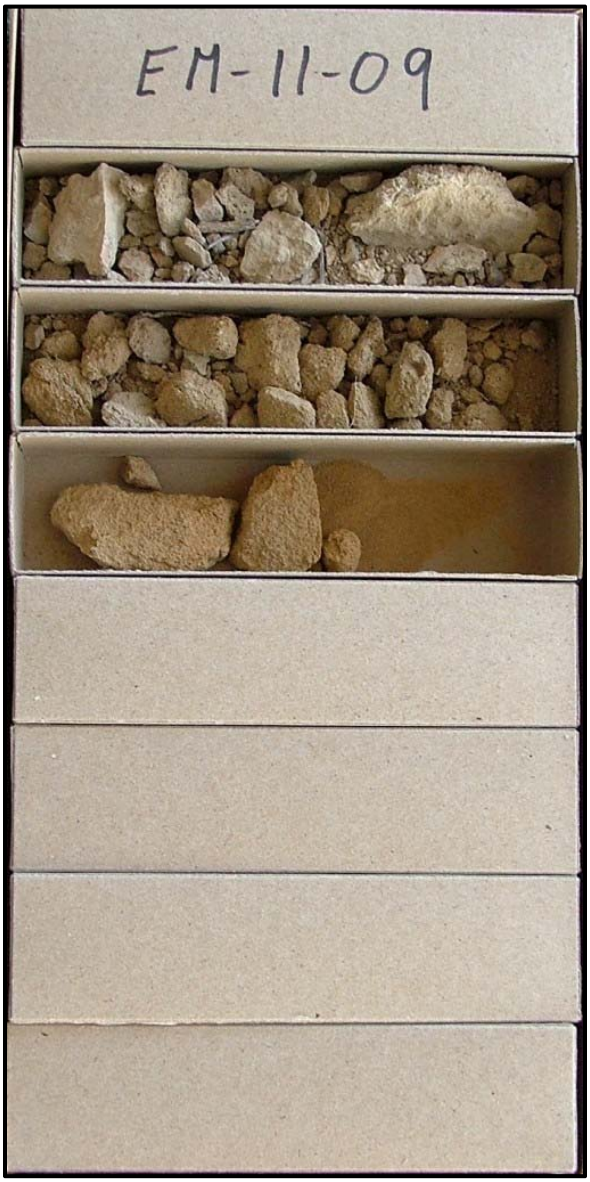
C1 7-27 cm (3-11 inches)

C2 27-45 cm (11-18 inches)

R 45 cm (18 inches)

EM-11-09 - Braf

Lithic Torriorthents, loamy, mixed, superactive, calcareous, mesic



A 0-3 cm (0-1 inches)

C 3-8 cm (1-3 inches)

R 8 cm (3 inches)

EM-12-09 - Garley, moderately well drained

Typic Torrifluvents, coarse-loamy, mixed, calcareous, active, mesic

A 0-15 cm (0-6 inches)

C1 15-35 cm (6-14 inches)

C2 35-46 cm (14-18 inches)

C3 46-72 cm (18-28 inches)

Ab 72-102 cm (28-40 inches)

C4 102-130 cm (40-51 inches)

C5 130-164 cm (51-65 inches)

EM-13-09 - Persayo

Typic Torriorthents, loamy, mixed, active, calcareous, mesic, shallow

A 0-10 cm (0-4 inches)

C 10-40 cm (4-16 inches)

Cr 40 cm (16 inches)

EM-14-09 - Braf

Lithic Torriorthents, loamy, mixed, superactive, calcareous, mesic

A 0-12 cm (0-5 inches)

C1 12-38 cm (5-15 inches)

C2 38-48 cm (15-19 inches)

Cr 48 cm (19 inches)
– no sandstone sample

EM-15-09 - Persayo

Typic Torriorthents, loamy, mixed, active, calcareous, mesic, shallow

A 0-17 cm (0-7 inches)

C 17-48 cm (7-19 inches)

R 48 cm (19 inches)

EM-16-09 - Monue family

Typic Haplocambids, coarse-loamy, mixed, superactive, mesic

A 0-8 cm (0-3 inches)

Bw1 8-21 cm (3-8 inches)

Bw2 21-46 cm (8-18 inches)

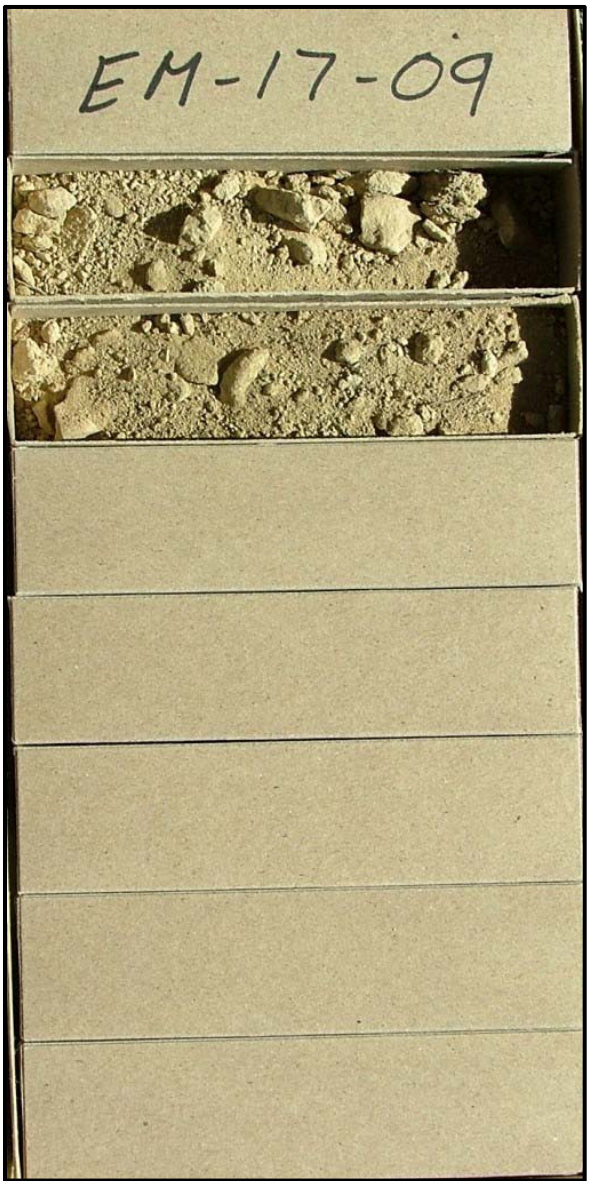
C1 46-80 cm (18-32 inches)

C2 80-122 cm (32-48 inches)

2C 122-170 cm (48-67 inches)

EM-17-09 - Hideout

Lithic Ustic Torriorthents, loamy, mixed, superactive, calcareous, mesic



A 0-4 cm (0-2 inches)

C 4-19 cm (2-7 inches)

Cr 19 cm (7 inches)
– no sandstone sample

EM-1-16

No box sample was collected.

EM-2-16

No box sample was collected.

Appendix F

Map Unit Salvage Depth Estimates

Table F - 1. Estimated topsoil and subsoil salvage depths for Emery 2 map units based on representative soil profiles as listed in the *Major Soil Types* section of Emery 2 Soil Survey Report.

Map Unit	Percent	Soil Series or Family	Topsoil Salvage Depth[1]	Weighted Topsoil Depth[2]	Total Weighted Topsoil Depth[3]	Subsoil Salvage Depth[4]	Weighted Subsoil Depth[5]	Total Weighted Subsoil Depth[6]	Total Weighted Topsoil Depth[7]	Total Weighted Subsoil Depth[8]	Total Weighted Salvage Depth[9]
			cm	cm	cm	cm	cm	cm	inches	inches	inches
A	**Rock Outcrop - Hideout complex, 3 to 8 percent slopes**										
	50	Sandstone outcrop	0	0.0		0	0.0				
	45	Braf	27	12.2		18	8.1				
	5	Persayo family	18	0.9		0	0.0				
					13			8	5	3	8
Ba	**Begay family - Lazear complex, 3 to 12 percent slopes**										
	50	Begay family	23	11.5		57	28.5				
	35	Lazear	20	7.0		0	0.0				
	10	Hideout	20	2.0		0	0.0				
	5	Sandstone outcrop	0	0.0		0	0.0				
					21			29	8	11	19
Bd	**Disturbed landscape, 3 to 15 percent slopes**										
	85	Disturbed soils	18	15.3		28	23.8				
	10	Begay family	23	2.3		57	5.7				
	5	Hideout	20	1.0		0	0.0				
					21			29	8	11	19
Ca	**Persayo family - Hideout - Rock Outcrop complex, 3 to 80 percent slopes**										
	50	Persayo family	18	9.0		0	0.0				
	20	Hideout	20	4.0		0	0.0				
	15	Sandstone Outcrop	0	0.0		0	0.0				
	8	Garley	9	0.7		0	0.0				
	7	Monue Family	46	3.2		76	5.3				
					17			5	7	2	9

