

Canyon Fuel Company, LLC
Dugout Canyon Mine

Methane Degassification Amendment
March 13, 2006

CHAPTER 1
LEGAL, FINANCIAL, COMPLIANCE AND RELATED INFORMATION

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Refer to Record No. 0045
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for additional information

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110 MINIMUM REQUIREMENTS FOR LEGAL, FINANCIAL, COMPLIANCE AND RELATED INFORMATION

111 Introduction

The degassification wells will be located on property owned by the Milton and Ardith Thayn Trust. The well locations are found in Table 1-1 and are shown in Figure 1-1.

**TABLE 1-1
 Degas Well Locations
 Pine Canyon, Utah Quadrangle, Salt Lake Meridian**

Hole Number	Section	Township and Range
G-1	Portion of N1/2SE1/4NW1/4 Section 24	Township 13 South, Range 12 East
G-2	Portion of N1/2SW1/4NE1/4 Section 24	Township 13 South, Range 12 East
G-3	Portion of N1/2SW1/4NW1/4 Section 19	Township 13 South, Range 13 East
G-4	Portion of N1/2NE1/4NW1/4 Section 24	Township 13 South, Range 12 East
G-5	Portion of N1/2NW1/4NE1/4 Section 24	Township 13 South, Range 12 East
G-6	Portion of S1/2SW1/4NW1/4 Section 18	Township 13 South, Range 13 East
G-7	Portion of SW1/4NE1/4SE1/4 Section 24	Township 13 South, Range 12 East
G-8	Portion of NE1/4NE1/4NE1/4 Section 26	Township 13 South, Range 12 East
G-9	Portion of NW1/4NW1/4SW1/4 Section 21	Township 13 South, Range 13 East
G-10	Portion of NE1/4NE1/4SE1/4 Section 20	Township 13 South, Range 13 East
G-11	Portion of NE1/4SE1/4SW1/4 Section 20	Township 13 South, Range 13 East
G-12	Portion of SE1/4NW1/4SW1/4 Section 20	Township 13 South, Range 13 East

112 Identification of Interests

Refer to the same section of the General Chapter 1 for Canyon Fuel Company, LLC prepared for the Dugout Canyon Mine, Soldier Canyon Mine and Banning Loadout operations.

112.100 Business Entity

Refer to the same section of the General Chapter 1 for Canyon Fuel Company, LLC prepared for the Dugout Canyon Mine, Soldier Canyon Mine and Banning Loadout operations.

112.200 Applicant and Operator

Refer to the same section of the General Chapter 1 for Canyon Fuel Company, LLC prepared for the Dugout Canyon Mine, Soldier Canyon Mine and Banning Loadout operations.

112.300 Officers of the Applicant

Refer to the same section of the General Chapter 1 for Canyon Fuel Company, LLC prepared for the Dugout Canyon Mine, Soldier Canyon Mine and Banning Loadout operations.

112.400 Coal Mining and Reclamation Operation Owned or Controlled

Refer to the same section of the General Chapter 1 for Canyon Fuel Company, LLC prepared for the Dugout Canyon Mine, Soldier Canyon Mine and Banning Loadout operations.

112.500 Legal or Equitable Owner of the Surface and Mineral Properties

The legal and equitable owner of the surface and mineral properties to be affected by this operation during the duration of the permit period are list below.

Canyon Fuel Company, LLC
Dugout Canyon Mine

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Milton & Ardith Thayn Trust
7730 East US Highway 6
Sunnyside Star Route
Price, Utah 84501

United States of America
State of Utah, Department of Interior
Bureau of Land Management
Price Field Office
125 South 600 West
Price, Utah 84501

State of Utah
School and Institutional
Trust Lands Administration
675 East 500 South
Salt Lake City, Utah 84102-2818

**112.600 Owners of Record of Property Contiguous to Proposed
Permit Area**

Owners of record for surface and mineral properties contiguous to the proposed permit area are list below.

United States of America
Department of Interior
Bureau of Land Management
Price Field Office
125 South 600 West
Price, Utah 84501

State of Utah
School and Industrial
Trust Lands Administration
675 East 500 South
Salt Lake City, Utah 84102-2818

George and Alice Conover, Et Al
2701 Georgia Way
Sandy, Utah 84092

112.700 MSHA Numbers

Refer to the same section of the approved M&RP.

112.800 Interest In Contiguous Lands

Canyon Fuel Company, LLC has no interest in contiguous lands other than those currently owned as shown on Plate 1-1 of the approved M&RP.

112.900 Certification of Submittal Information

No information has changed in the approved M&RP because of this submittal. Refer to the same section of the approved M&RP.

113 Violation Information

Refer to the same section of the General Chapter 1 for Canyon Fuel Company, LLC prepared for the Dugout Canyon Mine, Soldier Canyon Mine and Banning Loadout operations.

114 Right-of-Entry Information

Refer to the same section of the approved M&RP.

See Table 1-2 for disturbed acreage for each well site. The disturbed acres will be added to the total disturbed acreage for the Dugout Mine as each site is constructed.

TABLE 1-2
Disturbed Acres by Well Site

Well Site	Disturbed Acres
G-1	0.6
G-2	1.21
G-3	0.97
G-4	0.85
G-5	0.75
G-6	0.32
G-7	1.25
G-8	0.9
G-9	2.2
G-10	1.7
G-11	1.6
G-12	2

115 Status of Unsuitability Claims

Refer to the same section of the approved M&RP.

116 Permit Term

Refer to the same section of the approved M&RP.

117 Insurance, Proof of Publication, and Facilities and Structures Used in Common

The certificate of insurance(s) for each well will be obtained if required when the well is drilled. The certificate of insurance(s) will be included in Appendix 1-2 of the approved M&RP and General Chapter 1.

118 Filling Fees

Refer to the same section of the approved M&RP.

