

C/007/039 Incoming

#3801



Canyon Fuel Company, LLC  
Dugout Canyon Mine  
P.O. Box 1029  
Wellington, Utah 84542

March 29, 2011

Coal Regulatory Program  
Utah Division of Oil, Gas and Mining  
1594 West North Temple, Suite 1210  
Salt Lake City, UT 84114-5801

RE: Notice of Intent (NOI) to Conduct Minor Coal Exploration on behalf of Canyon Fuel Company, LLC – Dugout Canyon Mine, C/007/039

Dear Sirs:

Ark Land Company (a subsidiary of Arch Coal Inc.) and Dugout Canyon Mine are submitting this Notice of Intent (NOI) to Conduct Minor Coal Exploration to the Utah Division of Oil, Gas and Mining (Division) in order to obtain approval to conduct coal exploration in 2011. Four holes are planned to be drilled utilizing rubber-tired drilling rigs to obtain spot cores of the coal seams and associated strata. All exploration activities will occur on private surface held by the Canyon Fuel Company. Coal ownership is leased through the State of Utah (42648). The drill sites are located within the Mining Permit Boundary of the Dugout Canyon Mine (Permit number C/007/039). This NOI follows the format of the applicable parts of Division rules (R645-200 through R645-203) regarding the exploration of coal. We will need to start the exploration drilling following the wildlife exclusionary period (late July).

Ark Land Company has provided two copies of the NOI revisions to the Division for review and distribution to other agencies. The archeological and raptor reports are provided in Appendix E of this notice. A copy has been sent to SITLA and an additional copy of the NOI has been delivered to the Price Field office.

Please call with questions (435) 636-2869 (Vicky Miller) or Wade Robinson at (435) 613-2830.

Sincerely yours,

Vicky S. Miller

cc: Dave Spillman  
Wade Robinson

RECEIVED

MAR 31 2011

DIV. OF OIL, GAS & MINING

File in:  
 Confidential  
 Shelf  
 Expandable  
Date Folder 033111 C/0070039  
See: Wade Robinson For additional  
Confidential  
Skyline Mines

SUFSCO Mine

Dugout / Soldier Canyon Mines



# APPLICATION FOR COAL PERMIT PROCESSING

Permit Change  New Permit  Renewal  Exploration  Bond Release  Transfer

**Permittee:** Canyon Fuel Company, LLC

**Mine:** Dugout Canyon Mine

**Permit Number:** C/007/039

**Title:** 2011 Minor Coal Exploration

**Description,** Include reason for application and timing required to implement:

**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: \_\_\_\_\_ Disturbed Area: \_\_\_\_\_  increase  decrease.
- Yes  No 2. Is the application submitted as a result of a Division Order? DO# \_\_\_\_\_
- Yes  No 3. Does the application include operations outside a previously identified Cumulative Hydrologic Impact Area?
- Yes  No 4. Does the application include operations in hydrologic basins other than as currently approved?
- Yes  No 5. Does the application result from cancellation, reduction or increase of insurance or reclamation bond?
- Yes  No 6. Does the application require or include public notice publication?
- Yes  No 7. Does the application require or include ownership, control, right-of-entry, or compliance information?
- Yes  No 8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?
- Yes  No 9. Is the application submitted as a result of a Violation? NOV # \_\_\_\_\_
- Yes  No 10. Is the application submitted as a result of other laws or regulations or policies?

*Explain:* \_\_\_\_\_

- Yes  No 11. Does the application affect the surface landowner or change the post mining land use?
- Yes  No 12. Does the application require or include underground design or mine sequence and timing? (Modification of R2P2)
- Yes  No 13. Does the application require or include collection and reporting of any baseline information?
- Yes  No 14. Could the application have any effect on wildlife or vegetation outside the current disturbed area?
- Yes  No 15. Does the application require or include soil removal, storage or placement?
- Yes  No 16. Does the application require or include vegetation monitoring, removal or revegetation activities?
- Yes  No 17. Does the application require or include construction, modification, or removal of surface facilities?
- Yes  No 18. Does the application require or include water monitoring, sediment or drainage control measures?
- Yes  No 19. Does the application require or include certified designs, maps or calculation?
- Yes  No 20. Does the application require or include subsidence control or monitoring?
- Yes  No 21. Have reclamation costs for bonding been provided?
- Yes  No 22. Does the application involve a perennial stream, a stream buffer zone or discharges to a stream?
- Yes  No 23. Does the application affect permits issued by other agencies or permits issued to other entities?

**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.

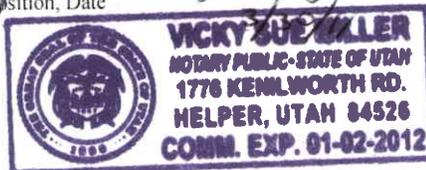
David Spillman  
Print Name

David Spillman, Engineering Manager  
Sign Name, Position, Date

Subscribed and sworn to before me this 30 day of March, 20 11

Vicky Sue Meller  
Notary Public

My commission Expires: 1-2, 20 12  
Attest: State of UTAH } ss:  
County of CARBON



<p><b>For Office Use Only:</b></p>	<p>Assigned Tracking Number:</p>	<p>Received by Oil, Gas &amp; Mining</p> <p style="text-align: center; color: red; font-weight: bold; font-size: 1.2em;">RECEIVED</p> <p style="text-align: center; color: red; font-weight: bold; font-size: 1.2em;">MAR 31 2011</p> <p style="text-align: center; color: red; font-weight: bold; font-size: 1.2em;">DIV. OF OIL, GAS &amp; MINING</p>
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**STATE MINOR COAL  
EXPLORATION PLAN APPLICATION  
2011**

Dugout Canyon Mine  
Carbon County, Utah

Exploration Plan  
March 30, 2011



Ark Land Company  
A Subsidiary of Arch Coal, Inc.

**STATE MINOR COAL  
EXPLORATION PLAN APPLICATION  
2011**

Dugout Canyon Mine  
Carbon County, Utah

Exploration Plan  
March 30, 2011



Ark Land Company  
A Subsidiary of Arch Coal, Inc.

exploration associated with this application, the Division will request and receive concurrence from SITLA and SHPO.

**R645-201. Coal Exploration: Requirements for Exploration Approval**

**R645-201-100. Responsibilities for Coal Exploration Plan Review**

**110. Coal Exploration Plan Review, Responsibility of the Division**

The lands upon which exploration will be conducted are under a state lease issued to Ark Land Company and, therefore not subject to 43 CFR Parts 3480-3487. Therefore, the exploration plan review will be the responsibility of the Division.

**120. Requirements of 43 CFR 3480-3487.**

As stated in R645-201-110 above, this requirement is not applicable.

**130. Division Responsibility to Coordinate with Other Agencies.**

This NOI will be submitted to the Division as the lead agency for review and approval.

**R645-201-200. Notices of Intention to Conduct Minor Coal Exploration.**

**210. Division Review Requirement.**

Ark Land Company is submitting a notice of intention to Conduct Minor Coal Exploration where removal of 100 tons or less of coal is planned.

**220. Required Applicant Information.**

**221. Name, Address and Telephone Number of Applicant**

Wendell A. Koontz  
Ark Land Company  
C/o Canyon Fuel Company  
Dugout Canyon Mine  
P.O. Box 1029  
Wellington, Utah 84542  
(Office Phone) 435-613-2830

The applicant is the same as the operator of the proposed exploration plan. Correspondence regarding this exploration plan should be addressed to:

Vicky Miller/Wendell Kootz  
Ark Land Company  
C/o Canyon Fuel Company  
Dugout Canyon Mine  
P.O. Box 1029  
Wellington, Utah 84542  
(Office Phone) 435-636-2869

**222. Name, Address and Telephone of Applicant's Representative**

The name, address and telephone number of the representative of the applicant who will be present during and be responsible for conducting the exploration is:

Wendell Koontz  
Mine Geologist  
Ark Land Company  
C/o Dugout Canyon Mine  
P.O. Box 1029  
Wellington, Utah 84542  
(Office Phone) 435-613-2830  
(Cell Phone) 970-261-4104

At times a consulting geologist may act as representative of the applicant.

**223. Description of Exploration Area**

The exploration area is located approximately 20 miles northeast of the town of Wellington, Carbon County, Utah (Figure 1). The legal description of the exploration area is as follows:

T13S R12E, Carbon County, Utah:  
Section 11 – Portions of S1/2 SE1/4 and S1/2SW1/4  
Section 14 – Portions of N1/2 N1/2 NW1/4, Portions of S1/2 S1/2 NE1/4,  
Portions of E1/2 NW1/4 SE1/4

Total: 180 acres (Actual surface disturbance approximately 3 acres)

The proposed exploration holes are located north of Dugout Canyon Mine facility. Figure 2 provides the location of exploration drill sites (EXP-01, EXP-02, EXP-03, and EXP-04) and access routes. Heavy Equipment access will be the Pine Canyon Road which joins the Soldier Canyon Road at approximately 1.5 miles above the Soldier Creek Mine. A second access will be the Dugout Canyon Road, which is used to access the Dugout Mine site. Existing drilling access routes will receive minor grading and localized repairs as needed. Vehicles associated with the drilling program may share the roads with suppliers, coal trucks, county construction vehicles and gas well maintenance vehicles.

The elevation in the area ranges from 7,200 feet in the south along the base of the Book Cliffs to 8,700 feet in the north atop the high mesas. The terrain is rugged with relatively gently sloping mesas bounded by the steep slopes of the Book Cliffs. Relatively deep and narrow valleys bisect the highlands and drain southward away from the Book Cliffs. The major drainages in the area are Pace Creek, Pine Creek, Rock Creek and Dugout Creek.

Rocks exposed in the exploration area belong to the Cretaceous age Blackhawk and Price River formations, and the Cretaceous-Tertiary age North Horn Formation. The rock types are predominantly sandstone, siltstone, shale, and coal. Quaternary alluvium and colluvium deposits of sand, silt, clay and boulders exist within the confines of the canyons. The major geologic features in the exploration area are the escarpments created by the various sandstone outcrops

including the 200 ft thick Castlegate Sandstone, a member of the Price River formation. Some faults are present within the area of the exploration program.

**Threatened and Endangered Plant and Wildlife Species** - There are no known federally or state listed threatened and endangered plant and wildlife species within the sites planned for the exploration drill hole. A letter report by Mt. Nebo Scientific listing cover and the existence of Threatened and Endangered species is provided in Appendix B.

There is no known groundwater or surface water flows to the Colorado or Green Rivers with potential for impact by the drilling of these exploration holes. Potential adverse affects to the four Colorado River endangered fish species would not be likely since there is no direct route to the Colorado River or Green River from the proposed drill hole locations. Per meetings with Division of Water Quality personnel during application for a UPDES permit in 2004, "there is no data supporting the premise that surface waters associated with the area of the mine operations reached the Price River or Colorado River prior to or since mining disturbance".

**Vegetation** - A vegetation report prepared by Mt. Nebo Scientific has been provided in Appendix B. The report covers species and cover for the area of the drill hole.

**Wildlife** - Drilling of the exploration holes will be post-July 15, eliminating the sites from the wildlife exclusionary period.

**Raptors** - Aerial raptor nest surveys done of the area by the Utah Division of Wildlife Resource are available for review in the confidential folder of the Dugout Canyon Mine's M&RP. The surveys have identified an active golden eagle nest 1/10 of a mile from EXP-01 and an inactive nest (since 2005) 3/4 of a mile from EXP-02. The 2010 raptor survey is provided in Appendix E (Confidential).

**Bats** - No known open mine shafts, caves, adits or other man made structures that might provide habitats for bats are known to exist in the project area. The sites are open and the lack of a food source would force the bats to seek habitat and nourishment elsewhere.

**Mexican Spotted Owl** - A calling point survey was conducted in the area by EIS Environmental and Engineering Consulting. The survey report concluded that "within the project area, a thorough search did not reveal the presence of any Mexican spotted owls". Additional studies by DW Wiley and F. Howe indicate that the habitat for the owls is in the southern parts of Utah, not in the Bookcliff area proposed for exploration drilling.

**Cultural Resources** - There are no known districts, sites, buildings, structures, or objects listed on, or eligible for listing on, the National Register of Historic Places within the area of the proposed exploration pads or access roads. There are no known archeological resources located in the proposed exploration area, refer to the Confidential Folder of the Dugout Canyon M&RP. Appendix E (Confidential File) is a site-specific cultural resource evaluation for three of the drilling locations. In 1980, AERC surveyed several sample blocks in Section 14, T13S, and R12E which included the location of the fourth hole proposed for drilling. Metcalf-Zier surveyed drill holes and access roads in Section 14, T13S and R12E in 1983.

Ark Land Company will notify the Division should the unlikely event of a cultural or paleontologist resource is discovered during operations. If discovered, the operation will cease and the Division will be notified.

**224. Period of Intended Exploration**

Ark Land Company plans to commence drilling operations in mid July 2011 and end on or around November 30, 2011. Following the completion and logging of the hole the disturbance will be reclaimed as described in Section 240.

A time table for exploration related activities is given below.

Task	WK 1	WK 2	WK 3	WK 4	WK 5	WK 6	WK 7	WK 8	WK 9	WK 10	WK 11	WK 12
Prepare roads, run water lines, set water tanks	█											
Prepare Sites	█	█	█									
Drilling			█	█	█	█	█	█	█	█		
Reclamation									█	█	█	█

**225. Method of Exploration**

The general method to be followed during drill hole exploration, reclamation, and abandonment of EXP-01 and 03 is: 1) repair the existing roads as needed, repair of roads may include hauling gravel to fill rough areas and grading rutted areas 2) set temporary water tank, pump, and water line as needed, 3) drill and log hole, 4) reclaim the drill site and remove the tank and pump.

EXP-01 will be drilled towards the end of the drilling season to facilitate the fledging of golden eagle chicks, should it be determined in the 2011 raptor survey that there are eggs in the nest located within a half mile radius of the proposed drill hole location.

The general method to be followed during drill hole exploration, reclamation, and abandonment of EXP-02 and 04 is: 1) repair the existing road as needed and extend the road to the drill pad 2) set temporary water tank, pump, and water line as needed, 3) drill and log hole, 3) reclaim the drill site, road extension and remove the tank and pump.

Water will be pumped and/or hauled from the Dugout Canyon Mine's fire water tanks and stock ponds to the drill sites and when necessary, water will be stored in water/frac tanks. Water lines may remain along roadways to facilitate future drilling activities. Access to the drill sites will be accomplished along existing roads and on foot, except as noted. No blasting is planned in the construction of the drill pads.

Core drilling typically involves one truck-mounted 2,000 ft rated core drill, one 3,000 gallon water truck, one drill pipe truck, one auxiliary air compressor, one supply trailer, four pick-up trucks, a geophysical logging truck and one covered trailer. The drilling procedure for the exploration hole will likely be rotary drilling and spot coring of selected zones. It is anticipated

that casing will be set into the top of the Castlegate Sandstone.

Additional equipment potentially used for the drilling of the exploration hole follows. A supply trailer will carry drill steels, coring equipment, drilling additives, cutting and welding equipment, a dog house and other supplies. Two pick-up trucks will be used by the drillers to carry personnel, fuel, and supplies and two pickup trucks will be used by the dirt contractor. A water truck will be used to supply water to the drilling equipment and/or the removal of water from the pit for disposal. The company representative and geological consultant will also use pick-up trucks for transportation. Support vehicles such as pickup trucks and geophysical logging truck will be parked at the drill sites or on adjacent existing roads.

The only coal removed during exploration activities will be cores. Cores will be a nominal three inches in diameter. Assuming an average thickness of 7 ft for the Rock Canyon Coal Seam and 8 ft for the Gilson Coal Seam, an estimated 60 pounds of coal will be removed. The drilling procedure will be to continuously core to total depth utilizing water, foam, polymer and/or mud as drilling medium.

The drill hole may range from 4 inches to 10 inches in diameter, depending on the drilling method. Most drilling will likely produce a 6 1/2" hole. The larger diameter will be associated with the installation of surface casing. The estimated depths of the proposed drill hole and disturbance area are as follows.

Drill Site	Location	Total Depth (ft)	Pad Area Disturbance (ft)	Disturbed Area (acres)
EXP-01	T13S, R12E Section 14 Portions of E1/2 NW1/4 SE1/4	900	100 X 140	0.5
EXP-02	Section 14 Portions of S1/2 S1/2 NE1/4	1600	100 X 140	0.7 (Includes short road segment)
EXP-03	Section 11 Portions of S1/2 SE1/4	2150	100 X 140	0.5
EXP-04	Section 11 Portions of S1/2 SW1/4 Section 14 Portions of N1/2 N1/2 NW1/4	1950	100 X 140	1.1 (Includes road 1200' X 20")

All gasoline and diesel powered equipment will be equipped with mufflers or spark arresters. Fire suppression equipment will be available to personnel on the project sites.

There are no occupied dwellings and no public utility pipelines located in the exploration pad areas. No trenches will be dug and no structures constructed.

The potential for water pollution will be minimized by keeping pollutants away from the drill hole and in their containers. When possible materials used during drilling operations will be

selected to be biodegradable. All spills of polluting materials will be removed from the area and disposed of in a proper manner.

The approximate depth of topsoil/growth medium as listed below will be salvaged when available. A qualified individual will be present at the sites during initial construction to identify topsoil and to direct topsoil/growth medium salvage. Additional soils information is provided in Appendix C.

Drill Site	Soil Type	Slopes (%)	Topsoil Depth
EXP-01	Unit 62, Midfork family-Comodore complex	50 to 70	18"
EXP-02	Unit 88, Rabbitex family – Datino variant complex	15 to 50	10 to 17"
EXP-03	Unit 62, Midfork family-Comodore complex	50 to 70	9 "
EXP-04	Unit 97, Rottulee family-Trag complex	30 to 60	5 to 24"
	Unit 7, Beje-Trag complex	3 to 30	

The drill pads will be constructed to be approximately 100 ft. X 140 ft., including a mud pit. A one and a half to three foot berm of subsoil will be constructed around the perimeter of the pad to ensure no runoff from the pad. The pad will be constructed such that fluids will drain toward the mud pit. When the pad is immediately adjacent to an ephemeral or perennial drainage the pit and pad slope will be opposite the drainage, the berm will be three feet tall and the pit will be lined.

Figure 3 shows a typical drill pad layout. Cuttings, excess drill core and used drill foam/mud will be placed in the mud pits and buried at a depth greater than 3.5 feet prior to distribution of soils during reclamation. The pit liner not buried beneath the cuttings will be cut off and removed from the sites for proper disposal.

When necessary during the drilling of the exploration holes water in the mud pit will be pumped into a water truck, pumped into a frac tank for pickup for disposal. Prior to the commencement of reclamation activities liquids in the mud pit will be allowed to evaporate or will be pumped and hauled for disposal. Mud pits will be fenced when unattended to prevent wildlife from possible entry. Each site will be kept free of trash and debris.

EXP-01 and EXP-03 sites are immediately adjacent to an existing road. However the road adjacent to EXP-04 will need to be extended approximately 1200 feet and the road to EXP-2 will need to be extended approximately 300 feet. EXP-01 encompasses an existing road which makes up approximately 50% of the drill site. The area of EXP-02 has been previously disturbed by logging operations.

As an integral part of the exploration activities reclamation will progress as contemporaneously as practical following the exploration activities. Each site will be returned to approximate original contour, pocked and gouged. An approved seed mix will be applied following gouging.

## **R645-202. Coal Exploration: Compliance Duties**

### **R645-202-100. Required Documents**

A copy of the NOI to Conduct Minor Coal Exploration including appendices will be available to personnel at the drill sites and will be available for review by an authorized representative of the Division upon request. No road use or special permits are required for the drill sites.

### **R645-202-200. Performance Standards**

#### **210. Requirements of the State Program**

Ark Land Company will comply with the coal exploration requirements of the State Program, and the conditions of the exploration plan upon its approval.

#### **220. Inspection and Enforcement**

Ark Land Company and Dugout Canyon Mine accept the Divisions rights to inspect the exploration operations when accompanied by company personnel.

#### **230. Operational Standards**

##### **231. Non-Disturbance of Habitats**

Dugout Canyon will apply the methods necessary to minimize disturbances or adverse effects to habitats of unique or unusually high value to T & E species. Refer to Section 223 for commitments and information related to threatened and endangered species.

##### **232. Road Construction and Use**

Regulations cited under R645-202-232 relative to roads will be followed, when they apply to existing roads and in the construction of the road extension to EXP-02 and EXP-04. The roads existing prior to starting the exploration program will not be reclaimed. Refer to Appendix D for additional commitments pertaining to roads.

##### **233. Topsoil Removal and Storage**

Topsoil/growth medium will be selectively removed, stored, and redistributed on areas disturbed by coal exploration activities as necessary to assure successful re-vegetation or as required by the Division. Refer to Section 225 for additional information related to topsoil removal.

##### **234. Diversion of Overland Flows**

No diversions of overland flows and ephemeral, perennial, or intermittent streams will be made in association with the construction of the exploration drill holes.

Ark Land Company has obtained the necessary permissions and water rights to take water for drilling from the Dugout Mine site tanks.

##### **235. Minimizing Disturbance to Hydrologic Balance**

Coal exploration will be conducted in a manner which minimizes the disturbance to the prevailing hydrologic balance in accordance with R645-301-356.300 and R645-301-763. Pads

and pits will be constructed on each site and measures will be implemented to minimize the effect of run off. Reclamation will follow the completion of the drill holes and collection of the drill hole data.

**236. Acid-or Toxic Forming Materials**

Based on historical drilling results, it is not anticipated that acid- or toxic- forming materials will be encountered during exploration. If encountered, the materials will be buried beneath four feet of material.

The excess cores will be either buried on site or taken to the waste rock site.

MSDS sheets for the drilling fluids, chemicals and other products used in drilling will be available for review at the drill sites.

**240. Reclamation Standards**

**241. Excavations**

Upon completion of drilling activities on a site, the site will be reasonably restored to its approximate original contour.

**242. Re-Vegetation**

The method of revegetation is intended to encourage prompt re-vegetation and recovery of a diverse, effective, and permanent vegetative cover. The seed mix is of the same seasonal variety native to the area to be disturbed. The following seed mixture will be used:

*Seed Mix*

<u>SPECIES</u>	<u># pls/acre</u>	<u>pls/sq. ft.**</u>
<b>Grasses, Forbs, and Shrubs</b>		
Kentucky Bluegrass (1,390,000 seeds/lb)*	0.5	16
Wildrye (130,000 seeds/lb)*	1.5	6
Sandberg Bluegrass (1,100,000 seeds/lb)*	1.0	25
Bluebunch Wheatgrass (126,000 seeds/lb)*	4.0	12
Indian Ricegrass (162,000 seed/lb)*	2.0	7
Needlegrass (150,000 seeds/lb)*	1.5	5
Mountain Big Sage (2,500,000 seeds/lb)*	<u>0.5</u>	<u>29</u>
TOTAL	11.0	100

\* Native Plants

\*\* Rounded nearest whole seed

When necessary a seed substitute may be made, the substitute will be native and of a similar genus. The seed mixture will be broadcast by hand. The seed mixture and cultivation methods will assure growth capable of stabilizing the soil surface from erosion.

### **243. Reclamation of Boreholes**

The exploration drill holes will be plugged as stipulated in the NOI. Typically the coal seams will be plugged with cement and the hole above the seam zone would be backfilled with bentonite chips/slurry to their full depth.

The completion method includes pulling surface casing when possible; but when not possible, cutting it flush with the ground, and then pumping the cement/bentonite slurry through the drill pipe starting at the bottom of the hole. Plugging will then be done in stages by tripping-out of the hole 3-4 joints (60-80 ft) and pumping again. This process will be repeated to the surface.

If bentonite chips are used, the chips will be dumped down the annulus of the hole in such a manner to prevent bridging in the hole and drilling water added to the hole as specified by the manufacturer. A monument marker will be placed in the top of the cement surface plug with the hole number and year. The Division will be notified prior to the completion of the drill hole abandonment procedure if so desired.

### **244. Removal of Equipment**

The equipment will be removed from the exploration sites upon completion of the drilling and reclamation program.

## **R645-203. Coal Exploration: Public Availability of Information**

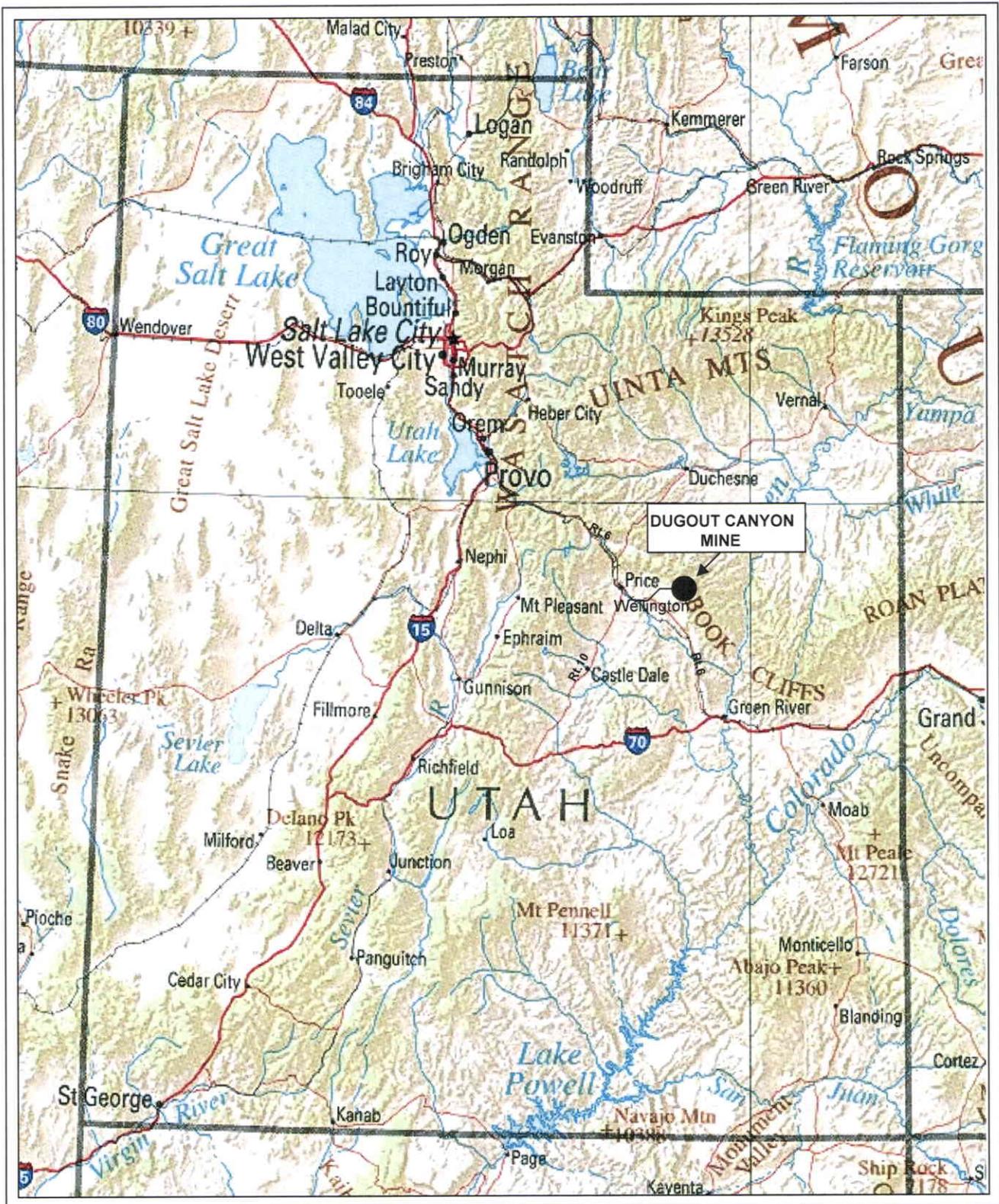
### **100. Public Records**

Except as provided in R645-203-200, all information submitted to the Division under R645-200 will be available for public inspection.

### **200. Confidentiality**

Ark Land Company requests that the Division not make any drilling information available for public inspection relative to coal seam thickness or quality. This information is considered crucial to Ark Land's competitive rights. Ark Land Company and Dugout Canyon Mine will retain all drill and geophysical logs. In addition, all information submitted with in the NOI which is designated "confidential" will be made unavailable for public inspection.

Figure 1: Location Map of Dugout Canyon Mine



Not to Scale





HOOF READ TDW BP

MINERAL LEASE NO. \_\_\_\_\_

MINERAL LEASE APPLICATION NO. 42648

GRANT: School

UTAH STATE LEASE FOR  
COAL  
(READJUSTED AS OF NOVEMBER 1, 1995)

THIS UTAH STATE MINERAL LEASE AND AGREEMENT entered into and executed in duplicate as of the 11th day of October, 1985, and readjusted as of November 1, 1995, by and between the STATE OF UTAH, acting by and through the SCHOOL AND INSTITUTIONAL TRUST LANDS ADMINISTRATION, with its offices located at 355 West North Temple, 3 Triad Center, Suite 400, Salt Lake City, Utah 84180-1204, hereinafter called the "LESSOR," and

Sage Point Coal Company  
P.O. Box 1029  
Wellington, Utah 84542

(whether one or more individuals, corporation, or other entities) with business office or address as shown above, hereinafter called the "LESSEE,"

WITNESSETH:

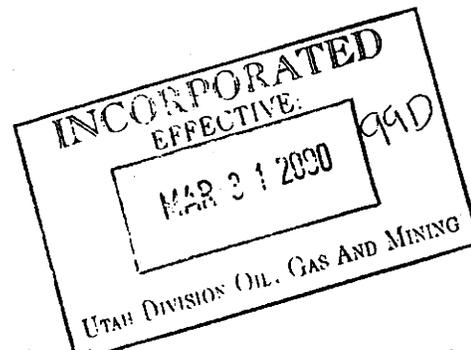
That the State of Utah as Lessor, for and in consideration of the fees, rents, royalties, and any other financial consideration paid or required to be paid by Lessee, and the terms and conditions to be performed by Lessee as hereinafter set forth, does hereby GRANT AND LEASE to the Lessee the exclusive right and privilege to explore for, drill for, mine, remove, and dispose of the particular minerals described in Article I hereof, hereinafter called the "leased substances," situated within the boundaries of the following-described tract of land (extending vertically downward from the surface) in Carbon County, State of Utah, to-wit:

Township 13 South, Range 12 East, SLB&M.

Section 8: E $\frac{1}{2}$   
Section 10: S $\frac{1}{2}$   
Section 11: S $\frac{1}{2}$   
Section 14: All  
Section 15: All  
Section 17: NE $\frac{1}{4}$ , E $\frac{1}{2}$ SW $\frac{1}{4}$ , SE $\frac{1}{4}$   
Section 20: E $\frac{1}{2}$ NW $\frac{1}{4}$ , SW $\frac{1}{4}$ NW $\frac{1}{4}$ , N $\frac{1}{2}$ NE $\frac{1}{4}$   
Section 21: N $\frac{1}{2}$ NW $\frac{1}{4}$ , NE $\frac{1}{4}$   
Section 22: N $\frac{1}{2}$ , N $\frac{1}{2}$ S $\frac{1}{2}$   
Section 23: W $\frac{1}{2}$ NW $\frac{1}{4}$

containing 3,640.00 acres, more or less.

This Mineral Lease is granted for and in consideration of and subject to all of the terms, provisions, and conditions hereinafter set forth:



ARTICLE IV. RIGHTS TO THE SURFACE ESTATE

If the surface estate of all or some portion of the leased lands is owned by the Lessor, Lessee may use such portions of the surface estate owned by Lessor as shall be reasonably necessary to explore and prospect for, mine, drill, remove, and dispose of the leased mineral substances, including permission to establish and maintain in a safe condition access roads, communication lines, tanks, pipelines, reservoirs, mills, processing plants, reduction works, dumps, and other essential structures, facilities, machinery, and equipment, reasonably necessary and expedient for the economic operation of the leasehold and in furtherance of production, treatment, and disposition of the leased substances under this lease. Such surface uses shall be exercised subject to the rights reserved to the State of Utah as provided in Article V hereof, and without unreasonable interference with the rights of any prior or subsequent lessee of the State of Utah under the program of multiple use. Upon the completion of mining, Lessee shall fully reclaim and restore the surface, including but not limited to the removal of all improvements, removal of dumps and spoils piles, recontouring, and revegetation. Lessee shall be liable for, and agrees to pay for, all damages to livestock, growing crops, water, and tangible improvements on the leased lands that may accrue by reason of Lessee's operations.

If the surface estate of any portion of the described lands is not owned by the State of Utah, except for a reserved right of entry to the mineral estate or mineral estates, the Lessee may exercise such right of entry to the mineral estate covered by this lease, at the sole cost and expense of Lessee herein and without cost to the State of Utah. If any damage is caused directly or indirectly to the surface estate by the Lessee or by the contractor or operator for Lessee, Lessee shall make proper restitution and indemnify the surface owner or owners. Lessee also shall make proper rehabilitation as required by the Utah Coal Mining and Reclamation Act, the Utah Mined Land Reclamation Act, and all lawful rules and regulations adopted thereunder.

Lessor will require a bond to be posted or other security given to the State to be filed with Lessor or any other State agency or officer in a principal amount determined by Lessor to be adequate to assure appropriate reclamation and restitution for any damage to the surface estate.

ARTICLE V. EXCEPTIONS AND EXCLUSIONS FROM LEASE

Lessor hereby excepts and reserves from the operation of this lease the following rights and privileges:

FIRST: The right to establish rights of way and easements on, through, or over the land above described, for utility corridors and for joint or joint and several uses, as may be necessary and appropriate for the management of the above-described lands and other lands of Lessor or lands administered by Lessor, and for the working of other deposits within said lands under mineral leases granted to others under the program of multiple use.

SECOND: The right to issue mineral leases to other lessees covering minerals not included in this lease, under such terms and conditions which will not unreasonably interfere with operations under this lease in accordance with the principle of multiple use provided by law.

THIRD: In the event Lessor owns the surface estate in said lands or portions of said lands above described, Lessor retains the right to use, lease, sell, or otherwise dispose of the surface estate in said lands or

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or otherwise treated coal; coal developed into liquid or gaseous products; or other commercial products by in-situ process or treatment, mined, or extracted from the hereinabove described lands, together with such other information required by the School and Institutional Trust Lands Administration to verify production and disposition of the coal or coal products from the leased premises.