Map Unit	Percent	Soil Series or Family	Topsoil Salvage Depth[1]	Weighted Topsoil Depth[2]	Total Weighted Topsoil Depth[3]	Subsoil Salvage Depth[4]	Weighted Subsoil Depth[5]	Total Weighted Subsoil Depth[6]	Total Weighted Topsoil Depth[7]	Total Weighted Subsoil Depth[8]	Total Weighted Salvage Depth[9]
			cm	cm	cm	cm	cm	cm	inches	inches	inches
Cb	**Monue family - Garley complex, 3 to 12 percent slopes**										
	60	Monue Family	46	27.6		76	45.6				
	30	Garley	9	2.7		0	0.0				
	10	Braf	27	2.7		18	1.8				
					33			47	13	19	32
D	**Braf sandy loam, 2 to 8 percent slopes**										
	85	Braf	27	23.0		18	15.3				
	10	Sandstone Outcrop	0	0.0		0	0.0				
	5	Persayo family	18	0.9		0	0.0				
					24			15	9	6	15
E	**Rock Outcrop - Braf complex, 6 to 15 percent slopes**										
	50	Sandstone outcrop	0	0.0		0	0.0				
	45	Braf	27	12.2		18	8.1				
	5	Persayo family	18	0.9		0	0.0				
					13			8	5	3	8
F	**Persayo very gravelly sandy loam, 15 to 45 percent slopes**										
	85	Persayo	10	8.5		30	25.5				
	10	Braf	27	2.7		18	1.8				
	5	Sandstone outcrop	0	0.0		0	0.0				
					11			27	4	11	15

Map Unit	Percent	Soil Series or Family	Topsoil Salvage Depth[1]	Weighted Topsoil Depth[2]	Total Weighted Topsoil Depth[3]	Subsoil Salvage Depth[4]	Weighted Subsoil Depth[5]	Total Weighted Subsoil Depth[6]	Total Weighted Topsoil Depth[7]	Total Weighted Subsoil Depth[8]	Total Weighted Salvage Depth[9]
			cm	cm	cm	cm	cm	cm	inches	inches	inches
G	**Garley fine sandy loam, 2 to 5 percent slopes**										
	85	Garley, mod well drain	0	0.0		0	0.0				
	10	Green River	15	1.5		135	13.5				
	5	Braf	27	1.4		18	0.9				
					3			14	1	6	7
H	**Green River, 1 to 2 percent slopes**										
	90	Green River	15	13.5		135	121.5				
	10	Garley, mod well drain	0	0.0		0	0.0				
					14			122	5	48	53

1. Topsoil salvage depth based on physical and chemical characteristics of the representative soil profile from Table 17.
2. Weighted topsoil depth is the product of multiplying the topsoil salvage depth by the component percent.
3. Total weighted topsoil depth is the sum of weighted topsoil depths for map unit.
4. Subsoil salvage depth based on physical and chemical characteristics of the representative soil profile from Table 17.
5. Weighted subsoil depth is the product of multiplying the subsoil salvage depth by the component percent.
6. Total weighted subsoil depth is the sum of weighted subsoil depths for map unit.
7. Total weighted topsoil depth for map unit converted to inches.
8. Total weighted subsoil depth for map unit converted to inches.
9. Sum of weighted topsoil depths for map unit (total estimated depth of topsoil and subsoil salvage).

CHAPTER VIII

VEGETATION

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Revised 05/2007
Revised 1/09
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VIII-3 Vegetation of the 4th East, 6th West, & 14th/15th West Areas Report: Mt. Nebo Scientific, April 2007 (includes T&E and sensitive species)

VIII-4 Biological Resources of the Full Extraction Pillar Splitting, Life of Mine Surface Area Report Mt. Nebo Scientific, November 2008

VIII-5 Biological Resources of the Zero Zero North Area, Mt. Nebo Scientific, June 2009

VIII-6 Biological Resources of the Zero Zero North LBA UTU-86038, Mt Nebo Scientific, Nov 2008 Plant Communities, Threatened, Endangered & Sensitive Species study, Burrowing Owl Survey, Prairie Dog Survey

VIII-7 Biological Resources of the Zero Zero North Wedge Mt. Nebo Scientific March 9, 2010

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Revised 05/2007
Revised 1/09
Revised 6/09
Revised 9/09
Revised 4/10
Revised 7/2016

CHAPTER VIII, APPENDIX VIII-8
Vegetation and Sensitive Species of the Emery 2 Area

Inserted 7/2016

VEGETATION AND SENSITIVE SPECIES OF THE EMERY 2 AREA

AT THE
EMERY MINE, UTAH

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July 2016

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Introduction

Bronco Utah Operations has proposed to develop underground coal mining at the Emery Mine site. The new mining will occur south of previous operations into what is called the Emery 2 Area. The Emery Mine is located in south-central Utah, about 4 air miles south of the town of Emery. The new Emery 2 Area is shown on the USGS Walker Flat Quadrangle 7.5 series topographic map (Figure 1). Coal for the Emery Mine lies within the Ferron Sandstone member in the cretaceous beds of the Mancos Shale Formation. Much of the surface area of the mine site is located on the Blue Gate Shale Member of that same formation. The Emery 2 study area is situated in the salt deserts of Utah and is dominated by a Shadscale plant community. The study area lies between the Wasatch Plateau to the west and the San Rafael Swell to the east and has an average elevation of approximately 6,000 ft above sea level.

Onsite field studies in the Emery 2 study area were conducted in 2009, 2010 and 2016. In 2009 and 2010, the permit area was much larger than what is proposed at the present time. Although the size of *permit area* was decreased in 2016, the *study area* for vegetation and sensitive species remained the same as the earlier boundary. Although this report focuses more on the 2016 permit area, because results were available for a larger area from earlier studies, additional information has been included in this report to provide greater detail for vegetation and wildlife habitats adjacent to the new Emery 2 Area.

Plant communities that could be impacted by proposed new surface disturbances have been quantitatively sampled along with reference areas chosen to represent future revegetation success standards at the time of final reclamation. Initial sampling was conducted in 2009 and 2010 when the previous owners, Consolidation Coal Company (Consol Energy), were planning to expand their operations within the same general area.

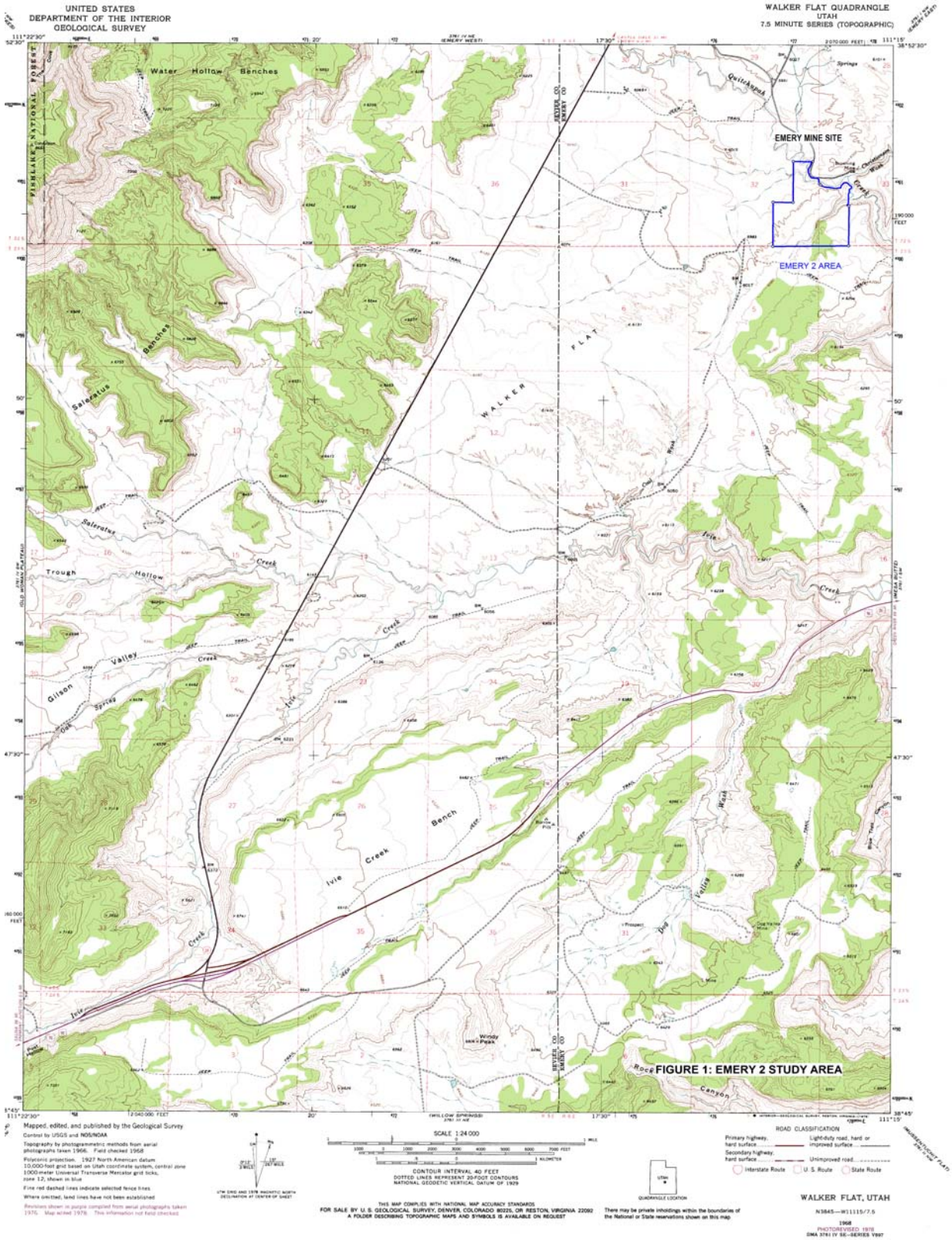


FIGURE 1: EMERY 2 STUDY AREA

Methods

Sampling methodologies used for this study were performed using guidelines supplied by the State of Utah, Division of Oil, Gas and Mining (DOGM) and other applicable sources. Quantitative and qualitative data were recorded in September 2009, May 2010 and June 2016 within the plant communities that have been proposed for disturbance, as well as those to be used for future revegetation success standards called "reference areas".