120 PERMIT APPLICATION FORMAT AND CONTENTS

This amendment submittal will comply with R645-301-120.

130 REPORTING OF TECHNICAL DATA

All technical data submitted in the amendment will be accompanied by the name or organization responsible for the collection and analysis of data, dates of collection and descriptions of methodology used. Technical analyses will be planned by or under the direction of a qualified professional in the subject to be analyzed.

140 MAPS AND PLANS

The maps and plans in the Mining and Reclamation Plan will correspond with the requirements in R645-301-140.

150 COMPLETENESS

CFC believes the information in this permit application to be complete and correct.

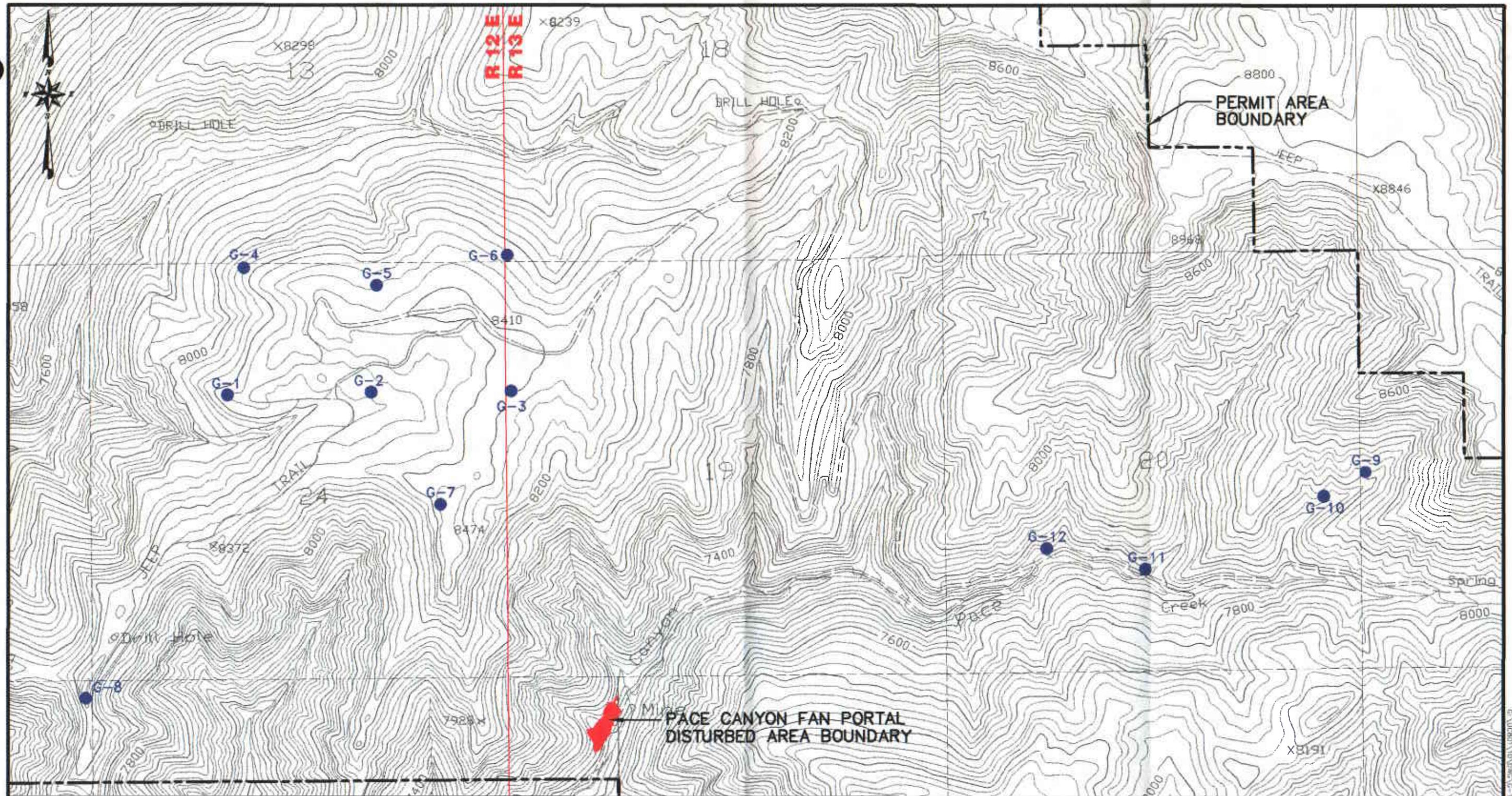


FIGURE 1-1. METHANE DEGAS BORE HOLE LOCATIONS



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CHAPTER 2
SOILS

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210 INTRODUCTION

This chapter and associated attachments address the pertinent data required for the addition of the degassification well sites for the Dugout Canyon Mine. Only those sections of the Division regulations that apply to the well sites have been addressed. The remainder of the regulations have already been addressed in the existing M&RP. The M&RP and this document contain pertinent information relating to the identification, management, and reclamation activities associated with the soil resources.

220 ENVIRONMENTAL DESCRIPTION

The well sites range in elevation from approximately 7400 to 9000 feet. The well sites are located in the Pace Canyon area of the Book Cliffs. General vegetation includes sagebrush, serviceberry, aspen, Douglas-fir, and snowberry.

221 Prime Farmland Investigation

Due to limiting terrain, lack of water for irrigation and no evidence of past cultivation of the sites, it is concluded that no prime farmland exists within the area of the well site disturbance.

222 Soil Survey

222.100 Soils Map

The soils have been mapped as part of the Soil Survey of the Carbon Area, Utah by the Soil Conservation Service (1988), at an Order III intensity level.