FOURTH: Lessee may maintain this lease in force beyond the primary term of ten (10) years from the effective date of this lease by paying Lessor, in addition to rentals and Production Royalties as hereinabove required, an annual minimum royalty of equivalent to ten times the annual rental, provided that the Lessee must also be engaged in diligent operations, exploration, research, or development activity which is reasonably calculated to advance development or production of the mineral covered by the lease from the leased premises or lands pooled or unitized with or constituting of an approved mining or drilling unit in respect to the leased premises. Said annual minimum royalty shall be paid each year in advance, commencing with the eleventh year of the lease, along with the regular annual rental required to be paid under the terms of this lease. Said rental per acre and said Minimum Royalty shall be paid on each and every acre in this lease to extend the term of this lease and to keep this lease in force and effect. In no event shall this lease remain in effect beyond twenty years in the absence of actual production of leased substances in commercial quantities.

Rentals and Minimum Royalties paid annually shall be credited against actual Production Royalties for the year in which they accrue during the original term, or any extension thereof; but annual rentals shall not be credited against Minimum Royalties.

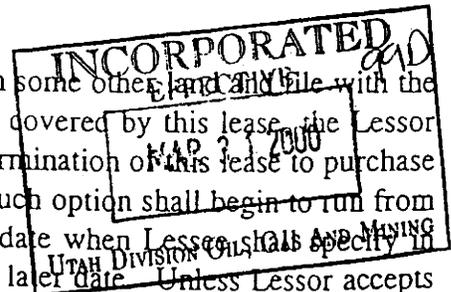
#### ARTICLE VII. MINERAL TITLE OF LESSOR

Lessor claims title to the mineral estate covered by this lease. Lessor does not warrant title nor represent that no one will dispute the title asserted by Lessor. It is expressly agreed that Lessor shall not be liable to Lessee for any alleged deficiency in title to the mineral estate, nor shall Lessee or any assigns of the Lessee become entitled to any refund for any rentals, bonuses, or royalties paid under this lease.

#### ARTICLE VIII. WATER RIGHTS

Any and all water rights developed on the leased land by Lessee shall be filed in the name of Lessor. Lessee shall have the full and free use of such water rights for lease operations during the term of the lease. Upon expiration or termination of the lease, such water rights shall be retained by Lessor. During the term of the lease, Lessee shall preserve, protect, and defend such water rights. Lessee shall assign and convey all existing water rights and any application for appropriation of water to beneficial use relating to the leased land or the mineral estate covered by this lease to Lessor.

If the Lessee shall purchase or otherwise acquire any water rights on some other land and file with the State Engineer appropriate application for change of use onto the premises covered by this lease, the Lessor herein shall have an option for 45 days after the expiration, surrender, or termination of this lease to purchase said otherwise acquired water rights at the acquisition costs of the Lessee. Such option shall begin to run from the date of termination, surrender, or expiration of this lease or from the date when Lessee shall specify in writing the acquisition costs of such other water rights, whichever date is the later date. Unless Lessor accepts such written offer to convey such rights at the actual acquisition costs within said period of 45 days, Lessor shall



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MINERAL LEASE NO. \_\_\_\_\_

MINERAL LEASE APPLICATION NO. 42648

GRANT: School

UTAH STATE LEASE FOR  
COAL  
(READJUSTED AS OF NOVEMBER 1, 1995)

THIS UTAH STATE MINERAL LEASE AND AGREEMENT entered into and executed in duplicate as of the 11th day of October, 1985, and readjusted as of November 1, 1995, by and between the STATE OF UTAH, acting by and through the SCHOOL AND INSTITUTIONAL TRUST LANDS ADMINISTRATION, with its offices located at 355 West North Temple, 3 Triad Center, Suite 400, Salt Lake City, Utah 84180-1204, hereinafter called the "LESSOR," and

Sage Point Coal Company  
P.O. Box 1029  
Wellington, Utah 84542

(whether one or more individuals, corporation, or other entities) with business office or address as shown above, hereinafter called the "LESSEE,"

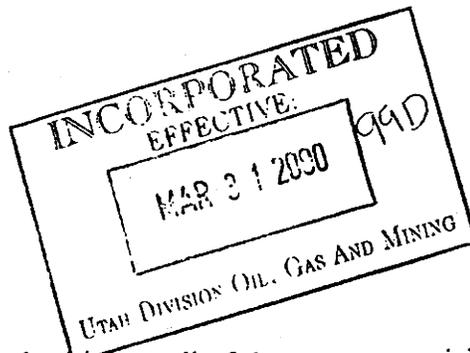
WITNESSETH:

That the State of Utah as Lessor, for and in consideration of the fees, rents, royalties, and any other financial consideration paid or required to be paid by Lessee, and the terms and conditions to be performed by Lessee as hereinafter set forth, does hereby GRANT AND LEASE to the Lessee the exclusive right and privilege to explore for, drill for, mine, remove, and dispose of the particular minerals described in Article I hereof, hereinafter called the "leased substances," situated within the boundaries of the following-described tract of land (extending vertically downward from the surface) in Carbon County, State of Utah, to-wit:

Township 13 South, Range 12 East, SLB&M.

- Section 8: E $\frac{1}{2}$
- Section 10: S $\frac{1}{2}$
- Section 11: S $\frac{1}{2}$
- Section 14: All
- Section 15: All
- Section 17: NE $\frac{1}{4}$ , E $\frac{1}{2}$ SW $\frac{1}{4}$ , SE $\frac{1}{4}$
- Section 20: E $\frac{1}{2}$ NW $\frac{1}{4}$ , SW $\frac{1}{4}$ NW $\frac{1}{4}$ , N $\frac{1}{2}$ NE $\frac{1}{4}$
- Section 21: N $\frac{1}{2}$ NW $\frac{1}{4}$ , NE $\frac{1}{4}$
- Section 22: N $\frac{1}{2}$ , N $\frac{1}{2}$ S $\frac{1}{2}$
- Section 23: W $\frac{1}{2}$ NW $\frac{1}{4}$

containing 3,640.00 acres, more or less.



This Mineral Lease is granted for and in consideration of and subject to all of the terms, provisions, and conditions hereinafter set forth:

## ARTICLE I. MINERALS COVERED BY THIS LEASE

This Mineral Lease covers the following-described leased mineral substances within the boundaries of the above-described lands:

COAL, which shall mean and include black or brownish-black solid fossil fuel that has been subjected to the natural processes of coalification, and which falls within the classification of coal by rank: I Anthracite, II Bituminous, III Sub-Bituminous, IV Lignitic.

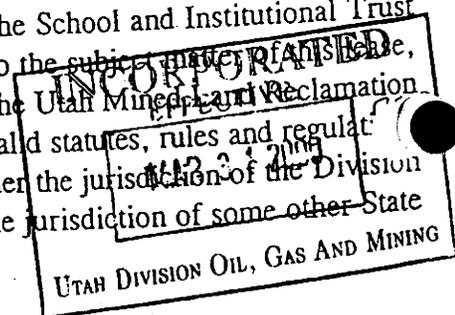
In the event Lessee, or the operator or any contractor for Lessee, shall discover within said lands some mineral or minerals other than the mineral or leased substances covered by this lease, Lessee shall promptly notify the Lessor of the kind or nature of such mineral not included in this lease.

## ARTICLE II. PRIMARY TERM AND POSSIBLE EXTENSION OF TERM OF LEASE

This lease is granted for a primary term of TEN (10) years commencing on the first day of the month following the date hereinabove first written and as long thereafter as the leased substances shall be produced in commercial quantities from the above-described lands, on condition that Lessee shall perform the terms and provisions required to be performed by Lessee including payment of rents and royalties within the times require herein; provided however, that it is expressly agreed that at the end of each period of ten (10) years following the effective date of this lease, the State of Utah as Lessor shall have the right to readjust the terms and conditions of this lease as may then be determined to be in the best interest of the State of Utah as trustee owner of the mineral estate. In the event of failure or refusal of the Lessee to accept and agree to the readjustment of the terms and conditions submitted by Lessor at the end of such ten (10)-year period, such failure or refusal to accept such readjustment of terms, conditions, or royalty shall operate to forfeit any right to extension of the term of this Mineral Lease and terminate this lease except for the rights of the State of Utah to recover any royalties then owing the State and/or any damages for which Lessee may be liable. This lease may be extended as provided in Article VI(Fourth), but in no event will it be extended beyond the end of the twentieth year except by the production of the leased substances in commercial quantities from the leased lands. If Lessee ceases production of leased substances in commercial quantities this lease will terminate one (1) year from the date of last commercial production, unless Lessee commences commercial production at least three (3) months prior to the end of such year and such commercial production then continues for at least six (6) months.

## ARTICLE III. APPLICABLE LAWS AND REGULATIONS

This lease is issued pursuant to the provisions of Title 53C, Utah Code Annotated, 1953, as amended, and subject to all valid Rules and Regulations and requirements adopted by the School and Institutional Trust Lands Administration, and of the Board of Oil, Gas, and Mining, applicable to the subject matter of this lease, together with all requirements of the Utah Coal Mining and Reclamation Act, the Utah Mineral Reclamation Act, all requirements of the State Antiquities Act, Title 9, Chapter 8, and all valid statutes, rules and regulations relating to safety, sanitation, environmental protection, and health whether under the jurisdiction of the Division of Oil, Gas, and Mining with respect to operations under this lease or under the jurisdiction of some other State or federal agency.



ARTICLE IV. RIGHTS TO THE SURFACE ESTATE

If the surface estate of all or some portion of the leased lands is owned by the Lessor, Lessee may use such portions of the surface estate owned by Lessor as shall be reasonably necessary to explore and prospect for, mine, drill, remove, and dispose of the leased mineral substances, including permission to establish and maintain in a safe condition access roads, communication lines, tanks, pipelines, reservoirs, mills, processing plants, reduction works, dumps, and other essential structures, facilities, machinery, and equipment, reasonably necessary and expedient for the economic operation of the leasehold and in furtherance of production, treatment, and disposition of the leased substances under this lease. Such surface uses shall be exercised subject to the rights reserved to the State of Utah as provided in Article V hereof, and without unreasonable interference with the rights of any prior or subsequent lessee of the State of Utah under the program of multiple use. Upon the completion of mining, Lessee shall fully reclaim and restore the surface, including but not limited to the removal of all improvements, removal of dumps and spoils piles, recontouring, and revegetation. Lessee shall be liable for, and agrees to pay for, all damages to livestock, growing crops, water, and tangible improvements on the leased lands that may accrue by reason of Lessee's operations.

If the surface estate of any portion of the described lands is not owned by the State of Utah, except for a reserved right of entry to the mineral estate or mineral estates, the Lessee may exercise such right of entry to the mineral estate covered by this lease, at the sole cost and expense of Lessee herein and without cost to the State of Utah. If any damage is caused directly or indirectly to the surface estate by the Lessee or by the contractor or operator for Lessee, Lessee shall make proper restitution and indemnify the surface owner or owners. Lessee also shall make proper rehabilitation as required by the Utah Coal Mining and Reclamation Act, the Utah Mined Land Reclamation Act, and all lawful rules and regulations adopted thereunder.

Lessor will require a bond to be posted or other security given to the State to be filed with Lessor or any other State agency or officer in a principal amount determined by Lessor to be adequate to assure appropriate reclamation and restitution for any damage to the surface estate.

ARTICLE V. EXCEPTIONS AND EXCLUSIONS FROM LEASE

Lessor hereby excepts and reserves from the operation of this lease the following rights and privileges:

FIRST: The right to establish rights of way and easements on, through, or over the land above described, for utility corridors and for joint or joint and several uses, as may be necessary and appropriate for the management of the above-described lands and other lands of Lessor or lands administered by Lessor, and for the working of other deposits within said lands under mineral leases granted to others under the program of multiple use.

SECOND: The right to issue mineral leases to other lessees covering minerals not included in this lease, under such terms and conditions which will not unreasonably interfere with operations under this lease in accordance with the principle of multiple use provided by law.

THIRD: In the event Lessor owns the surface estate in said lands or portions of said lands above described, Lessor retains the right to use, lease, sell, or otherwise dispose of the surface estate in said lands or

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any part thereof, under existing State laws or laws subsequently enacted, insofar as such surface is not essential for the Lessee herein in exploration, prospecting for, mining, drilling, removal, or disposal of the leased substances covered by this lease, to the extent that such use, lease, or sale of the surface estate does not unreasonably interfere with the rights granted to the Lessee herein. Lessor shall notify Lessee herein of any such sale, lease, use, or other disposition of the surface estate.

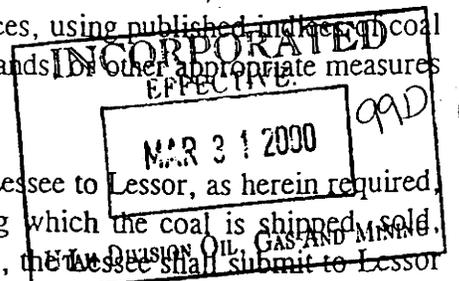
#### ARTICLE VI. PAYMENT OF RENTALS AND ROYALTIES

For and in consideration of the leasehold rights granted to the Lessee, in addition to all other terms and conditions required to be performed by the Lessee, the Lessee hereby covenants and agrees with Lessor to pay rentals and royalties as follows:

**FIRST:** Lessee agrees to pay Lessor as rental for the land covered by this lease the sum of One Dollar (\$1.00) per acre and for each fractional part of an acre, each year in advance on or before the first day of the month following the anniversary date of this lease, for the first ten years of this lease, except the rental for the first year which has been paid with the application for this lease. For the eleventh and subsequent years of this lease, Lessee agrees to pay an annual rental of Three Dollars (\$3.00) per acre and for each fractional part of an acre. All rentals paid shall be credited against actual Production Royalties for the lease year in which they shall accrue, but such rentals shall not be credited against the Minimum Royalties under subparagraph "Fourth" of this ARTICLE VI.

**SECOND:** Lessee shall pay a production royalty of 8% of the gross value at the mine of all leased substances produced from the leased premises. Where leased substances have been sold pursuant to an arms-length contract, gross value shall be the gross proceeds received by the Lessee, including all bonuses, allowances and reimbursements. It is expressly understood and agreed that none of Lessee's mining or product costs, including but not limited to materials, labor, overhead, taxes, loading costs, processing costs, or general and administrative costs may be deducted in computing production royalties. All such costs shall be entirely borne by Lessee and are anticipated by the rate of royalty assigned in this Agreement. If the coal is not sold at the mine, reasonable transportation costs incurred pursuant to arms-length transportation contracts may be deducted from the gross value of the coal. If the coal is washed or otherwise treated, royalty shall be paid on the basis of its value as washed or treated coal. Lessee shall maintain accurate records of the amount of coal washed or treated and report on the sale price or sale value of the washed coal or treated coal. In no event shall the value of leased substances used to calculate production royalties under this Agreement be less than the value that would be obtained were applicable federal valuation regulations used to value the leased substances. In the event that leased substances are sold other than pursuant to an arms-length contract, or if the Trust Lands Administration determines that the sales price does not reflect the true value of the leased substances, the Trust Lands Administration may make its own determination of the value of the substances, using published indices of coal prices, prevailing contract prices for similar coal in the area of the Subject Lands, or other appropriate measures of value.

**THIRD:** Payment of Production Royalty shall be made by the Lessee to Lessor, as herein required, on or before the last day of the month next succeeding the month during which the coal is shipped, sold, processed, or used. In connection with such payment of Production Royalty, the Lessee shall submit to Lessor a certified statement of the coal produced; shipped; sold; processed; or used; including unwashed coal, washed,



or otherwise treated coal; coal developed into liquid or gaseous products; or other commercial products by in-situ process or treatment, mined, or extracted from the hereinabove described lands, together with such other information required by the School and Institutional Trust Lands Administration to verify production and disposition of the coal or coal products from the leased premises.

FOURTH: Lessee may maintain this lease in force beyond the primary term of ten (10) years from the effective date of this lease by paying Lessor, in addition to rentals and Production Royalties as hereinabove required, an annual minimum royalty of equivalent to ten times the annual rental, provided that the Lessee must also be engaged in diligent operations, exploration, research, or development activity which is reasonably calculated to advance development or production of the mineral covered by the lease from the leased premises or lands pooled or unitized with or constituting of an approved mining or drilling unit in respect to the leased premises. Said annual minimum royalty shall be paid each year in advance, commencing with the eleventh year of the lease, along with the regular annual rental required to be paid under the terms of this lease. Said rental per acre and said Minimum Royalty shall be paid on each and every acre in this lease to extend the term of this lease and to keep this lease in force and effect. In no event shall this lease remain in effect beyond twenty years in the absence of actual production of leased substances in commercial quantities.

Rentals and Minimum Royalties paid annually shall be credited against actual Production Royalties for the year in which they accrue during the original term, or any extension thereof; but annual rentals shall not be credited against Minimum Royalties.

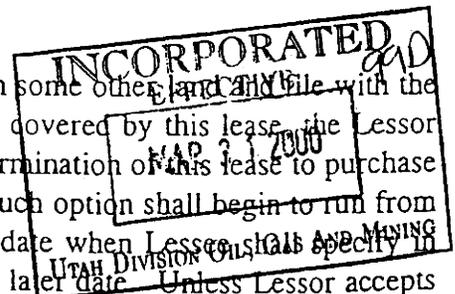
#### ARTICLE VII. MINERAL TITLE OF LESSOR

Lessor claims title to the mineral estate covered by this lease. Lessor does not warrant title nor represent that no one will dispute the title asserted by Lessor. It is expressly agreed that Lessor shall not be liable to Lessee for any alleged deficiency in title to the mineral estate, nor shall Lessee or any assigns of the Lessee become entitled to any refund for any rentals, bonuses, or royalties paid under this lease.

#### ARTICLE VIII. WATER RIGHTS

Any and all water rights developed on the leased land by Lessee shall be filed in the name of Lessor. Lessee shall have the full and free use of such water rights for lease operations during the term of the lease. Upon expiration or termination of the lease, such water rights shall be retained by Lessor. During the term of the lease, Lessee shall preserve, protect, and defend such water rights. Lessee shall assign and convey all existing water rights and any application for appropriation of water to beneficial use relating to the leased land or the mineral estate covered by this lease to Lessor.

If the Lessee shall purchase or otherwise acquire any water rights on some other land and file with the State Engineer appropriate application for change of use onto the premises covered by this lease, the Lessor herein shall have an option for 45 days after the expiration, surrender, or termination of this lease to purchase said otherwise acquired water rights at the acquisition costs of the Lessee. Such option shall begin to run from the date of termination, surrender, or expiration of this lease or from the date when Lessee shall specify in writing the acquisition costs of such other water rights, whichever date is the later date. Unless Lessor accepts such written offer to convey such rights at the actual acquisition costs within said period of 45 days, Lessor shall



be deemed to have rejected the offer. Upon payment of the said acquisition costs by the Lessor, Lessee herein shall assign and transfer such acquired water rights to the Lessor.

#### ARTICLE IX. WRITTEN CONSENT REQUIRED FOR ASSIGNMENT OR SUBLEASE

Lessee shall not assign this lease nor any portion thereof, nor any rights or privileges herein granted, without the prior written consent of Lessor. Nor shall the Lessee issue any sublease without the prior written consent of Lessor. Any assignment of lease and any sublease issued without prior written consent of Lessor shall be void ab initio.

In the event Lessor shall approve an assignment of this lease or of any part hereof, such assignment shall be subject to all of the terms, conditions, and obligations of the Lessee herein set forth. All of the terms, covenants, conditions, and obligations of the Lessee shall be binding upon the heirs, executors, administrators, successors, and assigns of the Lessee. This provision also shall apply to any sublease issued by Lessee and approved by Lessor.

#### ARTICLE X. OVERRIDING ROYALTY LIMITATION

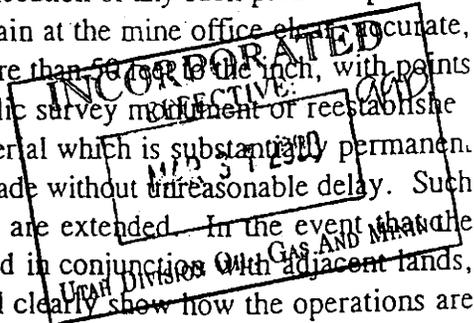
Neither the Lessee nor the assignee of Lessee shall create or grant any overriding royalty except as permitted by law and by the Rules and Regulations of the School and Institutional Trust Lands Administration. Overriding royalty assignments shall not become effective, even if otherwise valid, until filed with the Lessor.

#### ARTICLE XI. SURRENDER OR RELINQUISHMENT OF LEASE

Upon approval of the Lessor and the payment of all rentals, royalties and other amounts then owing, Lessee may surrender this lease for cancellation by Lessor as to all or any part of the leased lands, but not for less than a quarter-quarter section or surveyed lot.

#### ARTICLE XII. NOTICE OF COMMENCEMENT OF OPERATIONS, PLANS, PLATS, BOND

Not less than sixty (60) days before commencement of exploration, drilling, or mining operations, Lessee shall give written notice hereof to the School and Institutional Trust Lands Administration and the Division of Oil, Gas, and Mining, together with a plan of operations and a topographic map showing every proposed shaft, tunnel, open pit, drill site, and access road to be used. Lessor shall make an assessment of such plan of operation and either endorse or stipulate changes in Lessee's plan of operation, or request additional information within the sixty (60) day notification period. Lessee shall not proceed with the execution of any such plan of operation without first receiving the written approval of Lessor. Lessee shall maintain at the mine office accurate, and detailed maps of all actual and planned operations on a scale of not more than 50 feet to the inch, with points coordinated with public land surveys showing distance to the nearest public survey monument or reestablished survey corner. Such maps and plats shall be on tracing cloth or other material which is substantially permanent and of which clear and distinct photo copies or blueprints can be readily made without unreasonable delay. Such maps or plats shall show the workings from time to time, as the same are extended. In the event that the operations on the above-described leasehold are intended to be conducted in conjunction with adjacent lands, whether Federal, State, or privately-owned lands, the map and plats shall clearly show how the operations are



to be coordinated. All surveys shall be conducted by a licensed surveyor or engineer qualified to practice in Utah. All such maps or plats shall be certified by the surveyor or engineer preparing the same. The State or any agency of the State of Utah, including the Division of Oil, Gas, and Mining, shall be entitled to a true and correct copy thereof, together with the proposed plans of operation.

After Lessor receives notice of intent to commence mining operations, upon request of the Lessor, the Lessee shall furnish a bond with an approved corporate surety company authorized to transact business in the State of Utah, or such other security acceptable to the Lessor, in an amount to be determined by Lessor, after taking into account the value of the land and the amount of potential damage which likely will result from such proposed mining operations, and which bond or other security shall be conditioned upon payment of all rentals and royalties from the leasehold and other sums which may become payable to the Lessor, and to assure full compliance with the terms and conditions of this lease and compliance with all Rules and Regulations of the School and Institutional Trust Lands Administration and all Rules and Regulations of any other State agency having jurisdiction over mining operations, and also conditioned upon payment of all damages to the surface and improvements thereon if this lease covers surface estate or some portion of the surface estate which has been sold or otherwise leased, and any damage caused by Lessee to any other lessee of the State of Utah with respect to said land. Such bond or other security furnished prior to commencement of development of the leasehold may be increased in such reasonable amounts as the Lessor may require after discovery of any of the leased substances.

If the plan of mining development or mining operations includes core-drilling, the plan of operations shall disclose the locations of core-drilling operations.

ARTICLE XIII. ALL OPERATIONS TO BE CONDUCTED IN A LAWFUL, PRUDENT MANNER

Lessee shall conduct all operations under this lease in a lawful, prudent, and good workmanlike manner for the effective and safe production of the mineral substances covered by this lease, and to avoid unnecessary damage and injury to the leasehold estate, and also to avoid damage and wastage of other natural resources not covered by this lease. All operations of Lessee, whether conducted directly by Lessee or by operators or contractors, shall be at the sole cost and expense of Lessee. Such methods of mining shall be used that will ensure the extraction of all economically recoverable coal.

It is expressly covenanted and agreed that Lessor does not grant Lessee or any person dealing with Lessee any right to subject the property hereinabove described, nor any leased substances, to any lien-rights for labor or mechanic's liens, nor to any materialmen's liens, nor to any other lien for any act, omission, neglect, or performance of Lessee or its agents, employees, and contractors. In the event any one shall file any notice of claim of lien against said property or any estate in said property, Lessee shall take all necessary steps expeditiously to have such notice or claim released of record. Lessee shall save Lessor harmless from any and all lien notices and claims against said land arising from any act or neglect of Lessee and any contractor or operator of Lessee in any operations on or relating to the hereinabove described lands.

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Lessee shall not fence off or otherwise make inaccessible to livestock lawfully on the surface of said premises any watering place without the written consent of Lessor; provided, that Lessee shall not permit any livestock to come upon any portion of the leasehold to pollute any surface or subsurface water available or

capable of being made available for domestic use or irrigation. In the operations of Lessee, Lessee shall comply with all laws and regulations for control of water which might be encountered or which might seep into any formation, to avoid pollution of surface and underground waters as required by Chapter 11, Title 26, Utah Code Annotated, 1953, as amended. Lessee shall comply with all valid laws and regulations relating to prevention and suppression of fires, make all necessary provisions for sanitary disposal of wastes, and in all operations connected with said leasehold take appropriate measures for protection of human life and prevention of injuries and disease.

Lessee shall indemnify, defend and hold harmless the Lessor from all liability, claims, causes of action, damages or expenses arising out of or alleged to arise out of the operations of Lessee hereunder, or the presence on the leased lands of any employee, agent, contractor or subcontractor of Lessee.

ARTICLE XIV. RIGHTS OF LESSOR FOR INSPECTIONS OF LEASEHOLD AND RECORDS

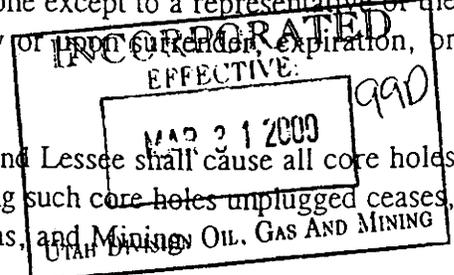
Lessor, its officers, and agents have the right at all reasonable times to enter upon the leased lands and premises to inspect the conditions of the leasehold, the work done under the terms of this lease, and the production obtained from the leasehold, such entry and inspections to be done in such a manner as shall not unreasonably interfere with the lawful operations by the Lessee in performance of the terms and conditions of this lease.

Lessor also shall have the right to examine all books and records pertaining to operations under this lease whether such books and records are located within a building on the leased premises or located in an office elsewhere and to make copies and abstracts of such records if desired by Lessor. Lessor, its officers, and agents shall have the right to post upon or within the leasehold such notices deemed proper or expedient by Lessor.

If Lessee maintains an office in another State or in a foreign country, Lessee nevertheless shall maintain within the State of Utah proper and adequate records relating to operations on this leasehold and also relating to production of leased substances and payment of rentals and royalties. Lessee also shall have a resident agent in the State of Utah to whom any and all notices may be sent by Lessor and on whom process may be served. In the event of any change in the address of Lessee's office in the State of Utah, Lessee shall promptly furnish Lessor with written notice of such change of address within the State of Utah. Examinations of records of Lessee by the Lessor shall be conducted at reasonable times.

In the event Lessee conducts core-drilling operations within the leasehold, or by directional drilling from adjacent land, Lessor shall have a right of inspection of core samples and any analysis made thereof and any assay; provided, that any report obtained by Lessor of any core-drilling operations may be declared confidential information by Lessee, in which event Lessor shall keep such information in a separate confidential information file. Such information shall not be disclosed to any competitor nor to any one except to a representative of the Attorney General of the State of Utah until Lessee waives confidentiality or upon surrender, expiration, or termination of this lease.

After completion of any core drilling, Lessee shall notify Lessor; and Lessee shall cause all core holes to be plugged or sealed as expeditiously as possible after the need for keeping such core holes unplugged ceases, in accordance with regulations and requirements of the Division of Oil, Gas, and Mining.



ARTICLE XV. OPERATIONS IN CONJUNCTION WITH MINING ON OTHER LANDS

In the event Lessee, in the interest of economy in mining operations, desires to conduct mining operations on or within the above-described lands in conjunction with mining operations on or within any adjacent Federal, State, or privately-owned land by utilization of shafts, inclines, or tunnels within either the above-described lands or within adjacent lands, Lessee shall make application in writing to the School and Institutional Trust Lands Administration and submit with such application a detailed plan of operations illustrating how leased substances mined from the above-described lands can and will be mined, segregated, and separately accounted for from leased substances mined from some adjacent land. No such operations shall be conducted without written approval of the School and Institutional Trust Lands Administration. Any approval granted by the School and Institutional Trust Lands Administration shall be conditioned upon proper segregation and proper accounting and record keeping of leased substances mined from each property. Separate records shall be required for accounting for leased substances mined from the above-described lands.

If there is any conjoint operation, there shall be no commingling of coal or coal products or substances produced from the above-described lands with those of adjacent lands until and unless there has been a completely accurate accounting on production from the above-described lands as distinguished from production from adjacent lands.

The production of coal and operations in connection therewith as conjoint operations shall be subject to such examination and review as deemed desirable by the School and Institutional Trust Lands Administration and the Division of Oil, Gas, and Mining, to determine whether any conjoint operations are detrimental to the State of Utah. If any such inspection results in an adverse report from either agency with recommendations for modification or discontinuance of such conjoint operations by order of the School and Institutional Trust Lands Administration, a copy of such report with recommendations for modification or discontinuance shall be submitted as expeditiously as possible to the Lessee. If any objectionable condition is not promptly remedied to safeguard the rights of the State as Lessor, the School and Institutional Trust Lands Administration shall have the right to order discontinuance of such arrangement; and failure to comply with such order of the School and Institutional Trust Lands Administration shall constitute a breach of this Lease Agreement.

ARTICLE XVI. SPECIAL REQUIREMENTS IN EVENT OF STRIP-MINING

In the event Lessee desires to conduct any strip-mining or open-pit mining or operations which will materially disturb the surface of the above-described lands or some portion thereof, at least sixty (60) days before commencing such type of mining activities, Lessee shall submit to the School and Institutional Trust Lands Administration the proposed plan of operations together with a proposed plan of surface rehabilitation in compliance with the Utah Coal Mining and Reclamation Act, and the Utah Mined Land Reclamation Act and in compliance with the Rules and Regulations adopted thereunder. A copy of such proposed plan of operations and proposed plan of surface rehabilitation also shall be submitted to the Division of Oil, Gas, and Mining. Operations shall be commenced until the Division of Oil, Gas, and Mining approves the proposed operations and approves a program of rehabilitation. Security may be required of Lessee to assure appropriate rehabilitation in accordance with the said statute and rules and regulations adopted thereunder.

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UTAH DIVISION OIL, GAS AND MINING

ARTICLE XVII. EQUIPMENT OR FACILITIES TO REMAIN WITH THE LAND

Upon surrender, forfeiture, expiration, or termination of this lease, any and all underground timbering supports, shaft linings, rails, and other installations necessary for the support of underground tunnels, shafts, inclines, or other underground mine supports, together with all rails or head frames and all other underground construction and safety equipment annexed to the ground (excluding detachable motor-driven machinery) which cannot be removed without creating a danger to any shaft, tunnel, incline, or other underground improvements annexed to the mine, and including equipment installed underground to provide for ventilation of the mine or some portion thereof, shall be left within said land above described by the Lessee, operator, and contractor of Lessee and shall remain a part of the realty. Lessor shall acquire all rights thereto without indemnification of Lessee or operator or contractor for Lessee.

Except as herein specifically excepted, all personal property of Lessee, including removable machinery, equipment, tools, and stockpiles of leased substances for which royalty has been paid, shall remain the property of Lessee or operator or contractor for Lessee and Lessee or operator or contractor for Lessee may remove the same at the sole expense of Lessee or operator or contractor within two (2) months following expiration, forfeiture, surrender, or termination of this lease, except that the School and Institutional Trust Lands Administration for good cause shown shall have the right to grant a reasonable extension of time beyond the period of two (2) months for removal of any and all equipment which may be removed by Lessee or operator or contractor as herein provided. At the end of such period, Lessor may consider abandoned and lay claim to any or all equipment or stockpiles remaining on the premises.

Upon expiration, surrender, forfeiture, or termination of this lease or abandonment of the leasehold by Lessee, the Lessee shall cause to be sealed or properly shut off all or parts of the mine openings including shafts and tunnels in the manner and method required by the Director of the Division of Oil, Gas, and Mining, and to abate any hazardous condition which may have been left by Lessee, such abatement of hazardous condition to be performed in accordance with reasonable requirements of the Director of the Division of Oil, Gas, and Mining.

ARTICLE XVIII. INTEREST

Interest shall accrue and be payable on all obligations arising under this lease at such rate as may be set from time to time by rule enacted by Lessor. Interest shall accrue and be payable, without necessity of demand, from the date each such obligation shall arise.

ARTICLE XIX. CONSENT TO SUIT IN STATE DISTRICT COURT

It is agreed that if there arises any controversy between Lessor and Lessee or any successor in interest of Lessee which needs to be litigated, Lessee or any one claiming by or under the Lessee shall bring such action in the District Court of Salt Lake County, State of Utah, after compliance with the requirements of Article XVIII for bringing suit, including compliance with the requirements of the State Governmental Immunity Act, Title 63, Chapter 30, Utah Code Annotated, 1953, as amended. Neither Lessee nor any assignee of lessee nor any one claiming under, by, or through the Lessee shall bring any suit against the State of Utah or against any State

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UTAH DIVISION OF OIL, GAS AND MINING

agency in the United States District Court for the District of Utah, nor in any other United States District Court in some other state, nor in the District of Columbia.

ARTICLE XX. REMEDIES FOR DEFAULT BY LESSEE OR ASSIGNS

This Mineral Lease and the terms and conditions of this lease agreement issued by the State of Utah are made with the Lessee herein on condition that Lessee and any lawful successor in interest to Lessee shall perform all covenants and terms and conditions herein set forth to be performed by Lessee or its lawful assigns including payment of rentals and royalties as herein provided; and if at any time there shall be default on the part of lessee or breach of any of the terms or conditions hereof on the part of Lessee or by the successor in interest to the Lessee; and if such default or breach shall continue for a period of thirty (30) days after written notice from Lessor of such default or breach given to Lessee or successor in interest addressed to Lessee or successor in interest at the last address furnished by Lessee or successor in interest by United States mail, then at the expiration of said period of thirty (30) days immediately following such notice if the default or breach has not been remedied, then at the expiration of said period of thirty (30) days, at the option of the Lessor, Lessor may issue written notice of termination and cancellation of this lease and forfeiture declaring that the leased premises and each and every part thereof have thereby reverted to the Lessor, including any and all fixtures and improvements required to be left with the property upon expiration, termination, or cancellation of this lease.