Sampling Design and Transect/Quadrat Placement

Transect lines for vegetation sampling in the communities were placed randomly within the boundaries of the proposed disturbed and reference areas. A transect placement technique was employed with the goal to adequately sample a representative subset of each site. Once the transects were established, quadrat locations for sampling were chosen using random numbers from the transect lines with the objective to record data without preconceived bias.

Cover and Composition

Cover estimates were made using ocular methods with meter square quadrats. Species composition, cover by species, and relative frequencies were also assessed from the quadrats. Additional information was recorded on the raw data sheets such as: slope, exposure, grazing use, disturbance and/or other appropriate notes. Plant nomenclature follows "A Utah Flora" (Welsh et al., 2008).

Woody Species Density

Density of woody plant species for the proposed disturbed and reference areas were estimated using the point-quarter method. In this method, random points were placed on the sample sites and measured into four quarters. The distances to the nearest woody plant species were then recorded in each quarter. The average point-to-individual distance was

equal to the square root of the mean area per individual. The number of individuals per acre was the end results of the calculations.

Sample Size & Adequacy

Sampling adequacy for cover and density was attempted by using the formula given below.

$$nMIN = \frac{t^2 s^2}{(dx)^2}$$

where,

nMIN	= minimum adequate sample
t	= appropriate confidence t-value
s	= standard deviation
x	= sample mean
d	= desired change from mean

Statistical Analyses

Student's t-tests were employed to compare the total living cover and total woody species density values of each proposed disturbed plant community with the proposed reference area for that site.

Threatened & Endangered Species Surveys

Prior to the field work, documents that provide the most recent accounting of the federally listed threatened, endangered and candidate species for Emery County, Utah were reviewed. Additionally, the State of Utah, Department of Natural Resources' biodiversity database was consulted with regard to threatened, endangered or otherwise sensitive species (TES) in the Emery 2 Area. Finally, the U.S. Fish & Wildlife Service's Information for Planning and Conservation database was utilized (IPaC). These information sources were used to drive the field surveys for sensitive species in the Emery 2 Area.

Once the target sensitive species were determined, a field reconnaissance visit was conducted at specific time periods, or during their flowering times, at known locations to note the growth stage at that specific point in time. Next, the onsite field surveys for the target species were conducted in the Emery 2 study area.

As mentioned above, at an earlier time the Emery 2 permit area was much larger than that proposed in 2016. In 2010, transect survey lines were placed over the vegetation study area that is shown on the attached map (Figure 2). During that year the transect lines were placed over the entire study area at regular intervals. In 2016, the most applicable transect lines for the new permit area were used in the survey – this survey focused on the smaller Emery 2 permit area.

Photographs

Color photographs of the sample areas were taken at the time of sampling and have been submitted with this report.

Seed Mixtures

Revegetation seed mixtures have been included in this report. They were formulated based on the results of the field studies.

Results

A vegetation map has been prepared that shows the plant communities located within the Emery 2 study area (Figure 2). This map shows the new permit area as well as adjacent plant communities and wildlife habitat types. A more generalized *Vegetation and Land Use Map* for the entire Emery Mine permit area can be found in the Mining & Reclamation Plan (Plate VIII-1).

Depending on the final mine plans, there are various plant communities that could be disturbed as a result of the proposed surface operations in the Emery 2 Area. Data have been collected in these plant communities in an attempt to accommodate any changes to the footprint of the current designed plans. These communities included: Pinyon-Juniper, Shadscale, Greasewood and Previously Disturbed Shadscale & Greasewood. Below is a summary of the results from sampling these plant communities.

Proposed Disturbed Pinyon-Juniper

A Pinyon-Juniper community is supported in the uplands above the Ferron Sandstone escarpments on the south end of the Emery 2 Area (Figure 2). As the community name suggests, the most common plant species here were pinyon-pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). Woody species dominated the site with only a few forbs present. No grasses were observed in the sample quadrats (Table 1).

The total living cover which includes the sum of the overstory and understory was estimated at 19.43% (Table 2-A). Shrubs dominated this cover; the composition of the understory by lifeform was comprised of 71.21% trees/shrubs and 28.79% forbs (Table 2-B).

Total woody species density was estimated at 546 individuals per acre and was dominated by black sagebrush (*Artemisia nova*), Utah juniper and pinyon-pine (Table 3).

Pinyon-Juniper Comparison Area

Initially, a similar Pinyon-Juniper community was chosen to represent future revegetation success standards. It was also dominated by the same species as the proposed disturbed area described above, or pinyon-pine and Utah juniper (Table 4). Later, because the proposed disturbance in thos community was much smaller than earlier plans, it seemed more practical to reclaim the site to a Shadscale community – this community will probably have the majority of the surface disturbance for mining and subsequent reclamation activities.

Consequently, the area that was initially sampled to be used as a *Pinyon-Juniper Reference Area* will remain on the vegetation map along with the corresponding data in this report. It is now called a *Comparison Area* and can be used as representative baseline data for the community that may be disturbed by mining activities.

The total living cover for this community was estimated at 19.40%, 10.23% came from understory cover and 9.17% from overstory (Table 5-A). Composition of the understory cover was calculated at 81.60% trees/shrubs and 18.40% forbs (Table 5-B).

Total density of woody species was estimated at 639 individuals per acre and again was mostly comprised of black sagebrush, Utah juniper and pinyon-pine (Table 6).

Proposed Disturbed Shadscale

The proposed disturbed Shadscale community, the most important plant community of the study area in size, was dominated by shadscale (*Atriplex confertifolia*) by quite a large margin, but was followed by galleta (*Hilaria jamesii*), blue grama (*Bouteloua gracilis*) and black sagebrush (Table 7).

The total living cover for this community was estimated at 22.33% (Table 8-A). Composition consisted of 68.83% shrubs and 31.17% grasses; no forbs were present in the sample quadrats (Table 8-B).

Woody species density totaled 5,077 individuals per acre (Table 9) and was much dominated by shadscale, with the next most important plants consisting of black sagebrush and budsage (*Artemisia spinescens*).

Shadscale Reference Area

The reference area chosen to represent the Shadscale community was also dominated by shadscale followed by galleta, Indian ricegrass (*Stipa hymenoides*) and budsage (Table 10).

The total living cover for this community was estimated at 21.67% (Table 11-A). Lifeform composition was comprised of 66.79% shrubs and 33.21% grasses; no forbs were present in the quadrats here either (Table 11-B).

Total woody species density was estimated at 5,009 individuals per acre with the dominant shrubs consisting of shadscale, black sagebrush and budsage (Table 12).

Proposed Disturbed Greasewood (Uplands)

There were two greasewood types in the vegetation study area. The largest Greasewood community in the area was initially sampled [Greasewood Sample Area (Uplands), Figure 2] when more of this type was proposed for disturbance. The community was in many ways unlike the more typical Greasewood bottoms common in the lower elevations near Quitchupah Creek and also in the ephemeral drainage of the new permit area [see Greasewood Sample Area (Bottoms), Figure 2]. The Greasewood (Uplands) community that was first sampled had a fair component of saltbush species (*Atriplex* spp.) which the bottomland Greasewood community lacked. Because of these differences, the greasewood types were divided up and sampled separately (Upland vs. Bottoms). Different reference areas for these two types were also studied.

The dominant plant in this upland community by a wide margin was greasewood (*Sarcobatus vermiculatus*), but shadscale and fourwing saltbush (*Atriplex canescens*) were also important

components. Only shrubs, no forbs and grasses, were present in the sample quadrats. For a list of all plant species observed in the sample quadrats refer to Table 13.

The total living cover of the proposed disturbed Greasewood community was estimated at 28.33% (Table 14-A). As mentioned, the composition here was comprised of 100% shrub species (Table 14-B).