A description of the soils is included in Appendix 2-2 of the approved M&RP and in Attachment 2-1, which includes a report by Dan Larsen, Soil Scientist, entitled "Soil Inventory and Assessment Six

Methane Degassification Borehole Sites". An additional report for well site G-6 was prepared in 2004 and is incorporated into Attachment 2-1. Soil information for Well G-7 is incorporated into Attachment 2-1. A photograph of the G-7 site is included in Attachment 3-1. Well site G-3 and the access road can be seen on the photograph.

The soils report prepared by Dan Larsen, Soil Scientist for wells G-8 thru G-13 is provided in Attachment 2-1. Wells are being permitted in groups: G-8 thru G-10, G-11 thru G-12 and G-13, G-14 (DUG0105 and DUG0205).

222.200 Soil Identification

<u>Well No.</u>	<u>Soil Map Unit</u>	<u>Soil Components</u>
G-1	62/88	Midfork-Comodore complex, Rabbitex-Datino Variant
G-2	7	Brycan, Beje-Trag complex, 3-30% slopes
G-3	7	Beje-Trag complex, 3-30% slopes
G-4	62/103	Midfork-Comodore complex, Senchert-Toze complex
G-5	103	Senchert-Croydon
G-6	62	Midfork-Comodore complex
G-7	7	Beje-Trag complex, 3-30% slopes
G-8	21	Croydon Loam, 8 to 30% slopes
G-9	97/62	Midfork-Comodore complex, Rottulee family-Trag complex
G-10	97	Rottulee family-Trag complex
G-11	11, 26	Cabba- family, 40 to 70 percent slopes, Doney family, 50 to 70 percent slopes
G-12	47, 88	Guben-Rock outcrop complex, Rabbitex family-Datino Variant complex

222.300 Soil Description

Refer to Attachment 2-1 of the submittal for soil descriptions.

222.400 Soil Productivity

The depth of topsoil at each site was measured to determine the amount of growth medium available for reclamation. The following table lists each well site and the approximate amount of growth medium available.

TABLE 2-1
Topsoil Volumes

Well No.	Cubic Yards of Material
G-1	415
G-2	3,104
G-3	1,182
G-4	1,100
G-5	1,909
G-6	792
G-7	1251
G-8	543
G-9	1,574
G-10	2,344
G-11	254
G-12	563

Figure 5-1 through Figure 5-25 show the layout and approximate size of well pads for G-1 thru G-6. Figures 5-27 thru 5-29 show the layout and size for well G-7. The figures for wells G-8, G-9, G-10

G-11 and G-12 are located in Attachment 5-1. Topsoil volume calculations can be found in Attachment 2-2.

Estimated topsoil salvage from the G-1 well site will average about 7". This site on a ridge top has previously been disturbed for exploration drilling. The site has pockets of fractured sandstone bedrock at the surface and stony subsoils, which are the limiting factors in the quantity of salvageable topsoil. The average topsoil depth at well site G-2 is 30". The average topsoil thickness for well site G-3 is 10". However, enough soil will be stripped to allow 12" of soil to be placed during reclamation. Thus some subsoils will be stripped with the topsoil to generate the required volume. The estimated topsoil salvage from well site G-4 area will be 28" except on the area of the exiting road(s). The average salvageable topsoil at well site G-5 is 22". Well site G-6 will be established on a pre-existing drill pad, with a portion of the new pad extending onto undisturbed area. Topsoil on the pre-existing drill pad ranges from 0 to 30 inches, on the north edge in from 20 to 28 inches and on the cut slope on the south edge from 6 to 30 inches. The slope will be restored to original contour with the application of topsoil, the entire site will receive at least 12 inches of topsoil. Twelve inches was used to calculate the volume of topsoil to be salvaged and to determine the size of the topsoil pile for drill site G-6. Degas well G-7 will be developed on a site with soils consistent with G-3. There is a pre-existing road to well G-3 that continues on to the G-7 proposed site. There are signs of previous vehicle disturbance at the site, however the majority of the site is undisturbed. Topsoil available for salvage has been estimated to be 10 to 12 inches. Available topsoil will be salvaged and if necessary some subsoils will be stripped with the topsoil to generate the required volume to place a minimum of 12 inches during site reclamation. Available topsoil at each site will be salvaged, stockpiled and redistributed.

Twelve inches of soil will be salvaged at well sites G-8 and G-9. The available topsoil at site G-8 is about six inches, therefore subsoil will be stripped with the topsoil to generate the additional growth medium. Well site G-9 has no topsoil over approximately half of the site, thus requiring the salvage of subsoil to generate the foot of soil proposed for reclamation. Suitable soil for salvage at site G-10 is approximately 15 inches with some areas having 24 inches of soil. Where available soil

will be salvaged to a minimum of 15 inches and approximately 18 inches will be available to cover the G-10 disturbed area at the time of reclamation.

The majority of the area at well site G-11 has been disturbed by road construction and the major part of the undisturbed portion has shallow eroded soils, except for a small area on the west side of the site. The shallow eroded soils are approximately 5 inches deep and the soils in the small area are between 10 and 16 inches deep. Approximately fifty percent of the G-12 well site is a road with no topsoil or vegetation. Between 12 and 30 inches of soil is suitable for salvage from the other fifty percent of the pad area for site G-12. Twelve inches will be returned to the reclamation slope at G-11 and between 12 and 15 inches at G-12. Large boulders are suspected to be present at the G-12 site, therefore a range has been given.

223 Soil Characterization

The topsoil evaluation described in this chapter was performed by Daniel M. Larsen, Professional Soil Scientist and Dean Stacy, NRCS Range Management Specialist in accordance with the standards of the National Cooperative Soil Survey.

224 Substitute Topsoil

Dugout Canyon does not plan to use substitute topsoil as growth media except as described in Section 222.400.

230 OPERATION PLAN

231 General Requirements

231.100 Removing and Storing Topsoil Methods

The topsoil will be removed, stockpiled and protected with a berm and/or silt fence. A qualified person will be on site during soil salvage to monitor and supervise the operation for the purpose of maximizing salvage volumes. Prior to topsoil salvage shrubs/vegetation will be removed and placed/wind rowed along the inside perimeter of the disturbed area.