In the event that the leasehold estate shall have been damaged or injured by the acts or neglect of the Lessee or operator, contractor, or assigns of Lessee, Lessor also shall have a right of action for damages and for restitution for any failure or refusal to comply with the terms and conditions of any statute of this State relating to reclamation or rehabilitation, or for abatement of pollution, together with rights for injunctive relief. Lessor also shall have the right to recover on any bond or other security deposited with the State of Utah in accordance with the terms or conditions hereinabove set forth for indemnification.

IN WITNESS WHEREOF, the parties have executed this lease as of the date hereinabove first written.

THE STATE OF UTAH, acting by and through the  
SCHOOL AND INSTITUTIONAL TRUST LANDS  
ADMINISTRATION

DAVID T. TERRY, DIRECTOR

By *[Signature]*  
JAMES D. COOPER, ASSISTANT DIRECTOR  
School & Institutional Trust Lands Administration - LESSOR

APPROVED AS TO FORM:

JAN GRAHAM  
ATTORNEY GENERAL

By *[Signature]*  
Special Asst. Atty. Gen.

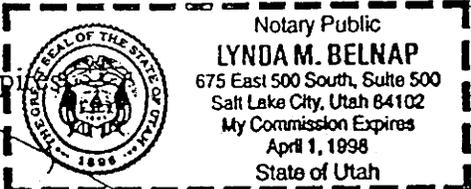
Form Approved: March 26, 1996

*[Signature]* INCORPORATED  
Vernal J. Mortensen, Executive Vice President  
Sage Point Coal Company  
EFFECTIVE  
MAR 31 2000  
LESSEE  
UTAH DIVISION OIL, GAS AND MINING

STATE OF UTAH )  
COUNTY OF SALT LAKE )

On the 15<sup>th</sup> day of October, 1996, personally appeared before me JAMES D. COOPER, who being by me duly sworn did say that he is the Assistant Director of the School and Institutional Trust Lands Administration of the State of Utah and the signer of the above instrument, who duly acknowledged that he executed the same.

Given under my hand and seal this 15<sup>th</sup> day of October, 1996.

My Commission Expires \_\_\_\_\_  
STATE OF UTAH )  
COUNTY OF \_\_\_\_\_ )  
  
Notary Public  
**LYNDA M. BELNAP**  
675 East 500 South, Suite 500  
Salt Lake City, Utah 84102  
My Commission Expires  
April 1, 1998  
State of Utah  
Lynda Belnap  
NOTARY PUBLIC, residing at: \_\_\_\_\_

On the \_\_\_\_\_ day of \_\_\_\_\_, 19\_\_\_\_\_, personally appeared before me \_\_\_\_\_, signer of the above instrument, who duly acknowledged to me that \_\_\_\_\_ executed the same.

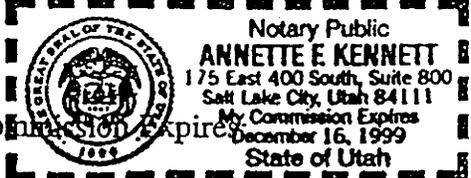
Given under my hand and seal this \_\_\_\_\_ day of \_\_\_\_\_, 19\_\_\_\_\_.

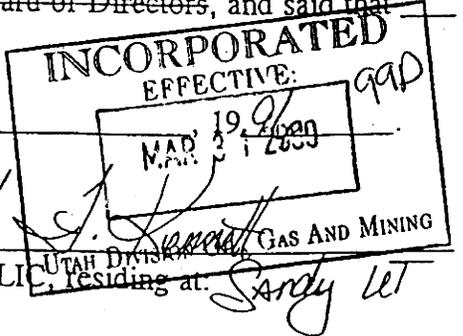
My Commission Expires: \_\_\_\_\_  
NOTARY PUBLIC, residing at: \_\_\_\_\_

STATE OF UTAH )  
COUNTY OF SL )

On the 26<sup>th</sup> day of August, 1996, personally appeared before me VERNAL J. MORTENSEN, who being duly sworn did say that he is an officer of Sage Point Coal Co and that said instrument was signed in behalf of said corporation by resolution of its Board of Directors, and said that acknowledged to me that said corporation executed the same.

Given under my hand and seal this 26<sup>th</sup> day of August.

My Commission Expires \_\_\_\_\_  
  
Notary Public  
**ANNETTE E. KENNETT**  
175 East 400 South, Suite 800  
Salt Lake City, Utah 84111  
My Commission Expires  
December 16, 1999  
State of Utah

  
INCORPORATED  
EFFECTIVE: 1996  
MAR 11 1999  
UTAH DIVISION OF OIL, GAS AND MINING  
Annette E. Kennett  
NOTARY PUBLIC, residing at: Sandy UT

Vegetation & Sensitive Species of Drill Sites:  
EXP-01, EXP-02, EXP-03, EXP-04, G-32 G-34  
&  
Revegetation Success Standards

for the  
Dugout Canyon Mine

in  
Carbon County, Utah



*Prepared by*

**MT. NEBO SCIENTIFIC, INC.**

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P.O. Box 337  
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(801) 489-6937

Patrick D. Collins, Ph.D.

*for*

**CANYON FUEL COMPANY, LLC**

Dugout Canyon Mine  
P.O. Box 1029  
Wellington, UT 84542



January 2011

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# Introduction

For the past few years, the Dugout Canyon Mine in Carbon County, Utah has been constructing surface drill sites for exploration and de-gasification as safety precautions for underground coal mining activities. In doing so, drill pad construction necessitates disturbance to the existing vegetation on the proposed pads, and where applicable, access roads to them. Permitting through the regulatory agency of the "de-gas" drill sites and exploration holes has been done in consecutive order on a site-by-site basis and has been driven by their location and role in the mine plan. This is the next document in a sequence of vegetation reports prepared for Canyon Fuel Company to assess impacts caused by the drilling activities.

## History of Vegetation Sampling in the Area

The contents of this report describes the expected impacts to the plant communities and also information regarding potential affects to any threatened, endangered or sensitive species at drill sites: EXP-01, EXP-02, EXP-03, EXP-04, G-32, G-34 and their respective reference areas. Reference areas are communities proposed to be used as standards for future revegetation success. Earlier reports have been submitted to address the plant communities that were impacted by the previously-constructed drill pads. A recent history of vegetation studies in the area is shown in Table 1.

**Table 1: Recent History of Vegetation Reports for the Exploration & De-Gas Drill Sites for the Dugout Canyon Mine: 2003-2010.**

<b>REPORT TITLE</b>	<b>REPORT DATE</b>
<i>Vegetation of the Dugout Canyon Mine De-gas Borehole Sites (G-1, G-2, G-3, G-4, G-5 and G-6)</i>	July 2003
<i>Vegetation of the De-gas Borehole Sites: G-8, G-9, G-10 &amp; Reference Areas</i>	August 2005
<i>Vegetation of the De-gas Borehole Sites: G-11, G-12 &amp; Reference Areas</i>	November 2005
<i>Vegetation of the De-gas Borehole Sites: G-13, G-14, G-15, G-16, G-17 &amp; Reference Areas</i>	March 2006
<i>Vegetation of the De-gas Borehole Site G-19 &amp; Reference Area</i>	May 2007
<i>Vegetation of the De-gas Borehole Sites: G-21, G-22 &amp; Reference Areas</i>	July 2008
<i>Vegetation of the De-gas Drill Sites: G-25, G-26, G-29 &amp; Reference Areas</i>	October 2008
<i>Vegetation of Drill Sites: DUG-07/R-02, DUG-08, DUG-09, DUG-10, H-01 and Reference Areas</i>	March 2009
<i>Vegetation and Sensitive Species at Drill Site G-30 &amp; Reference Area</i>	November 2009
<i>Vegetation and Sensitive Species of Drill Sites: DUG-01, DUG-03/G-27, DUG-04, DUG-05, R-01, R-04, G-28 &amp; Reference Areas</i>	December 2009
<i>Vegetation and Sensitive Species of Drill Sites: F-01, F-02, F-03, F-06, F-07 &amp; Reference Areas</i>	February 2010
<i>Vegetation and Sensitive Species of the Settling Pond Area</i>	November 2010
<i>Vegetation and Sensitive Species of Drill Sites: EXP-01, EXP-02, EXP-03, EXP-04, G-32 G-34 &amp; Revegetation Success Standards</i>	January 2011 (this document)

## Drill Pad Construction

In order to develop each drill pad, a small amount of land has been proposed to be disturbed at each site location. Most of the proposed drill pads have been approximately 200 ft x 300 ft in size, but some are somewhat less than that. The plant communities proposed for disturbance at each site has been described and sampled with the results provided in this report. A sensitive plant species survey was also conducted in each area.

## Revegetation Success Standards

Reference areas have been chosen to represent future standards for final revegetation success at the disturbed sites once they are reclaimed. These reference areas were chosen with respect to their similarities in geology, soils, slopes, aspects and plant community composition to the areas that are proposed for disturbance.

As shown above, vegetation sampling has been conducted on proposed de-gas and exploration drill sites for the past several years. Consequently, many of the plant communities that were sampled previously on the earlier drill sites are the same, or very similar to, those that have been proposed for new drilling activities. Because earlier drill sites have reference areas associated with them, and because some of these reference areas are very similar to the plant communities that were proposed for disturbance subsequent to establishment of the reference areas, some of the same reference areas will be used for revegetation success standards for other drill sites at the time of final reclamation. A list of the reference areas established to-date along with the drill sites associated with them is shown in Table 2.

**Table 2: A list of reference areas and the drill sites that will be used for revegetation success standards. Also included are the dates of the reports where they were described. (color denotes sites described in this report).**

<b>REFERENCE AREA</b>	<b>DRILL SITE</b>	<b>REPORT DATE</b>
Sagebrush/Snowberry/Grass	G-2, G-3, G-5 DUG-05, G-28	July 2003 December 2009
Aspen/Maple/Douglas Fir	G-1, G-4, G-6 H-01	July 2003 March 2009
Grass/Forb	G-8	August 2005
Mtn. Brush/Conifer	G-9, G-10 G-11 R-01	August 2005 November 2005 December 2009
Conifer/Pinyon-Juniper/Mtn. Brush	G-12 G-13, G-15	November 2005 March 2006
Conifer/Aspen	G-14 G-19 G-21	March 2006 May 2007 July 2008
Mtn. Brush/Sagebrush/Snowberry	G-16, G17 G-22 G-26, G-29 DUG-07/R-02, DUG-10 G-30 F-01, F-02, F-03, F-06, F-07 G-32, EXP-03, EXP-04, EXP-04 Access Road	March 2006 July 2008 October 2008 March 2009 November 2009 February 2010 January 2011
Pre-Set Standard	G-25 DUG-08, DUG-09 DUG-01, DUG-03/G-27, DUG-04, R-04 G-34, EXP-01, EXP-02	October 2008 March 2009 December 2009 January 2011
Pinyon-Juniper Reference Area	Settling Pond Area	November 2010

Some of the proposed new drill sites had already been disturbed before by activities other than mining-related such as logging, road building, heavy grazing and so on. In these areas predetermined or "pre-set" success standards have been recommended. These standards will be discussed in greater detail later in this report.

## Methods

Vegetation sample design for this study was consistent with previous quantitative sampling methods in the area. Methodologies used for the studies were performed in accordance with the guidelines supplied by the State of Utah, Division of Oil, Gas and Mining (DOGGM). Quantitative and qualitative data were recorded within the plant communities proposed for disturbance in September 2010. The Mtn. Brush/Sagebrush Reference Area chosen to represent future revegetation success standards for some of the sites was sampled in September 2005. As mentioned, for some of the previously disturbed drill sites, pre-set standards have been proposed in this report.

Proposed drill sites were surveyed, mapped and staked in the field by representatives of the Dugout Canyon Mine prior to the vegetation sampling. The drill site centers and corners were marked in the field using a GPS device during the studies. The reference area chosen was approximately one acre in size and was also marked in the field using a GPS instrument. The coordinates for the proposed drill pads, pad corners and reference areas are provided in Table 3.

### Threatened, Endangered & Sensitive Species

Prior to recording quantitative data in the plant communities, a sensitive plant species survey was conducted. To initiate the studies in the area, appropriate agencies had been consulted and reviewed (e.g. *Utah Natural Heritage Program* and the *Utah Division of Wildlife Resources GIS Information Database*) along with other sources (i.e. sensitive species files at *Mt. Nebo Scientific, Inc.*) for potential plant and animal species that are known to be rare, endemic, threatened, endangered or otherwise sensitive in the study areas. Additionally, the current list of federally protected species – plant and animal – for Carbon County, Utah was reviewed and addressed including potential habitats for these

species in the areas proposed for disturbance.

<b>TABLE 3: Drill site coordinates (NAD 27; Zone 12S).</b>		
<b>DRILL SITE</b>	<b>GPS NAME</b>	<b>COORDINATES</b> Easting; Northing (m)
EXP-01	DUGEXP01	539671 4393409
	Corners DUGEXP01NE	539695 4393411
	DUGEXP01NW	539676 4393430
	DUGEXP01SE	539662 4393385
	DUGEXP01SW	539648 4393402
EXP-02	DUGEXP02	539473 4393859
	Corners DUGEXP02NE	539495 4393894
	DUGEXP02NW	539463 4393902
	DUGEXP02SE	539466 4393834
	DUGEXP02SW	539444 4393844
EXP-03	DUGEXP03	539691 4394693
	Corners DUGEXP03NE	539728 4394697
	DUGEXP03NW	539685 4394726
	DUGEXP03SE	539685 4394662
	DUGEXP03SW	539656 4394687
EXP-04	DUGEXP04	538959 4394504
	Corners DUGEXP04NE	538983 4394509
	DUGEXP04NW	538944 4394535
	DUGEXP04SE	538967 4394479
	DUGEXP04SW	538934 4394484
	Access Road DUGEXP04RdNo	538876 4394872
	DUGEXP04RdSo	538945 4394534
G-32	DUG10G32	541745 4393429
	Corners DUG10G32NE	541782 4393448
	DUG10G32NW	541742 4393471
	DUG10G32SE	541759 4393384
	DUG10G32SW	541709 4393421
G-34	DUG10G34	540878 4393328
	Corners DUG10G34NE	540889 4393338
	DUG10G34NW	540864 4393341
	DUG10G34SE	540893 4393324
	DUG10G34SW	540866 4393310
Mtn. Brush/ Sagebrush/ Snowberry Reference Area	DUG16R	542993 4392921

## Sampling Design and Transect/Quadrat Placement

Transect lines for vegetation sampling were placed randomly within the boundaries of the proposed disturbed and reference areas. The sample boundary included 100 ft outside the proposed drill sites. A transect placement technique was employed with the goal to adequately sample a representative subset of each entire study area. 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 biases.

## Cover & 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 recorded on the raw data sheets were notes 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

Densities 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 total living cover and density was attempted by using the formula given below.

$$n_{MIN} = \frac{t^2 s^2}{(dx)^2}$$

where,

- $n_{MIN}$  = minimum adequate sample
- $t$  = appropriate confidence t-value
- $s$  = standard deviation
- $x$  = sample mean
- $d$  = desired change from mean

With the values used for "t" and "d" above, the goal was to meet sample adequacy with 80% confidence within a 10% deviation from the true mean. In areas where sample viability was unnaturally high (e.g. previous disturbance sites), these parameters can sometimes prove to be too stringent due to the high viability of plant density and cover.

## Statistical Analyses

Student's t-tests were employed of the summarize datasets to statistically compare the total living cover and total woody species density of each proposed disturbed drill site with its reference area.

## Photographs & Maps

Color photographs of the study areas were taken at the time of sampling and have been submitted with this report. A Drill Site Location Map was created using a USGS 7.5 minute series quadrangle map. Additionally, an Aerial View Map was created on a Google Earth® aerial photograph. The map and aerial view have been included at the end of this report.

## Raw Data

The raw data were summarized on spreadsheets and are available upon request by Canyon Fuel or DOGM.

# Results

## Drill Site: EXP-01

Primarily a north-northwest exposure and supporting a Douglas Fir/Aspen/Maple plant community (see Photo 1), the vegetation at this drill site has been somewhat disturbed by previous activities. One portion of the site remains relatively undisturbed with the exception of logging of



Photo 1: EXP-01 Drill Site

the larger trees there; the remaining portion has been severely disturbed by constructing the dirt access road in the canyon. Consequently, to provide representation of each portion of the site in the dataset, 75% of the sample quadrats were placed in the less-disturbed area (which constitutes a greater portion of the pad) and 25% were placed in the road-cut portions of the drill site (the remaining portion).

As shown in Table 4, the overstory cover and frequency at EXP-01 was dominated by aspen (*Populus tremuloides*), maples (*Acer glabrum* and *A. grandidentatum*) and Douglas Fir (*Pseudotsuga menziesii*). The understory dominants were comprised of bigtooth maple, mountain brome (*Bromus carinatus*), snowberry (*Symphoricarpos oreophilus*), Douglas fir and Oregon grape (*Mahonia repens*).

The total overstory cover at this site was estimated at 17.75%, and the understory at 42.25%. Therefore, the total living cover consisting of all layers was estimated to be 60.00% (Table 5-A). Composition of the understory included 67.25% trees and shrubs, 18.84% grasses and 13.92% forbs (Table 5-B).

The woody species density of EXP-01 was dominated by snowberry, Douglas fir Rocky Mountain maple and big sagebrush (*Artemisia tridentata*). The total woody species density here was estimated to be 1,460 individuals per acre (Table 6).

## Drill Site: EXP-02

Located on the point of a ridge that sloped gently southward, Drill Site EXP-02 (and the short access road to it) was once probably a climax stand of ponderosa pine trees, but past logging activities have changed the community structure and cover to be dominated by more herbaceous plant species (Photo 2). Still, the community



Photo 2: EXP-02 Drill Site & Access

supports ponderosa pine (*Pinus ponderosa*)

and Douglas fir, but at much less cover, frequency and density than probably existed in its native condition (Table 7). As also reported on Table 7, the understory cover is currently dominated by the grass, Salina wildrye (*Elymus salinus*), followed distantly by the forbs, rough mulesear (*Wyethia scabra*) and rock goldenrod (*Petradoria pumila*), and the woody species, Utah serviceberry (*Amelanchier utahensis*) and alder-leaf mountain-mahogany (*Cercocarpus montanus*).

The total living cover of this drill site was estimated at 39.00%, with only 2.25% of it comprised of overstory and the remaining 36.75% from understory species (Table 8-A). Grasses currently dominate for composition at 62.33% of the understory cover followed by trees and shrubs at 19.55% and forbs at 18.12% (Table 8-B).

The total woody species density of EXP-02 was only 367 individuals per acre. The

dominate species in the density measurements were alder-leaf mountain-mahogany, Utah serviceberry and ponderosa pine (Table 8).

### Drill Site: EXP-03

Mostly supported on a gentle, west-facing slope at an elevation of about 8,250 ft, EXP-03 was a diverse, undisturbed, native Sagebrush/Grass/Serviceberry plant community (Photo 3). As shown in Table 10, the dominant woody plant species at this site were Vasey big sagebrush (*Artemisia tridentata* var. *vaseyana*), Utah serviceberry and snowberry; dominant grasses were Nelson's needlegrass (*Stipa nelsonii*) and bluebunch wheatgrass (*Elymus spicatus*); the dominant forb was Watson's penstemon (*Penstemon watsonii*).

The total living cover at EXP-03 was estimated at 57.50%, all of which was from the understory cover observed in the sample quadrats (Table 11-A). Shrubs comprised 64.97%, grasses 27.63% and forbs 7.40% of the living cover (Table 11-B).

Total woody species density at this study site was estimated at 5,617 plants per acre, most of it coming from snowberry and Utah serviceberry (Table 12).

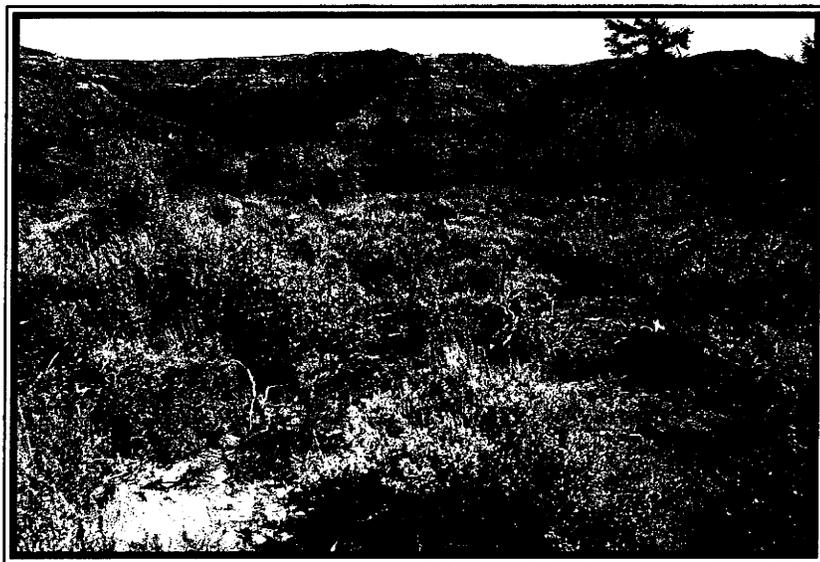


Photo 3: EXP-03 Drill Site

### Drill Site: EXP-04

Like the EXP-03 drill site described above, EXP-04 drill site (Photo 4) and the proposed new access road to it supported a native, undisturbed Sagebrush/Grass/Serviceberry plant community.

Although the drill site pad and access road for EXP-04 supported very similar plant communities, the road covered much greater distances and appreciably more land surface, so the datasets were summed and reported separately in this document.

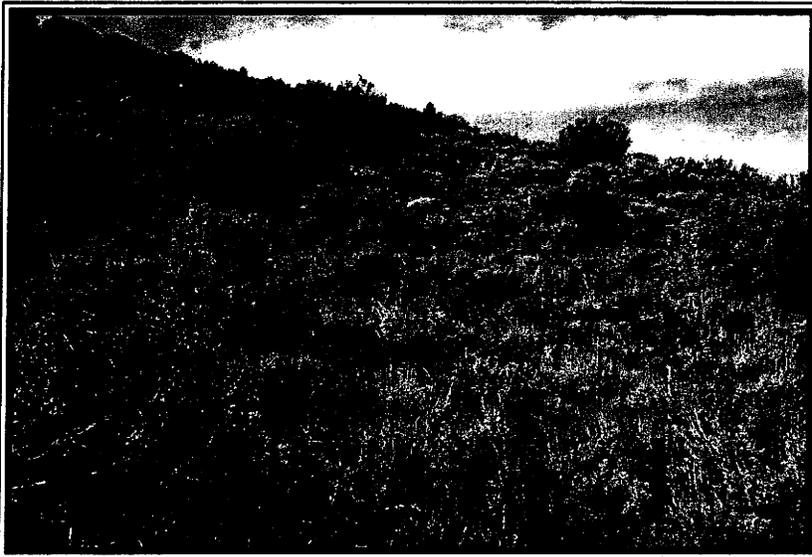


Photo 4: EXP-04 Drill Site

The dominant plant species of the pad were Vasey sagebrush, Salina wildrye, snowberry, Utah serviceberry and Nelson's needlegrass (Table 13). The total living cover here was estimated at 62.75%, all it coming from understory cover (Table 14-A). The composition at the pad was comprised of 63.88% shrubs and 36.12% grasses. No forbs were present in the sample quadrats (Table 14-B). As shown on Table 15, the total woody species density was estimated at 4,634 individuals per acre, and in descending order consisted of Vasey sagebrush, snowberry, Utah serviceberry and viscid rabbitbrush (*Chrysothamnus viscidiflorus*).

### Access Road. EXP-04

The dominant species of the access road to EXP-04 were Vasey sagebrush, Utah serviceberry, snowberry, Watson's penstemon and Salina wildrye (Photos 5, 6, 7 & 8). Most of the cover was understory, but unlike the pad described above, an appreciable amount came from serviceberry in the overstory (Table 16).

The total living cover for the access road was estimated at 58.75%, 52.75% was understory and 6.00% overstory cover (Table 17-A). Woody species comprised 67.86% of the understory composition, whereas grasses and forbs comprised 21.09% and 11.04%, respectively (Table 17-B).

The total density here was estimated at 4,616 plants per acre (Table 18) and consisted of Vasey sagebrush, Utah serviceberry, snowberry and Utah juniper (*Juniperus osteosperma*).

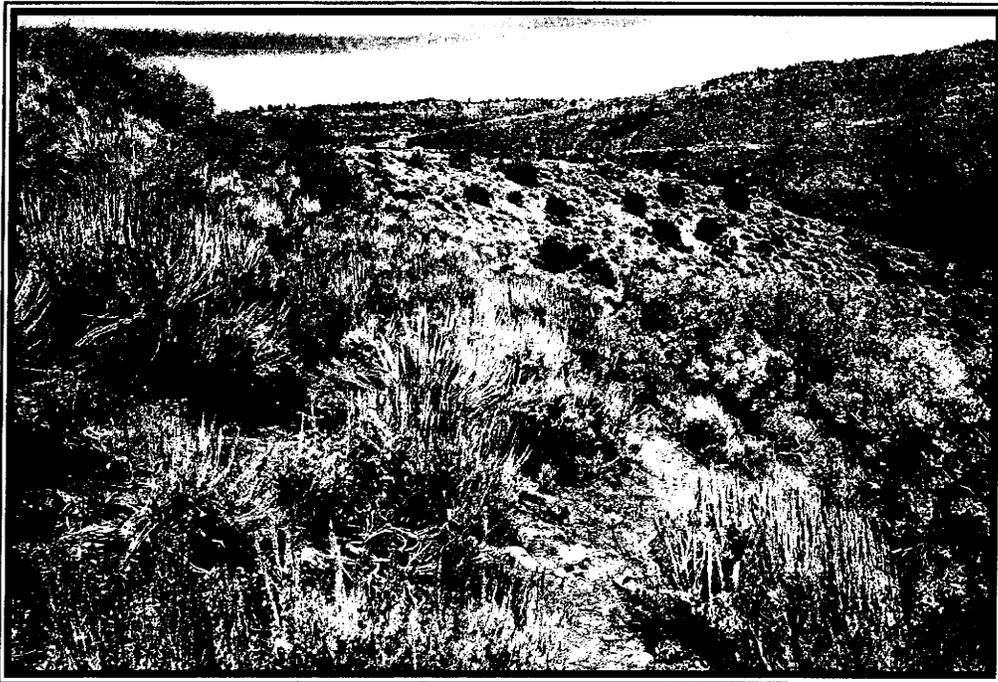


Photo 5: EXP-04 Access Road (1 of 4)



Photo 6: EXP-04 Access Road (2 of 4)

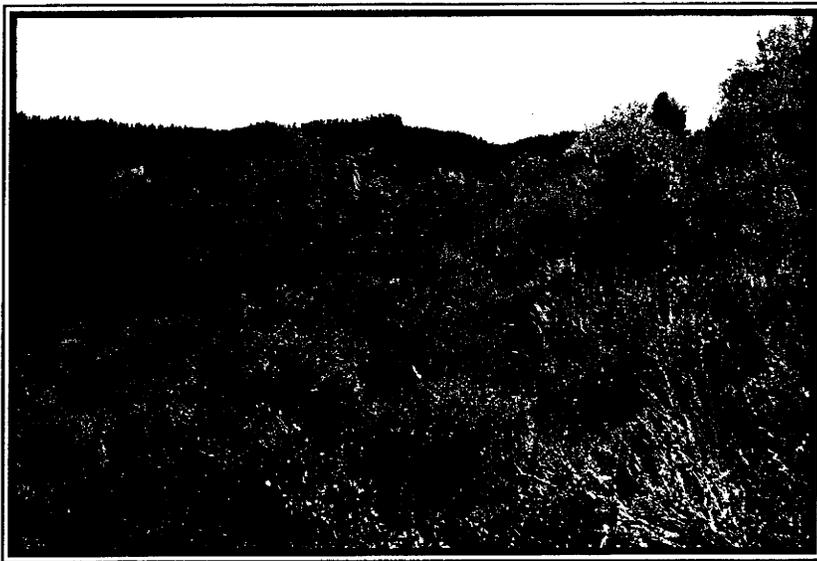


Photo 7: EXP-04 Access Road (3 of 4)

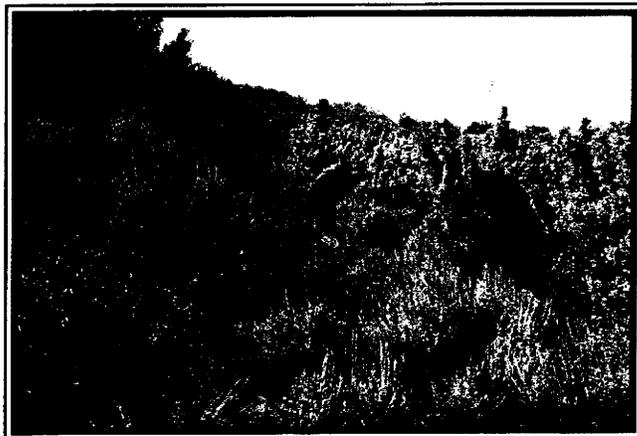


Photo 8: EXP-04 Access Road (4 of 4)

Drill Site: G-32

Drill Site G-32 was an undisturbed Sagebrush/Grass/Snowberry community located at an elevation about 7,900 ft with primarily a gently sloped, west-facing exposure (Photo 9). Like the community name suggests, the dominate plant species here were big sagebrush, Salina wildrye and snowberry. Although not as common, there were several other shrub, grass and forb species present in the sample quadrats (see Table 19).

The total living cover for G-32 comes only from understory at 50.00% (Table 20-A).



Shrubs dominated the composition at 53.57%, followed by grasses at 32.75% and forbs at 13.68% (Table 20-B).

The woody species density

Photo 9: G-32 Drill Site

measurements found 6,911 total plants per acre, with the dominants here. by far, consisting of big sagebrush and snowberry (Table 21).

### Drill Site: G-34

Once a native Aspen/Douglas Fir community, the site has been severely disturbed previously, possibly by logging and/or other activities (Photo 10). Elevation of the site was about 7,740 ft with a west exposure.

The site currently supports a host of invader and "weedy" plants with dominants consisting of hounds-tongue (*Cynoglossum officinale*), big sagebrush, Kentucky bluegrass (*Poa pratensis*) and common dandelion (*Taraxacum officinale*). For a list of all species present in the sample quadrats, refer to Table 22.

Total living cover on this drill site was estimated at 50.75%; this cover was comprised of 49.75% understory and only 1.00% overstory cover (Table 23-



Photo 10: G-34 Drill Site

A). The three lifeforms in the understory composition were nearly equally represented at 37.53% forbs, 31.65% grasses and 30.82% woody species (Table 23-B).

The woody species density totaled 2,123 plants per acre (Table 24) with the most

important species by a wide margin being big sagebrush, then followed distantly by snowberry, aspen, Douglas fir and Wood's rose (*Rosa woodsii*).

Reference Area: Mtn. Brush/Sagebrush/Snowberry

Existing reference areas were considered for their appropriateness to represent future revegetation success standards for the native, undisturbed Sagebrush/Grass/Spp.

plant communities found at the proposed drill sites described in this report. One such reference area met the qualifications quite well. This previously-studied reference



Photo 11: Mtn. Brush/Sagebrush/Snowberry Reference Area

area has been called the Mtn. Brush/Sagebrush/Snowberry Reference Area (Photo 11). Consequently, this reference area has been chosen to represent future revegetation success standards for EXP-03, EXP-04, Access Road to EXP-04 and G-32.

The most common species in this reference area were big sagebrush, Watson's penstemon, snowberry and serviceberry (Table 25).

The total living combined cover here was 64.50%; 57.00%, was comprised from understory and 7.50% from overstory (Table 26-A). Woody species dominated the composition at 54.44%, followed by forbs at 28.08% and grasses at 17.49% (Table 26-B).

The woody species density was estimated at 5,137 plants per acres and was dominated by big sagebrush and snowberry (Table 27).