Woody species density was relatively high at 3,359 individuals per acre and was dominated by the same species that dominated the cover (Table 15).

Greasewood Reference Area (Uplands)

Like the proposed disturbed community it was chosen to represent, the Greasewood Reference Area (Uplands) and was dominated by greasewood, shadscale and fourwing saltbush. Similarly, the cover consisted only of shrubs, with no forbs and grasses present in the sample quadrats (Table 16).

The total living cover here was 29.83% (Table 17-A) and the composition was comprised of 100% shrubs (Table 17-B).

Woody species density totaled 3,216 plants per acre. This reference area had fewer greasewood plants than the proposed disturbed area, but supported many more Torrey's seepweed (*Suaeda nigra*) plants which are often a strong component in greasewood communities (Table 18).

Proposed Disturbed Greasewood (Bottoms)

As mentioned above, the proposed disturbed Greasewood (Bottoms) were sampled separate from the Greasewood (Uplands). Although greasewood was the dominant species in most of the bottomland areas, there were also isolated pockets where other shrub species such as fourwing saltbush, shadscale and sagebrush were the single dominant plant.

In fact, fourwing saltbush had a slightly higher cover value in the proposed disturbed sample area followed by greasewood (Table 19).

The total living cover here was 39.00% (Table 20-A), where shrubs, followed by forbs then grasses made up the lifeform composition (Table 20-B).

Woody species density was dominated by fourwing saltbush and greasewood and had a total value of 2,884 individuals per acre (Table 21).

Greasewood Reference Area (Bottoms)

As shown on Table 22, the Greasewood Reference Area (Bottoms) was dominated by greasewood, shadscale and broom snakeweed (*Gutierrezia sarothrae*).

The total living cover here was estimated at 40.33% (Table 22) and comprised of 84.85% shrubs, 14.12% grasses and 1.03% forbs (Table 23-B).

Woody species density totaled 3,322 plants per acre. This reference area had more greasewood plants and quite a bit more shadscale plants when compared to the proposed disturbed area (Table 24).

Previously Disturbed Shadscale & Greasewood

There was one area located within Shadscale and Greasewood communities that was previously disturbed by other activities (Figure 2). It appeared that there may have been drilling and other activities in the area; it also looked like much of the land surface had once been graded using heavy equipment. The land surface was not severely disturbed, but the plants present in this area reflected a change in species, composition and density when compared to the adjacent native plant communities, so the area was sampled separately.

The previously disturbed community was dominated by shadscale, black sagebrush and Indian ricegrass (Table 25).

The total living cover in the community was estimated at 16.25% (Table 26-A). Shrubs dominated the understory cover at 69.57%, followed distantly by forbs and grasses at 17.50% and 12.93%, respectively (Table 26-B).

The total woody species density in the area was 1,439 individuals per acre and, similar to the cover results, the dominant plants for this parameter were black sagebrush and shadscale (Table 27).

Community Comparisons

When the **total living cover** values for the proposed disturbed areas including Pinyon-Juniper, Shadscale and Greasewood communities were compared with their respective reference areas using Student's t-tests, the differences were *non-significant* statistically (Figure 3). Moreover, when the **woody species density** values of these same communities and reference areas were compared statistically, the differences were

Figure 3. A statistical comparison (Student's t-tests) of the **total living covers** of the proposed disturbed and reference areas.

	$\bar{x}$	s	n	t	df	SL
Pinyon-Juniper						
Proposed Disturbed:	19.43	19.55	30			
Reference Area:	19.40	17.54	30			
t-test				0.006	58	N.S.
Shadscale						
Proposed Disturbed:	22.33	5.59	30			
Reference Area:	21.67	6.62	30			
t-test				0.417	58	N.S.
Greasewood (Uplands)						
Proposed Disturbed:	28.33	8.69	30			
Reference Area:	29.83	7.24	30			
t-test				-0.726	58	N.S.
Greasewood (Bottoms)						
Proposed Disturbed:	39.00	8.21	15			
Reference Area:	40.33	10.87	15			
t-test				0.3781	28	N.S.
Shadscale & Greasewood						
Previously Disturbed:	16.25	10.23	20			
Reference Area:	–	–	–			
t-test				n/a	n/a	n/a

$\bar{x}$ = mean
s = standard deviation
n = sample size
t = Student's t-value
df = degrees of freedom

n/a = not applicable
p = probability
SL= Significance Level
N.S.=Non-Significant

again *non-significant* (see attached Figure 4). In other words, there were no significant differences in those communities proposed for disturbance by future mining-associated activities when compared to those communities that have been chosen to represent future revegetation success standards for them. Accordingly, these results suggest that the reference areas chosen would probably be appropriate for future revegetation success standards following final reclamation.

Figure 4. A statistical comparison (Student's t-tests) of the **woody species densities** of the proposed disturbed area and reference areas.

	$\bar{x}$	s	n	t	df	SL
Pinyon-Juniper						
Proposed Disturbed:	545.93	239.63	30			
Reference Area:	639.17	325.78	30			
t-test				-1.263	58	N.S.
Shadscale						
Proposed Disturbed:	5077.30	2472.61	30			
Reference Area:	5008.53	2351.38	30			
t-test				0.110	58	N.S.
Greasewood (Uplands)						
Proposed Disturbed:	3359.19	1560.91	30			
Reference Area:	3215.53	1177.39	30			
t-test				0.402	58	N.S.
Greasewood (Bottoms)						
Proposed Disturbed;	2883.84	1204.71	15			
Reference Area:	3321.63	1704.11	15			
t-test				0.8125	28	N.S.
Shadscale & Greasewood						
Previously Disturbed:	1439.40	2268.73	20			
Reference Area:	–	–	–			
t-test				n/a	n/a	n/a

$\bar{x}$ = mean
s = standard deviation
n = sample size
t = Student's t-value
df = degrees of freedom

n/a = not applicable
p = probability
SL= Significance Level
N.S.=Non-Significant

Threatened, Endangered & Sensitive Species

A table of federally listed threatened, endangered and candidate species for the study area has been provided (Table 28). Table 28 shows all the listed species (plant and animal), results of the field surveys, potential habitats, as well as the likelihood of impact to the given species by the proposed mine-related activities in the project area. Of all the listed species, perhaps the most likely species to be present in the study were Last Chance townsendia (*Townsendia aprica*), Wright's fishhook cactus *(Sclerocactus wrightiae*), San Rafael footcactus (*Pediocactus despainii*) and Winkler's footcactus (*P. winkleri*). Additionally, the borrowing owl (*Athene cunicularia*), a species protected by the Migratory Bird Treaty Act (MBTA), is known to exist in the immediate area.

Of the target species mentioned above, similar habitat and a species of fishhook cactus (*Sclerocactus* sp.) were found in the vegetation study area (more about this below). The habitat where this cactus was found was in a relatively small portion of the general study area; this habitat was *not* found in the smaller Emery 2 permit area.

The Emery Mine site is situated close to where two species of fishhook cacti (*Sclerocactus* spp.) meet. The more common Whipple's fishhook (*S. whipplei*) has been observed in another portion of the Emery Mine permit area during previous vegetation studies by the author. Its geographic range extends from the northeast to the southeast cold desert regions of Utah, and also includes portions of Colorado, Arizona, New Mexico and Nevada. Another species, the Wright's fishhook cactus, is a federally listed endangered plant. This cactus is endemic to Utah's Emery and Wayne Counties. The Emery Mine site includes habitats that are very close to those utilized by both species.

Figure 5: *Sclerocactus whipplei var. roseus*

Whipple's fishhook is most often found at elevations that range from 3,700 ft to 8,000 ft above sea level. *S. whipplei* var. *rosea* (Figure 5), the variety found in this area, grows in

various geologic strata, including the formations found in the Emery study area, or Mancos Shale at the contact point between the Ferron Sandstone and Bluegate Shale Members of this formation. This species also grows in a variety of plant communities including mixed desert shrub, pinyon-pine, sagebrush, and ponderosa pine.

The rare Wright's fishhook (Figure 6), on the other hand, is mostly found at lower elevations, or between 4,800 ft to 6,100 ft above sea level. Plant communities where this species grows is more restricted, and includes salt desert shrub and shrub-grass communities to pinyon-juniper. The geology is also more restricted for this species. Wright's fishhook cactus grows in the Mancos Shale Formation, but is more often found in the Tununk Shale and Ferron Sandstone Members and in the contact area between them. The species also, however, can also be found in the Bluegate Shale Member of the Mancos Shale Formation.