After the topsoil is removed, the mud pit will be excavated and the soils from the mud pit excavation will be stored immediately adjacent to the mud pit. Mud pit excavation of subsoil will be approximately 110 CY at each well site. The subsoil excavation for the mud pits at G-7 thru G-12 was approximately 430 CY. A portable container for drilling fluids will be used if necessary, should there not be sufficient subsoil depth to excavate a mud pit.

Topsoil beneath the topsoil stockpiles will not be removed. Ribbon or a marking fabric will be placed on top of the topsoil prior to placement of the topsoil from the well pad area.

The approximate volume of subsoil to be salvaged and used to create berms around the perimeter of the well site including the topsoil stockpile perimeter is: G-1 - 161 CY; G-2 - 254 CY, G-3 - 208 CY, G-4-165 CY, G-5 - 191 CY, G-6 - 156 CY, G-7 - 107 CY, G-8 - 143 CY, G-9 - 182 CY, G-10 - 137 CY, G-11 - 185 and G-12 - 260 .

231.200 Suitability of Topsoil Substitutes/Supplements

See Section 224.

231.300 Testing of Topsoil Handling and Reclamation Procedures Regarding Revegetation

Dugout will exercise care to guard against erosion during and after application of topsoil and will employ the necessary measures to ensure the stability on graded slopes. Erosion control measures will include silt fences, berms, seeding, straw bales, soil roughening, and mulching of the soils.

Topsoil will be redistributed and the original soil surface beneath the topsoil stockpile will be roughened as presented in Section 242.100 and seeded with the seed mix described in Chapter 3, Section 352.

Methods used to evaluate success of revegetation and stabilization are discussed in Chapter 3, Section 356.

231.400 Construction, Modification, Use, and Maintenance of Topsoil Storage Pile

Topsoil removed from the drill pad sites will be stockpiled on the site. The estimated volumes of topsoil stockpile for each site are shown in Table 2-1. The stockpiles will be sized as shown in Table 2-2.

The slopes of the stockpile will be 1H:1V or approximately 45° during the construction phase. Soils in these areas generally have an angle of repose greater than 50 degrees, making a stockpile with 1:1 slopes feasible. The steeper slope also help minimize the area to be disturbed. When space is available topsoil will be stockpiled with slopes of 2H:1V.

TABLE 2-2
Topsoil Stockpile Dimensions*

Well No.	Length (ft)	Width (ft)	Height (ft)
G-1	55	35	16
G-2	156	50	20
G-3	70	60	17
G-4	110	35	17
G-5	90	65	21
G-6	105	30	13
G-7	80	70	6 to12
G-8**	168	60	6
G-9**	160	90	30
G-10**	170	80	65
G-11**	40	50	12
G-12**	60	80	18

* These are approximate dimensions of the topsoil stockpile and construction dimensions may vary.

** The height represents the elevation difference between the lowest point and highest point of the topsoil stockpile. The topsoil thickness will vary with the slope of the native ground surface. When stored on steep slopes the topsoil thickness will be much less than the estimated height of the stockpile.

See Section 234.200 for detailed information on the topsoil stockpile(s).

232 Topsoil and Subsoil Removal

232.100 Topsoil Removal and Segregation

All topsoil will be removed as a single layer with no segregation. Topsoil will be removed using a dozer and/or loader. Refer to Section 231.100 for additional details.

232.200 Poor Topsoil

No poor soils exist at the well sites see Attachment 2-1.

232.300 Thin Topsoil

Not applicable see Attachment 2-1.

232.400 Minor Disturbances Not Requiring Topsoil Removal

Topsoil will not be removed along the fence line at the wells sites.

232.500 Subsoil Segregation

The B and C soil horizons will not be removed. Any small quantity of subsoil removed with the topsoil will not be segregated.

232.600 Timing

Topsoil removal will take place after all vegetation that could interfere with salvaging the topsoil has been grubbed.

232.700 Topsoil and Subsoil Removal Under Adverse Conditions

The topsoil will be removed first and stockpiled and the remaining soil horizons will be left in place, except where natural conditions render removal operations hazardous or detrimental to soils outside the disturbed area then topsoil will not be removed.

Conventional Machines - In locations where steep grades, adverse terrains, severe rockiness, limited depth of soils, or other adverse conditions exist that render soil removal activities using conventional machines hazardous, soils will not be salvaged and stockpiled. Such conditions are not likely to occur in these areas.

Substitute Topsoil - Importing of substitute topsoil is not anticipated (Section 224).

233 Topsoil Substitutes and Supplements

233.100 Overburden Materials Supplementing and/or Replacing Topsoil

No overburden material will be used.

233.200 Suitability of Topsoil Substitutes and Supplements

No substitute topsoil is planned.

233.300 Physical and Chemical Analysis

See Section 243.

233.400 Testing of Substitute Topsoil

No substitute topsoil is planned.

234 Topsoil Storage

234.100 Topsoil Stockpiling

Topsoil will be stockpiled for later use in reclamation operations. The topsoil will be stored and treated as outlined in Section 234 of this amendment. Refer to Sections 231 through 234 of the M&RP for additional information pertaining to the topsoil at the Pace Canyon Fan site.

234.200 Topsoil Stockpile

Stable Stockpile Site - Stockpiled material will be placed on a stable site.

Protection from Contaminants and Compaction - To protect the topsoil from contaminants and unnecessary compaction that could interfere with vegetation, the stockpile will be isolated from the main surface area by a berm and/or silt fence. A sign designating "topsoil" will be installed on the stockpile.

The topsoil stockpile will be constructed in such a manner as to allow access for repair of the pile surfaces and diversion structures.