**A DISCUSSION section for this report can be found after the following summary tables.**

**Table 4: Dugout Mine Drill Site EXP-01. Total cover, standard deviation and frequency by species (2010).**

Douglas Fir/Aspen/Maple (Undisturbed & Roadcut)	Mean Percent	Standard Deviation	Percent Frequency
n=20			
<b>OVERSTORY</b>			
<i>Acer glabrum</i>	4.75	12.60	15.00
<i>Acer grandidentatum</i>	2.25	6.80	10.00
<i>Alnus incana</i>	1.75	5.31	10.00
<i>Populus tremuloides</i>	6.50	15.17	20.00
<i>Prunus virginiana</i>	0.50	2.18	5.00
<i>Pseudotsuga menziesii</i>	2.00	8.72	5.00
<b>UNDERSTORY</b>			
<b>TREES &amp; SHRUBS</b>			
<i>Acer glabrum</i>	1.75	3.63	20.00
<i>Acer grandidentatum</i>	7.25	11.88	40.00
<i>Alnus incana</i>	1.75	4.82	15.00
<i>Artemisia tridentata</i>	0.50	2.18	5.00
<i>Mahonia repens</i>	4.25	5.76	40.00
<i>Pachistima myrsinites</i>	1.75	3.63	20.00
<i>Physocarpus malvaceus</i>	2.25	6.80	10.00
<i>Populus tremuloides</i>	1.00	3.00	10.00
<i>Pseudotsuga menziesii</i>	4.50	10.11	25.00
<i>Rubus idaeus</i>	0.25	1.09	5.00
<i>Symphoricarpos oreophilus</i>	5.50	9.47	35.00
<b>FORBS</b>			
<i>Aster engelmannii</i>	3.50	6.73	25.00
<i>Aster sp.</i>	0.25	1.09	5.00
<i>Cynoglossum officinale</i>	0.50	2.18	5.00
<i>Smilacina racemosa</i>	0.25	1.09	5.00
<b>GRASSES</b>			
<i>Bromus carinatus</i>	6.25	6.87	65.00
<i>Elymus trachycaulus</i>	0.75	3.27	5.00

**Table 5: Dugout Mine Drill Site EXP-01. Cover and composition (2010).**

n=20		
Douglas Fir/Aspen/Maple (Undisturbed & Roadcut)	Mean Percent	Standard Deviation
<b>A. TOTAL COVER</b>		
Overstory (o)	17.75	17.50
Understory (u)	42.25	15.61
Litter	29.75	16.32
Bareground	14.00	17.00
Rock	14.00	9.82
o + u	60.00	24.39
<b>B. % COMPOSITION</b>		
Trees/Shrubs	67.25	33.42
Forbs	13.92	25.05
Grasses	18.84	19.94

**Table 6: Dugout Mine Drill Site EXP-01. Woody Species Density (2010).**

n=20	
SPECIES	Individuals Per Acre
<i>Acer glabrum</i>	219.05
<i>Acer grandidentatum</i>	146.03
<i>Alnus incana</i>	18.25
<i>Amelanchier utahensis</i>	18.25
<i>Artemisia tridentata</i>	164.29
<i>Prunus virginiana</i>	18.25
<i>Pachistima myrsinites</i>	91.27
<i>Physocarpus malvaceus</i>	91.27
<i>Populus tremuloides</i>	91.27
<i>Pseudotsuga menziesii</i>	237.31
<i>Ribes sp.</i>	54.76
<i>Rosa woodsii</i>	18.25
<i>Rubus idaeus</i>	18.25
<i>Symphoricarpos oreophilus</i>	273.81
<b>TOTAL</b>	<b>1460.34</b>

**Table 7: Dugout Mine Drill Site EXP-02. Total cover, standard deviation and frequency by species (2010).**

n=20			
Ponderosa Pine/Gt. Basin Wildrye/Serviceberry (Previously Disturbed)	Mean Percent	Standard Deviation	Percent Frequency
<b>OVERSTORY</b>			
<i>Pinus ponderosa</i>	1.00	4.36	5.00
<i>Pseudotsuga menziesii</i>	1.25	5.45	5.00
<b>UNDERSTORY</b>			
<b>TREES &amp; SHRUBS</b>			
<i>Amelanchier utahensis</i>	4.25	16.30	15.00
<i>Cercocarpus montanus</i>	2.00	4.30	20.00
<i>Pinus edulis</i>	0.25	1.09	5.00
<i>Pinus ponderosa</i>	1.75	4.82	15.00
<b>FORBS</b>			
<i>Cirsium sp.</i>	1.00	2.55	15.00
<i>Crepis acuminata</i>	0.25	1.09	5.00
<i>Machaeranthera canescens</i>	1.25	3.11	15.00
<i>Penstemon sp.</i>	0.25	1.09	5.00
<i>Petroradia pumila</i>	2.00	5.34	15.00
<i>Wyethia scabra</i>	2.00	3.67	25.00
<b>GRASSES</b>			
<i>Elymus salinus</i>	20.00	13.51	90.00
<i>Stipa hymenoides</i>	1.75	5.76	10.00

**Table 8: Dugout Mine Drill Site EXP-02. Cover and composition (2010).**

n=20		
Ponderosa Pine/Gt. Basin Wildrye/Serviceberry (Previously Disturbed)	Mean Percent	Standard Deviation
<b>A. TOTAL COVER</b>		
Overstory (o)	2.25	6.80
Understory (u)	36.75	14.60
Litter	26.50	24.70
Bareground	14.50	11.87
Rock	22.25	18.98
Overstory + Understory	39.00	14.46
<b>B. % COMPOSITION</b>		
Trees/Shrubs	19.55	31.78
Forbs	18.12	19.86
Grasses	62.33	29.52

**Table 9: Dugout Mine Drill Site EXP-02. Woody Species Density (2010).**

n=20	
SPECIES	Individuals Per Acre
<i>Amelanchier utahensis</i>	73.41
<i>Cercocarpus montanus</i>	133.05
<i>Ceanothus martinii</i>	9.18
<i>Juniperus osteosperma</i>	13.76
<i>Pinus edulis</i>	9.18
<i>Pinus ponderosa</i>	87.17
<i>Pseudotsuga menziesii</i>	13.76
<i>Symphoricarpos oreophilus</i>	27.53
<b>TOTAL</b>	<b>367.04</b>

**Table 10: Dugout Mine Drill Site EXP-03. Total cover, standard deviation and frequency by species (2010).**

n=20			
Sagebrush/Grass/Serviceberry (Undisturbed)	Mean Percent	Standard Deviation	Percent Frequency
<b>TREES &amp; SHRUBS</b>			
<i>Amelanchier utahensis</i>	13.85	15.67	55.00
<i>Artemisia tridentata</i> var. <i>vaseyana</i>	14.90	11.01	80.00
<i>Pseudotsuga menziesii</i>	1.50	6.54	30.00
<i>Symphoricarpos oreophilus</i>	9.25	9.78	65.00
<b>FORBS</b>			
<i>Lupinus argenteus</i>	0.75	2.38	10.00
<i>Penstemon watsonii</i>	3.50	5.02	40.00
<b>GRASSES</b>			
<i>Elymus salinus</i>	2.75	5.80	20.00
<i>Elymus spicatus</i>	4.75	8.14	40.00
<i>Koeleria macrantha</i>	0.75	2.38	10.00
<i>Stipa nelsonii</i>	5.50	7.40	50.00

**Table 11: Dugout Mine Drill Site EXP-03. Cover and composition (2010).**

n=20		
Sagebrush/Grass/Serviceberry (Undisturbed)	Mean Percent	Standard Deviation
<b>A. TOTAL COVER</b>		
Understory	57.50	15.04
Litter	26.05	13.80
Bareground	12.55	8.48
Rock	3.90	3.79
<b>B. % COMPOSITION</b>		
Trees/Shrubs	64.97	20.26
Forbs	7.40	10.76
Grasses	27.63	19.53

**Table 12: Dugout Mine Drill Site EXP-03. Woody Species Density (2010).**

n=20	
SPECIES	Individuals Per Acre
<i>Amelanchier utahensis</i>	1053.23
<i>Artemisia tridentata</i> var. <i>vaseyana</i>	3089.46
<i>Juniperus communis</i>	70.22
<i>Pseudotsuga menziesii</i>	70.22
<i>Symphoricarpos oreophilus</i>	1334.09
<b>TOTAL</b>	<b>5617.20</b>

**Table 13: Dugout Mine Drill Site EXP-04. Total cover, standard deviation and frequency by species (2010).**

Sagebrush/Grass/Serviceberry (Undisturbed)	Mean Percent	Standard Deviation	Percent Frequency
n=20			
<b>TREES &amp; SHRUBS</b>			
<i>Amelanchier utahensis</i>	6.75	10.87	35.00
<i>Artemisia tridentata</i> var. <i>vaseyana</i>	23.00	12.69	90.00
<i>Chrysothamnus viscidiflorus</i>	1.25	3.11	15.00
<i>Symphoricarpos oreophilus</i>	9.50	12.64	45.00
<b>FORBS</b>			
<b>GRASSES</b>			
<i>Elymus salinus</i>	15.50	11.39	80.00
<i>Elymus spicatus</i>	1.00	4.36	5.00
<i>Poa pratensis</i>	1.50	6.54	5.00
<i>Stipa nelsonii</i>	4.25	8.70	25.00

**Table 14: Dugout Mine Drill Site EXP-04. Cover and composition (2010).**

n=20		
Sagebrush/Grass/Serviceberry (Undisturbed)	Mean Percent	Standard Deviation
<b>A. TOTAL COVER</b>		
Understory	62.75	4.87
Litter	13.25	5.07
Bareground	14.75	6.80
Rock	9.25	5.07
<b>B. % COMPOSITION</b>		
Trees/Shrubs	63.88	14.99
Forbs	0.00	0.00
Grasses	36.12	14.99

**Table 15: Dugout Mine Drill Site EXP-04. Woody Species Density (2010).**

n=20	
SPECIES	Individuals Per Acre
<i>Amelanchier utahensis</i>	347.54
<i>Artemisia tridentata</i>	3591.25
<i>Chrysothamnus viscidiflorus</i>	173.77
<i>Symphoricarpos oreophilus</i>	521.31
<b>TOTAL</b>	<b>4633.87</b>

**Table 16: Dugout Mine Drill Site EXP-04 Access Road. Total cover, standard deviation and frequency by species (2010).**

n=20			
Sagebrush/Grass/Serviceberry (Undisturbed)	Mean Percent	Standard Deviation	Percent Frequency
<b>OVERSTORY</b>			
<i>Amelanchier utahensis</i>	6.00	12.31	20.00
<b>UNDERSTORY</b>			
<b>TREES &amp; SHRUBS</b>			
<i>Amelanchier utahensis</i>	7.75	11.67	35.00
<i>Artemisia tridentata var. vaseyana</i>	20.75	14.86	85.00
<i>Rosa woodsii</i>	0.25	1.09	5.00
<i>Symphoricarpos oreophilus</i>	8.00	6.96	65.00
<b>FORBS</b>			
<i>Lupinus argenteus</i>	0.25	1.09	5.00
<i>Penstemon watsonii</i>	5.50	5.89	50.00
<b>GRASSES</b>			
<i>Elymus salinus</i>	5.00	6.12	45.00
<i>Elymus spicatus</i>	2.50	4.33	25.00
<i>Koeleria macrantha</i>	0.50	2.18	5.00
<i>Stipa hymenoides</i>	1.00	3.00	10.00
<i>Stipa nelsonii</i>	1.25	3.11	15.00

**Table 17: Dugout Mine Drill Site EXP-04 Access Road Cover and composition (2010).**

n=20		
Sagebrush/Grass/Serviceberry (Undisturbed)	Mean Percent	Standard Deviation
<b>A. TOTAL COVER</b>		
Overstory (o)	6.00	12.31
Understory (u)	52.75	14.70
Litter	17.15	13.34
Bareground	18.70	13.81
Rock	11.40	7.75
o + u	58.75	17.17
<b>B. % COMPOSITION</b>		
Trees/Shrubs	67.86	15.09
Forbs	11.04	13.31
Grasses	21.09	10.53

**Table 18: Dugout Mine Drill Site EXP-04 Access Road. Woody Species Density (2010).**

n=20	
SPECIES	Individuals Per Acre
<i>Amelanchier utahensis</i>	1096.26
<i>Artemisia tridentata</i> var. <i>vaseyana</i>	2596.40
<i>Juniperus osteosperma</i>	57.70
<i>Symphoricarpos oreophilus</i>	865.47
<b>TOTAL</b>	<b>4615.83</b>

**Table 19: Dugout Mine Drill Site G-32. Total cover, standard deviation and frequency by species (2010).**

n=20			
Sagebrush/Grass/Snowberry (Undisturbed)	Mean Percent	Standard Deviation	Percent Frequency
<b>TREES &amp; SHRUBS</b>			
<i>Amelanchier utahensis</i>	1.75	5.31	10.00
<i>Artemisia tridentata</i>	15.25	9.93	90.00
<i>Gutierrezia sarothrae</i>	1.25	3.11	15.00
<i>Symphoricarpos oreophilus</i>	11.00	11.25	65.00
<b>FORBS</b>			
<i>Antennaria parvifolia</i>	3.00	6.60	20.00
<i>Artemisia dracunculus</i>	0.50	2.18	5.00
<i>Aster engelmannii</i>	0.90	2.72	10.00
<i>Cryptantha sp.</i>	0.50	2.18	5.00
<i>Penstemon watsonii</i>	0.25	1.09	5.00
<i>Swertia radiata</i>	1.00	3.39	10.00
<b>GRASSES</b>			
<i>Bromus carinatus</i>	0.50	2.18	5.00
<i>Elymus salinus</i>	12.85	5.69	95.00
<i>Festuca sp.</i>	0.25	1.09	5.00
<i>Poa pratensis</i>	0.50	2.18	5.00
<i>Stipa hymenoides</i>	0.50	2.18	5.00

**Table 20: Dugout Mine Drill Site G-32. Cover and composition (2010).**

n=20		
Sagebrush/Grass/Snowberry (Undisturbed)	Mean Percent	Standard Deviation
<b>A. TOTAL COVER</b>		
Understory	50.00	13.78
Litter	15.50	8.20
Bareground	24.00	14.11
Rock	10.50	7.57
<b>B. % COMPOSITION</b>		
Trees/Shrubs	53.57	23.66
Forbs	13.68	17.11
Grasses	32.75	16.27

**Table 21: Dugout Mine Drill Site G-32. Woody Species Density (2010).**

n=20	
SPECIES	Individuals Per Acre
<i>Amelanchier utahensis</i>	259.18
<i>Artemisia tridentata</i>	4233.22
<i>Gutierrezia sarothrae</i>	172.78
<i>Symphoricarpos oreophilus</i>	2246.20
<b>TOTAL</b>	<b>6911.38</b>

**Table 22: Dugout Mine Drill Site G-34. Total cover, standard deviation and frequency by species (2010).**

n=20			
Aspen/Douglas Fir (Disturbed)	Mean Percent	Standard Deviation	Percent Frequency
<b>OVERSTORY</b>			
<i>Populus tremuloides</i>	1.00	4.36	5.00
<b>UNDERSTORY</b>			
<b>TREES &amp; SHRUBS</b>			
<i>Artemisia tridentata</i>	7.75	7.66	60.00
<i>Populus tremuloides</i>	3.50	8.08	25.00
<i>Pseudotsuga menziesii</i>	1.50	3.57	15.00
<i>Rosa woodsii</i>	0.75	3.27	5.00
<i>Symphoricarpos oreophilus</i>	1.25	5.45	5.00
<b>FORBS</b>			
<i>Cirsium sp.</i>	1.50	2.78	25.00
<i>Cynoglossum officinale</i>	11.25	14.39	80.00
<i>Erigeron sp.</i>	1.25	5.45	5.00
<i>Taraxacum officinale</i>	4.50	4.44	60.00
<b>GRASSES</b>			
<i>Elymus salinus</i>	0.25	1.09	5.00
<i>Elymus spicatus</i>	3.75	15.24	10.00
<i>Elymus trachycaulus</i>	4.25	11.54	20.00
<i>Poa pratensis</i>	5.25	6.22	45.00
<i>Poa secunda</i>	3.00	8.86	20.00

**Table 23: Dugout Mine Drill Site G-34. Cover and composition (2010).**

n=20		
Aspen/Douglas Fir (Disturbed)	Mean Percent	Standard Deviation
<b>A. TOTAL COVER</b>		
Overstory (o)	1.00	4.36
Understory (u)	49.75	14.01
Litter	16.50	10.97
Bareground	26.00	16.08
Rock	7.75	10.14
o + u	50.75	14.69
<b>B. % COMPOSITION</b>		
Trees/Shrubs	30.82	23.03
Forbs	37.53	26.38
Grasses	31.65	24.79

**Table 24: Dugout Mine Drill Site G-34. Woody Species Density (2010).**

n=20	
SPECIES	Individuals Per Acre
<i>Artemisia tridentata</i>	1326.64
<i>Populus tremuloides</i>	265.33
<i>Pseudotsuga menziesii</i>	106.13
<i>Rosa woodsii</i>	106.13
<i>Symphoricarpos oreophilus</i>	318.39
<b>TOTAL</b>	<b>2122.62</b>

**Table 25. Dugout Mine: Mtn. Brush/Sagebrush/Snowberry Reference Area for Drill Sites EXP-03, EXP-04, EXP-04 Access Road and G-32.**

(also for previous reported sites: DUG-07, G-16, G-17, G-22, G-26, G-29, F-01, F-02, F-03, F-06, F-07).

**Species Cover, Standard Deviation and Sample Size (2005 data).**

Mtn. Brush/Sagebrush Reference Area	Mean Percent	Standard Deviation	Percent Frequency
<b>OVERSTORY</b>			
<i>Amelanchier utahensis</i>	6.75	12.58	25.00
<i>Juniperus scopulorum</i>	0.75	3.27	5.00
<b>UNDERSTORY</b>			
<b>TREES &amp; SHRUBS</b>			
<i>Amelanchier utahensis</i>	7.00	16.16	35.00
<i>Artemisia tridentata</i>	15.25	14.79	75.00
<i>Juniperus scopulorum</i>	0.25	1.09	5.00
<i>Symphoricarpos oreophilus</i>	10.50	15.96	50.00
<b>FORBS</b>			
<i>Astragalus sp.</i>	0.25	1.09	5.00
<i>Lupinus argenteus</i>	4.05	4.60	55.00
<i>Penstemon watsonii</i>	10.70	7.89	80.00
<b>GRASSES</b>			
<i>Elymus salinus</i>	0.25	1.09	5.00
<i>Elymus spicatus</i>	2.00	3.67	25.00
<i>Elymus trachycaulus</i>	2.00	3.67	25.00
<i>Poa pratensis</i>	2.25	5.36	20.00
<i>Poa secunda</i>	2.50	6.22	20.00

**Table 26. Dugout Mine: Mtn. Brush/Sagebrush/Snowberry Reference Area for drill Sites EXP-03, EXP-04, EXP-04 Access Road and G-32.**  
*(also for previous reported sites: DUG-07, G-16, G-17, G-22, G-26, G-29, F-01, F-02, F-03, F-06, F-07).*  
**Total cover, standard deviation and sample size (2005 data).**

Mtn. Brush/Sagebrush Reference Area	Mean Percent	Standard Deviation	Sample Size
<b>A. TOTAL COVER</b>			
Overstory (o)	7.50	12.60	20
Understory (u)	57.00	12.08	20
Litter	18.60	7.52	20
Bareground	15.65	13.13	20
Rock	8.75	9.59	20
o + u	64.50	19.49	20
<b>B. % COMPOSITION</b>			
Trees/Shrubs	54.44	26.60	20
Forbs	28.08	17.03	20
Grasses	17.49	14.43	20

**Table 27. Dugout Mine: Mtn. Brush/Sagebrush/Snowberry Reference Area for Drill Sites EXP-03, EXP-04, EXP-04 Access Road and G-32.**  
*(also for previous reported sites: DUG-07, G-16, G-17, G-22, G-26, G-29, F-01, F-02, F-03, F-06, F-07).*  
**Woody Species Densities (2005 data).**

Mtn. Brush/Sagebrush Reference Area	
Species	Individuals Per Acre
<i>Amelanchier utahensis</i>	834.68
<i>Artemisia tridentata</i>	2375.64
<i>Juniperus scopulorum</i>	64.21
<i>Symphoricarpos oreophilus</i>	1861.99
<b>TOTAL</b>	<b>5136.52</b>

## Threatened, Endangered & Candidate Species

The following table shows the federally listed threatened, endangered and candidates plant and wildlife species for Carbon County, Utah. Also described in the table are potential impacts (if any) to the species and their habitats by the proposed drill site construction activities.

**Table 28: Federally listed threatened, endangered & candidate species in Carbon County, Utah and notes regarding potential impacts to them as a result of the proposed drill sites.**

**NOTE:** This list was compiled using known species occurrences and species observations from the Utah Natural Heritage Program's Biodiversity Tracking and Conservation System (BIOTICS). This list includes both current and historic records. (Last updated on November 9, 2010).

Scientific Name	Common Name	Status*	Site-Specific Notes
<i>Gila cypha</i>	Humpback chub	E	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. The drainage control measures of the site limit impacts to the downstream drainage of the Colorado River system. There should be no impacts to this species as a result of construction of the drill sites.
<i>Gila elegans</i>	Bonytail	E	The bonytail is a very rare minnow originally native to the Colorado River system. These rivers do not occur in the study areas. The drainage control measures of the site limit impacts to the downstream drainage of the Colorado River system. There should be no impacts to this species as a result of construction of the drill sites.
<i>Mustela nigripes</i>	Black-footed ferret	Ex	Black-footed ferret habitat is primarily prairie grasslands. The ferret has a diet consisting of almost 90% prairie dogs. This habitat and food source does not occur in the study areas. There should be no impacts to this species as a result of construction of the drill sites.

**Table 28: Federally listed threatened, endangered & candidate species in Carbon County, Utah and notes regarding potential impacts to them as a result of the proposed drill sites.**

**NOTE:** This list was compiled using known species occurrences and species observations from the Utah Natural Heritage Program's Biodiversity Tracking and Conservation System (BIOTICS). This list includes both current and historic records. (Last updated on November 9, 2010).

<i>Ptychocheilus lucius</i>	Colorado pikeminnow	E	<p>The Colorado pikeminnow is a fish that prefers medium to large rivers. With the loss of habitat they are now restricted to the upper Colorado River system.</p> <p>These rivers do not occur in the study area. The drainage control measures of the site limit impacts to the downstream drainage of the Colorado River system.</p> <p>There should be no impacts to this species as a result of construction of the drill sites.</p>
<i>Sclerocactus wetlandicus</i>	Uinta Basin hookless cactus	T	<p><i>Sclerocactus wetlandicus</i> generally occurs on cobbly, gravelly, or rocky surfaces on river terrace deposits along the White and Green Rivers of Utah.</p> <p><i>S. glaucus</i> occurs on varying exposures, but is more abundant on south facing exposures, and on slopes to about 30 percent grade; it is most abundant at the point where terrace deposits break from level tops to steeper side slopes.</p> <p>Plant communities and species associated with this species are bud sage, shadscale, black sagebrush and horsebrush.</p> <p>These plant communities nor habitats associate with them occur in the study areas, therefore, there should be no impacts to this species as a result of construction of the drill sites.</p>
<i>Xyrauchen texanus</i>	Razorback sucker	E	<p>This species prefers slow backwater habitats and impoundments in the Colorado River system. Utah Division of Wildlife Resources distribution maps of this species for Carbon County shows to occur near the Green River in extreme eastern portion of the county.</p> <p>These rivers do not occur in the study areas. The drainage control measures of the site limit impacts to the downstream drainage of the Colorado River system.</p> <p>There should be no impacts to this species as a result of construction of the drill sites.</p>

**Table 28: Federally listed threatened, endangered & candidate species in Carbon County, Utah and notes regarding potential impacts to them as a result of the proposed drill sites.**

**NOTE:** This list was compiled using known species occurrences and species observations from the Utah Natural Heritage Program's Biodiversity Tracking and Conservation System (BIOTICS). This list includes both current and historic records. (Last updated on November 9, 2010).

Centrocercus urophasianus	Greater sage-grouse	C	<p>Greater sage-grouse inhabit sagebrush zone in Utah's mountain valleys and foothills. No leks are known to be located at the proposed drill sites, but the area has been mapped as winter and brooding habitat by DWR.</p> <p>If present, there should be no impact to population numbers of this species as a result of construction of the drill sites.</p>
Canus lupus	Gray Wolf	E	<p>Although once common in Utah, the gray wolf was extirpated (exterminated) from the state by early settlers. Although they have been reintroduced in adjacent states, and may move into the state, reintroduction to Utah has been planned to-date.</p> <p>The gray wolf can live in many habitats, but there will be no impacts to this species as a result of construction and operation of construction of the drill sites.</p>

\* Status  
 C = Candidate  
 E = Endangered  
 T = Threatened  
 Ex = Extirpated

## Discussion

Objectives and goals for quantitatively sampling the vegetation in areas where the existing plant communities have been proposed for disturbance by drilling activities are basically twofold. First, sampling results provide data about the community type and current conditions prior to any disturbance. Next, based on these datasets, biologists may suggest revegetation success standards to be used at the time of final reclamation. Success standards can be formulated by comparing the data of the proposed disturbed areas with data of reference areas (reference areas are similar plant communities that are to remain undisturbed for the life of the drill pad) or by proposing other standards pre-determined to be appropriate following final revegetation (called "pre-set standards").

Several reference areas have been chosen previously to represent future revegetation success standards of exploration and de-gas sites that were studied earlier (see Table 2). The existing reference areas were reviewed as candidates to also represent success standards for the drill sites included in this report. Some of the areas in this study that were proposed for disturbance by de-gas or exploration drill sites were in native, undisturbed plant communities. However, other drill sites had been disturbed previously by unrelated activities such as road building and logging operations. State 645 regulations require lands previously disturbed *"and that are remined by or otherwise redisturbed by coal mining and reclamation operations, at a minimum, the vegetative cover will be not less than the ground cover that existed before redisturbance and will be adequate to control erosion"*. A discussion regarding these sites and suggestions for revegetation success standards for them have been provided below.

## Revegetation Success Standards: EXP-01

As described in the RESULTS section, EXP-01 has had a varying degree of previous disturbance. With the exception of logging the large trees, one area within the drill site was relatively undisturbed, whereas another area of the pad had severe disturbance to it caused by road construction activities. Sampling was conducted in both of these areas; the data were then "lumped" and the mean **cover** values are shown in Table 5. The mean understory cover was estimated at 42.25%. In the raw dataset (not included), if one separates the minor disturbed from the severely disturbed portions of the drill pad, the understory cover values were: 47.67% (minor disturbed); 26.00% (severely disturbed). With this in mind, and because overstory cover will play a minor roll in the data following the *responsibility period* of the mine operator after final revegetation, a fair and just cover standard that could be used at the time of final reclamation could be the current average understory cover value of all the data combined, or 42.25% (Table 5).

Similarly, woody species **density** values greatly differed between the minor disturbed and the severely disturbed portions of the drill site. The mean total woody species density of all areas lumped together was 1,460 plants per acre (from Table 6). Summed separately using the raw data, the mean density totals were: 5,275 (minor disturbed areas only) and 461 (severely disturbed areas only). Therefore, a figure close to the average of all plots seems more prudent to be used for a final revegetation success standard, or 1,500 plants per acre.

It is therefore recommended that the following pre-determined or preset standards for revegetation success standards of the site be made. This should provide fair and just standards for this previously disturbed site and also ensure that it is left in better condition and more diverse than it was prior to the proposed new disturbance.

- Total Living Cover: 42.25% (from Table 5, the current understory cover value). Also, the final total living cover must be dominated by desirable, native, non-weedy plant species.
- Woody Species Density: 1,500 individuals per acre (from Table 6, the rounded up current density value).
- Diversity: None (but living cover must be dominated by desirable, native, non-weedy plant species).

### Revegetation Success Standards: EXP-02

EXP-02 was another site that has been altered by previous activities. It was obvious that logging operations have occurred here changing the site from a ponderosa pine stand to one where grasses were more dominate (refer to Tables 7 and 8). Accordingly, the pre-set revegetation success standards proposed are close to the current conditions of the site and are shown below.

- Total Living Cover: 39.00% [from Table 8-A, the current total living cover (overstory + understory) value]. Also, the final total living cover must be dominated by desirable, native, non-weedy plant species).
- Woody Species Density: 400 individuals per acre (from Table 9, the rounded up current density value).
- Diversity: None (but living cover must be dominated by desirable, native, non-weedy plant species).

### Revegetation Success Standards: EXP-03

EXP-03 was a native, undisturbed Sagebrush/Grass/Serviceberry plant community. The parameters of the existing Mtn. Brush/Sagebrush/ Snowberry Reference Area were compared to represent future revegetation success standards. When the understory living **cover** of the reference area was

compared statistically to the total living cover of the proposed disturbed drill site (no overstory was present in the samples), the differences were non-significant (Figure 1-C).

Similarly when the total woody species **density** of the reference area was compared with that of EXP-03, the differences were again non-significant statistically (Figure 2-C).

**NOTE:** Like so many areas in the western U.S. that have been heavily grazed over the years, woody species begin to displace the herbaceous grasses and forbs because they are often more sought out than the woody plants. Although there was no significant difference in the woody species density between the reference area and the proposed disturbed area, and the reference area's density value may be an appropriate revegetation success standard, it is this author's opinion that fewer woody species may be more appropriate for a revegetation standard. Fewer woody species would probably give rise to more herbaceous plant cover and could provide greater forage diversity for domestic livestock and wildlife species. It is therefore recommended here that a lower woody species density value than the reference area be used as the final revegetation success standard, or 2,500 individuals. This standard, like all other proposed standards, is subject to approval, by regulatory agency biologists.

The following revegetation success standards are therefore recommended.

- Total Living Cover: The understory cover value of Mtn. Brush/Sagebrush/Snowberry Reference Area at the time of final reclamation.
- Woody Species Density: A total density of 2,500 plants per acre (see NOTE above).
- Diversity: The value of Mtn. Brush/Sagebrush/Snowberry Reference Area at the time of final reclamation.

## Revegetation Success Standards: EXP-04

The drill site for EXP-04 has been planned in an area that supported a native, undisturbed Sagebrush/Grass/Serviceberry plant community. Consequently, the same reference area mentioned above for EXP-03, the Mtn. Brush/Sagebrush/Snowberry Reference Area, was compared to be used for future revegetation success standards. However, because the total living cover was greater than the above site, even though no overstory was found in the quadrats, the total living cover (understory + overstory) of the reference area was used for comparison. Figure 1-D shows the results from the statistical comparison for the total living cover of each area. Results here suggested no significant difference between the **cover** the two areas.

When the total woody species **density** of the two areas – the reference area and the area proposed for disturbance at the drill site – were compared, the differences were also non-significant statistically (Figure 2-D).

The following revegetation success standards are therefore recommended.

- Total Living Cover: The total living cover (understory + overstory) value of Mtn. Brush/Sagebrush/ Snowberry Reference Area at the time of final reclamation.
- Woody Species Density: A total density of 2,500 plants per acre (see NOTE above in EXP-03).
- Diversity: The value of Mtn. Brush/Sagebrush/Snowberry Reference Area at the time of final reclamation.

## Revegetation Success Standards: EXP-04 (Access Road)

Even though it was the same plant community as the drill site to which it leads, because the access road to EXP-04 would entail new disturbance and covered much more property than the drill site itself, it was sampled and reported separately. Results suggested a difference in the total living cover of the access road and drill site. Even though overstory was present in the sample quadrats, when one combines the overstory and the understory cover of the access road, the cover was less than the total living cover of the drill pad. Because of this difference, and because overstory and understory cover were reported separately for all areas including the reference area, it seemed more appropriate to use the understory value of the reference area because it was closer to the access road's cover value. In other words, it seemed to be a more accurate representation of the area proposed for disturbance thus a better standard for final revegetation success. That said, when the total living **cover** value of the proposed disturbed access road (overstory + understory) was compared to the living cover value (understory only) of the reference area, the differences were not significant statistically (Figure 1-E).

The total woody species **density** of the access road was then compared with the reference area's density. The differences here were also non-significant (Figure 2-E).

The following revegetation success standards are therefore recommended.

- Total Living Cover: The understory cover value of Mountain Brush/Sagebrush/Snowberry Reference Area at the time of final reclamation.
- Woody Species Density: A total density of 2,500 plants per acre (see NOTE above in EXP-03).
- Diversity: The value of Mtn. Brush/Sagebrush/Snowberry Reference Area at the time of final reclamation.

## Revegetation Success Standards: G-32

Site G-32 was an undisturbed, native Sagebrush/Grass/Snowberry plant community common to the area. Again, the Mtn. Brush/Sagebrush/Grass Reference Area appeared to be the most appropriate area to be used for final revegetation success standards. Like similar areas, the understory cover of the reference area, not the combined overstory and understory total, seemed to be the more appropriate standard to be compared with the total living cover of the proposed disturbed G-32 site (the drill site had no overstory present in the sample quadrats). Therefore, when the total living **cover** of G-32 was statistically compared with the Mtn. Brush/Sagebrush/Grass Reference Area, the differences were non-significant (Figure 1-F).

Next, the total woody species **density** of G-32 was compared with the reference area's density. The differences here, however, were significant (Figure 2-E); the proposed disturbed area had significantly more woody species than the proposed disturbed drill site.

The following revegetation success standards are therefore recommended.

- Total Living Cover: The understory cover value of Mountain Brush/Sagebrush/Snowberry Reference Area at the time of final reclamation.
- Woody Species Density: A total density of 2,500 plants per acre (see NOTE above in EXP-03).
- Diversity: The value of Mtn. Brush/Sagebrush/Snowberry Reference Area at the time of final reclamation.

## Revegetation Success Standards: G-34

As described in the RESULTS section above, G-34 was an Aspen/Douglas Fir forest that has been severely disturbed by previous logging activities. Consequently, pre-set standards for revegetation success have been proposed below.

- Total Living Cover: 49.75% (from Table 23-A, the current understory living cover value). Also, the final total living cover must be dominated by desirable, native, non-weedy plant species.
- Woody Species Density: 2,100 individuals per acre (from Table 24 the rounded current density value).
- Diversity: None (but living cover must be dominated by desirable, native, non-weedy plant species).

**Figure 1.** A statistical comparison (Student's t-tests;  $\alpha=0.05$ ) of the **total living cover** between the proposed disturbed drill sites and their recommended revegetation success standards.

	$\bar{x}$	s	n	t	df	SL
<b>A. EXP-01</b>						
Previously Disturbed:	42.25	15.61	20			
Reference Area:	42.25 (pss)					
t-test				n/a	n/a	n/a
<b>B. EXP-02</b>						
Previously Disturbed:	39.00 (u+o)	14.46	20			
Reference Area:	39.00 (pss)					
t-test				n/a	n/a	n/a
<b>C. EXP-03</b>						
Previously Disturbed:	57.50	15.04	20			
Reference Area: (MB/S/S)	57.00 (u)	12.08	20			
t-test				0.116	38	N.S.
<b>D. EXP-04</b>						
Proposed Disturbed	62.75	4.87	20			
Reference Area (MB/S/S):	64.50 (o+u)	19.49	20			
t-test				0.393	38	N.S.
<b>E. EXP-04 (Access Road)</b>						
Proposed Disturbed	58.75 (o+u)	17.17	20			
Reference Area (MB/S/S):	57.00 (u)	12.08	20			
t-test				0.373	38	N.S.
<b>F. G-32</b>						
Proposed Disturbed	50.00	13.78	20			
Reference Area: (MB/S/S)	57.00 (u)	12.08	20			
t-test				1.708	38	N.S.
<b>G. G-34</b>						
Previously Disturbed:	49.75 (u)	14.01	20			
Reference Area:	50.00 (pss)					
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  
S/S/G = Sagebrush/Snowberry/Grass  
MB/S/S = Mtn. Brush/Sagebrush/Snowberry  
u = understory  
o = overstory  
pss = pre-set standards (see DISCUSSION section)

**Figure 2.** A statistical comparison (Student's t-tests;  $\alpha < 0.05$ ) of the **woody species density** between the proposed disturbed drill sites and their recommended revegetation success standards.