Figure 6: *Sclerocactus wrightiae*

Small populations of a species of fishhook cactus (*Sclerocactus* sp.) were found in vegetation study area (Figure 7). These plants were located at the contact area between the Bluegate Shale and Ferron Sandstone. If the plants were indeed Wright's fishhook, the endangered one, the elevation of these populations would be near the upper range of its elevational gradient (5,928 ft). All things considered, including habitat, geology, soils, elevation, exposures and diagnostic characteristics, the populations in this area appear intermediate between *S. whipplei* and *S. wrightiae,* possibly leaning closer to the former. Interestingly, Welsh, et al. in *A Utah Flora* (2008) evidently also found the difficulties

Figure 7: *Sclerocactus* sp.

in naming their collections in an area very close to the study area. They stated the following in the Utah Flora's description for *S. wrightiae*:

> "*The small flowers and short spines are evidently diagnostic. Occasional intermediates with S. whipplei var. roseus occur in Emery Co. near the Sevier Co. line – at edaphic ecotones marking the boundary between shale and sandstone member of the Mancos Shale Formation. This entity is almost an identical match both morphologically and ecologically to S. mesaverdae (Boissevain) L. Benson, and that name being older will have priority should the two be combined*".

The results of the sensitive species surveys suggest the cacti observed had morphological characteristics very close to both species of *S. whipplei* and *S. wrightiae*. Many of the plants observed appeared to be juveniles and too young to flower (it can take four years or more to mature enough to produce flowers). Yet, for other unknown reasons, the more mature plants in these small populations displayed few flowers when they were observed. When known populations of *S. whipplei* (on-site) and *S. wrightiae* (off-site) were visited during the same time periods in May and August, 2010, both species displayed many flowers.

As a second opinion, another botanist was taken to the site. Dr. Ronald J. Kass observed the *S. whipplei* populations in the Emery Mine and adjacent areas and well as the *Sclerocactus* sp. that were found at the drill sites in the Emery 2 study. Dr. Kass has probably conducted as many or more surveys for *S. wrightiae* as anyone in the country. His opinion and the findings in this report were consistent with the statements above.

This information was worth reporting but again, although these cactus individuals were within the vegetation study area, they were outside the Emery 2 permit area, or those areas that could be disturbed by the proposed new mining operations.

Revegetation Seed Mixtures

Seed mixtures for the above community types to be used at the time of revegetation have been included in the Appendix of this report.

Discussion

Study Goals & Objectives

In this study, the primary objectives were to: 1) provide quantitative baseline data for the plant communities that may be impacted by future mining-related activities, 2) provide quantitative data of similar communities that could be used in the future for revegetation success standards and 3) survey the area for potential threatened, endangered or sensitive species. In accomplishing these objectives, one should keep in mind that the goal is to eventually reclaim those plant communities that are disturbed by the mining-related activities, and as required by state and federal regulations, to a condition that is "*diverse, effective, and permanent*" and to their approximate natural, native conditions prior to disturbance. That said, the investigators should provide data that is quantitative and descriptive, yet practical for revegetation planning and implementation. The following information explains some of the considerations and decisions made by studying the plant communities in the Emery 2 Area.

Pinyon-Juniper Community Considerations

As mentioned before, initially a Pinyon-Juniper community was chosen to represent future revegetation success standards. It was also dominated by the same species as the proposed disturbed area described above, or pinyon-pine and Utah juniper. Later, because the proposed disturbance in this community was reduced (totaled about 5% of the permit area), it seemed prudent and more practical to reclaim the site to a shadscale community, the same community that the majority of the surface disturbance and subsequent reclamation will involves. Because this small P-J area is adjacent to the Shadscale community and will be seeded with the same seed mix, the Shadscale Reference Area could be used for revegetation success standards.

Greasewood Community Considerations

Figure 2 shows the different greasewood communities in the study area. The major Greasewood community by total area in the Emery 2 study area was initially sampled. In this report, it has been called *Greasewood (Uplands)*. This community was unlike the more typical greasewood bottoms common in the area near Quitchupah Creek and in the drainage channel of the new permit area, which have been called *Greasewood (Bottoms)*. Although some plant species were common in both Greasewood community types, there were several differences, most notably species composition and total living cover. Additionally, a review of the *Order 2 Soil Survey of the Emery 2 Mine Disturbance Area* (Long Resource Consultants, July 2016) revealed that the soil chemistry for these two Greasewood types were quite different.

When the Greasewood community was first studied in 2009 and 2010, the greasewood community types were "lumped" together on the vegetation map because little or no disturbance was planned in the *bottoms*, the much smaller area by acreage. The quantitative sampling at that time was conducted in the *uplands*, the larger area. However, because the footprint of the Emery 2 permit area and proposed disturbed areas changed significantly in 2016, impacts to the bottoms became more likely. Because of these changes, additional field studies were conducted in the *bottoms* in 2016 to augment the existing greasewood baseline datasets and for reclamation planning purposes.

Shadscale Community Considerations

One of the most common plant communities in the salt deserts of Utah is Shadscale. It is also the dominant plant community of the Emery 2 Area. There were isolated areas within this community where species composition differed. For example, the Shadscale community was mapped on the upper benches of the study area, but also mapped on the slopes of the major drainage in the permit area. In the Shadscale community, shadscale plants usually the dominated cover and density, but in other relatively small areas, Castle Valley saltbush (*Atriplex gardneri* var. *cuneata*) and black sagebrush were the dominant plant

species. This small patches of isolated communities were lumped into a larger plant community for reasons more practical for revegetation at the time of final reclamation.

Previously Disturbed Community Considerations

One area described above was disturbed previously by other surface activities. This disturbance was found contiguous both Greasewood and Shadscale communities. State regulations regarding revegetation success standards of areas that were previously disturbed and are to be "*redisturbed by coal mining and reclamation operations, at a minimum, the vegetative ground cover will be not less than the ground cover existing before redisturbance and will be adequate to control erosion*". Accordingly, a reference area will not be used at the time of final reclamation in this area, rather the quantitative data reported in this report will be used as the benchmark for final revegetation success standards.

Summary & Conclusions

There were five major plant community types studied in the Emery 2 study area including: 1) Pinyon-Juniper, 2) Shadscale, 3) Greasewood, 4) Previously Disturbed Shadscale & Greasewood, and 5) Tamarisk. The communities that could be impacted by mine-related activities include all the above with the exception of Tamarisk. Therefore, only the data for those communities that have the potential for disturbance, along with their corresponding reference areas, were reported in this document.

A vegetation map showing the plant communities, reference areas and sample locations has been prepared and attached to this report.

All reference areas appear to have meet the qualifications to be used for standards for revegetation success at the time of final reclamation and will be compared with the reclaimed areas. However, the Pinyon-Juniper community will be reclaimed with the Shadscale seed mix and compared with that reference area. Moreover, the previously disturbed Shadscale & Greasewood areas will also be seeded with Shadscale seed mixture.

The revegetation success standards here will be that of the "current ground cover" (data found in this report) as the state regulations suggest.

Threatened, endangered and sensitive species surveys were conducted in 2010 and 2016. No TES species were found within the new permit area boundary.

Revegetation seed mixtures have been included in the Appendix of this report.

Table 1: Cover and frequency by plant species in the Emery 2 study area (2009).

Proposed Disturbed Pinyon-Juniper			n=30
	MEAN	**STANDARD DEVIATION**	**FREQUENCY**
OVERSTORY			
Juniperus osteosperma	4.67	11.83	20.00
Pinus edulis	3.17	8.11	26.67
UNDERSTORY			
TREES & SHRUBS			
Amelanchier utahensis	0.33	1.80	3.33
Artemisia nova	1.57	2.54	33.33
Artemisia tridentata	0.33	1.80	3.33
Juniperus osteosperma	2.23	5.00	20.00
Pinus edulis	4.83	11.74	26.67
Yucca harrimaniae	0.23	1.26	3.33
FORBS			
Cryptantha sp.	1.83	2.71	36.67
Eriogonum bicolor	0.17	0.90	3.33
Euphorbia fendleri	0.07	0.36	3.33
GRASSES			

Table 2: Total cover and composition for the Emery 2 study area (2009).

Proposed Disturbed Pinyon-Juniper		n=30
A. COVER	**MEAN**	**STD. DEV.**
Overstory (o)	7.83	13.27
Understory (u)	11.60	10.02
Litter	21.30	15.26
Bareground	24.93	21.67
Rock	42.17	22.53
o + u	19.43	19.55
B. % COMPOSITION		
Trees & Shrubs	71.21	39.87
Forbs	28.79	39.87
Grasses	0.00	0.00

Table 3: Woody species density in the Emery 2 study area (2009). **n=30**

Proposed Disturbed Pinyon-Juniper	Number/Acre
Amelanchier utahensis	13.65
Artemisia nova	200.18
Artemisia tridentata	4.55
Atriplex confertifolia	4.55
Cercocarpus ledifolius	4.55
Chrysothamnus nauseosus	4.55
Juniperus osteosperma	150.13
Opuntia sp.	18.20
Pinus edulis	141.03
Yucca harrimaniae	4.55
TOTAL	**545.93**

Table 4: Cover and frequency by plant species in the Emery 2 study area (2009).