Wind and Water Erosion Protection - The topsoil stockpile will be protected from water erosion by berms, which trap sediment runoff from the stockpile. The berms have been designed to completely contain the 10-year 24-hour storm event (see Attachment 7-1). The stockpile will be surface pitted, gouged and/or roughened and revegetated using the grass seeds listed in Table 3-2 to prevent wind erosion.

Topsoil Redistribution - Stockpile soil will not be moved until redistribution during contemporaneous or final reclamation operations unless approved by the Division.

234.300 Topsoil Stockpile Relocation

Stockpiled soil in jeopardy of being detrimentally affected in terms of its quantity and quality by drilling operations may be temporarily redistributed or relocated on approval by the Division and modification of this M&RP.

240 RECLAMATION PLAN

241 General Information

Reclamation of the degassification sites (topsoil redistribution, amendments, and stabilization) is discussed in Sections 242, 243, and 244 respectively.

242 Soil Redistribution

242.100 Soil Redistribution Practices

The topsoil will be placed after recontouring of the site has occurred. Topsoil will be handled when they are loose or in a friable condition. The moisture content will be visually monitored and water will be added as needed to enhance the soil's condition for handling. The approximate amount of topsoil available for each site is shown in Table 2-1. The reclamation time line can be found on Figure 5-15 for sites G-2 and G-3 and on Figure 5-26 for sites G-4, G-5, G-6, G-7, G-8, G-9, G-10, G-11 and G-12.

The topsoil will be distributed in two phases at well site G-2, the first phase will be the contemporaneous reclamation of a portion of the pad area used during well construction (see Figures 5-4, 5-8 and 5-12). During contemporaneous reclamation topsoil from the stockpile will be distributed in the depths shown in Table 2-3.

Final reclamation will occur at all well sites after venting of the methane gas is complete, venting equipment has been removed and the well has been plugged. Well plugging will be delayed at well

sites G-2, G-5 and G-7, to allow additional time for venting of the gob behind the sealed panels and to provide surface access to the mine. The surface at well sites G-2 and G-5 will be reclaimed in 2006/2007, however the wells will not be plugged. The surface at well site G-7 will be reclaimed in 2008, but the wells will not be plugged. The topsoil stockpile storage area and access road (G-2 and G-5) will be reclaimed during this final phase. The access roads to G-3, G-4, G-6, G-7, G-8, G-9, G-10, G-11 and G-12 are pre-existing and will not be reclaimed.

Refer to Section 341 for additional information.

Soil Thickness - The topsoil will be distributed during contemporaneous and final reclamation in the thickness shown in Table 2-3.

TABLE 2-3
Approximate Topsoil Distribution Thickness

Well Site No.	Topsoil Thickness (Inches)
G-1	7
G-2	30
G-3	12
G-4	28
G-5	22
G-6	12
G-7	12
G-8	12
G-9	12
G-10	18
G-11	12
G-12	15

Compaction - Prior to the application of topsoil, compacted subsoils will be roughened or loosened for a depth of 18 to 24 inches. To prevent compaction of topsoil, soil moving equipment will refrain from unnecessary operation over spread topsoil. The topsoil will be in a loosened condition prior to seeding.

Following the drying of the mud pit materials, the dirt excavated to create the mud pit will be mixed with the drill cutting and returned to the pit to prevent a boundary of hard material from forming in the mud pit area that would hamper root penetration and then compacted to minimize settling.

Erosion - Care will be exercised to ensure the stability of topsoil on graded slopes to guard against erosion during and after topsoil application. Post reclamation (contemporaneous and final) erosion control measures will be surface roughing, mulching and seeding.

242.200 Regrading

The areas will be graded to their approximate original topographic configuration except as requested by the land owners. Well sites G-11 and G-12 will not be return to approximate original contour, refer to Attachment 5-3.

David Thayn representing the "Milton and Ardith Thayn Trust" has requesting that well sites G-11 and G-12 remain as constructed. Once the operator has finished using the sites, the mud pits will be filled, the area leveled, topsoil will be distributed, and native grasses planted.

Refer to Chapter 5 and of this amendment for additional detail.

242.300 Topsoil Redistribution on Impoundments and Roads

The mud pits will be dismantled and filled following completion of drilling. See Section 242.100, Compaction for additional information. Mud pits will be covered with the same amount of topsoil as the rest of the site. The roads existing prior to starting the drilling program will not be reclaimed.

Access roads built to allow entrance to the drilling pads will be reclaimed and will receive topsoil in the same depth as their corresponding pad areas when methane venting is complete.

243 Soil Nutrients and Amendments

The soils will be analyzed directly following salvage to determine if amendments are needed. Testing of the topsoil will be done according to Table 6 of the Division's Topsoil and Overburden Guidelines. The topsoil will be tested at a minimum for the following parameters: pH, electrical conductivity, total carbon, SAR, water holding capacity, plant available nitrogen, and phosphorus. Results of these analyses will be incorporated into Attachment 2-2.

244 Soil Stabilization

244.100 Protection and Stabilization of Surface Area

All reclaimed areas will be stabilized to control erosion by application of mulch, tackifier, and roughening of the surface. The areas will be graded to the approximately original topographic configuration. Seeding will be accomplished with the application of seeds and mulch with a long fiber tackifier or broadcast. Methods of protection and stabilization are further discussed in Chapter 3, Section 341.

244.200 Mulch Application

Mulch/tackifier will be applied to stabilize the soil on all areas that have been regraded and covered with growth media. For further discussion of revegetation practices to be utilized, see Chapter 3, Section 341.

244.300 Rills and Gullies

Postmining Land Use and Revegetation - Rills and gullies that are approximately nine (9) inches in depth and disrupt the postmining land use or reestablishment of vegetative cover will be regraded

and seeded. In addition, the repair of rills and gullies will assist in the maintenance of water quality standards.