	$\bar{x}$	s	n	t	df	SL
<b>A. EXP-01</b>						
Proposed Disturbed	1460.34	2873.31	20			
Reference Area:	1500.00	(pss)				
t-test				n/a	n/a	n/a
<b>B. EXP-02</b>						
Previously Disturbed:	367.04	226.81	20			
Reference Area:	400.00	(pss)				
t-test				n/a	n/a	n/a
<b>C. EXP-03</b>						
Previously Disturbed:	5617.20	1904.01	20			
Reference Area: (MB/S/S)	5136.52	2140.90	20			
	2500.00	(pss)				
t-test				0.750	38	N.S.
<b>D. EXP-04</b>						
Proposed Disturbed	4633.87	2444.10	20			
Reference Area: (MB/S/S)	5136.52	2140.90	20			
	2500.00	(pss)				
t-test				0.692	38	N.S.
<b>E. EXP-04 (Access Road)</b>						
Proposed Disturbed	4615.83	1838.22	20			
Reference Area: (MB/S/S)	5136.52	2140.90	20			
	2500.00	(pss)				
t-test				0.825	38	N.S.
<b>F. G-32</b>						
Proposed Disturbed	6911.38	2840.36	20			
Reference Area: (MB/S/S)	5136.52	2140.90	20			
	2500.00	(pss)				
t-test				2.232	30	p < .05
<b>G. G-34</b>						
Previously Disturbed:	2122.62	1357.33	20			
Reference Area:	2000.00	(pss)				
t-test				n/a	n/a	n/a

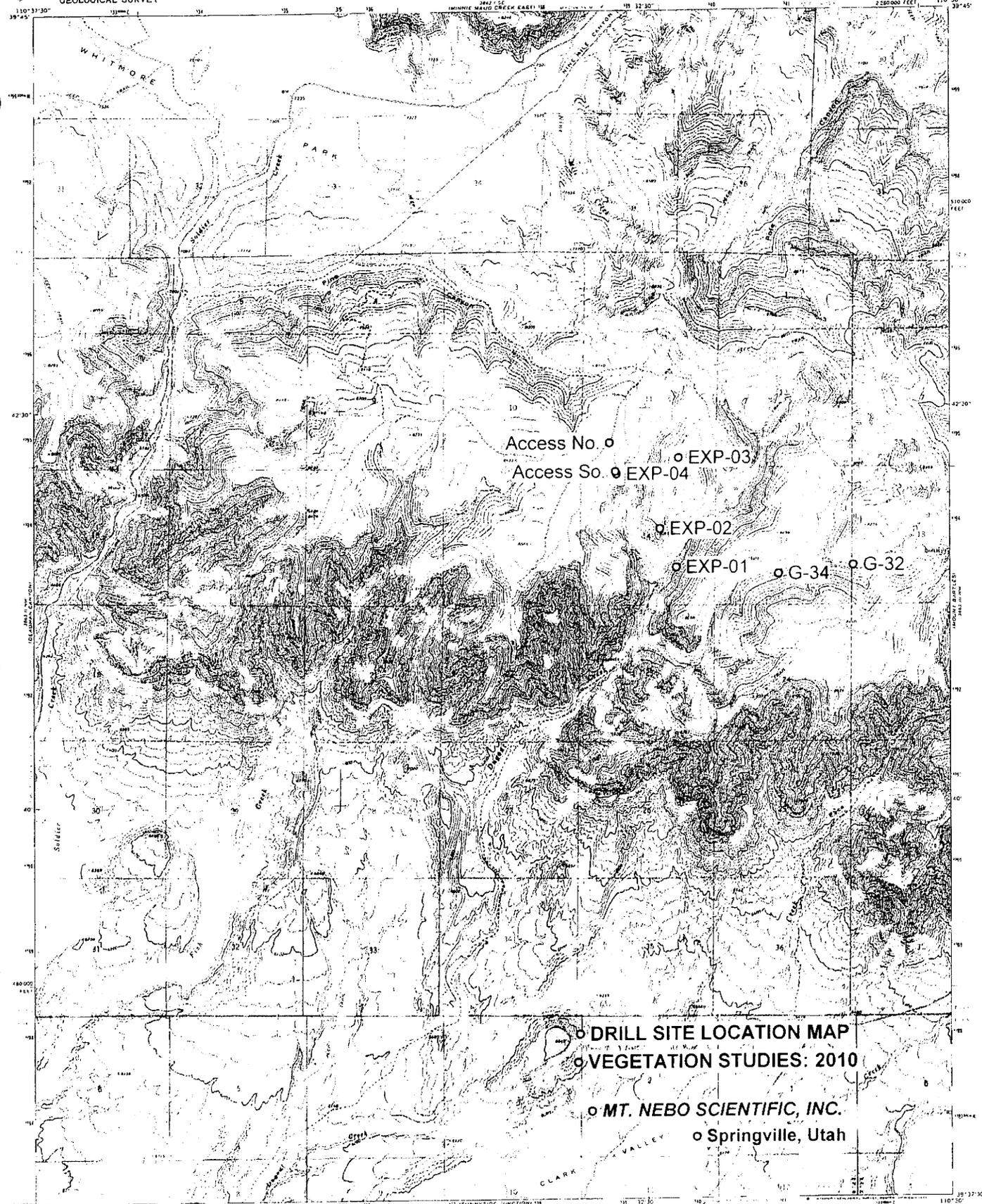
$\bar{x}$  = mean  
s = standard deviation  
n = sample size  
t = Student's t-value  
df = degrees of freedom  
n/a = not applicable  
p = probability

SL = Significance Level  
N.S. = Non-Significant  
MB/S/S = Mtn. Brush/Sagebrush/Snowberry  
u = understory  
o = overstory  
pss = pre-set standards (see DISCUSSION section)

## Summary & Conclusions

Plant communities that existed on several sites proposed for new disturbance by exploration and de-gas drilling have been studied for this report. The proposed drill sites were quantitatively sampled during the growing season of 2010 to provide baseline data and other information. Next, appropriate reference areas were chosen to be used as final revegetation success standards for those native plant communities proposed for disturbance that have had no previous disturbance to them. For those areas where new disturbance has been planned, but that had been disturbed previously by other activities, "pre-set" or predetermined revegetation success standards were recommended.

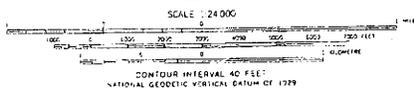
Sensitive species surveys were conducted at each proposed drill pad and access roads (where appropriate). No threatened, endangered or candidate species, plant or animal, were observed at the sites. However, the general area has been mapped as brooding and winter habitat for greater-sage grouse, a federally listed candidate species. No impact to the population of these birds, if present, are expected by construction of the drill sites.



Access No. o EXP-03  
Access So. o EXP-04  
o EXP-02  
o EXP-01 o G-34 o G-32

o DRILL SITE LOCATION MAP  
o VEGETATION STUDIES: 2010  
o MT. NEBO SCIENTIFIC, INC.  
o Springville, Utah

Map prepared, edited, and published by the Geological Survey  
Control by USGS and FIOS/MLAA  
Photography by aerial stereoscopic methods from aerial  
photographs taken 1972. Scale checked 15-7  
Projection and 10,000 foot grid are UTM  
coordinate system. Center of the Lambert conformal conic  
1000 meter Universal Transverse Mercator grid cells  
zone 12, shown in blue. 1973 North American datum.  
Certain land uses are based on aerial photography data.



ROAD CLASSIFICATION

Primary highway	Lightly used road	Hard or improved surface
Secondary highway	Unimproved road	
Interstate Route	U.S. Route	State Route



THIS MAP COMPLETES WITH NATIONAL MAP ACCURACY STANDARDS  
FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225 OR RESTON, VIRGINIA 22092  
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

PINE CANYON, UTAH  
1:24,000 SCALE  
7.5 MINUTE SERIES  
1973  
AMS 2865 H.C. SERIES 5957



EXP-03

EXP-04

EXP-02

EXP-01

G-32

G-34

Dugout Mine  
Vegetation Studies: 2010

**AERIAL VIEW**

Drill Sites

Mt. Nebo Scientific, Inc.  
Springville, Utah

Image USA Farm Service Agency  
© 2010 Google

1095 m

Imagery Date: Jun 23, 2009

39°41'30.45"N 110°31'34.79"W elev: 2366 m

Google

Eye alt 5.85 km

**Soil Resource Assessment**

*of*

**De-gas Sites: G-32 and G-34**

*and*

**Exploration Sites: EXP-1-11, EXP-2-11, EXP-3-11, and EXP-4-11**

*at*

**Dugout Mine Area**

*prepared for*

**MT. NEBO SCIENTIFIC, INC.**

**330 East 400 South, Suite 6  
Springville, UT 84663**

*by*

Robert E. Long, CPSS

**Long Resource Consultants, Inc.**

**1960 W Deep Creek Road  
Morgan, Utah 84050  
(801) 791-3447**

*for*

**Canyon Fuels.**

**Dugout Mine  
P.O. Box 1029  
Wellington, Utah 84520**

January 6, 2011

**EXP-01**

**Exploration Site**

**Location:** Easting 539620  
Northing 4393622  
Zone 12  
NAD 1983

Township 13 South  
Range 12 East  
Section 14  
Meridian Salt Lake

USGS Quad: Pine Canyon, Utah

**Elevation:** 7,350 feet

**General Site Description**

EXP-01 is a small site (approximately 0.26 plane acres) located on a very steep (60 percent) northwest facing (300°) canyon sideslope in a fork of Dugout Canyon. It is 0.82 miles from the Dugout mine office. The site is approximately 145 feet from southwest to northeast and 80 feet from the outside edge of the road to the upslope boundary. The existing road encompasses about one-third of the proposed location. A very steep cutbank (25 to 35 feet high) separates the road from the undisturbed native vegetation and soils, photo 1.

Geologic materials at this location are identified as Castlegate sandstone formation on the geology map (Weiss et. al. 2003).

Precipitation at EXP-01 ranges from 16 to 20 inches annually according to general precipitation records (Daly and Taylor, 1998). Local site vegetation indicates that the effective annual precipitation range on this northwest facing slope is likely 20 to 24 inches.

**NRCS Soil Map Unit**

NRCS soil map unit 62: Midfork family-Comodore complex. Slopes are 50 to 70 percent

Midfork family soils (loamy-skeletal, mixed, superactive Typic Haplocryolls) have a dark surface (mollic) and greater than 35 percent rock fragments. Comodore soils (loamy-skeletal, mixed, superactive frigid Aridic Lithic Haplustolls) are shallow to sandstone (NRCS, 2010).

The EXP-01 soil description collected from the roadcut was correlated to Elwood family (Loamy-skeletal, mixed, superactive Typic Argicryolls), photos 7, 8, and 9. The soil identified at EXP-01 is

similar to Midfork family soils, but EXP-01 soils have an accumulation of clay (argillic) at 46 cm below the surface. The clay increase is 9 percentage points between the AB and Bt horizons.

The soil profile description and sampling were done according to NRCS standards (Schoenberger et. al., 2002).

#### **Lab Analysis**

Samples of the mineral soil horizons in EXP-01 were submitted for laboratory analysis. No unsuitable parameters (Utah DOGM, 2005) were identified. The results of these analyses are in the appendix.

#### **Topsoil Resource**

The existing topsoil resource in the undisturbed native soils is thick at the EXP-01 description location. The Oi, Oe, A, and AB horizons have a combined thickness of 46 cm at the description location. The underlying Bt1 horizon has 35 percent clay and the Bt2 has 33 percent. Mottles in the Bt2 indicate that water may be perching in the clay.

The estimated average topsoil salvage depth for the EXP-01 location is 46 cm (18 inches) when the organic surface (10 cm) is included.

Salvageable topsoil materials were not observed in the existing road portion of the location.

#### **Vegetation**

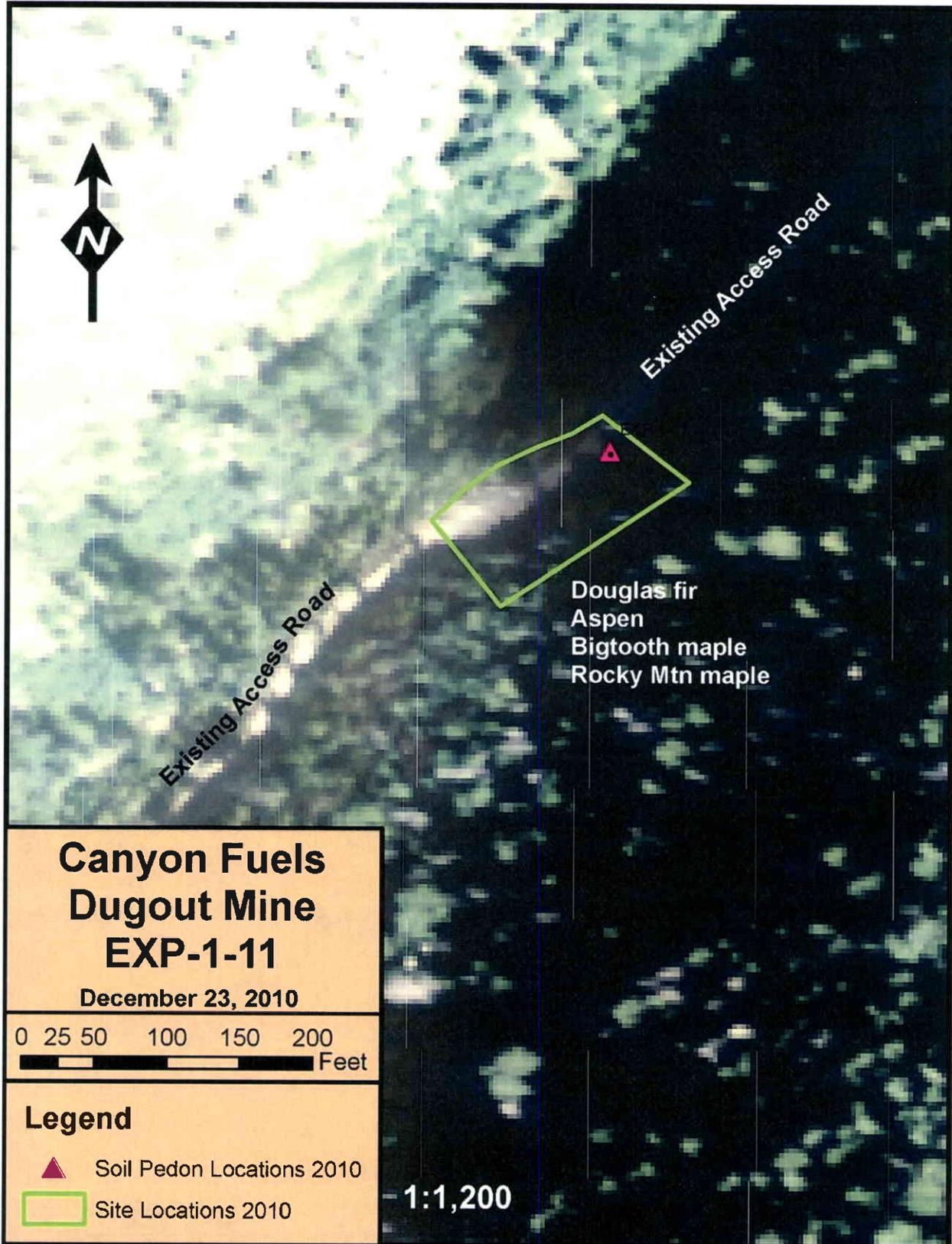
The following plant species were observed on the undisturbed native slope. The vegetation report written by Mt. Nebo Scientific contains a more detailed quantitative description of the site vegetation.

Aspen	currant
Rocky Mountain maple	wild rose
Bigtooth maple	Oregon grape
Douglas fir	Mountain snowberry

The existing cutslope is mostly barren.

#### **Reclamation**

The potential for successful revegetation of the EXP-01 area is good, if topsoil materials are salvaged prior to disturbance. The replaced topsoil will need to be protected from erosion on the very steep slope until vegetation has become established.



**Soil Profile Description**

**Pedon ID:** EXP-01

**Description Date:** 9/14/2010

**Describer:** Robert Long

**Soil Name As Described/Sampled:** Elwood

**Classification:** Loamy-skeletal, mixed, superactive Typic Argicryolls

**Pedon Type:** Within range of series

**Lat/Long:** 39°41'29" north, 110°32'17" west

**UTM:** 539620.86E, 4393621.45N -- Datum NAD83, Zone 12

**Legal Description:** Section 14, Township 12 East, Range 13 South of the Salt Lake Meridian

**Landscape:** mountain range

**Landform:** canyon

**Geomorphic Component:** Center third of mountain flank

**Profile Position:** Backslope

**Slope:** 60 percent

**Elevation:** 2248 meters (7375.3 feet)

**Aspect:** 300°

**Shape:** up/down: Linear; across: Linear

**Complexity:** Simple

**Flooding:** None

**Ponding:** None

**Drainage:** Somewhat poorly drained

**Runoff:** Medium

**Permeability:** Slow

**Erosion:** None - deposition

**Primary Earth Cover:** Tree cover; Secondary Earth Cover: Other shrub cover

**Existing Vegetation:** ACGL - Rocky Mountain maple (*Acer glabrum*); PSME - Douglas-fir (*Pseudotsuga menziesii*); MARE11 - Oregongrape (*Mahonia repens*); SYMPH - snowberry (*Symphoricarpos*); POTR5 - quaking aspen (*Populus tremuloides*); ROWO - Woods' rose (*Rosa woodsii*); RIBES - currant (*Ribes*)

**Parent Materials:** colluvium

**Particle Size Control Section:** 46 to 96 centimeters (18.1 to 37.8 inches)

**Diagnostic Features:** Mollic epipedon: 10 to 46 centimeters (3.9 to 18.1 inches) and Argillic horizon: 46 to 150 centimeters (18.1 to 59.1 inches)

Slope	Elevation	Aspect	MAAT	MSAT	MWAT	MAP	Frost-Free Days	Drainage Class	Slope Length	Upslope Length
60 percent	2248 m (7375.3 ft)	300°	4.4° C (40° F)			762 millimeters (30 inches)	60 days	somewhat poorly		

**Oi** --- 0 to 4 centimeters (0 to 1.6 inches); Partially decomposed leaves and needles; clear smooth boundary.

**Oe** --- 4 to 10 centimeters (1.6 to 3.9 inches); Decomposed organic matter; abrupt smooth boundary.

**A1** --- 10 to 26 centimeters (3.9 to 10.2 inches); dark brown (10YR 3/3) moist, cobbly loam; brown (10YR 5/3) dry; 44 percent sand; 34 percent silt; 22 percent clay; structure; very friable, hard, slightly sticky, slightly plastic; common coarse roots throughout, common medium roots throughout, common fine roots throughout and many very fine roots throughout; common very fine tubular pores; 5 percent nonflat subangular 250 to 600 millimeters (10 to 24 inches) calcareous sandstone fragments, 10 percent nonflat subangular 76 to 250 millimeters (3 to 10 inches) calcareous sandstone fragments and 10 percent nonflat subangular 2 to 76 millimeters (0.1 to 3 inches) calcareous sandstone fragments; electrical conductivity of 0.46 mmhos/cm by EC meter, saturated paste; sodium absorption ratio of 0.16; noneffervescent by HCl, 1 normal; neutral, pH 7.2, pH meter, saturated paste; clear smooth boundary.

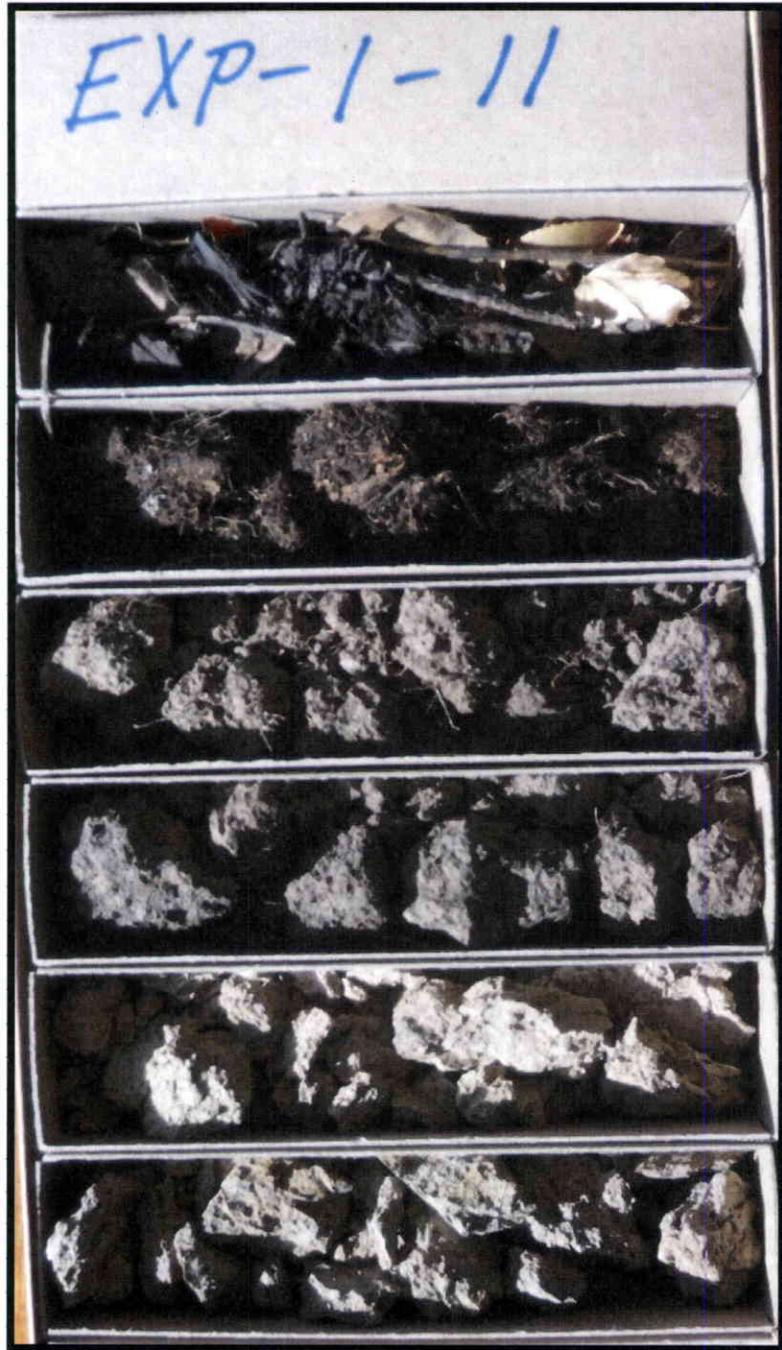
**AB** --- 26 to 46 centimeters (10.2 to 18.1 inches); very dark grayish brown (10YR 3/2) moist, very stony loam; dark grayish brown (10YR 4/2) dry; 37 percent sand; 37 percent silt; 26 percent clay; moderate medium subangular blocky structure; friable, hard, slightly sticky, slightly plastic; common coarse roots throughout, common medium roots throughout, common fine roots throughout and common very fine roots throughout; common very fine tubular pores; 15 percent nonflat subangular 250 to 600 millimeters (10 to 24 inches) calcareous sandstone fragments, 15 percent nonflat subangular 76 to 250 millimeters (3 to 10 inches) calcareous sandstone fragments and 10 percent nonflat

subangular 2 to 76 millimeters (0.1 to 3 inches) calcareous sandstone fragments; electrical conductivity of 0.24 mmhos/cm by EC meter, saturated paste; sodium absorption ratio of 0.16; noneffervescent by HCl, 1 normal; neutral, pH 6.9, pH meter, saturated paste; clear wavy boundary.

**Bt1** --- 46 to 90 centimeters (18.1 to 35.4 inches); brown (10YR 5/3) moist, very stony clay loam; pale brown (10YR 6/3) dry; 29 percent sand; 36 percent silt; 35 percent clay; moderate medium subangular blocky structure; friable, very hard, moderately sticky, moderately plastic; common coarse roots throughout, common medium roots throughout, common fine roots throughout and common very fine roots throughout; common very fine tubular pores; 5 percent (few) clay films between sand grains and 15 percent (few) clay films on all faces of peds; 20 percent nonflat subangular 250 to 600 millimeters (10 to 24 inches) calcareous sandstone fragments, 15 percent nonflat subangular 76 to 250 millimeters (3 to 10 inches) calcareous sandstone fragments and 10 percent nonflat subangular 2 to 76 millimeters (0.1 to 3 inches) calcareous sandstone fragments; electrical conductivity of 0.25 mmhos/cm by EC meter, saturated paste; sodium absorption ratio of 0.27; noneffervescent by HCl, 1 normal; neutral, pH 6.8, pH meter, saturated paste; clear wavy boundary; Field Measured Properties: CaCO<sub>3</sub> 7 Percent.

**Bt2** --- 90 to 150 centimeters (35.4 to 59.1 inches); grayish brown (10YR 5/2) moist, very stony clay loam; light brownish gray (10YR 6/2) dry; 25 percent sand; 42 percent silt; 33 percent clay; 4 percent fine distinct spherical yellow (10YR 7/6) mottles; moderate medium prismatic parting to strong medium subangular blocky structure; firm, very hard, moderately sticky, moderately plastic; common medium roots throughout, common fine roots throughout and common very fine roots throughout; common very fine tubular pores; 25 percent (common) clay films between sand grains and 45 percent (common) clay films on all faces of peds; 20 percent nonflat subangular 250 to 600 millimeters (10 to 24 inches) calcareous sandstone fragments, 20 percent nonflat subangular 76 to 250 millimeters (3 to 10 inches) calcareous sandstone fragments and 10 percent nonflat subangular 2 to 76 millimeters (0.1 to 3 inches) calcareous sandstone fragments; electrical conductivity of 0.24 mmhos/cm by EC meter, saturated paste; sodium absorption ratio of 0.29; noneffervescent by HCl, 1 normal; neutral, pH 6.8, pH meter, saturated paste;; Field Measured Properties: CaCO<sub>3</sub> 5 Percent.

Soil Profile Box Sample EXP-01



EXP-01 soil profile box:

Oi, 0 to 4 cm (0 to 1.6 inches);

Oe, 4 to 10 cm (1.6 to 3.9 inches);

A, 10 to 26 cm (3.9 to 10.2 inches);

AB, 26 to 46 cm (10.2 to 18.1 inches);

Bt1, 46 to 90 cm (18.1 to 35.4 inches);

Bt2, 90 to 150 (35.4 to 59.1 inches).

**Site Photos**



Photo 1. Looking northeast up Dugout Canyon road from center of site. The existing road encompasses approximately one-third of the total width of the EXP-01 location.

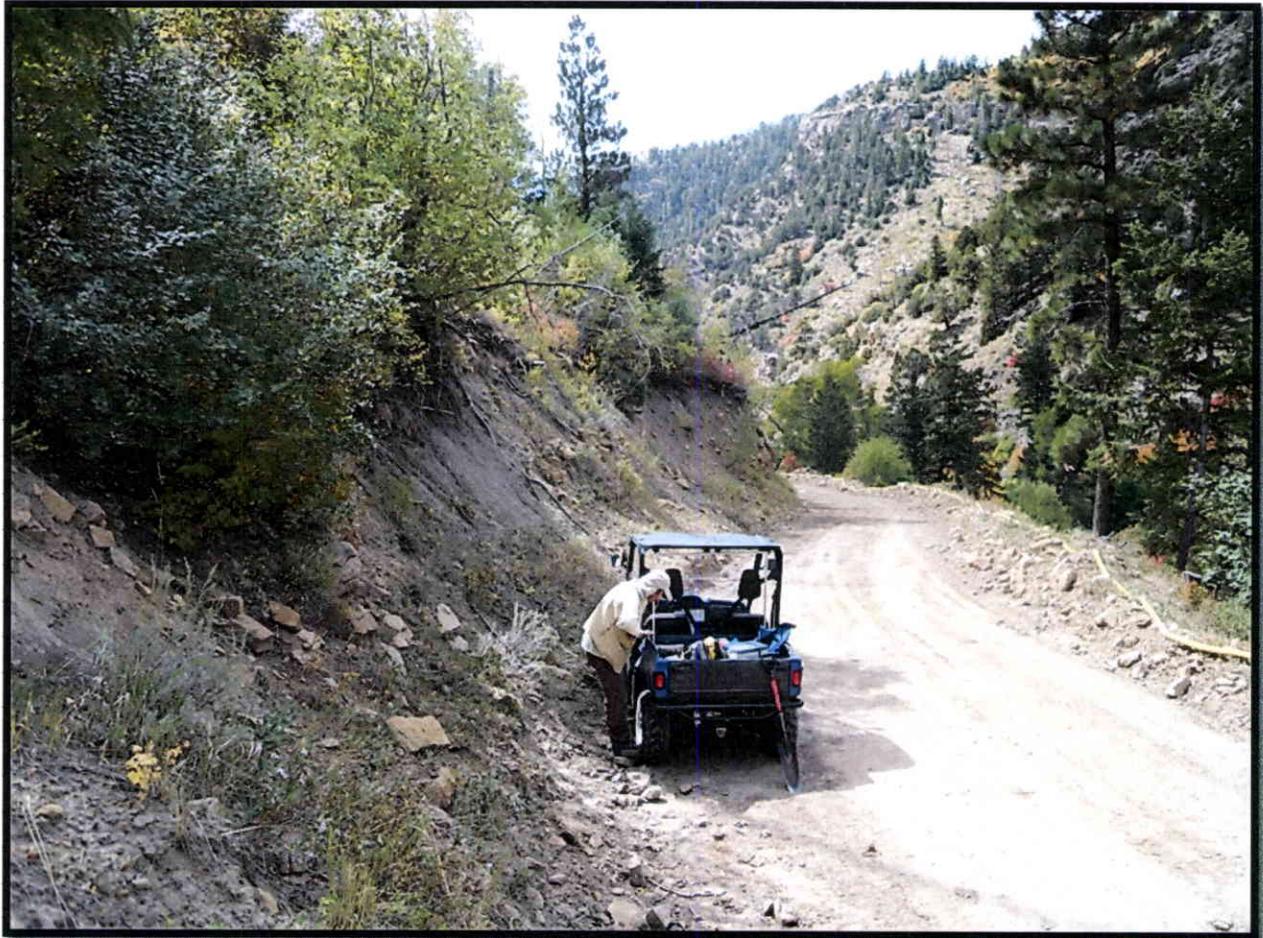


Photo 2. Looking southwest down Dugout Canyon road. ATV is parked near north edge of site. Soil profile was described just outside left edge of photo.



Photo 3. Looking north in area above road. Dominant vegetation is aspen, Rocky Mountain maple, Douglas fir, currant, wild rose, and mountain snowberry.



Photo 4. Looking east in area above road.



Photo 5. Looking south in area above road. Dominant vegetation is aspen, Rocky Mountain maple, Douglas fir, currant, wild rose, and mountain snowberry.



Photo 6. Looking southwest across road from above road.



Photo 7. Soil profile at EXP-01 was described in an existing road cut near north edge of location. Setting is on a very steep (60 percent) northwest facing canyon sideslope.

**Literature Cited**

- Daly, C. and G. Taylor. April 1998. Western U.S. Average Monthly or Annual Precipitation, 1961-90. Climate Service at Oregon State University
- Schoeneberger, P.J., Wysocki, D.A., Benham, E.C. and Broderson, W.D. (editors). 2002. Field book for describing and sampling soils, Version 2.0. Natural Resources Conservation Service. National Soil Survey Center. Lincoln, NE.
- NRCS – USDA. Custom Soil Resource Report for Carbon Area, Utah, Parts of Carbon and Emery Counties. Downloaded from Web Soil Survey September 13, 2010.
- Utah DOGM. October 2005. Guidelines for Management of Topsoil and Overburden, R645-301-200 Soils.
- Weiss, M.P, I.J. Witkind, and W.B. Cashion. 2003. Geological Map of the Price 30' x 60' Quadrangle, Carbon, Duchesne, Uintah, Utah, and Wasatch Counties, Utah.

**EXP-2**

**Exploration Site**

**Location:** Easting 539408  
Northing 4394057  
Zone 12  
NAD 1983

Township 13 South  
Range 12 East  
Section 14  
Meridian Salt Lake

USGS Quad: Pine Canyon, Utah

**Elevation:** 8,080 feet

**General Site Description**

The EXP-2 site is located near the point of a narrow ridge overlooking Dugout Canyon, photo 4. It is located approximately 1 mile north northeast of the Dugout Canyon mine office. The combined area including the extended road portion is approximately 1.2 plane acres. It is about 460 feet north to south and 160 feet at the widest east west point, photo 2.

This site is situated on a series of structural benches over sandstone and limestone, photo 1. These materials are identified as Price River formation on the geology map (Weiss et. al. 2003). Sandstone outcrops were observed at various locations within the site, photo 5.

Access to EXP-2 is along an eroding roadway cut into a steep canyon sideslope that enters the site from the northwest, photo 7.

Precipitation at EXP-2 ranges from 16 to 20 inches (Daly and Taylor, 1998).

Timber harvesting has taken place at this location in the past (see photos).

**NRCS Soil Map Unit**

NRCS soil map unit 88: Rabbitex family – Datino variant complex, 15 to 50 percent slopes

Rabbitex family soils (fine-loamy, mixed, superactive, frigid Aridic Calciustolls) have a dark surface (mollic), are very deep to bedrock, and have an accumulation of calcium carbonate at 15 to 43 inches. Datino variant (loamy-skeletal, mixed, Typic Haplustolls) have a dark surface (mollic), are very deep and have greater than 35 percent rock fragments. Midfork, Comodore,

and Trag soils are listed as inclusions. This map unit fits the very steep adjacent sideslopes, but not the actual EXP-2 site (NRCS 2008).

Soils observed on the EXP-2 location are shallow to either sandstone or limestone. Modo (loamy-skeletal, mixed, superactive, frigid Lithic Haplustepts) soils typify the shallow soils found on the EXP-2 location. Soil descriptions EXP-2 and EXP-2 Road typify the Modo soils identified at this location. Depth to sandstone or limestone ranges from a few cm up to 50 cm (20 inches).

Soils at the EXP-2 location have calcium carbonate concentrations that are fair (15 to 30 percent to poor (greater than 30 percent) based on field tests (Utah DOGM 2005). These calcium carbonate levels correspond to the strongly to violently calcareous field observations.

Soil profile descriptions and sampling were done according to NRCS standards (Schoenberger et. al., 2002).

#### **Lab Analysis**

Samples of the mineral soil horizons in EXP-2 and EXP-2 Road were submitted for laboratory analysis. No unsuitable parameters (Utah DOGM 2005) were identified. The results of these analyses are in the appendix.

#### **Topsoil Resource**

The topsoil resource is of limited extent at the EXP-2 location due to the shallow soils and rock outcrop. It is recommended that all soil material above the sandstone and limestone be salvaged for use as topsoil during reclamation. The depth to sandstone was 27 cm (10 inches) in the EXP-2 description profile and 44 cm (17 inches) to limestone in the EXP-2 Road profile.