Pinyon-Juniper Comparison Area			n=30
	MEAN	STANDARD DEVIATION	FREQUENCY
OVERSTORY			
Juniperus osteosperma	1.50	3.45	20.00
Pinus edulis	7.67	14.65	26.67
TREES & SHRUBS			
Artemisia nova	2.27	3.26	40.00
Juniperus osteosperma	1.77	4.98	16.67
Opuntia sp.	0.60	2.03	10.00
Pinus edulis	4.17	7.20	30.00
Yucca harrimaniae	0.07	0.36	3.33
FORBS			
Cryptantha sp.	0.23	0.96	6.67
Eriogonum bicolor	0.40	1.28	10.00
Euphorbia fendleri	0.40	1.28	10.00
Petradoria pumila	0.33	1.80	3.33
GRASSES			

Table 5: Total cover and composition for the Emery 2 study area (2009).

Pinyon-Juniper Comparison Area		n=30
A. COVER	**MEAN**	**STD. DEV.**
Overstory (o)	9.17	15.06
Understory (u)	10.23	5.79
Litter	20.27	16.75
Bareground	21.50	16.89
Rock	48.00	21.55
o + u	19.40	17.54
B. % COMPOSITION		
Trees & Shrubs	81.60	34.58
Forbs	18.40	34.58
Grasses	0.00	0.00

Table 6: Woody species density in the Emery 2 study area (2009). **n=30**

Pinyon-Juniper Comparison Area	Number/Acre
Artemisia nova	245.01
Atriplex confertifolia	5.33
Gutierrezia sarothrae	10.65
Juniperus osteosperma	170.44
Opuntia sp.	15.98
Pinus edulis	165.12
Yucca harrimaniae	26.63
TOTAL	**639.17**

Table 7: Cover and frequency by plant species in the Emery 2 study area (2009).

Proposed Disturbed Shadscale			n=30
	MEAN	STANDARD DEVIATION	FREQUENCY
TREES & SHRUBS			
Artemisia nova	2.17	4.60	23.33
Artemisia spinescens	1.67	2.98	26.67
Atriplex confertifolia	11.83	9.62	73.33
Gutierrezia sarothrae	0.17	0.90	3.33
Opuntia sp.	0.23	0.96	6.67
FORBS			
GRASSES			
Bouteloua gracilis	2.17	4.95	26.67
Hilaria jamesii	3.67	4.07	53.33
Stipa hymenoides	0.43	1.86	6.67

Table 8: Total cover and composition for the Emery 2 study area (2009).

Proposed Disturbed Shadscale		n=30
A. COVER	**MEAN**	**STD. DEV.**
Understory	22.33	5.59
Litter	8.67	8.36
Bareground	49.00	14.34
Rock	20.00	12.45
B. % COMPOSITION		
Shrubs	68.83	31.96
Forbs	0.00	0.00
Grasses	31.17	31.96

Table 9: Woody species density in the Emery 2 study area (2009). n=30

Proposed Disturbed Shadscale	Number/Acre
Artemisia nova	930.84
Artemisia spinescens	550.04
Artemisia tridentata	42.31
Atriplex confertifolia	3427.18
Gutierrezia sarothrae	42.31
Opuntia sp.	42.31
Sarcobatus vermiculatus	42.31
TOTAL	**5077.30**

Table 10: Cover and frequency by plant species in the Emery 2 study area (2009).

Shadscale Reference Area			n=30
	MEAN	STANDARD DEVIATION	FREQUENCY
TREES & SHRUBS			
Artemisia nova	1.77	3.14	26.67
Artemisia spinescens	2.00	3.56	26.67
Atriplex confertifolia	8.43	7.67	73.33
Gutierrezia sarothrae	1.00	3.74	10.00
Opuntia sp.	1.17	3.34	13.33
FORBS			
GRASSES			
Bouteloua gracilis	0.73	2.29	10.00
Hilaria jamesii	4.47	4.85	53.33
Stipa hymenoides	2.10	2.93	36.67

Table 11: Total cover and composition for the Emery 2 study area (2009).

Shadscale Reference Area		n=30
A. COVER	**MEAN**	**STD. DEV.**
Understory	21.67	6.62
Litter	8.33	4.53
Bareground	51.17	12.09
Rock	18.83	13.52
B. % COMPOSITION		
Shrubs	66.79	22.19
Forbs	0.00	0.00
Grasses	33.21	22.19

Table 12: Woody species density in the Emery 2 study area (2009). n=30

Shadscale Reference Area	Number/Acre
Artemisia nova	1043.44
Artemisia spinescens	626.07
Atriplex confertifolia	3046.86
Gutierrezia sarothrae	83.48
Opuntia sp.	208.69
TOTAL	**5008.53**

Table 13: Cover and frequency by plant species in the Emery 2 study area (2009).

Proposed Disturbed Greasewood (Uplands)			n=30
	MEAN	STANDARD DEVIATION	FREQUENCY
TREES & SHRUBS			
Atriplex canescens	4.33	10.55	16.67
Atriplex confertifolia	4.73	7.19	36.67
Gutierrezia sarothrae	0.17	0.90	3.33
Opuntia sp.	1.50	3.69	16.67
Sarcobatus vermiculatus	16.43	13.72	73.33
Suaeda nigra	1.17	3.34	13.33
FORBS			
GRASSES			

Table 14: Total cover and composition for the Emery 2 Study area (2009).

Proposed Disturbed Greasewood (Uplands)		n=30
A. COVER	**MEAN**	**STD. DEV.**
Understory	28.33	8.69
Litter	15.80	7.76
Bareground	45.33	16.12
Rock	10.53	14.69
B. % COMPOSITION		
Shrubs	100.00	0.00
Forbs	0.00	0.00
Grasses	0.00	0.00

Table 15: Woody species density in the Emery 2 study area (2009). n=30

Proposed Disturbed Greasewood (Uplands)	Number/Acre
Atriplex canescens	531.87
Atriplex confertifolia	839.80
Gutierrezia sarothrae	139.97
Opuntia sp.	223.95
Sarcobatus vermiculatus	1315.68
Suaeda nigra	307.93
TOTAL	**3359.19**

Table 16: Cover and frequency by plant species in the Emery 2 study area (2009).

Greasewood Reference Area (Uplands)			n=30
	MEAN	STANDARD DEVIATION	FREQUENCY
TREES & SHRUBS			
Artemisia nova	0.17	0.90	3.33
Atriplex canescens	2.33	6.80	13.33
Atriplex confertifolia	8.67	11.03	50.00
Gutierrezia sarothrae	0.33	1.25	6.67
Opuntia sp.	1.50	4.11	13.33
Sarcobatus vermiculatus	16.33	15.16	60.00
Suaeda nigra	0.50	1.98	6.67
FORBS			
GRASSES			

Table 17: Total cover and composition for the Emery 2 study area (2009).

Greasewood Reference Area (Uplands)		n=30
A. COVER	**MEAN**	**STD. DEV.**
Understory	29.83	7.24
Litter	12.60	8.60
Bareground	45.00	14.43
Rock	12.57	8.64
B. % COMPOSITION		
Shrubs	100.00	0.00
Forbs	0.00	0.00
Grasses	0.00	0.00

Table 18: Woody species density in the Emery 2 study area (2009). n=30

Greasewood/Shadscale Reference Area (Uplands)	Number/Acre
Artemisia nova	187.57
Atriplex canescens	107.18
Atriplex confertifolia	1500.58
Gutierrezia sarothrae	53.59
Juniperus osteosperma	26.80
Pinus edulis	241.16
Sarcobatus vermiculatus	107.18
Suaeda nigra	991.45
TOTAL	**3215.53**

Table 19: Cover and frequency by plant species in the Emery 2 study area (2016)

Proposed Disturbed Greasewood (Bottoms)			n=15
	MEAN	STANDARD DEVIATION	FREQUENCY
TREES & SHRUBS			
Artemisia nova	1.33	4.99	6.67
Atriplex canescens	9.33	10.93	46.67
Atriplex confertifolia	2.00	5.10	13.33
Gutierrezia sarothrae	0.67	2.49	6.67
Sarcobatus vermiculatus	7.00	11.52	33.33
FORBS			
Lepidium montanum	3.33	7.23	20.00
Salsola tragus	2.67	7.72	13.33
Cleome lutea	3.67	7.63	20.00
GRASSES			
Bromus tectorum	7.33	9.46	46.67
Stipa hymenoides	1.67	6.24	6.67

Table 20: Total cover and composition for the Emery 2 study area (2016).