250 PERFORMANCE STANDARDS

251 Topsoil, Subsoil, and Topsoil Supplements Management

All topsoil, subsoil, and topsoil supplements will be managed as outlined in Sections 230 and 240.

252 Stockpiled Topsoil and Subsoil

All stockpiled topsoil and subsoil will be managed according to plans outlined in Sections 230 and 240.

Canyon Fuel Company, LLC
Dugout Canyon Mine

Methane Degassification Amendment
March 13, 2006

ATTACHMENT 2-1
SOIL INVENTORY AND ASSESSMENT

add to the back of existing information

United States Department of Agriculture



Natural Resources Conservation Service
540 West Price River Drive
Field Office
Price, UT 84501
(435) 637-0041
FAX (435) 637-3146

June 3, 2005

REC'D JUN - 6 2005

Ms. Vicky Miller
Canyon Fuel Company, LLC
Dugout Canyon Mine
P.O. Box 1029
Wellington, UT 84542

Re: Vegetation Production of Proposed Degas Wells G7-G13 and GUG0105/DUG0205

Dear Ms Miller,

Following our visit to the proposed degas wells for Dugout Canyon Mine, I have made the following determinations for vegetative production and overall, health and trend of the sites. The three ecotypes that will be described in relation to these proposed well sites are sagebrush/grass and browse. It is noted that all of the sites have previously been disturbed (except G13) with differing levels of success in the reestablishment of the Potential Natural Community (PNC).

For a high seral (good condition) rating to be obtained in the *shallow loam sagebrush areas* (Well G7), percent air-dry weight for the primary functional groups should be as such; herbaceous 55-65%, forbs 5-15% and shrubs 25-35%. Although the site had already been disturbed, it was apparent that it was similar to the surrounding undisturbed areas of the same soil mapping unit and Ecological Site Description (ESD). It is apparent that past management practices (grazing and/or fire management) have allowed the shrub (mainly mountain sage brush) to surpass the 25-35%, while the herbaceous production has declined. Although the annual production for the site (1,200 lbs acre⁻¹) is representative of the recent climatic conditions we have experienced, there has been a slight shift in functional group composition (i.e. increase in shrub biomass with a decline in herbaceous biomass).

Well locations G9-13 & DUG0105/DUG0205 are all located in *very steep stony loam browse areas* that have all been previously disturbed (with the exception of G13) and show little resemblance to the PNC for the sites. For this reason, I will reference surrounding areas that have not historically been disturbed and use these values for production estimates. In a high seral state (good condition), this site would demonstrate the following characteristics in regards to annual production; herbaceous 20-30%, forbs 10-15% and shrubs 60-70%. Due to the nature of these sites (high shrub component) and resilience to drought (compared to sites with a higher herbaceous component), production (1,000 lbs acre⁻¹) and functional groups are more representative to the PNC.

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Well location G8 is located within *stony loam browse* that has been previously disturbed, but has shown a higher success in reaching the PNC for the site. In a high seral state (good condition), this site would demonstrate the following characteristics in regards to annual production; herbaceous 15-25%, forbs 10-15% and shrubs 65-75%. Similar to well sites G9-13, the nature of this site along with the higher success of vegetative reestablishment, production (1,200 lbs acre⁻¹) and functional groups are more representative to the PNC.

Please feel free to contact me if you have any further questions or concerns.

Sincerely,



M. Dean Stacy
Range Management Specialist
USDA-NRCS, Price FO

cc: Barry Hamilton, Assistant State Conservationist for Field Operations, Price AO
Gary Roeder, Area Resource Conservationist, Price AO
Wayne Greenhalgh, District Conservationist, Price FO

Report ID: 010601168

1633 Terra Avenue
Sheridan, WY 82801

Page 1 of 1

Soil Analysis Report

Canyon Fuel Co

Dugout Mine -Canyon Fuel

P.O. Box 1029

Wellington, UT 84542

Client Project ID: Dugout Canyon Mine

Date Received: 01/20/06

Set #0106S01168

Report Date: 02/08/06

REC'D FEB 13 2006

Lab Id	Sample Id	Nitrogen		
		Nitrate ppm	Phosphorus ppm	Potassium ppm
0106S01168	G9 TOPSOIL	1.22	0.40	146

These results only apply 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, Neut. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By: Joey Sheeley
Joey Sheeley, Soils Lab Supervisor

Intermountain Laboratories, Inc.

Report ID: 010512862

1633 Ferns Avenue
Sheridan, WY 82801

Soil Analysis Report

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

Page 1 of 3

Client Project ID: Topsoil
Date Received: 11/18/05

Set #0105S12862
Report Date: 12/09/05

Lab Id	Sample Id	pH	Saturation	EC	Calcium	Magnesium	Sodium	SAR	Sand	Silt	Clay	Texture
		s.u.	%	@ 25°C	meq/L	meq/L	meq/L		%	%	%	
0105S12862	G10 Topsoil	7.4	44.6	0.46	3.28	0.94	0.22	0.15	28.0	42.0	30.0	CLAY LOAM

These results only apply to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2Oso= 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, PyS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By: Joy Shesley
Joy Shesley, Soils Lab Supervisor

Inter-Mountain Laboratories, Inc.

Report ID: 010512862

1633 Terra Avenue
Sheridan, WY 82801

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

Page 2 of 3

Client Project ID: Topsoil
Date Received: 11/18/05

Set #0105S12862
Report Date: 12/09/05

Lab Id	Sample Id	Coarse Fragments %	Field Capacity %	Wilting Point %	Boron ppm	Nitrogen Nitrate ppm	TKN %	Phosphorus ppm	Selenium ppm	Available Sodium mg/100g	Exchangeable Sodium mg/100g
0105S12862	G10 Topsoil	8.8	28.4	15.8	0.28	1.48	0.12	9.67	<0.02	0.12	0.11

These results only apply to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2Osof= 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, Pyn+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By: Joey Shreeley
Joey Shreeley, Soils Lab Supervisor

Inter-Mountain Laboratories, Inc.