Areas with excessive amounts of lime near the existing road may be less desirable for use as topsoil and should be evaluated for suitability during construction.

#### **Vegetation**

The following plant species were observed on the native slope ridge. The vegetation report written by Mt. Nebo Scientific contains a more detailed quantitative description of the site vegetation.

Utah serviceberry

Birchleaf mountain mahogany

Ponderosa pine

Utah juniper

Salina wildrye

bluegrass

Indian ricegrass

Canada thistle

**Reclamation**

The potential for successful revegetation of the EXP-2 area is good, if topsoil materials are salvaged prior to disturbance. The topsoil is of limited extent and will need to be protected from erosion on the ridge until vegetation has become established.

**Soil Profile Descriptions**

**Pedon ID:** EXP-2

**Description Date:** 9/15/2010

**Describer:** Robert Long

**Soil Name As Described/Sampled:** Modo - skeletal disturbed taxadjunct

**Classification:** Loamy-skeletal, mixed, superactive, frigid Lithic Haplustepts

**Pedon Type:** Taxadjunct to the series

**Pedon Purpose:** Full pedon description

**Lat/Long:** 39°41'44" north, 110°32'25" west

**UTM:** 539409E, 4394056.03N -- Datum NAD83, Zone 12

**Legal Description:** Section 14, Township 12 East, Range 13 South of the Salt Lake Meridian

**Landscape:** mountain range

**Landform:** structural bench

**Geomorphic Component:** Center third of mountainflank

**Profile Pos:** Summit

**Slope:** 3 percent

**Elevation:** 2463 meters (8080.7 feet)

**Aspect:** 170°

**Shape: up/down:** Convex; **across:** Convex

**Complexity:** Complex

**Flooding:** None

**Ponding:** None

**Drainage:** Well drained

**Runoff:** Low

**Permeability:** Moderate

**Erosion:** None

**Primary Earth Cover:** Shrub cover; **Secondary Earth Cover:** Other shrub cover

**Existing Vegetation:** LESAS - Salina wildrye (*Leymus salinus ssp. salinus*); AMUT - Utah serviceberry (*Amelanchier utahensis*); CEMOG - birchleaf mountain mahogany (*Cercocarpus montanus var. glaber*); PIPO - ponderosa pine (*Pinus ponderosa*); JUOS - Utah juniper (*Juniperus osteosperma*); CIRSI - thistle (*Cirsium*)

**Parent Materials:** residuum

**Particle Size Control Section:** 6 to 27 centimeters (2.4 to 10.6 inches)

**Diagnostic Features:** Lithic contact: 27 centimeters (10.6 inches) (Restrictive layer)

Slope	Elevation	Aspect	MAAT	MSAT	MWAT	MAP	Frost-Free Days	Drainage Class	Slope Length	Upslope Length
3 percent	2463 meters (8080.7 feet)	170°	5.2° C (41° F)			508 millimeters (20 inches)	80 days	well		

**Oi** --- 0 to 6 centimeters (0 to 2.4 inches); Partially decomposed needles and cones.

**Bw** --- 6 to 27 centimeters (2.4 to 10.6 inches); very pale brown (10YR 7/4) dry, very gravelly loam; yellowish brown (10YR 5/4) moist; 42 percent sand; 36 percent silt; 22 percent clay; weak medium subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; common medium roots throughout, common fine roots throughout and common very fine roots throughout; common very fine tubular pores finely disseminated carbonates throughout and 3 percent (common) fine carbonate concretions on bottom of rock fragments; 10 percent nonflat subangular 250 to 600 millimeters (10 to 24 inches) calcareous sandstone fragments, 5 percent nonflat subangular 76 to 250 millimeters (3 to 10 inches) calcareous sandstone fragments and 25 percent nonflat subangular 2 to 76 millimeters (0.1 to 3 inches) calcareous sandstone fragments; electrical conductivity of 0.74 mmhos/cm by EC meter, saturated paste; sodium absorption ratio of 0.08; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5, pH meter, saturated paste; abrupt smooth boundary; Field Measured Properties: CaCO<sub>3</sub> 33 Percent.

**R** --- 27 centimeters (10.6 inches); Fractured Sandstone.

**Pedon ID:** EXP-2 Road

**Description Date:** 9/29/2010

**Describer:** Robert Long

**Soil Name As Described/Sampled:** Modo - disturbed

**Classification:** Loamy, mixed, superactive, frigid Lithic Haplustepts

**Pedon Type:** Outside range of series

**Pedon Purpose:** Full pedon description

**Lat/Long:** 39°41'46" north, 110°32'25" west

**UTM:** 539416.73E, 4394141.2N -- Datum NAD83, Zone 12

**Legal Description:** Section 14, Township 12 East, Range 13 South of the Salt Lake Meridian

**Landscape:** mountain range

**Landform:** structural bench

**Geomorphic Component:** Center third of mountain flank

**Profile Pos:** Summit

**Slope:** 5 percent

**Elevation:** 2454 meters (8051.2 feet)

**Aspect:** 180°

**Shape: up/down:** Concave; **across:** Convex

**Complexity:** Complex

**Flooding:** None

**Ponding:** None

**Drainage:** Well drained

**Runoff:** Low

**Permeability:** Moderate

**Erosion:** Class 2 - water

**Primary Earth Cover:** Shrub cover; **Secondary Earth Cover:** Other tree cover

**Existing Vegetation:** ARTRW8 - Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*); PIED - twoneedle pinyon (*Pinus edulis*)

**Parent Materials:** residuum

**Particle Size Control Section:** 25 to 44 centimeters (9.8 to 17.3 inches)

**Diagnostic Features:** Lithic contact 44 centimeters (17.3 inches)

Slope	Elevation	Aspect	MAAT	MSAT	MWAT	MAP	Frost-Free Days	Drainage Class	Slope Length	Upslope Length
5 percent	2454 meters (8051.2 feet)	180°	5.2° C (41° F)			508 millimeters (20 inches)	80 days	well		

**Oi** --- 0 to 2 centimeters (0 to 0.8 inches); Decomposing plant material (leaves and needles).

**A** --- 2 to 17 centimeters (0.8 to 6.7 inches); pale brown (10YR 6/3) dry, gravelly loam; yellowish brown (10YR 5/4) moist; 39 percent sand; 41 percent silt; 20 percent clay; weak medium subangular blocky structure; very friable, slightly hard, slightly sticky, nonplastic; common fine roots throughout and many very fine roots throughout; common very fine interstitial pores finely disseminated carbonates and 12 percent (common) fine masses of carbonate on faces of peds; 20 percent nonflat subangular 2 to 76 millimeters (0.1 to 3 inches) calcareous sandstone fragments; electrical conductivity of 0.49 mmhos/cm by EC meter, saturated paste; sodium absorption ratio of 0.07; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7, pH meter, saturated paste; clear smooth boundary; Field Measured Properties: CaCO<sub>3</sub> 27 Percent.

**Bk** --- 17 to 44 centimeters (6.7 to 17.3 inches); very pale brown (10YR 7/3) dry, gravelly loam; pale brown (10YR 6/3) moist; 35 percent sand; 45 percent silt; 20 percent clay; moderate medium subangular blocky structure; very friable, slightly hard, slightly sticky, nonplastic; common fine roots throughout and common very fine roots throughout; common very fine interstitial pores finely disseminated carbonates and 10 percent (common) fine carbonate concretions on bottom of rock fragments; 20 percent nonflat subangular 2 to 76 millimeters (0.1 to 3 inches) calcareous sandstone fragments; electrical conductivity of 0.47 mmhos/cm by EC meter, saturated paste; sodium absorption ratio of 0.13; violently effervescent by HCl, 1 normal; slightly alkaline, pH 7.8, pH meter, saturated paste; abrupt smooth boundary; Field Measured Properties: CaCO<sub>3</sub> 35 Percent.

**R** --- 44 centimeters (17.3 inches).

Soil Profile Boxes EXP-2

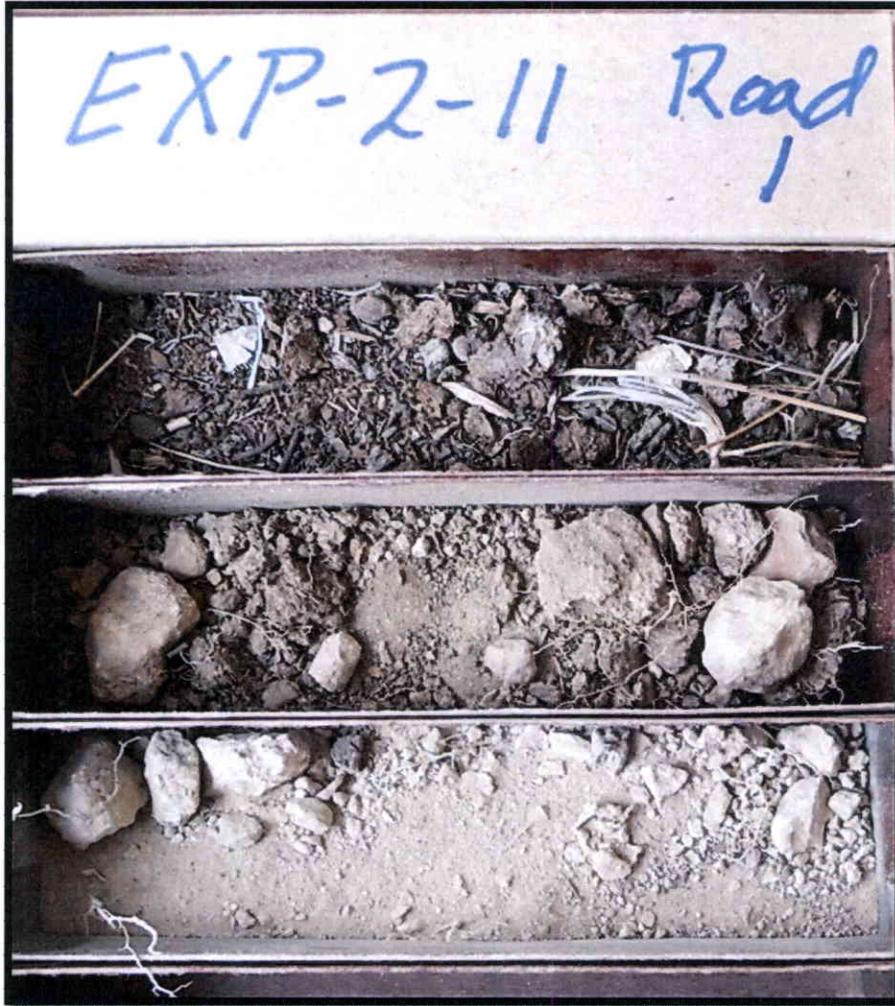


EXP-2 profile box:

Oi, 0 to 6 cm (0 to 10.6 inches) at top;

A, 6 to 27 cm (2.4 to 10.6 inches);

R, 27 cm (10.6 inches) on bottom.



EXP-4-11 Road soil  
profile:

Oi, 0 to 2 cm (0 to 0.8  
inches) at top;

A, 2 to 17 cm (0.8 to  
6.7 inches);

Bk, 17 to 44 cm (6.7 to  
17.3 inches) on  
bottom;

R, 44 cm (17.3 inches).

**Site Photos**



Photo 1. Looking north from center of EXP-2 at sandstone outcrop on north edge of exploration site. Modo soils are shallow to sandstone or limestone.



Photo 2. Looking north across center of EXP-2 from sandstone outcrop at south edge of exploration location. The widest east west portion of the site is approximately 160 feet.



Photo 3. Looking east from center of EXP-2 across Dugout Canyon. Timber was previously harvested in this area.



Photo 4. Looking south across center of EXP-2 toward point at south end of ridge.



Photo 5. Sandstone outcrop at south edge of EXP-2. Point of ridge is in the near distance. The geology map (Weiss et. al. 2003) identifies this area as being part of the Price River formation.



Photo 6. Looking west across center of EXP-2. Mado soils dominate this area. They are shallow to sandstone in this portion of EXP-2.



Photo 7. Looking northwest at southeast end of existing access road.



Photo 8. Looking east across center of EXP-2 road extension area. Timber was previously harvested in this area.



Photo 9. Looking south across center of EXP-2 road extension area. Modo soils dominate this area. They are shallow to limestone in this portion of EXP-2.



Photo 10. Looking west across center of EXP-2 road extension area. Vegetation is sparse in this area.

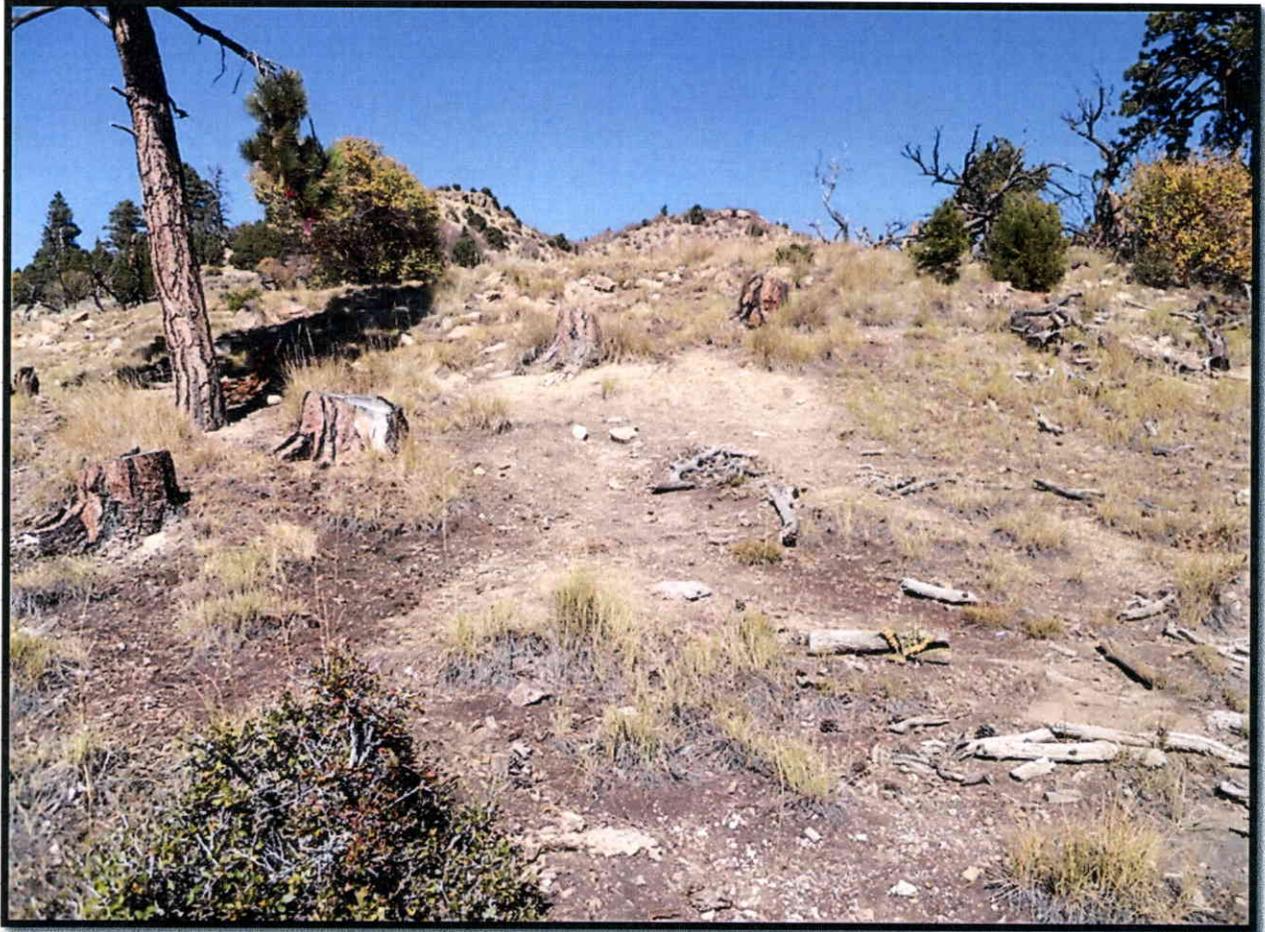


Photo 11. Looking north from south edge of EXP-2 road area at limestone structural bench. EXP-2 Road soil profile was described on top of the bench.

**Literature Cited**

Daly, C. and G. Taylor. April 1998. Western U.S. Average Monthly or Annual Precipitation, 1961-90. Climate Service at Oregon State University

Schoeneberger, P.J., Wysocki, D.A., Benham, E.C. and Broderson, W.D. (editors). 2002. Field book for describing and sampling soils, Version 2.0. Natural Resources Conservation Service. National Soil Survey Center. Lincoln, NE.

NRCS – USDA. Custom Soil Resource Report for Carbon Area, Utah, Parts of Carbon and Emery Counties. Downloaded from Web Soil Survey September 13, 2010.

Utah DOGM. October 2005. Guidelines for Management of Topsoil and Overburden, R645-301-200 Soils.

Weiss, M.P, I.J. Witkind, and W.B. Cashion. 2003. Geological Map of the Price 30' x 60' Quadrangle, Carbon, Duchesne, Uintah, Utah, and Wasatch Counties, Utah.

## EXP-3

### Exploration Site

**Location:** Easting 539624  
Northing 4394900  
Zone 12 N  
NAD 1983

Township 13 South  
Range 12 East  
Section 11  
Meridian Salt Lake

USGS Quad: Pine Canyon, Utah

**Elevation:** 8260 feet

### General Site Description

The EXP-3 is a small site (approximately 0.66 plane acres) situated on the summit of a mountain ridge between forks of Dugout Canyon. The site slopes to the northeast at 5 to 10 percent. An existing road traverses the site. The EXP-3 area is approximately 150 feet from west to east at the widest point and 230 feet from southwest to northeast.

Parent materials in this area were identified as Flagstaff Limestone and North Horn formation on the Price geology map (Weiss et. al. 2003). An outcrop of sandstone, approximately 60 feet wide, is on the south edge of the site lying southeast to northwest.

Average annual precipitation is approximately 19 inches (Daly and Taylor, 1998).

### NRCS Soil Map Unit

NRCS soil map unit 62: Midfork family-Comodore complex. Slopes are 50 to 70 percent

Midfork family soils (loamy-skeletal, mixed, superactive Typic Haplocryolls) have a dark surface (mollic) and greater than 35 percent rock fragments. Comodore soils (loamy-skeletal, mixed, superactive frigid Aridic Lithic Haplustolls) are shallow to sandstone (NRCS, 2010).

The EXP-3 profile does not have a dark surface (not mollic), has an accumulation of clay at 8 cm (3 inches), and an accumulation of secondary carbonates (calcic) at 23 cm (9 inches). The soil was classified as fine-loamy, mixed, superactive, frigid Calcic Haplustalf. There is no existing soil series in this family. It is a moist and moderately deep phase of the Mantlemine series (12 to 16 inches of annual precipitation).

The soil profile description and sampling were done according to NRCS standards (Schoenberger et. al., 2002).

#### **Lab Analysis**

Samples of the mineral soil horizons in EXP-3 were submitted for laboratory analysis. No unsuitable parameters (Utah DOGM 2005) were identified. The results of these analyses are in the appendix.

#### **Topsoil Resource**

The existing topsoil resource ranges from moderately deep to shallow to sandstone. Depth to sandstone at the EXP-3 profile was 85 cm (33 inches). The A and Btk horizons have a combined thickness of 23 cm (9 inches) at the profile description location. The calcium carbonate concentrations range from 27 to 29 percent in the Bk1 and Bk2 horizons (below 23 cm, 9.1 inches).

The estimated average topsoil salvage depth is 23 cm (9 inches) based on the EXP-3 profile characteristics. The calcium carbonate concentrations observed below 23 cm (9 inches) indicates that the subsoil is *Fair* for reclamation (Utah DOGM 2005).

#### **Vegetation**

The following dominant plant species were observed at EXP-3 site. The vegetation report written by Mt. Nebo Scientific contains a more detailed quantitative description of the site vegetation.

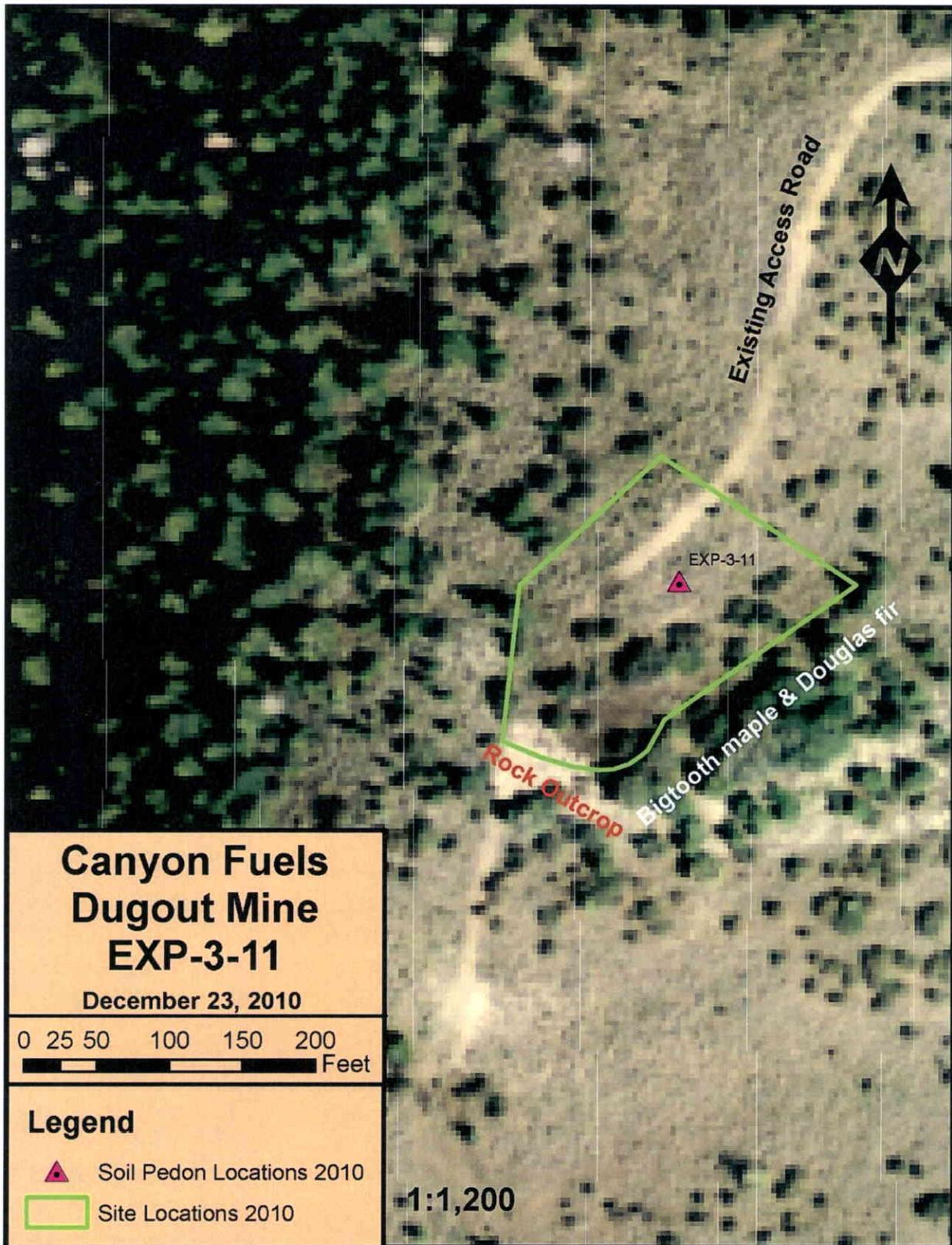
big sagebrush  
Utah serviceberry  
mountain snowberry

Salina wildrye  
Columbia needlegrass

Douglas fir (on edges of site)  
bigtooth maple

#### **Reclamation**

The potential for successful revegetation of the EXP-3 area is good. Topsoil depths appear to be adequate in most of the site for vegetation to become established. Existing trees and tall shrubs on the east, south and west sides of the site will provide some protection against wind.



**Soil Profile Description**

**Pedon ID:** EXP-3

**Description Date:** 9/15/2010

**Describer:** Robert Long

**Soil Name As Described/Sampled:** Mantlemine moist (moderately deep) family

**Classification:** Fine-loamy, mixed, superactive, frigid Calcic Haplustalfs

**Pedon Type:** Outside range of series

**Pedon Purpose:** Full pedon description

**Lat/Long:** 39°42'10" north, 110°32'17" west

**UTM:** 539613.18E, 4394881.69N -- Datum NAD83, Zone 12

**Legal Description:** Section 11, Township 12 East, Range 13 South of the Salt Lake Meridian

**Landscape:** mountain range

**Landform:** ridge

**Geomorphic Component:** Mountaintop

**Profile Position:** Summit

**Slope:** 8 percent

**Elevation:** 2527 meters (8290.7 feet)

**Aspect:** 42°

**Shape: up/down:** Linear; **across:** Convex

**Complexity:** Simple

**Flooding:** None

**Ponding:** None

**Drainage:** Well drained

**Runoff:** Low

**Permeability:** Moderately slow

**Erosion:** Class 1 - Sheet erosion

**Primary Earth Cover:** Shrub cover; **Secondary Earth Cover:** Other grass/herbaceous cover

**Existing Vegetation:** ARTRV - mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*);

AMUT - Utah serviceberry (*Amelanchier utahensis*); SYORO - mountain snowberry

(*Symphoricarpos oreophilus var. oreophilus*); LESAS - Salina wildrye (*Leymus salinus ssp.*

*salinus*); ACNE9 - Columbia needlegrass (*Achnatherum nelsonii*)

**Parent Materials:** residuum

**Particle Size Control Section:** 8 to 23 centimeters (3.1 to 9.1 inches)

**Diagnostic Features:** Mollic epipedon: 0 to 23 centimeters (0 to 9.1 inches), Argillic horizon: 8 to 23 centimeters (3.1 to 9.1 inches) and Calcic horizon: 23 to 60 centimeters (9.1 to 23.6 inches)

Slope	Elevation	Aspect	MAAT	MSAT	MWAT	MAP	Frost-Free Days	Drainage Class	Slope Length	Upslope Length
8 percent	2527 meters (8290.7 ft)	42°	5.2° C (41° F)			508 millimeters (20 inches)	80 days	well		

**A** --- 0 to 8 centimeters (0 to 3.1 inches); pale brown (10YR 6/3) dry, loam; brown (10YR 4/3) moist; 51 percent sand; 29 percent silt; 20 percent clay; moderate medium platy structure; very friable, hard, slightly sticky, slightly plastic; common fine roots throughout and many very fine roots throughout; common very fine tubular pores; electrical conductivity of 0.54 mmhos/cm by EC meter, saturated paste; sodium absorption ratio of 0.05; slightly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5, pH meter, saturated paste; abrupt smooth boundary; Field Measured Properties: CaCO<sub>3</sub> 7 Percent.

**Btk** --- 8 to 23 centimeters (3.1 to 9.1 inches); brown (10YR 5/3) dry, loam; brown (10YR 4/3) moist; 41 percent sand; 35 percent silt; 24 percent clay; strong medium subangular blocky structure; firm, very hard, slightly sticky, slightly plastic; common medium roots throughout, common fine roots throughout and many very fine roots throughout; common very fine tubular pores; 20 percent (few) clay films between sand grains and 40 percent (common) clay films on all faces of peds; electrical conductivity of 0.44 mmhos/cm by EC meter, saturated paste; sodium absorption ratio of 0.07; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7, pH meter, saturated paste; clear smooth boundary; Field Measured Properties: CaCO<sub>3</sub> 12 Percent.

**Bk1** --- 23 to 60 centimeters (9.1 to 23.6 inches); very pale brown (10YR 8/3) dry, clay loam; light yellowish brown (10YR 6/4) moist; 28 percent sand; 44 percent silt; 28 percent clay; moderate medium subangular blocky structure; friable, hard, moderately sticky, slightly plastic; common medium roots throughout, common fine roots throughout and common very fine roots throughout; common very fine tubular pores finely disseminated carbonates and 15 percent (common) medium masses of carbonate on faces of peds; electrical conductivity of 0.28 mmhos/cm by EC meter, saturated paste; sodium absorption ratio of 0.07; violently effervescent by HCl, 1 normal; slightly alkaline, pH 7.8, pH meter, saturated paste; clear smooth boundary; Field Measured Properties: CaCO<sub>3</sub> 27 Percent.

**Bk2** --- 60 to 85 centimeters (23.6 to 33.5 inches); very pale brown (10YR 8/2) dry, silt loam; pale brown (10YR 6/3) moist; 23 percent sand; 54 percent silt; 23 percent clay; weak medium subangular blocky structure; friable, hard, slightly sticky, slightly plastic; common very fine roots throughout; common very fine tubular pores finely disseminated carbonates and 20 percent (many) medium masses of carbonate on faces

of peds; electrical conductivity of 0.31 mmhos/cm by EC meter, saturated paste; sodium absorption ratio of 0.12; violently effervescent by HCl, 1 normal; moderately alkaline, pH 7.9, pH meter, saturated paste; abrupt smooth boundary; Field Measured Properties: CaCO<sub>3</sub> 29 Percent.

R --- 85 centimeters (33.5 inches); sandstone.

Soil Profile Box EXP-3



EXP-3 Soil Profile box:

A, 0 to 8 cm (0 to 3.1 inches);

Btk, 8 to 23 cm (3.1 to 9.1 inches);

Bk1, 23 to 60 cm (9.1 to 23.6 inches);

Bk2, 60 to 85 cm (23.6 to 33.5 inches);

R, 85 cm (33.5 inches).

Site Photos

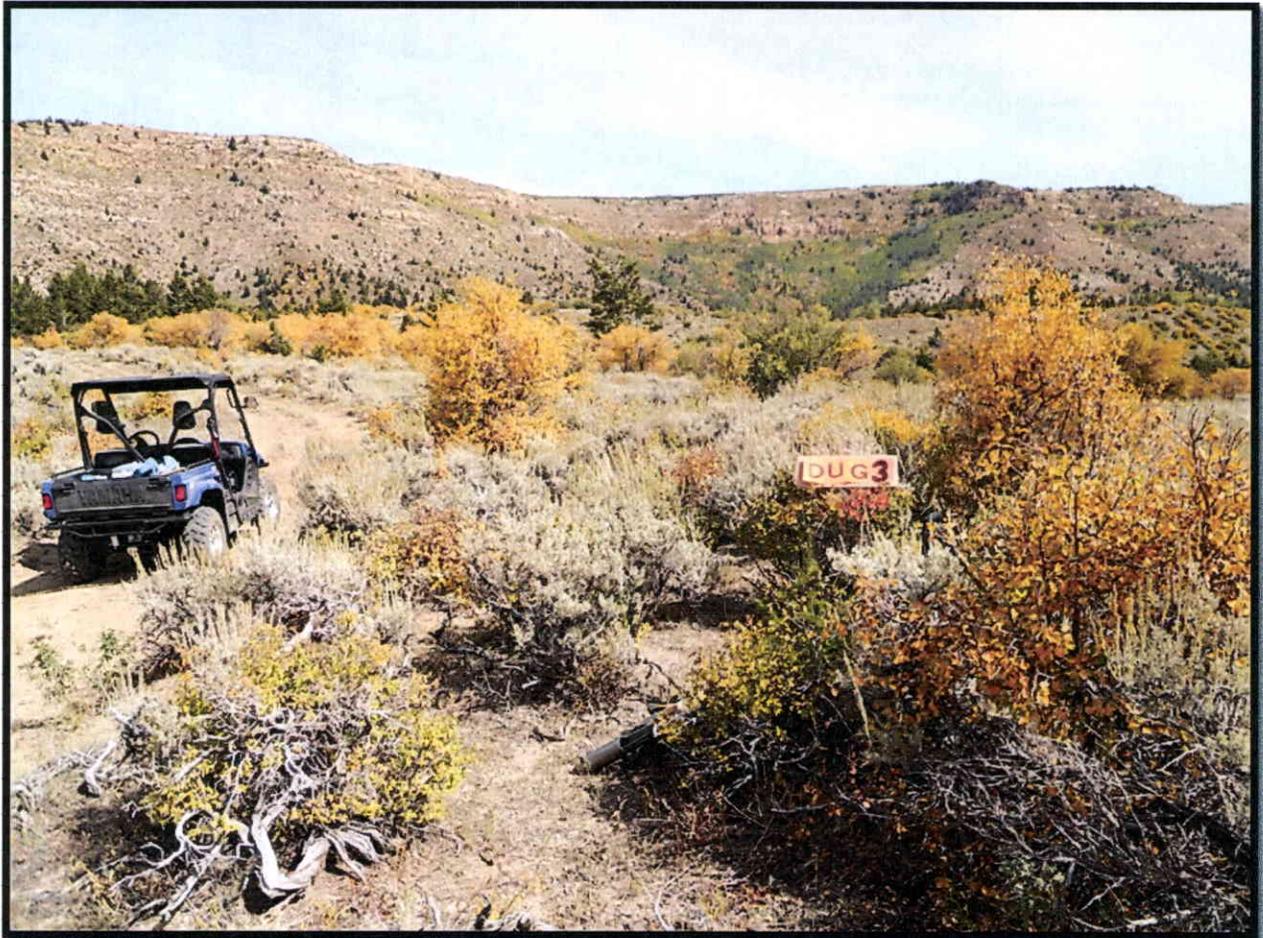


Photo 1. Looking north across center of EXP-3 in area of mountain big sagebrush and Utah serviceberry. Site slopes to the north at 5 to 10 percent.



Photo 2. Looking east across center of EXP-3 in area of mountain big sagebrush, Utah serviceberry, and Rocky mountain maple.



Photo 3. Looking south across center of EXP-3. Utah service berry, big sagebrush, and mountain snowberry are the dominant shrubs. Young Douglas firs are present near the edges of the site.



Photo 4. Looking west across center of EXP-3.



Photo 5. Sandstone outcrop near south edge of EXP-3. Existing road continues past this point to EXP-2 location. Soils are shallower in the south portion of the site.

**Literature Cited**

Daly, C. and G. Taylor. April 1998. Western U.S. Average Monthly or Annual Precipitation, 1961-90. Climate Service at Oregon State University.

Schoeneberger, P.J., Wysocki, D.A., Benham, E.C. and Broderson, W.D. (editors). 2002. Field book for describing and sampling soils, Version 2.0. Natural Resources Conservation Service. National Soil Survey Center. Lincoln, NE.