Proposed Disturbed Greasewood (Bottoms)		n=15
A. COVER	**MEAN**	**STD. DEV.**
Understory	39.00	8.21
Litter	14.00	8.60
Bareground	31.00	15.83
Rock	16.00	14.51
B. % COMPOSITION		
Shrubs	50.61	35.97
Forbs	28.67	39.90
Grasses	20.72	21.94

Table 21: Woody species density in the Emery 2 study area (2016). n=15

Proposed Disturbed Greasewood (Bottoms)	Number/Acre
Artemisia nova	192.26
Atriplex canescens	1441.92
Atriplex confertifolia	48.06
Gutierrezia sarothrae	336.45
Opuntia sp.	48.06
Sarcobatus vermiculatus	817.09
TOTAL	**2883.84**

Table 22: Cover and frequency by plant species in the Emery 2 study area (2016)

Greasewood (Bottoms) Reference Area			n=15
	MEAN	STANDARD DEVIATION	FREQUENCY
TREES & SHRUBS			
Artemisia nova	0.33	1.25	6.67
Atriplex confertifolia	9.67	9.57	60.00
Gutierrezia sarothrae	6.67	9.60	46.67
Sarcobatus vermiculatus	18.33	18.14	66.67
FORBS			
Lepidium montanum	0.67	2.49	6.67
GRASSES			
Stipa hymenoides	3.00	6.78	20.00
Stipa comata	1.67	6.24	6.67

Table 23: Total cover and composition for the Emery 2 study area (2016)

Greasewood (Bottoms) Reference Area		n=15
A. COVER	**MEAN**	**STD. DEV.**
Understory	40.33	10.87
Litter	15.33	12.04
Bareground	36.67	17.48
Rock	7.67	3.09
B. % COMPOSITION		
Shrubs	84.85	29.70
Forbs	1.03	3.84
Grasses	14.12	29.41

Table 24: Woody species density in the Emery 2 study area (2016). n=15

Greasewood (Bottoms) Reference Area	Number/Acre
Artemisia nova	166.08
Atriplex canescens	110.72
Atriplex confertifolia	1273.29
Gutierrezia sarothrae	664.33
Sarcobatus vermiculatus	1107.21
TOTAL	**3321.63**

Table 25: Cover and frequency by plant species in the Emery 2 study area (2010)

Previously Disturbed Shadscale & Greasewood			n=20
	MEAN	STANDARD DEVIATION	FREQUENCY
TREES & SHRUBS			
Artemisia nova	5.35	7.83	40.00
Atriplex confertifolia	5.40	9.22	35.00
Chrysothamnus nauseosus	0.50	2.18	5.00
Juniperus osteosperma	0.40	1.74	5.00
Sarcobatus vermiculatus	0.75	3.27	5.00
FORBS			
Bassia hyssopifolia	0.50	2.18	5.00
Eriogonum sp.	0.25	1.09	5.00
Kochia scoparia	0.75	1.79	15.00
GRASSES			
Bouteloua gracilis	0.60	2.20	10.00
Stipa hymenoides	1.75	3.55	20.00

Table 26: Total cover and composition for the Emery 2 study area (2010)

Previously Disturbed Shadscale & Greasewood		n=20
A. COVER	**MEAN**	**STD. DEV.**
Understory	16.25	10.23
Litter	8.25	13.06
Bareground	62.50	21.48
Rock	13.00	14.78
B. % COMPOSITION		
Shrubs	69.57	39.06
Forbs	17.50	36.31
Grasses	12.93	20.24

Table 27: Woody species density in the Emery 2 study area (2010) **n=20**

Previously Disturbed Shadscale & Greasewood	Number/Acre
Artemisia nova	539.78
Atriplex confertifolia	485.80
Atriplex canescens	35.99
Chrysothamnus nauseosus	89.96
Juniperus osteosperma	53.98
Opuntia sp.	17.99
Sarcobatus vermiculatus	215.91
TOTAL	**1439.40**

Table 28: Federally listed threatened, endangered and candidate species for Emery County, Utah.

(1) This list was compiled using known species occurrences and species observations from the Utah Natural Heritage Program's Biodiversity Tracking and Conservation System (BIOTICS). The list was accessed on-line June 24, 2016. Its last update was dated October 1, 2015.

(2) Additional species added from a search of the U.S. Fish & Wildlife Service database (IPaC); access date: June 23, 2016.

(3) Additional GIS data was used from Utah Division of Wildlife Resources, Conservation Data Center; access date: June 24, 2016.

ENDANGERED		SITE-SPECIFIC NOTES
Empidonax traillii extimus(2)	Southwestern willow flycatcher	The southwestern willow flycatcher is known to breed in the southwestern U.S. Although the bird showed up in the IPaC database, the Division of Wildlife Resources (DWR) distribution map shows its distribution to be in the extreme southern regions of Utah, well below the Emery Mine project area. The Emery 2 permit area does not have dense willow riparian habitats where this bird is most frequently found. All evidence suggest that this species will not be impacted by the new mine activities.
Gila cypha (1)	Humpback chub	Humpback chub in Utah are now confined to a few white-water areas in the Colorado, Green, and White Rivers. These rivers do not occur in the study area. No perennial streams that are tributaries to the Colorado River system occur in the Emery 2 study area. There will be no impact to this species from mining activities in the study area.
Gila elegans (1)	Bonytail	The bonytail is a very rare minnow originally native to the Colorado River system. This river does not occur in the study area, nor do perennial streams that are tributaries to the Colorado River system occur in the Emery 2 study area. There will be no impact to this species from mining in the study area.
Mustela nigripes (1)	Black-footed ferret (extirpated)	Nearly becoming extinct, according to DWR records the black-footed ferret was reintroduced into Uintah County, Utah in late 1999. This mammal depends on prairie-dogs for food and their burrows for shelter. Although white-tailed prairie dogs are known to occur in the general Emery Mine area, there were no colonies found in the Emery 2 area during the survey periods. There will be no impact to this species from mining in the study area.
Pediocactus despainii (1,2)	San Rafael footcactus	A survey was conducted for this species in the Emery 2 Area as well as the adjacent vegetation survey areas. No individuals of this plant were found nor likely habitat in the project area. Consequently, no impact to this cactus is expected with the proposed new mining operations in the Emery 2 Area.

Table 28: Federally listed threatened, endangered and candidate species for Emery County, Utah.

(1) This list was compiled using known species occurrences and species observations from the Utah Natural Heritage Program's Biodiversity Tracking and Conservation System (BIOTICS). The list was accessed on-line June 24, 2016. Its last update was dated October 1, 2015.

(2) Additional species added from a search of the U.S. Fish & Wildlife Service database (IPaC); access date: June 23, 2016.

(3) Additional GIS data was used from Utah Division of Wildlife Resources, Conservation Data Center; access date: June 24, 2016.

Ptychocheilus lucius (1)	Colorado pike minnow	This fish is a large minnow native to the Colorado River system and now only exists in the upper reaches of this river system. These rivers do not occur in the study area, nor do perennial streams that are tributaries to the Colorado River system occur in the Emery 2 study area. There will be no impact to this species from mining in the study area.
Schoenocrambe barnebyi (1,2)	Barneby reed-mustard	Barneby reed-mustard grows in soils derived from strata much lower (older) in the geologic column than what is found in the project area such as Chinle and Moenkopi (Triassic) formations. The geology, soils and habitat do not occur in the project area. There will be no impact to this species from the mine-related operations in the study area.
Sclerocactus wrightiae (1,2)	Wright fishhook cactus	Wright's fishhook cactus is known to be present primarily in salt desert habitats on Mancos Shale, Dakota, Morrison, Summerville and Entrada Sandstone formations. Although Mancos Shale is found in the in the project area, the other formations are not. It is possible this species could occur in the project area. Consequently, a survey was conducted for this cactus in the Emery 2 Area as well as the adjacent vegetation survey area. No individuals of this plant were found in the permit area, but potential habitat does exist in the vegetation survey area. More information about this species and the survey is provided in the Results section of this report.
Xyrauchen texanus (1)	Razorback sucker	The razorback is native to the Colorado River system and now only exists in the upper reaches of this river system. This river does not occur in the study area, nor do perennial streams that are tributaries to the Colorado River system occur in the Emery 2 study area. There will be no impact to this species from mining in the study area.
THREATENED		
Coccyzus americanus (2)	Yellow-billed cuckoo	The historical range of this species is thought to have been found in Utah and across the Gt. Basin. According to DWR database information, the current range of yellow-billed cuckoo is limited to disjunct fragments of riparian habitat in northern Utah, western Colorado, southwestern Wyoming, southeastern Idaho, southern Nevada and California. This habitat in not found near or within the study area. Consequently, there will be no impact to this species from operations in the Emery 2 Area.

Table 28: Federally listed threatened, endangered and candidate species for Emery County, Utah.

(1) This list was compiled using known species occurrences and species observations from the Utah Natural Heritage Program's Biodiversity Tracking and Conservation System (BIOTICS). The list was accessed on-line June 24, 2016. Its last update was dated October 1, 2015.

(2) Additional species added from a search of the U.S. Fish & Wildlife Service database (IPaC); access date: June 23, 2016.

(3) Additional GIS data was used from Utah Division of Wildlife Resources, Conservation Data Center; access date: June 24, 2016.