Report ID: 010512862

1633 Terra Avenue
Sheridan, WY 82801

Soil Analysis Report

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

Page 3 of 3

Client Project ID: Topsoil
Date Received: 11/18/05

Set #0105512862
Report Date: 12/09/05

Lab Id	Sample Id	TOC %	Total Sulfur %	T.S. AB #/1000x	Neutral. Pot. #/1000x	T.S. ABP #/1000x
0105512862	G10 Topsoil	0.7	0.01	0.31	178	178

These results only apply 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, PyS= Pyritic Sulfur, Pyr-Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
 Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By: Joey Sheeley
Joey Sheeley, Soils Lab Supervisor

Canyon Fuel Company, LLC
Dugout Canyon Mine

Methane Degassification Amendment
March 13, 2006

**ATTACHMENT 2-2
TOPSOIL CALCULATIONS**

add to the back of existing information

G-11

The majority of this site has been disturbed by roading building. There is no topsoil to be removed from these road Areas.

The topsoil resources in undisturbed Areas are limited. The soils report identifies most of the area to have less than 8" of topsoil. A small area has up to 16" of topsoil.

All topsoil available will be removed. An average depth of 12" will be removed from the undisturbed Areas.

$$\text{Area of available topsoil} = 6855 \text{ ft}^2$$

$$\text{Vol. of topsoil} = (6855 \text{ ft}^2 \times 1') = 6855 \text{ ft}^3 = 254 \text{ CY}$$

Due to limited space for storage the stockpile will be constructed with 1.5:1 slopes.

Stockpile Design

<u>Elev</u>	<u>Area (ft²)</u>	<u>Volume (ft³)</u>
7552	50	89
53	128	185
54	243	314
7555	385	458
56	531	605
57	678	735
58	793	834
59	874	894
7560	915	888
61	861	787
62	713	640
63	566	500
64	434	
		<u>6929</u>

$$6929 > 6855 \text{ ft}^3 \therefore \text{OK}$$

G-12

This site has been previously disturbed by road construction.

The soils report identifies topsoil from 12-30" deep in the undisturbed area. Enough topsoil will be removed to cover the area to be reclaimed with 15" of topsoil.

The reclaimed area will be larger than the current undisturbed Area where the topsoil will be removed from.

Area to be covered during reclamation = 12,166 ft²

Volume to be stripped = (12,166 ft²) (15'/12") = 15,208 ft³
= 563 CY

Due to limited storage space and a desire to limit disturbance the stockpile will be constructed with 1.5:1 slopes.

Stockpile Design

<u>Elevation</u>	<u>Area (ft²)</u>	<u>Volume (ft³)</u>
7470	64	108
71	151	188
72	225	257
73	289	323
74	357	394
7475	432	473
76	514	578
77	641	739
78	838	940
79	1041	1127
7480	1213	1275
81	1338	1383
82	1429	1452
83	1475	1476
84	1478	1454
7485	1430	1376
86	1321	1245
87	1170	1063
88	956	

15,851 ft³

15,851 ft³ > 15,208 ft³ ∴ OK

Canyon Fuel Company, LLC
Dugout Canyon Mine

Methane Degassification Amendment
March 13, 2006

CHAPTER 3
BIOLOGY

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310 INTRODUCTION

This chapter presents a description of the biological resources found on the Dugout Canyon degas well site areas.

311 Vegetative, Fish and Wildlife Resources

Vegetative, fish, and wildlife resource conditions in and adjacent to the proposed degassification wells are discussed in Section 320 of this submittal and the approved M&RP.

312 Potential Impacts to Vegetative, Fish, and Wildlife Resources

Potential impacts to vegetative, fish, and wildlife resources and the associated mitigation plan is presented in Sections 330 and 340 of this chapter.

313 Description of Reclamation Plan

The reclamation plan used to restore the vegetative, fish, and wildlife resources to a condition suitable for the post mining land use is presented in Section 340.

320 ENVIRONMENTAL DESCRIPTION

321 Vegetation Information

This section and the approved M&RP contain the environmental descriptions of the vegetation for the permit and adjacent areas.

321.100 Plant Communities Within the Proposed Permit Area

During June 2003, the degassification well sites were surveyed by Patrick Collins, Mt. Nebo Scientific. The report and survey for the areas are included in Attachment 3-1. The site for G-6 was moved to a pre-disturbed exploration well pad, the plant communities described in Mr. Collins report reflect the undisturbed portions on the north and south edges of the well pad. Vegetation information for G-7 was obtained from a report prepared by the NRCS Range Management Specialist, Dean Stacy (refer to Attachment 2-1 and 3-1) and the Patrick Collins survey prepared for well site G-3. A photograph of the G-7 site is included in Attachment 3-1. Well site G-3 and the access road can be seen on the photograph.

A vegetation survey of well sites G-8 thru G-12 was completed in July 2005 by Patrick Collins, Mt. Nebo Scientific. These sites have all been pre-disturbed, with a road running through the center of G-8 and remnants of logging activity at both G-9 and G-10. Approximately fifty percent of the well pads at sites G-11 and G-12 are existing roads which have no topsoil or vegetation. The remaining area at site G-11 has been disturbed, except for a small portion on the west side of the site. Well site G-12 has evidence of disturbance above the road cut however both soil and vegetation are intact. The reports and surveys for the areas will be included in Attachment 3-1.

321.200 Land Productivity Prior to Mining

Productivity of the well site lands prior to mining are shown in Table 3-1. Refer to Appendix 3-1 for a copy of the NRCS letter pertaining to productivity.