NRCS – USDA. Custom Soil Resource Report for Carbon Area, Utah, Parts of Carbon and Emery Counties. Downloaded from Web Soil Survey September 13, 2010.

Utah DOGM. October 2005. Guidelines for Management of Topsoil and Overburden, R645-301-200 Soils.

Weiss, M.P, I.J. Witkind, and W.B. Cashion. 2003. Geological Map of the Price 30' x 60' Quadrangle, Carbon, Duchesne, Uintah, Utah, and Wasatch Counties, Utah.

## EXP-4

### Exploration Site

**Location:** Easting 538823  
Northing 4394986  
Zone 12 N  
NAD 1983

Township 13 South  
Range 12 East  
Section 11 and 14  
Meridian Salt Lake

USGS Quad: Pine Canyon, Utah

**Elevation:** 8,250 to 8,330 feet

### General Site Description

The EXP-4 location consists of an exploration drill site and an area that has been proposed for construction of an access road.

The proposed exploration drill site is situated on a structural bench on northeast facing mountain sideslope. It is located in the upper northwestern portion of the Dugout Creek drainage. The EXP-4 exploration drill location is approximately 0.93 plane acres.

The proposed access road traverses a northeast facing mountain sideslope, photos 8, 9, 10, and 11. Field reconnaissance of the soil resource was conducted on an area 100 feet each side of a staked centerline. The road evaluation area was approximately 1,260 feet long (existing access road to proposed EXP-4 exploration site and 5.9 plane acres).

Parent material in the drill site and access road areas is limestone from the Flagstaff Limestone and North Horn formation (Weiss et. al. 2003). Depth to limestone ranges from 12 to greater than 150 cm (5 to greater than 60 inches).

Precipitation at EXP-4 ranges from 18 to 20 inches (Daly and Taylor, 1998). The summit ridge area at the west end of the proposed access road is more susceptible to the prevailing winds and may lose some of its annual snowpack by the wind. The portions of the road and drill site on northeast mountain sideslope show signs of increased effective moisture resulting from snowbank accumulation in the concave areas immediately below the ridge.

### **NRCS Soil Map Unit**

The exploration drill site and lower portion of the proposed road are in NRCS soil map unit 97, Rottulee family – Trag complex, 30 to 60 percent slopes. Rottulee family soils (fine-loamy, mixed, superactive, frigid Entic Haplustolls) have a dark surface (mollic) and are moderately deep (20 to 40 inches) to unweathered bedrock. Trag soils (fine-loamy, mixed, superactive, frigid Typic Argiustolls) have a dark surface (mollic), have a zone of clay accumulation (argillic), and are very deep.

The upper portion of the proposed access road crosses NRCS soil map unit 7 in the area near the existing access road. NRCS soil map unit 7 is Beje – Trag complex, 3 to 30 percent slopes. Beje soils (loamy, mixed, superactive, frigid Lithic Argiustolls) are shallow to bedrock, have a dark surface (mollic), and have a zone of clay accumulation. Trag soils (fine-loamy, mixed, superactive, frigid Typic Argiustolls) have a dark surface (mollic), a zone of clay accumulation (argillic), and are very deep.

The soils identified at the EXP-4 exploration site are fine textured and do not have a mollic epipedon. They are moderately deep which is similar to the depth of the Rottulee family soils.

Soils along the proposed accessed road range in depth from shallow (EXP-4 Road 2) to very deep (EXP-4 Road 1). EXP-4 Road 1 is very deep like Trag soils, but does not have a dark surface. The lack of a dark surface may be the result of previous soil erosion. EXP-4 Road 2 has shallow depth similar to Beje soils, but does not have a dark surface or a zone of clay accumulation. In addition, EXP-4 and EXP-4 Road 1 soil profiles have distinct calcic horizons (calcium carbonate accumulation).

### **Lab Analysis**

Samples of the mineral soil horizons at EXP-4, EXP-4 Road 1, and EXP-4 Road 2 were submitted for laboratory analysis. Fine textured soils are the primary limiting feature of the EXP-4 soils based on the laboratory analysis (Utah DOGM 2005). Clay percentages ranged from 26 to 54 percent at EXP-4. The surface of EXP-4 Road 1 location had clay percentages of 39 to 42 percent in the upper 60 cm (24 inches). The results of these analyses are in the appendix.

### **Topsoil Resource**

Topsoil depths vary widely over the length of the proposed EXP-4 project. Fine textured soils, accumulation of secondary calcium carbonates, and soil depth are the primary topsoil limiting features in the project area.

The fine soil textures are described in the lab analysis section of this report. Fine textured soils have slower water infiltration rates. Soil erosion can be expected to increase when runoff increases as infiltration rates decrease. Vehicle traction can also be a problem when fine textured soils become wet.

Calcium carbonate concentrations are: *Fair* at EXP-4; *Good* to 60 cm and *Fair* below 60 cm at EXP-4 Road 1; and *Poor* throughout the EXP-4 Road 2 profile (Utah DOGM 2005). Subsoil with calcium carbonate concentrations from 15 to 30 percent should not be mixed with salvaged topsoil. Soil in the shallow areas near EXP-4 Road 2 may be used for reclamation, but should not be stockpiled with salvaged topsoil; because of the *Poor* calcium carbonate concentrations.

Salvageable topsoil depths range from 12 to 60 cm (5 to 24 inches) and should be monitored during construction.

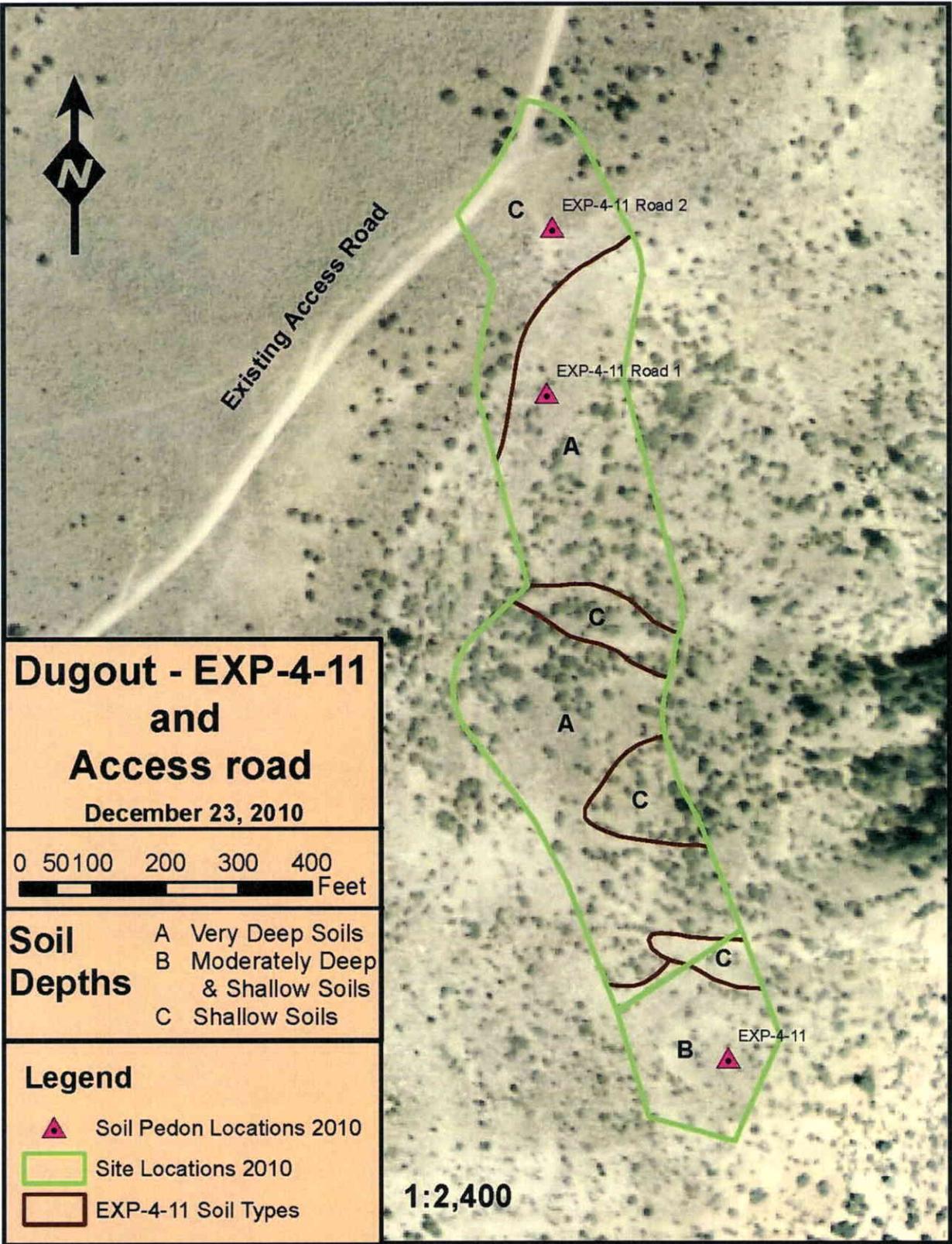
### **Vegetation**

The following plant species were observed at the EXP-4 exploration site and proposed access road corridor. The vegetation report written by Mt. Nebo Scientific contains a more detailed quantitative description of the site vegetation.

Big sagebrush	Salina wildrye
Utah serviceberry	bluegrass
Mountain snowberry	
Utah juniper (few small)	

### **Reclamation**

The potential for successful reclamation at the EXP-4 exploration drill site and adjacent access road is fair. Fine textured soils, calcium carbonate subsoil, and shallow soils are limiting features. These limitations can be mitigated by controlling surface runoff and monitoring topsoil salvage and replacement operations. Runoff from potential snowbanks along the road corridor may contribute to soil erosion.



Soil Profile Descriptions

**Pedon ID:** EXP-4

**Description Date:** 9/15/2010

**Describer:** Robert Long

**Pedon Notes: Text:** Clay percents may be due to carbonate clays rather than silicate clays.

**Soil Name As Described/Sampled:** Whitesage - clayey moist taxadjunct family

**Classification:** Fine, smectitic, superactive, frigid Typic Calciustepts

**Pedon Type:** Taxadjunct to the series

**Pedon Purpose:** Full pedon description

**Lat/Long:** 39°42'5" north, 110°32'47" west

**UTM:** 538899.87E, 4394707.96N -- Datum NAD83, Zone 12

**Legal Description:** Section 14, Township 12 East, Range 13 South of the Salt Lake Meridian

**Landscape:** mountain range

**Landform:** structural bench

**Geomorphic Component:** Upper third of mountain flank

**Profile Poition:** Backslope

**Slope:** 27 percent

**Elevation:** 2500 meters (8202.1 feet)

**Aspect:** 110°

**Shape:** up/down: Convex; across: Linear

**Complexity:** Complex

**Flooding:** None

**Ponding:** None

**Drainage:** Well drained

**Runoff:** High

**Permeability:** Very slow

**Erosion:** Class 2 - Sheet erosion

**Primary Earth Cover:** Shrub cover; **Secondary Earth Cover:** Other grass/herbaceous cover

Existing Vegetation: ARTRV - mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*);

AMUT - Utah serviceberry (*Amelanchier utahensis*); SYMPH - snowberry (*Symphoricarpos*);

LESAS - Salina wildrye (*Leymus salinus ssp. salinus*); POSE - big bluegrass (*Poa secunda*); JUOS -

Utah juniper (*Juniperus osteosperma*)

**Parent Materials:** residuum

**Particle Size Control Section:** 25 to 100 centimeters (9.8 to 39.4 inches)

**Diagnostic Features:** Cambic horizon: 5 to 30 centimeters (2 to 11.8 inches) and Calcic horizon: 30 to 90 centimeters (11.8 to 35.4 inches)

Slope	Elevation	Aspect	MAAT	MSAT	MWAT	MAP	Frost-Free Days	Drainage Class	Slope Length	Upslope Length
27 %	2500 m (8202.1 ft)	110°	5.2° C (41° F)			508 mm (20 inches)	80 days	well		

**A ---** 0 to 5 centimeters (0 to 2 inches); light yellowish brown (2.5Y 6/3) dry, loam; light olive brown (2.5Y 5/3) moist; 34 percent sand; 40 percent silt; 26 percent clay; moderate medium platy parting to moderate fine granular structure; friable, hard, slightly sticky, slightly plastic; common medium roots throughout, common fine roots throughout and common very fine roots throughout; common very fine tubular pores finely disseminated carbonates throughout; electrical conductivity of 0.42 mmhos/cm by EC meter, saturated paste; sodium absorption ratio of 0.1; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7, pH meter, saturated paste; clear smooth boundary; Field Measured Properties: CaCO<sub>3</sub> 19 Percent.

**Bw ---** 5 to 30 centimeters (2 to 11.8 inches); light yellowish brown (2.5Y 6/3) dry, clay loam; light olive brown (2.5Y 5/3) moist; 32 percent sand; 38 percent silt; 30 percent clay; structure; friable, hard, moderately sticky, moderately plastic; common medium roots throughout, common fine roots throughout and common very fine roots throughout; common very fine tubular pores finely disseminated carbonates throughout; electrical conductivity of 0.32 mmhos/cm by EC meter, saturated paste; sodium absorption ratio of 0.1; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8, pH meter, saturated paste; clear smooth boundary; Field Measured Properties: CaCO<sub>3</sub> 15 Percent.

**Bk ---** 30 to 55 centimeters (11.8 to 21.7 inches); pale yellow (2.5Y 8/2) dry, silty clay; light yellowish brown (2.5Y 6/3) moist; 11 percent sand; 47 percent silt; 42 percent clay; moderate fine subangular blocky structure; friable, hard, very sticky, very plastic; common fine roots throughout and common very fine roots throughout; common very

fine tubular pores finely disseminated carbonates and 8 percent (common) medium masses of carbonate on faces of peds; electrical conductivity of 0.34 mmhos/cm by EC meter, saturated paste; sodium absorption ratio of 0.12; violently effervescent by HCl, 1 normal; moderately alkaline, pH 7.9, pH meter, saturated paste; clear smooth boundary; Field Measured Properties: CaCO<sub>3</sub> 27 Percent.

**Bck** --- 55 to 90 centimeters (21.7 to 35.4 inches); light gray (2.5Y 7/2) dry, clay; light olive brown (2.5Y 5/3) moist; 9 percent sand; 37 percent silt; 54 percent clay; massive; friable, very hard, very sticky, very plastic; common very fine roots throughout; 12 percent (common) medium masses of carbonate throughout; electrical conductivity of 0.29 mmhos/cm by EC meter, saturated paste; sodium absorption ratio of 0.19; violently effervescent by HCl, 1 normal; moderately alkaline, pH 7.9, pH meter, saturated paste; clear smooth boundary; Field Measured Properties: CaCO<sub>3</sub> 29 Percent.

**Cr** --- 90 centimeters (35.4 inches); Soft Shale.

**Pedon ID:** EXP-4 Road 1

**Description Date:** 9/15/2010

**Describer:** Robert Long

**Pedon Notes:** Clay percentages may be due to carbonate clays.

**Soil Name As Described/Sampled:** Iles

**Classification:** Fine, smectitic, superactive, frigid Calcic Haplustalfs

**Pedon Type:** Within series range

**Pedon Purpose:** Full pedon description

**Lat/Long:** 39°42'16" north, 110°32'50" west

**UTM:** 538826.55E, 4395054.66N -- Datum NAD83, Zone 12

**Legal Description:** Section 11, Township 12 East, Range 13 South of the Salt Lake Meridian

**Landscape:** mountain range

**Landform:** mountain slope

**Geomorphic Component:** Upper third of mountain flank

**Profile Position:** Backslope

**Slope:** 35 percent

**Elevation:** 2547 meters (8356.3 feet)

**Aspect:** 45°

**Shape: up/down:** Concave; **across:** Concave

**Complexity:** Simple

**Flooding:** None

**Ponding:** None

**Drainage:** Well drained

**Runoff:** High

**Permeability:** Very slow

**Erosion:** Class 2 - Sheet erosion

**Primary Earth Cover:** Shrub cover; **Secondary Earth Cover:** Other grass/herbaceous cover

**Existing Vegetation:** ARTRV - mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*);

AMUT - Utah serviceberry (*Amelanchier utahensis*); SYORO - mountain snowberry

(*Symphoricarpos oreophilus* var. *oreophilus*); LESAS - Salina wildrye (*Leymus salinus* ssp. *salinus*)

**Parent Materials:** residuum

**Particle Size Control Section:** 25 to 100 centimeters (9.8 to 39.4 inches)

**Diagnostic Features:** **Mollic epipedon:** 0 to 8 centimeters (0 to 3.1 inches), Cambic horizon: 8 to 38 centimeters (3.1 to 15 inches) and Calcic horizon: 60 to 150 centimeters (23.6 to 59.1 inches)

Slope	Elevation	Aspect	MAAT	MSAT	MWAT	MAP	Frost-Free Days	Drainage Class	Slope Length	Upslope Length
35 percent	2547 meters (8356.3 feet)	45°	5.2° C (41° F)			508 millimeters (20 inches)	80 days	well		

**BA** --- 0 to 8 centimeters (0 to 3.1 inches); brown (10YR 5/3) dry, clay; dark brown (10YR 3/3) moist; 25 percent sand; 35 percent silt; 40 percent clay; moderate medium platy structure; very friable, hard, very sticky, very plastic; common fine roots throughout and common very fine roots throughout; 1 percent nonflat subrounded 250 to 600 millimeters (10 to 24 inches) calcareous sandstone fragments, 2 percent nonflat subrounded 76 to 250 millimeters (3 to 10 inches) calcareous sandstone fragments and 3 percent nonflat subrounded 2 to 76 millimeters (0.1 to 3 inches) calcareous sandstone fragments; electrical conductivity of 0.51 mmhos/cm by EC meter, saturated paste; sodium absorption ratio of 0.07; slightly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6, pH meter, saturated paste; clear smooth boundary; Field Measured Properties: CaCO<sub>3</sub> 7 Percent.

**Bt** --- 8 to 38 centimeters (3.1 to 15 inches); brown (10YR 5/3) dry, clay; brown (10YR 4/3) moist; 22 percent sand; 36 percent silt; 42 percent clay; moderate medium prismatic parting to strong medium subangular blocky structure; firm, very hard, very sticky, very plastic; common medium roots throughout, common fine roots throughout and many very fine roots throughout; 20 percent (few) clay films between sand grains and 40 percent (common) clay films on all faces of peds; electrical conductivity of 0.41 mmhos/cm by EC meter, saturated paste; sodium absorption ratio of 0.08; slightly

effervescent by HCl, 1 normal; slightly alkaline, pH 7.6, pH meter, saturated paste; clear wavy boundary; Field Measured Properties: CaCO<sub>3</sub> 7 Percent.

**Bk1** --- 38 to 60 centimeters (15 to 23.6 inches); light yellowish brown (10YR 6/4) dry, clay loam; yellowish brown (10YR 5/4) moist; 20 percent sand; 41 percent silt; 39 percent clay; moderate medium subangular blocky structure; firm, very hard, moderately sticky, moderately plastic; common medium roots throughout, common fine roots throughout and common very fine roots throughout; 4 percent (common) fine masses of carbonate on faces of peds; electrical conductivity of 0.44 mmhos/cm by EC meter, saturated paste; sodium absorption ratio of 0.09; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6, pH meter, saturated paste; clear smooth boundary; Field Measured Properties: CaCO<sub>3</sub> 14 Percent.

**Bk2** --- 60 to 95 centimeters (23.6 to 37.4 inches); very pale brown (10YR 7/4) dry, clay loam; yellowish brown (10YR 5/4) moist; 25 percent sand; 40 percent silt; 35 percent clay; weak medium subangular blocky structure; friable, hard, moderately sticky, moderately plastic; common very fine roots throughout finely disseminated carbonates and 10 percent (common) medium masses of carbonate on faces of peds; electrical conductivity of 0.43 mmhos/cm by EC meter, saturated paste; sodium absorption ratio of 0.09; violently effervescent by HCl, 1 normal; slightly alkaline, pH 7.7, pH meter, saturated paste; gradual smooth boundary; Field Measured Properties: CaCO<sub>3</sub> 16 Percent.

**Bk3** --- 95 to 150 centimeters (37.4 to 59.1 inches); very pale brown (10YR 7/3) dry, silt loam; pale brown (10YR 6/3) moist; 27 percent sand; 50 percent silt; 23 percent clay; weak fine subangular blocky structure; very friable, slightly hard, slightly sticky, slightly plastic; common very fine roots throughout finely disseminated carbonates and 15 percent (common) medium masses of carbonate on faces of peds; electrical conductivity of 0.27 mmhos/cm by EC meter, saturated paste; sodium absorption ratio of 0.11; violently effervescent by HCl, 1 normal; slightly alkaline, pH 7.8, pH meter, saturated paste; Field Measured Properties: CaCO<sub>3</sub> 21 Percent.

**Pedon ID:** EXP-4 Road 2

**Description Date:** 9/15/2010

**Describer:** Robert Long

**Soil Name As Described/Sampled:** Modo - carbonatic skeletal taxadjunct

**Classification:** Loamy-skeletal, carbonatic, superactive, frigid Lithic Ustorthents

**Pedon Type:** Taxadjunct to the series

**Pedon Purpose:** Full pedon description

**Lat/Long:** 39°42'14" north, 110°32'50" west

**UTM:** 538824.37E, 4394985.58N -- Datum NAD83, Zone 12

**Legal Description:** Section 11, Township 12 East, Range 13 South of the Salt Lake Meridian

**Landscape:** mountain range

**Landform:** ridge

**Geomorphic Component:** Mountaintop

**Profile Position:** Summit

**Slope:** 7 percent

**Elevation:** 2558 meters (8392.4 feet)

**Aspect:** 60°

**Shape: up/down:** Linear; **across:** Convex

**Complexity:** Simple

**Flooding:** None

**Ponding:** None

**Drainage:** Well drained

**Runoff:** Medium

**Permeability:** Slow

**Erosion:** Class 2 - Sheet erosion

**Primary Earth Cover:** Shrub cover; **Secondary Earth Cover:** Other grass/herbaceous cover

**Existing Vegetation:** ARTRV - mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*);

AMUT - Utah serviceberry (*Amelanchier utahensis*); SYORO - mountain snowberry

(*Symphoricarpos oreophilus var. oreophilus*); LESAS - Salina wildrye (*Leymus salinus ssp. salinus*)

**Parent Materials:** residuum

**Bedrock:**

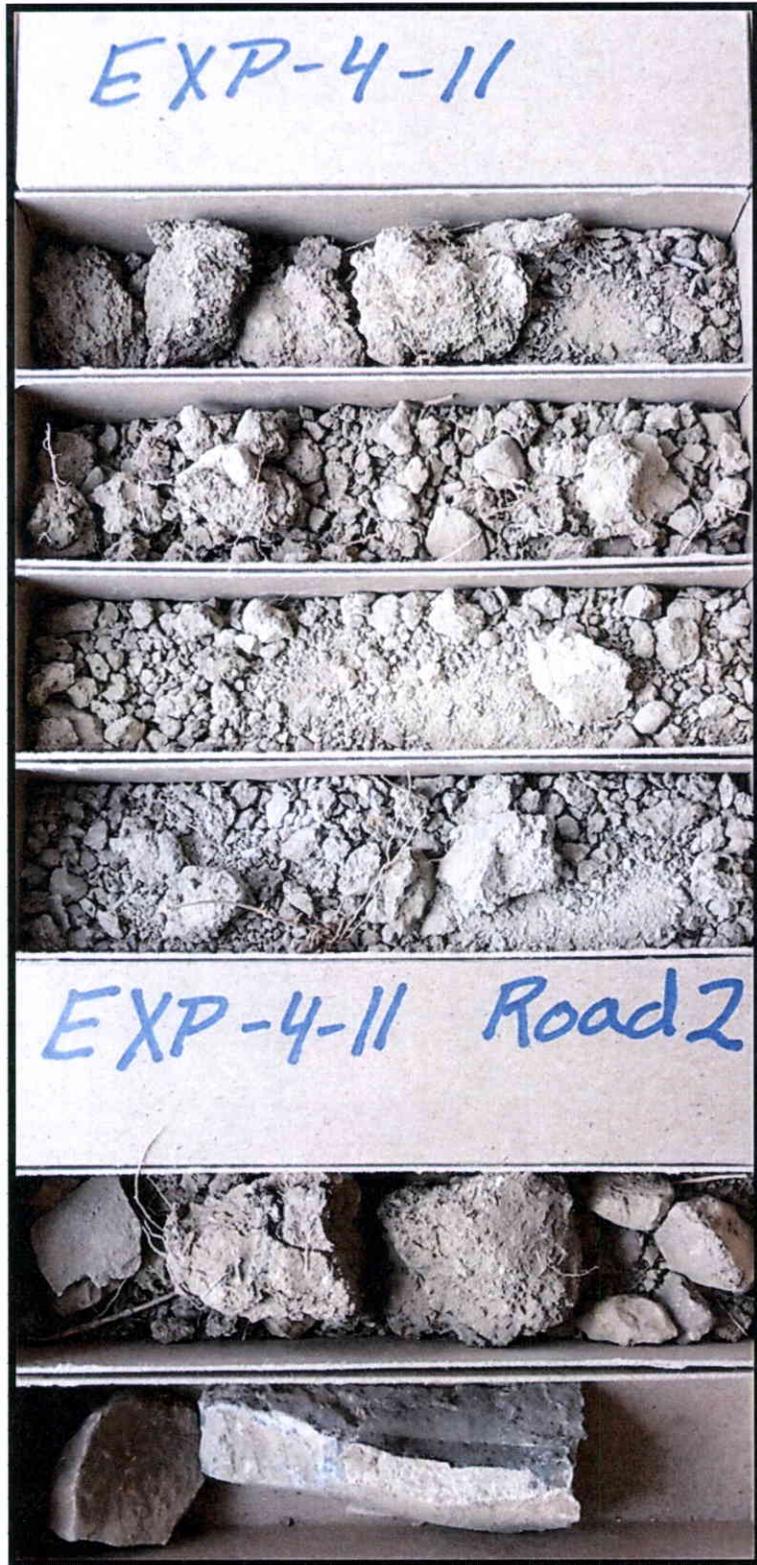
**Particle Size Control Section:** 0 to 12 centimeters (0 to 4.7 inches)

Slope	Elevation	Aspect	MAAT	MSAT	MWAT	MAP	Frost-Free Days	Drainage Class	Slope Length	Upslope Length
7 percent	2558 meters (8392.4 feet)	60°	5.2° C (41° F)			508 millimeters (20 inches)	80 days	well		

**Bw** --- 0 to 12 centimeters (0 to 4.7 inches); light brownish gray (10YR 6/2) dry, very gravelly clay loam; grayish brown (10YR 5/2) moist; 38 percent sand; 32 percent silt; 30 percent clay; structure; very friable, hard, slightly sticky, slightly plastic; common very fine roots throughout; common very fine tubular pores; 5 percent nonflat subangular 76 to 250 millimeters (3 to 10 inches) limestone fragments and 35 percent nonflat subangular 2 to 76 millimeters (0.1 to 3 inches) limestone fragments; electrical conductivity of 0.25 mmhos/cm by EC meter, saturated paste; sodium absorption ratio of 0.06; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7, pH meter, saturated paste; abrupt smooth boundary; Field Measured Properties: CaCO<sub>3</sub> 46 Percent.

**R** --- 12 centimeters (4.7 inches); (10YR) dry; Limestone.

EXP-4 Soil Profile Boxes



**EXP-4:**

A, 0 to 5 cm (0 to 2 inches);

Bw, 5 to 30 cm (2 to 11.8 inches);

Bk, 30 to 55 cm (11.8 to 21.7 inches);

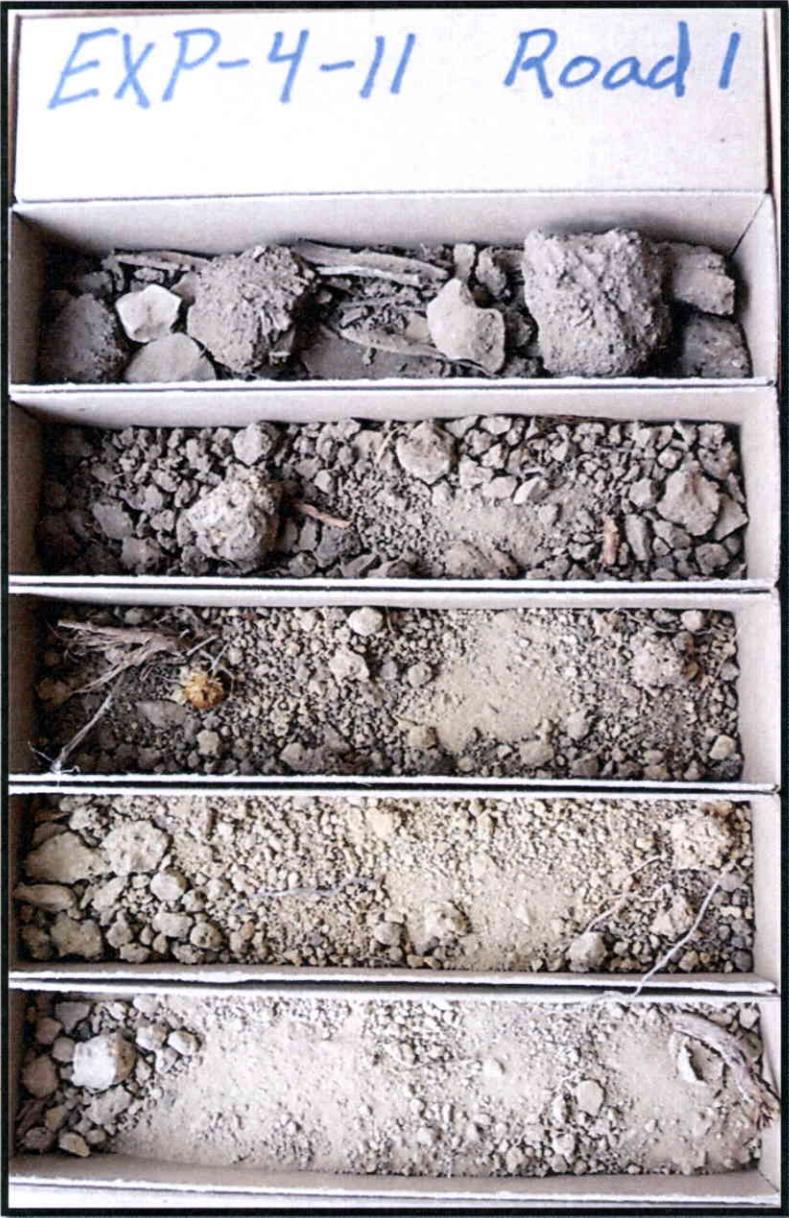
Bck, 55 to 90 cm (21.7 to 35.4 inches).

R, 90 cm (35.4 inches)

**EXP-4 Road 2:**

Bw, 0 to 12 cm (0 to 4.7 inches);

R, 12 cm (4.7 inches).



**EXP-4 Road 1:**

BA, 0 to 8 cm (0 to 3.1 inches)

Bt, 8 to 38 cm (3.1 to 15 inches)

Bk1, 38 to 60 cm (15 to 23.6 inches)

Bk2, 60 to 95 cm (23.6 to 37.4 inches)

Bk3, 95 to 150 cm (37.4 to 59.1 inches)

Site Photos



Photo 1. Looking north across center of EXP-4 at location of soil profile description.



Photo 2. Looking east across center of EXP-4. Access road to EXP-2 is visible in upper right of photo sloping down from left to right.



Photo 3. Looking south across center of EXP-4 toward Dugout Canyon on left of photo.



Photo 4. Looking upslope to west across center of EXP-4. Site vegetation is big sagebrush, Utah serviceberry, and Salina wildrye.



Photo 5. Looking northwest from center of site to area where road will enter EXP-4. Limestone outcrop along ridge.



Photo 6. Looking northwest at EXP-4 Road 1 soil profile location in area of mountain big sagebrush, Utah serviceberry, mountain snowberry and Utah juniper. Location is near top of proposed access road corridor. EXP-4 Road 2 location is on the bench immediately behind the juniper in this picture.



Photo 7. Looking west at upper end of proposed access road for EXP-4. There is an existing two-track road in this area. Location of soil profile description EXP-4 Road 2 is to the left of center near Utah serviceberry (second bush with gold leaves back from photo view point).



Photo 8. Looking southeast down proposed EXP-4 road corridor from ridge near northwest end. Location of soil profile EXP-4 Road 1 is near Utah juniper in right center of photo.



Photo 9. Looking west at EXP-4 location (center of photo above rock outcrop) from EXP-2 access road.



Photo 10. Looking west northwest at slope which will be crossed by proposed EXP-4 access road. View is from EXP-2 access road. EXP-4 location is above rock outcrop at right center of photo.

**Literature Cited**

Daly, C. and G. Taylor. April 1998. Western U.S. Average Monthly or Annual Precipitation, 1961-90. Climate Service at Oregon State University.

Schoeneberger, P.J., Wysocki, D.A., Benham, E.C. and Broderson, W.D. (editors). 2002. Field book for describing and sampling soils, Version 2.0. Natural Resources Conservation Service. National Soil Survey Center. Lincoln, NE.

NRCS – USDA. Custom Soil Resource Report for Carbon Area, Utah, Parts of Carbon and Emery Counties. Downloaded from Web Soil Survey September 13, 2010.

Utah DOGM. October 2005. Guidelines for Management of Topsoil and Overburden, R645-301-200 Soils.

Weiss, M.P, I.J. Witkind, and W.B. Cashion. 2003. Geological Map of the Price 30' x 60' Quadrangle, Carbon, Duchesne, Uintah, Utah, and Wasatch Counties, Utah.