Cycladenia humilis var jonesii (1,2)	Jones cycladenia	Jones cycladenia grows in gypsiferous, saline soils derived from strata much lower (older) in the geologic column than what is found in the project area such as Summerville (Jurassic), Chinle (Triassic), and Cutler (Permian) formations. The project area soils are derived mostly from Manco Shale and Ferron sandstone formations of Cretaceous age. The geology, soils and habitat do not occur in the project area. There will be no impact to this species from mining in the study area.
Lynx canadensis (1)	Canada lynx	The Canada lynx range extends from Canada and Alaska south to Maine, the Rocky Mountains, and also to the Great Lakes region. DWR biologists state that, *although sightings of the Canada lynx in Utah over the past twenty years are exceedingly rare, the USDA Forest Service recently announced that Canada lynx hair was found in the Manti-La Sal National Forest in 2002*. DWR distribution maps show that the "predicted" habitat for this lynx to be on the Wasatch Plateau in northwestern Emery County and it may be "critical habitat". However, this habitat would be in montane coniferous forests of which do not occur in the near the Emery 2 study area. Consequently, there will be no impact to this species as a result of construction in the study area.
Pediocactus winkleri (1,2)	Winkler's footcactus	A survey was conducted for this species in the Emery 2 area as well as the adjacent vegetation survey areas. No individuals of this plant were found nor likely habitat in the project area. Consequently, no impact to this cactus is expected with the proposed new mining operations in the Emery 2 Area.
Strix occidentalis lucida (2)	Mexican spotted owl	The primary habitats in Utah for this owl are various forest types and steep rocky canyons. DWR distribution maps do not show the spotted owl in Emery County. The required habitat and apparent distributional information indicate that the likelihood for impacts to this bird by the proposed mining is extremely unlikely.
Townsendia aprica (1,2,3)	Last chance townsendia	This species is usually found in pinyon-juniper communities. of which are found in the study area. There is a very small stand of pinyon-juniper trees in the permit area. A survey was conducted for this species in the Emery 2 Area as well as the adjacent vegetation survey areas. No individuals of this plant were found nor likely habitat in the project area. There should be no impact to this species as a result of the proposed new mine-related activities.

Color Photographs of the Sample Areas

Proposed Disturbed Pinyon-Juniper

Pinyon-Juniper Comparison Area

Proposed Disturbed Shadscale

Shadscale Reference Area

Proposed Disturbed Greasewood (Uplands)

Greasewood Reference Area (Uplands)

Proposed Disturbed Greasewood (Bottoms)

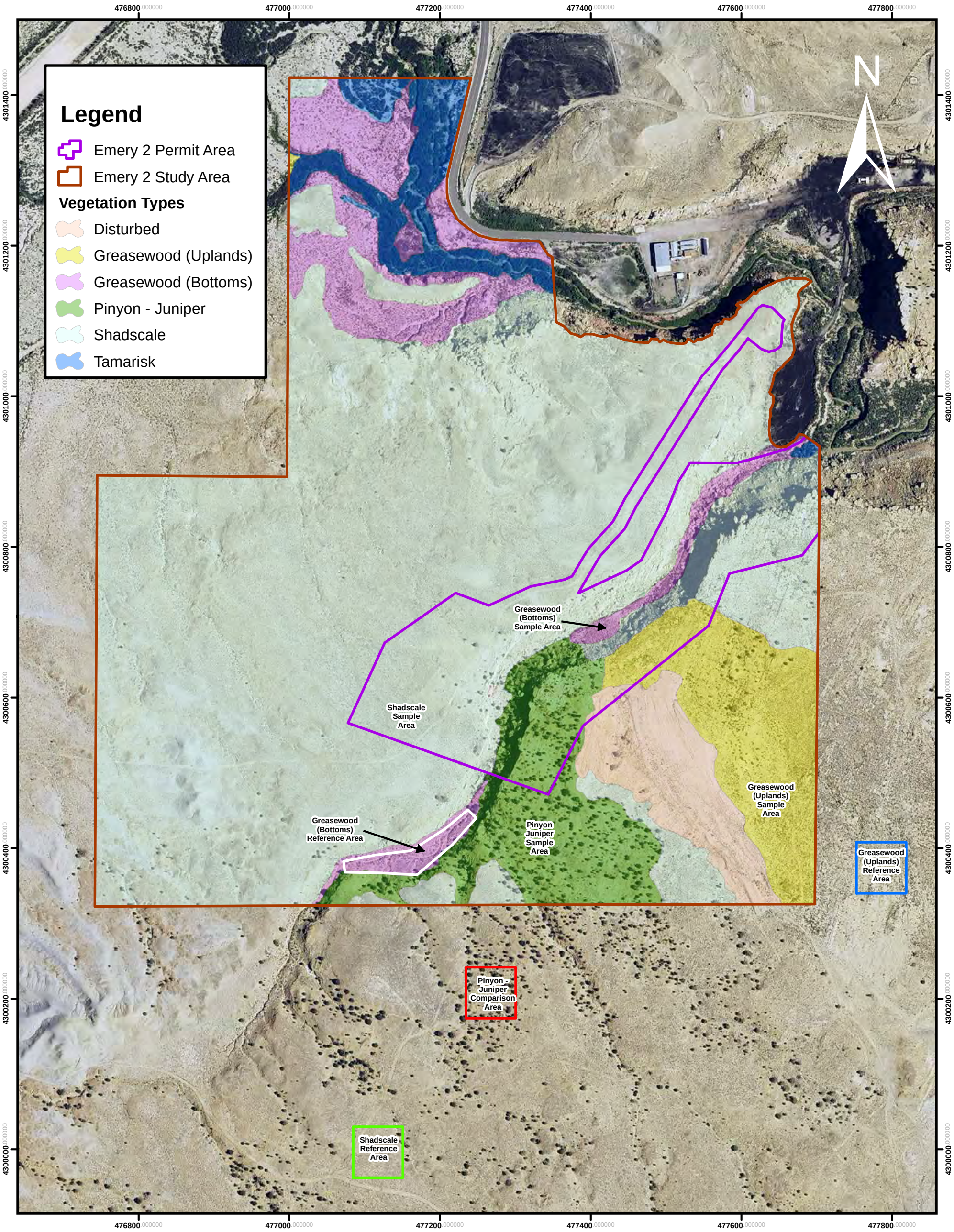
Greasewood Reference Area (Bottoms)

Previously Disturbed Shadscale & Greasewood

Previously Disturbed Shadscale & Greasewood

Tamarisk (no disturbance planned)

Tamarisk Reference Area (if needed in the future)



Bronco UTAH OPERATIONS, LLC

Figure 2. Emery 2 Study Area Vegetation Map

Rev. July 19, 2016
June 30, 2016 Base map NAIP 2014 UTM NAD 83 1 inch = 400 feet

Prepared By:
Mt Nebo Scientific
Springville, Utah

0 200 400 600 800 Feet

APPENDIX

Seed Mixtures for Revegetation
in the Emery 2 Area

Table A-1: Revegetation seed mixture for the Emery 2 study area

Pinyon-Juniper Community Shadscale Community Previously Disturbed Shadscale & Greasewood			
Scientific Name	Common Name	Rate PLS/Ac	No. Seeds Per Sq Ft
SHRUBS			
Artemisia nova	Black sagebrush	0.35	7.29
Atriplex canescens	Fourwing saltbush	5.00	6.31
Atriplex confertifolia	Shadscale	5.00	7.35
Ephedra viridis	Mormon tea	8.00	4.59
Ceratoides lanata	Winterfat	5.00	6.31
FORBS			
Eriogonum unbellatum	Sulfur buckwheat	1.50	7.20
Helianthus annuus	Sunflower	5.00	6.66
Linum perenne	Blue flax	1.00	6.38
Sphaeralcea grossulariaefolia	Gooseberry-leaf globemallow	0.50	5.74
Bouteloua gracilis		0.30	4.90
GRASSES			
Elymus smithii	Western wheatgrass	2.00	5.79
Hilaria jamesii	Galleta	2.00	7.30
Sporobolus airoides	Sand dropseed	0.15	6.03
Stipa hymenoides	Indian ricegrass	1.50	6.47
TOTALS		**36.95**	**88.31**

* Rates based on employing broadcast seeding methods (reduce by 50% when drill-seeded).
** Due to commercial availability, species can be substituted by a qualified botanist.

Table A-2: Revegetation seed mixture for the Emery 2 study area.

Greasewood (Uplands) Community **Greasewood (Bottoms) Community**			
Scientific Name	Common Name	Rate PLS/Ac	No. Seeds Per Sq Ft
SHRUBS			
Atriplex confertifolia	Shadscale	5.00	6.31
Atriplex canescens	Fourwing saltbush	5.00	6.89
Ceratoides lanata	Winterfat	5.00	6.31
Chrysothamnus nauseosus	Rubber rabbitbrush	0.75	6.89
Sarcobatus vermiculatus	Greasewood	1.00	6.57
FORBS			
Helianthus annuus	Sunflower	5.00	6.66
Sphaeralcea grossulariaefolia	Gooseberry-leaf Globemallow	0.75	8.61
GRASSES (and grass-likes)			
Distichlis spicata	Saltgrass	0.75	8.95
Elymus cinereus	Gt. Basin wildrye	4.00	8.72
Elymus smithii	Western wheatgrass	2.50	7.23
Sporobolus airoides	Sand dropseed	0.15	6.03
Stipa hymenoides	Indian ricegrass	1.50	6.47
TOTALS		**31.40**	**85.64**

* Rates based on employing broadcast seeding methods (reduce by 50% when drill-seeded).

** Based on commercial availability, species can be substituted by a qualified botanist.