# APPENDIX

## EXPLORATION HOLE SOILS REPORT LABORATORY DATA



**Soil Analysis Report**  
**Canyon Fuel Company**  
Dugout Canyon Mine  
P.O. Box 1029  
Wellington, UT 84542

Report ID: S1010127001

Date Reported:  
Work Order: S1010127

Project: Dugout Canyon Mine  
Date Received: 10/7/2010

Lab ID	Sample ID	Depths cm	pH s.u.	Saturation %	Electrical		Field		Wilt		Sand %	Silt %	Clay %	Texture
					Conductivity dS/m	Capacity %	Point %	Clay %						
S1010127-001	EXP-01	10-26	7.2	53.8	0.46			44.0	34.0	22.0	Loam			
S1010127-002	EXP-01	26-46	6.9	39.0	0.24			37.0	37.0	26.0	Loam			
S1010127-003	EXP-01	46-90	6.8	36.7	0.25			29.0	36.0	35.0	Clay Loam			
S1010127-004	EXP-01	90-150	6.8	35.1	0.24			25.0	42.0	33.0	Clay Loam			
S1010127-005	EXP-02	6-27	7.5	66.7	0.74			42.0	36.0	22.0	Loam			
S1010127-006	EXP-02 ROAD	2-17	7.7	49.3	0.49			39.0	41.0	20.0	Loam			
S1010127-007	EXP-02 ROAD	17-44	7.8	38.0	0.47			35.0	45.0	20.0	Loam			
S1010127-008	EXP-03	0-8	7.5	50.1	0.54			51.0	29.0	20.0	Loam			
S1010127-009	EXP-03	8-23	7.7	50.3	0.44			41.0	35.0	24.0	Loam			
S1010127-010	EXP-03	23-60	7.8	38.1	0.28			28.0	44.0	28.0	Clay Loam			
S1010127-011	EXP-03	60-85	7.9	37.8	0.31			23.0	54.0	23.0	Silty Loam			
S1010127-012	EXP-04	0-5	7.7	38.5	0.42			34.0	40.0	26.0	Loam			
S1010127-013	EXP-04	5-30	8.0	42.2	0.32			32.0	38.0	30.0	Clay Loam			
S1010127-014	EXP-04	30-55	7.9	45.1	0.34			11.0	47.0	42.0	Silty Clay			
S1010127-015	EXP-04	55-90	7.9	46.7	0.29			9.0	37.0	54.0	Clay			
S1010127-016	EXP-04 ROAD	0-8	7.6	60.2	0.51			25.0	35.0	40.0	Clay			
S1010127-017	EXP-04 ROAD	8-38	7.6	55.2	0.41			22.0	36.0	42.0	Clay			
S1010127-018	EXP-04 ROAD	38-60	7.6	47.4	0.44			20.0	41.0	39.0	Clay Loam			
S1010127-019	EXP-04 ROAD	60-95	7.7	40.0	0.43			25.0	40.0	35.0	Clay Loam			
S1010127-020	EXP-04 ROAD	95-150	7.8	32.4	0.27			27.0	50.0	23.0	Silty Loam			

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2OSol= 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



**Soil Analysis Report**  
**Canyon Fuel Company**  
Dugout Canyon Mine  
P.O. Box 1029  
Wellington, UT 84542

Report ID: S1010127001

Project: Dugout Canyon Mine

Date Reported:

Date Received: 10/7/2010

Work Order: S1010127

Lab ID	Sample ID	Depths cm	PE			PE			Available			Exchangeable		
			Calcium meq/L	Magnesium meq/L	Potassium meq/L	Sodium meq/L	SAR	Sodium meq/100g	Sulfur meq/100g	Sodium meq/100g	Sulfur meq/100g	Sodium meq/100g	Sulfur meq/100g	CO3 %
S1010127-001	EXP-01	10-26	2.90	0.99	0.62	0.23	0.16	0.02	0.02	<0.01	<0.01	<0.01	<0.01	
S1010127-002	EXP-01	26-46	1.25	0.38	0.26	0.15	0.16	0.01	0.01	<0.01	<0.01	<0.01	<0.01	
S1010127-003	EXP-01	46-90	0.82	0.72	0.23	0.24	0.27	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
S1010127-004	EXP-01	90-150	1.14	0.89	0.31	0.29	0.29	0.01	0.01	<0.01	<0.01	<0.01	<0.01	
S1010127-005	EXP-02	6-27	4.49	1.36	2.78	0.14	0.08	0.01	0.01	<0.01	<0.01	<0.01	<0.01	
S1010127-006	EXP-02 ROAD	2-17	4.42	0.84	0.47	0.12	0.07	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
S1010127-007	EXP-02 ROAD	17-44	3.44	1.08	0.47	0.19	0.13	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
S1010127-008	EXP-03	0-8	5.37	0.74	0.54	0.09	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
S1010127-009	EXP-03	8-23	4.35	0.50	0.32	0.10	0.07	0.01	0.01	<0.01	<0.01	<0.01	<0.01	
S1010127-010	EXP-03	23-60	2.28	0.37	0.12	0.08	0.07	0.01	0.01	0.01	0.01	0.01	0.01	
S1010127-011	EXP-03	60-85	2.32	0.66	0.04	0.15	0.12	0.03	0.03	0.02	0.02	0.02	0.02	
S1010127-012	EXP-04	0-5	3.77	0.60	0.30	0.15	0.10	0.01	0.01	<0.01	<0.01	<0.01	<0.01	
S1010127-013	EXP-04	5-30	2.07	0.72	0.14	0.12	0.10	0.02	0.02	0.02	0.02	0.02	0.02	
S1010127-014	EXP-04	30-55	2.05	1.05	0.06	0.15	0.12	0.04	0.04	0.03	0.03	0.03	0.03	
S1010127-015	EXP-04	55-90	1.43	1.11	0.04	0.21	0.19	0.06	0.06	0.05	0.05	0.05	0.05	
S1010127-016	EXP-04 ROAD	0-8	4.33	0.68	0.61	0.11	0.07	0.02	0.02	0.02	0.02	0.02	0.02	
S1010127-017	EXP-04 ROAD	8-38	3.27	0.43	0.35	0.12	0.08	0.03	0.03	0.02	0.02	0.02	0.02	
S1010127-018	EXP-04 ROAD	38-60	3.52	0.47	0.30	0.12	0.09	0.03	0.03	0.03	0.03	0.03	0.03	
S1010127-019	EXP-04 ROAD	60-95	2.34	0.50	0.16	0.11	0.09	0.01	0.01	0.01	0.01	0.01	0.01	
S1010127-020	EXP-04 ROAD	95-150	1.85	0.28	0.07	0.11	0.11	0.07	0.07	0.07	0.07	0.07	0.07	

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2OSol= water soluble, AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate

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Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor

Karen Secor, Soil Lab Supervisor



**Soil Analysis Report**  
**Canyon Fuel Company**

Dugout Canyon Mine  
P.O. Box 1029  
Wellington, UT 84542

Report ID: S1010127001

Project: Dugout Canyon Mine

Date Received: 10/7/2010

Date Reported:  
Work Order: S1010127

Lab ID	Sample ID	Depths cm	Nitrogen		Available		Available		Available		Total	
			Nitrate ppm	Selenium ppm	Boron ppm	Phosphorus ppm	Potassium ppm	TKN %	Carbon %	TOC %		
S1010127-001	EXP-01	10-26	0.7	<0.02	0.36	0.36	259	<0.01	2.5			
S1010127-002	EXP-01	26-46	<0.1	<0.02	0.25	0.25	233	0.06	1.6			
S1010127-003	EXP-01	46-90	0.2	<0.02	0.27	0.27	154	<0.01	0.8			
S1010127-004	EXP-01	90-150	0.4	<0.02	0.31	0.31	119	<0.01	1.2			
S1010127-005	EXP-02	6-27	0.8	<0.02	0.76	0.76	523	0.20	10.5			
S1010127-006	EXP-02 ROAD	2-17	0.3	<0.02	0.27	0.27	127	0.07	9.0			
S1010127-007	EXP-02 ROAD	17-44	0.6	<0.02	0.16	0.16	72.4	<0.01	8.4			
S1010127-008	EXP-03	0-8	<0.1	<0.02	0.39	0.39	334	0.11	3.3			
S1010127-009	EXP-03	8-23	0.8	<0.02	0.24	0.24	249	0.17	3.3			
S1010127-010	EXP-03	23-60	<0.1	<0.02	0.18	0.18	125	<0.01	4.1			
S1010127-011	EXP-03	60-85	<0.1	<0.02	0.30	0.30	50.9	<0.01	4.0			
S1010127-012	EXP-04	0-5	3.1	<0.02	0.37	0.37	187	0.06	4.0			
S1010127-013	EXP-04	5-30	0.7	<0.02	0.39	0.39	134	<0.01	3.8			
S1010127-014	EXP-04	30-55	<0.1	<0.02	0.36	0.36	95.9	<0.01	4.4			
S1010127-015	EXP-04	55-90	0.7	<0.02	0.18	0.18	109	<0.01	3.7			
S1010127-016	EXP-04 ROAD	0-8	17.0	<0.02	0.98	0.98	755	0.36	5.1			
S1010127-017	EXP-04 ROAD	8-38	6.2	<0.02	0.61	0.61	535	0.12	2.8			
S1010127-018	EXP-04 ROAD	38-60	2.7	<0.02	0.21	0.21	401	0.06	2.4			
S1010127-019	EXP-04 ROAD	60-95	0.7	<0.02	0.12	0.12		<0.01	1.5			
S1010127-020	EXP-04 ROAD	95-150	0.5	<0.02	0.14	0.14		<0.01	3.3			

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2OSol= 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



**Soil Analysis Report**  
**Canyon Fuel Company**  
 Dugout Canyon Mine  
 P.O. Box 1029  
 Wellington, UT 84542

Report ID: S1010127001

Date Reported:  
 Work Order: S1010127

Project: Dugout Canyon Mine  
 Date Received: 10/7/2010

Lab ID	Sample ID	Depths cm	Total		T.S.		Neutral.		T.S.		Sulfate		Pyritic		Organic		PyriticS		
			Sulfur	%	AB	1/1000t	Potential	ABP	Sulfur	%	Sulfur	%	Sulfur	%	Sulfur	AB	1/1000t	Sulfur	ABP
S1010127-001	EXP-01	10-26																	
S1010127-002	EXP-01	26-46																	
S1010127-003	EXP-01	46-90																	
S1010127-004	EXP-01	90-150																	
S1010127-005	EXP-02	6-27																	
S1010127-006	EXP-02 ROAD	2-17																	
S1010127-007	EXP-02 ROAD	17-44																	
S1010127-008	EXP-03	0-8																	
S1010127-009	EXP-03	8-23																	
S1010127-010	EXP-03	23-60																	
S1010127-011	EXP-03	60-85																	
S1010127-012	EXP-04	0-5																	
S1010127-013	EXP-04	5-30																	
S1010127-014	EXP-04	30-55																	
S1010127-015	EXP-04	55-90																	
S1010127-016	EXP-04 ROAD	0-8																	
S1010127-017	EXP-04 ROAD	8-38																	
S1010127-018	EXP-04 ROAD	38-60																	
S1010127-019	EXP-04 ROAD	60-95																	
S1010127-020	EXP-04 ROAD	95-150																	

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2OSol= water soluble, AB-DTPA= Ammonium Bicarbonate-DTPA, AAC= 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



**Soil Analysis Report**  
**Canyon Fuel Company**  
Dugout Canyon Mine  
P.O. Box 1029  
Wellington, UT 84542

Report ID: S1010127001

Date Reported:  
Work Order: S1010127

Project: Dugout Canyon Mine  
Date Received: 10/7/2010

Lab ID	Sample ID	Depths cm	pH s.u.	Saturation %	Electrical		Field		Wilt		Sand %	Silt %	Clay %	Texture
					Conductivity dS/m	Capacity %	Point %							
S1010127-021	EXP-04 ROAD 2	0-12	7.7	39.8	0.25						38.0	32.0	30.0	Clay Loam
S1010127-022	G-32	0-14	7.9	41.7	0.48						47.0	30.0	23.0	Loam
S1010127-023	G-32	14-30	7.9	38.8	0.41						39.0	33.0	28.0	Clay Loam
S1010127-024	G-32	30-65	7.9	39.0	0.35						37.0	35.0	28.0	Clay Loam
S1010127-025	G-32	65-93	8.0	41.8	0.27						33.0	37.0	30.0	Clay Loam
S1010127-026	G-32	93-130	8.1	34.8	0.32						42.0	31.0	27.0	Clay Loam
S1010127-027	G-34	0-15	7.5	36.2	0.33						49.0	30.0	21.0	Loam
S1010127-028	G-34	15-30	7.3	35.3	0.29						46.0	32.0	22.0	Loam
S1010127-029	G-34	30-55	7.1	35.6	0.15						47.0	31.0	22.0	Loam
S1010127-030	SP-1	1-15	7.9	33.7	0.35		27.2	6.1			65.0	22.0	13.0	Sandy Loam
S1010127-031	SP-1	15-35	7.9	30.2	0.40		22.3	6.4			72.0	16.0	12.0	Sandy Loam
S1010127-032	SP-1	35-67	8.1	31.3	0.42		20.8	7.2			66.0	23.0	11.0	Sandy Loam
S1010127-033	SP-1	67-97	8.0	29.7	1.00		22.0	5.6			68.0	22.0	10.0	Sandy Loam
S1010127-034	SP-1	97-150	8.1	30.4	0.54		20.3	7.0			67.0	21.0	12.0	Sandy Loam
S1010127-035	SP-2	0-8	7.7	39.0	0.41		28.7	7.6			62.0	30.0	8.0	Sandy Loam
S1010127-036	SP-2	8-23	7.9	39.4	0.40		28.3	8.0			56.0	30.0	14.0	Sandy Loam
S1010127-037	SP-2	23-60	7.9	39.0	0.34		26.7	9.7			58.0	23.0	19.0	Sandy Loam
S1010127-038	SP-2	60-100	8.0	31.7	0.84		22.2	5.4			74.0	18.0	8.0	Sandy Loam
S1010127-039	SP-2	100-120	7.9	33.5	1.52		22.7	6.4			71.0	19.0	10.0	Sandy Loam
S1010127-040	SP-3	2-15	7.8	43.8	0.75						68.0	22.0	10.0	Sandy Loam

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2OSol= water soluble, AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate

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Reviewed by: Karen A Secor

Karen Secor, Soil Lab Supervisor



**Soil Analysis Report**  
**Canyon Fuel Company**  
Dugout Canyon Mine  
P.O. Box 1029  
Wellington, UT 84542

Report ID: S1010127001

Date Reported:  
Work Order: S1010127

Project: Dugout Canyon Mine  
Date Received: 10/7/2010

Lab ID	Sample ID	Depths cm	PE			PE			Available			Exchangeable		
			Calcium meq/L	Magnesium meq/L	Potassium meq/L	Sodium meq/L	Calcium meq/L	Magnesium meq/L	Potassium meq/L	Sodium meq/L	SAR	Sodium meq/100g	Sulfur meq/100g	CO3 %
S1010127-021	EXP-04 ROAD 2	0-12	4.46	0.39	0.37	0.10	0.10	0.06						
S1010127-022	G-32	0-14	3.59	0.88	1.12	0.12	0.12	0.08						
S1010127-023	G-32	14-30	3.09	0.56	0.60	0.11	0.11	0.08						
S1010127-024	G-32	30-65	2.58	0.56	0.35	0.12	0.12	0.10						
S1010127-025	G-32	65-93	1.78	0.38	0.14	0.14	0.14	0.13						
S1010127-026	G-32	93-130	2.14	0.62	0.10	0.23	0.23	0.20						
S1010127-027	G-34	0-15	2.23	0.64	0.34	0.11	0.11	0.09						
S1010127-028	G-34	15-30	1.51	0.69	0.34	0.14	0.14	0.13						
S1010127-029	G-34	30-55	0.56	0.27	0.16	0.08	0.08	0.13						
S1010127-030	SP-1	1-15	2.45	0.59	0.14	0.10	0.10	0.08						2.3
S1010127-031	SP-1	15-35	3.27	1.15	0.16	0.16	0.16	0.11						10.7
S1010127-032	SP-1	35-67	3.37	2.11	0.24	0.25	0.25	0.15						14.8
S1010127-033	SP-1	67-97	6.51	5.82	0.41	0.55	0.55	0.22						14.1
S1010127-034	SP-1	97-150	3.09	2.65	0.36	0.35	0.35	0.21						13.2
S1010127-035	SP-2	0-8	2.83	0.78	0.45	0.13	0.13	0.10						0.9
S1010127-036	SP-2	8-23	2.88	0.92	0.17	0.18	0.18	0.13						1.8
S1010127-037	SP-2	23-60	2.69	0.63	0.15	0.33	0.33	0.26						5.9
S1010127-038	SP-2	60-100	8.21	1.77	0.15	1.01	1.01	0.45						
S1010127-039	SP-2	100-120	16.3	4.14	0.25	1.12	1.12	0.35						
S1010127-040	SP-3	2-15	5.02	2.41	1.50	0.51	0.51	0.27						

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Reviewed by: Karen A Secor  
Karen Secor, Soil Lab Supervisor



**Soil Analysis Report**  
**Canyon Fuel Company**

Dugout Canyon Mine  
P.O. Box 1029  
Wellington, UT 84542

Report ID: S1010127001

Date Reported:  
Work Order: S1010127

Project: Dugout Canyon Mine  
Date Received: 10/7/2010

Lab ID	Sample ID	Depths cm	Nitrogen		Available		Available		Available		Total	
			Nitrate ppm	Selenium ppm	Boron ppm	Phosphorus ppm	Potassium ppm	TKN %	Carbon %	TOC %		
S1010127-021	EXP-04 ROAD 2	0-12	2.1	<0.02	0.49					0.09	9.0	
S1010127-022	G-32	0-14	1.7	<0.02	0.32					0.19	4.7	
S1010127-023	G-32	14-30	0.7	<0.02	0.26					0.04	3.6	
S1010127-024	G-32	30-65	1.5	<0.02	0.30					0.01	4.0	
S1010127-025	G-32	65-93	1.0	<0.02	0.26					<0.01	4.5	
S1010127-026	G-32	93-130	1.3	<0.02	0.29					<0.01	5.0	
S1010127-027	G-34	0-15	0.9	<0.02	0.26					<0.01	1.6	
S1010127-028	G-34	15-30	<0.1	<0.02	0.16					<0.01	0.7	
S1010127-029	G-34	30-55	0.3	<0.02	0.25					<0.01	0.5	
S1010127-030	SP-1	1-15	1.3	<0.02	0.29	7.01		80.3		<0.01	1.1	0.8
S1010127-031	SP-1	15-35	<0.1	<0.02	0.22	4.97		61.0		<0.01	2.2	0.9
S1010127-032	SP-1	35-67	<0.1	<0.02	0.14	4.63		75.6		<0.01	2.3	0.5
S1010127-033	SP-1	67-97	1.2	<0.02	0.20	5.89		85.0		<0.01	2.2	0.5
S1010127-034	SP-1	97-150	<0.1	<0.02	0.27	8.06		104		<0.01	2.0	0.4
S1010127-035	SP-2	0-8	7.3	<0.02	0.20	27.9		181		0.05	1.4	1.3
S1010127-036	SP-2	8-23	1.1	<0.02	0.20	8.19		135		0.02	1.2	1.0
S1010127-037	SP-2	23-60	0.6	<0.02	0.30	9.19		124		0.05	1.8	1.1
S1010127-038	SP-2	60-100	8.1	<0.02	0.25	14.8				<0.01	0.6	
S1010127-039	SP-2	100-120	30.6	<0.02	0.29					0.01	0.8	
S1010127-040	SP-3	2-15	1.5	<0.02	0.38					<0.01	1.8	

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2OSol= 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

**Soil Analysis Report**  
**Canyon Fuel Company**

Dugout Canyon Mine  
P.O. Box 1029  
Wellington, UT 84542

Report ID: S1010127001

Project: Dugout Canyon Mine

Date Received: 10/7/2010

Date Reported:  
Work Order: S1010127

Lab ID	Sample ID	Depths cm	Total		T.S.		Neutral.		T.S.		Sulfate		Pyritic		Organic		PyriticS		
			Sulfur	%	AB	/1000t	Potential	/1000t	ABP	/1000t	Sulfur	%	Sulfur	%	Sulfur	%	AB	/1000t	ABP
S1010127-021	EXP-04 ROAD 2	0-12																	
S1010127-022	G-32	0-14																	
S1010127-023	G-32	14-30																	
S1010127-024	G-32	30-65																	
S1010127-025	G-32	65-93																	
S1010127-026	G-32	93-130																	
S1010127-027	G-34	0-15																	
S1010127-028	G-34	15-30																	
S1010127-029	G-34	30-55																	
S1010127-030	SP-1	1-15	0.02	0.56	22.9	22.3	0.01	<0.01	22.9	107	107	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	22.9	107
S1010127-031	SP-1	15-35	<0.01	<0.01	107	107	<0.01	<0.01	107	148	148	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	148	141
S1010127-032	SP-1	35-67	<0.01	<0.01	148	140	0.02	<0.01	141	132	132	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	132	8.59
S1010127-033	SP-1	67-97	0.03	0.92	141	140	0.02	<0.01	141	16.9	16.9	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	17.6	59.0
S1010127-034	SP-1	97-150	<0.01	<0.01	132	132	<0.01	<0.01	132	59.0	59.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	59.0	59.0
S1010127-035	SP-2	0-8	<0.01	<0.01	8.59	8.59	0.02	<0.01	8.59	17.6	17.6	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	17.6	59.0
S1010127-036	SP-2	8-23	0.02	0.75	17.6	16.9	0.02	<0.01	17.6	59.0	59.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	59.0	59.0
S1010127-037	SP-2	23-60	<0.01	<0.01	59.0	59.0	<0.01	<0.01	59.0	59.0	59.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	59.0	59.0
S1010127-038	SP-2	60-100																	
S1010127-039	SP-2	100-120																	
S1010127-040	SP-3	2-15																	

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2OSol= water soluble, AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate

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Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor

Karen Secor, Soil Lab Supervisor



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Wellington, UT 84542

Report ID: S1010127001

Project: Dugout Canyon Mine  
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Date Reported:  
Work Order: S1010127

Lab ID	Sample ID	Depths cm	pH s.u.	Saturation %	Electrical		Field		Wilt		Sand %	Silt %	Clay %	Texture
					Conductivity dS/m	Capacity %	Point %							
S1010127-041	SP-3	15-33	7.9	38.5	0.57	70.0	18.0	12.0	18.0	12.0	70.0	18.0	12.0	Sandy Loam
S1010127-042	SP-3	33-62	7.9	38.2	0.65	62.0	21.0	17.0	21.0	17.0	62.0	21.0	17.0	Sandy Loam
S1010127-043	SP-3	62-100	7.9	34.8	0.91	59.0	25.0	16.0	25.0	16.0	59.0	25.0	16.0	Sandy Loam
S1010127-044	SP-3	100-150	8.1	23.4	1.36	67.0	21.0	12.0	21.0	12.0	67.0	21.0	12.0	Sandy Loam
S1010127-045	SP-4	2-12	7.8	35.5	0.80	67.0	24.0	9.0	24.0	9.0	67.0	24.0	9.0	Sandy Loam
S1010127-046	SP-4	12-26	7.6	32.4	0.29	65.0	21.0	14.0	21.0	14.0	65.0	21.0	14.0	Sandy Loam
S1010127-047	SP-4	26-58	7.3	31.9	0.24	63.0	23.0	14.0	23.0	14.0	63.0	23.0	14.0	Sandy Loam
S1010127-048	SP-4	58-95	7.9	30.6	0.35	62.0	22.0	16.0	22.0	16.0	62.0	22.0	16.0	Sandy Loam
S1010127-049	SP-4	95-115	7.8	33.6	0.40	62.0	23.0	15.0	23.0	15.0	62.0	23.0	15.0	Sandy Loam
S1010127-050	SP-6	0-14	7.9	38.9	0.44	58.0	24.0	18.0	24.0	18.0	58.0	24.0	18.0	Sandy Loam
S1010127-051	SP-6	14-36	8.0	30.7	0.45	63.0	22.0	15.0	22.0	15.0	63.0	22.0	15.0	Sandy Loam
S1010127-052	SP-6	36-100	8.2	28.5	0.43	77.0	13.0	10.0	13.0	10.0	77.0	13.0	10.0	Sandy Loam
S1010127-053	SP-6	100-150	8.2	32.6	0.49	63.0	19.0	18.0	19.0	18.0	63.0	19.0	18.0	Sandy Loam

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2OSol= 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



**Soil Analysis Report**  
**Canyon Fuel Company**  
 Dugout Canyon Mine  
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 Wellington, UT 84542

Report ID: S1010127001

Project: Dugout Canyon Mine  
 Date Received: 10/7/2010

Date Reported:  
 Work Order: S1010127

Lab ID	Sample ID	Depths cm	PE			PE			Exchangeable		
			Calcium meq/L	Magnesium meq/L	Potassium meq/L	Sodium meq/L	Sulfur meq/100g	SAR	Available Sodium meq/100g	Sodium meq/100g	CO3 %
S1010127-041	SP-3	15-33	3.36	1.34	1.04	0.31	0.20				
S1010127-042	SP-3	33-62	5.02	1.71	0.83	0.47	0.25				
S1010127-043	SP-3	62-100	7.46	2.66	0.72	0.98	0.44				
S1010127-044	SP-3	100-150	10.8	4.92	0.59	3.79	1.35				
S1010127-045	SP-4	2-12	1.34	0.72	0.33	0.15	0.15				
S1010127-046	SP-4	12-26	1.17	0.55	0.34	0.13	0.14				
S1010127-047	SP-4	26-58	1.04	0.58	0.43	0.13	0.15				
S1010127-048	SP-4	58-95	2.30	0.76	0.26	0.16	0.13				
S1010127-049	SP-4	95-115	2.60	0.83	0.31	0.25	0.19				
S1010127-050	SP-6	0-14	3.83	0.65	0.24	0.11	0.07				
S1010127-051	SP-6	14-36	4.26	1.03	0.19	0.28	0.17				
S1010127-052	SP-6	36-100	2.18	2.19	0.08	0.41	0.28				
S1010127-053	SP-6	100-150	2.01	2.98	0.14	0.35	0.22				

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2OSol= water soluble, AB-DTPA= Ammonium Bicarbonate-DTPA, AAC= 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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Date Reported:

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Lab ID	Sample ID	Depths cm	Nitrogen		Available Selenium		Available Boron		Available Phosphorus		Available Potassium		TKN		Total Carbon	
			Nitrate ppm	Nitrite ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	%	%	%		
S1010127-041	SP-3	15-33	0.9	<0.02	0.38	<0.01	<0.01	0.9	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.9	
S1010127-042	SP-3	33-62	2.4	<0.02	0.52	<0.01	<0.01	1.4	<0.01	<0.01	<0.01	<0.01	<0.01	1.4		
S1010127-043	SP-3	62-100	2.2	<0.02	0.29	<0.01	<0.01	1.7	<0.01	<0.01	<0.01	<0.01	<0.01	1.7		
S1010127-044	SP-3	100-150	1.1	<0.02	0.12	<0.01	<0.01	3.1	<0.01	<0.01	<0.01	<0.01	<0.01	3.1		
S1010127-045	SP-4	2-12	<0.1	<0.02	0.10	<0.01	<0.01	0.8	<0.01	<0.01	<0.01	<0.01	<0.01	0.8		
S1010127-046	SP-4	12-26	<0.1	<0.02	0.16	<0.01	<0.01	0.6	<0.01	<0.01	<0.01	<0.01	<0.01	0.6		
S1010127-047	SP-4	26-58	0.3	<0.02	0.18	<0.01	<0.01	0.5	<0.01	<0.01	<0.01	<0.01	<0.01	0.5		
S1010127-048	SP-4	58-95	<0.1	<0.02	0.19	<0.01	<0.01	1.3	<0.01	<0.01	<0.01	<0.01	<0.01	1.3		
S1010127-049	SP-4	95-115	<0.1	<0.02	0.20	<0.01	<0.01	1.1	<0.01	<0.01	<0.01	<0.01	<0.01	1.1		
S1010127-050	SP-6	0-14	2.5	<0.02	0.31	0.02	0.02	2.3	0.02	0.02	0.02	0.02	0.02	2.3		
S1010127-051	SP-6	14-36	3.4	<0.02	0.30	<0.01	<0.01	3.6	<0.01	<0.01	<0.01	<0.01	<0.01	3.6		
S1010127-052	SP-6	36-100	0.9	<0.02	0.15	<0.01	<0.01	3.0	<0.01	<0.01	<0.01	<0.01	<0.01	3.0		
S1010127-053	SP-6	100-150	2.6	<0.02	0.20	<0.01	<0.01	2.0	<0.01	<0.01	<0.01	<0.01	<0.01	2.0		

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2Osol= 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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 Karen Secor, Soil Lab Supervisor



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 Dugout Canyon Mine  
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Report ID: S1010127001

Project: Dugout Canyon Mine  
 Date Received: 10/7/2010

Date Reported:  
 Work Order: S1010127

Lab ID	Sample ID	Depths cm	Total		T.S.		Neutral.		T.S.		Sulfate		Pyritic		Organic		PyriticS		
			Sulfur	%	AB	1/1000t	Potential	ABP	Sulfur	%	Sulfur	%	Sulfur	%	Sulfur	AB	1/1000t	Sulfur	ABP
S1010127-041	SP-3	15-33																	
S1010127-042	SP-3	33-62																	
S1010127-043	SP-3	62-100																	
S1010127-044	SP-3	100-150																	
S1010127-045	SP-4	2-12																	
S1010127-046	SP-4	12-26																	
S1010127-047	SP-4	26-58																	
S1010127-048	SP-4	58-95																	
S1010127-049	SP-4	95-115																	
S1010127-050	SP-6	0-14																	
S1010127-051	SP-6	14-36																	
S1010127-052	SP-6	36-100																	
S1010127-053	SP-6	100-150																	

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2OSol= 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= 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**

### **R645-301 Regulation Information and Commitments**

#### **R645-301-358**

The operator will to the extent possible using the best technology currently available, minimize disturbances and adverse impacts on fish, wildlife, and related environmental values and will achieve enhancement of such resources where practicable.

Dugout Canyon will minimize disturbances and adverse impacts on wildlife and their related environments as outline in this NOI and it associated appendices.

The sites will not be constructed or operated where they might jeopardize the existence of any endangered or threatened species. State or federally listed endangered or threatened species will be reported to the Division upon its discovery.

Dugout Canyon understands that there is no permission implied by these regulations for taking of bald or golden eagles, their nests, or eggs. If found eagle nests will be reported to the Division.

Dugout Canyon understands that there is no permission implied by these regulations for taking of endangered or threatened species, their nests, or eggs.

The sites contain no wetland or riparian vegetation.

No potential barriers will exist at any of the well sites, except for the perimeter fence when necessary. No ponds exist on the well sites.

#### **R645-301-512.250**

The extension to EXP-02 and EXP-04 of an existing road will be an ancillary road, not a primary road. The road will be reclaimed following the exploration activities. Refer to the time table in Section 224 for the length of time for the time of construction to the time of reclamation.

#### **R645-301-526-200**

No major utilities pass over, under, or through the exploration area. Use of roads and development of the exploration sites will not disrupt or damage any utility service.

#### **R645-301-527.100, 230, 240**

The gated drilling access roads are private roads and are preexisting. The existing roads will be maintained by Dugout Canyon Mine as required to in accordance with private landowner maintenance agreements.

If a road is damaged by a catastrophic event, the road will be repaired as soon as practical after the damage occurs.

#### **R645-301-534.100 thru 300**

The road extension will be located, designed, constructed, used, maintained and reclaimed so as to prevent or control damage to public or private property. The EXP-02 and EXP-04 road extensions are surrounded by private property owned by Canyon Fuel Company; the nearest public property is at a minimum two miles away in all directions. The road extension will be made of dirt with no embankment and no surfacing materials being used. Refer to Section 224 for construction and reclamation schedule. To control or prevent erosion the road will be bermed and have a very short life. Reclamation will occur as outlined in the time table in Section 224. The road extensions are not primary roads but ancillary roads. Waterbars will be installed where necessary to direct water off the road for the short life of the road extension. Also refer to R645-301-742.410 thru 742.420, 752.200.

**R645-301-542.600, 762**

The road extensions will be reclaimed after they are no longer needed for drilling and reclamation operations. The road bed will be reclaimed by ripping the surface, replacing the topsoil, pocking and gouging the road's surface and seeding. No natural drainage patterns will be disrupted with the extension of the roads.

**R645-301-731.100**

An approved water right for the water to be used in the drilling process is in place. The application for temporary diversions is under review.

**R645-301-742.410 thru 742.420, 752.200**

Also refer to Sections R645-301-542.600, R645-301-534.100 thru 300.

The road extension to EXP-02 and EXP-04 are not located in a channel of any stream including an intermittent or perennial stream. The road extensions are approximately 125 feet higher in elevation than the bottom of the canyon. There is not a stream in the canyon bottom. The road extension will be bermed and constructed to minimize sediment and flooding. Waterbars will be constructed where necessary.

Minimal surface disturbance will be required for the drilling project. No changes will occur to drainage patterns. The drill sites will be setup such that water runoff will not be allowed to impact surrounding soils.

The potential for water pollution will be minimized by keeping pollutants away from the drill hole and in their containers. Materials used during drilling operations will be selected to be as non-polluting as possible. All spills of polluting materials will be removed from the area and properly disposed of.

A one and one half to three foot berm of subsoil will be constructed around the perimeter of the pad to ensure no runoff from the pad. The pad will be constructed such that fluids will drain toward the mud pit. When the pad is immediately adjacent to an ephemeral or perennial drainage the pit will be lined. The pit and pad slope will be opposite the drainage. If deemed necessary other forms of sediment control such as silt fence, straw bales will be used at the drill sites.

Drill fluids and/or cuttings will be contained within the mud pit. If necessary, excess fluids will be pumped out and excess drill cuttings and core will be hauled off and disposed of properly.

**R645-201-221 to 225** Applicable parts of these stipulations were addressed in previous portions of this exploration plan.

**R645-201-310 to 323.300** Requirements of these sections were addressed in previous portions of this exploration plan.

**R645-201-323.400** The requirements of R645-202 will be met as follows:

**R645-202-100** This was addressed in a previous portion of this exploration plan.

**R645-202-231** This was addressed in a previous portion of this exploration plan.

**R645-202-232** No roads or other transportation facilities will be constructed.

**R645-202-233** This was addressed in a previous portion of this exploration plan. During reclamation, any hand grubbed vegetative material will be distributed over the areas from which it was removed to enhance germination. Salvaged topsoil may be contained within berms.

**R645-202-234** There will be no diversion of overland flows.

**R645-202-235** The drill holes will be plugged to preclude cross-connection. Impoundments will not be constructed.

**R645-202-236** Based on historical drilling results, it is not anticipated that acid- or toxic-forming materials will be encountered during exploration. However, an in-mine floor sample taken in 2008 exhibited some acid potential. In the unlikely event unsuitable material is encountered the excess cores will either be buried under four feet of cover on site or taken to the waste rock site and buried beneath four feet of cover.

**R645-202-241** This was addressed in a previous portion of this exploration plan.