TABLE 3-1
Land Productivity

Well No.	Productivity (lbs.) Per Acre
G-1 (Previously Disturbed)	100
G-2	1,500*
G-3	1,500*
G-4 (Previously Disturbed)	150
G-5	1500*
G-6 (Majority Previously Disturbed)	300*
G-7	1200*
G-8 (Previously Disturbed)	1200
G-9 (Previously Disturbed)	1000*
G-10 (Previously Disturbed)	1000*
G-11 (Previously Disturbed)	1000*
G-12 (Previously Disturbed)	1000*
Reference Areas	
Sagebrush, Snowberry, Grass (G-2, G-3, G-4, G-5, and G-7)	1,500*
Aspen, Maple, Douglas Fir (G-1, G-6, and G-8)	300*
Transitional Mountain Brush and Conifer (G-9 thru G-11)	1200
Conifer, Mountain Brush and Pinyon Juniper (G-12, G-13 and G-15)	1100

* Community composition is experiencing a declining trend, with decrease in herbaceous production, increase in shrub/tree production.

322 Fish and Wildlife Information

Fish and wildlife information associated with the degas wells is provided in this chapter. A summary of the fish and wildlife resource information for the permit and adjacent areas is contained in Sections 322.100 through 322.200 of the approved M&RP.

322.100 Level of Detail

The scope and level of detail within the "Methane Degassification Amendment" are sufficient to design the protection and enhancement plan for wildlife and fish associated with the degas wells. Additional information pertaining to fish and wildlife in the permit area is located in the M&RP.

322.200 Site-Specific Resource Information

Raptors - An aerial raptor nest survey was done of the area by the Utah Division of Wildlife Resource (DWR, Chris Colt, Leroy Mead) and CFC personnel in May of 2003, refer to the Confidential Folder. Surveys were completed in May of 2004 and 2005, the information has been incorporated into the Confidential Folder.

No raptor nests were recorded during the survey (2003) in the area (portions of N1/2SE1/4NW1/4 and N1/2SW1/4NE1/4 of Section 24; a portions of N1/2SW1/4NW1/4 Section 19, Township 13 South, Range 13 East) of the degas wells. Refer to Figure 1-1 for mapped well locations.

During the 2004 raptor survey, there were no active or tended nests identified in the vicinity of the degas wells. During the 2005 raptor survey (May 12 & 20), there were no active or tended nests identified in the vicinity of degas wells G-9 and G-10. Two golden eagles nests were observed in the cliffs adjacent to degas well G-8 (Nest 9, DWR 2005 Raptor Survey). A single young eagle was

observed, but habitually vacates the nest within 45 days of birth. A raptor survey will be conducted of the well site areas, each year that the wells are in operation.

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 degas 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 - In the Summer of 2003, a calling point survey was conducted in the degas well 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". The report is included in Attachment 3-2. A second survey was completed in May of 2004, the information is incorporated into Appendix 3-3 of the M&RP .

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 degassification wells.

There are no known groundwater or surface water flows to the Colorado or Green Rivers with potential for impact by the drilling of the degas wells. Potential adverse affects to the four Colorado River endangered fish species (refer to table below) would not be likely since there is no direct route to the Colorado River or Green River from the proposed well locations. Per the Windy Gap Process (referenced by personal communication Jerriann Ernstsens, 8/19/03) consumption estimates for the degas wells: evaporation from ventilation - zero, drill holes will not intersect the coal seam being mined, therefore no access to mine ventilation until after area is sealed; coal preparation - zero, no coal preparation at degas sites (see Sections 522 and 523) ; sediment pond evaporation - zero, no sediment pond at degas sites (see Section 732.200); subsidence effects on springs - zero, no anticipated subsidence at degas sites (see Section525); alluvial aquifer abstractions into mines - zero, no alluvial aquifer abstractions associated with degas drill holes (see Sections 513.500 and 600); postmining inflow to workings - zero, no workings for postmining inflow associated with degas wells (see Sections 513.500 and 600); coal moisture loss - zero, no coal therefore no moisture loss (see Sections 522 and 523); direct diversion - zero, no direct diversions associated with degas wells

Alluvial Well Pumpage - Not Applicable

Deep Aquifer Pumpage - Not Applicable

Postmining Inflow to Workings - Not Applicable

Direct Diversions: - Not Applicable

Dust Suppression - 1,000 gallons per truck load, 3 load per day, for 335 days = 1,005,000 gallons plus 1,000 per truck load, 1 load per day, for 193 days = 193,000. Total: 1,198,000 gallons per year.

Mine Discharge: 6 Month Average 420,537gpd = 155,260,050 gal/yr

Calculation estimates for water use in 2005 were necessary since we are using 2005 purchases and usage and the year is 2 months short.

322.300 Fish and Wildlife Service Review

If requested, Dugout Canyon authorizes the release of information pertaining to Section 322 and 333 to the U. S. Fish and Wildlife Service Regional and Field Office for their review. On the 25th of May 2005, Leroy Mead of the DWR toured degas well sites G-8, G-9, G-10, G-11 and G-12. During the tour no wildlife concerns were noted.

323 Maps and Aerial Photographs

Location of the well sites can be seen in Figure 1-1 of this submittal.

323.100 Location and Boundary of Proposed Reference Area

Reference areas for the degassification wells were established during the vegetative study conducted in the Summer of 2003. Well sites G-2, G-3, G-4, G-5, and G-7 will be compared to the Sagebrush/Snowberry/Grass reference area and G-1, G-6, and G-8 to the Aspen/Maple/Douglas Fir reference area. Transitional Mountain Brush and Conifer is the reference area for well sites G-9 thru G-11. The reference area for Degas Well G-12 is Conifer, Mountain Brush and Pinyon Juniper. Refer to Attachment 3-1 and Figure 3-1 for the location of the reference areas associated specifically with the degas wells. Reference areas are also shown on Plate 3-1 and 3-1E in the M&RP.

**Federal and State Listed, Threatened, Endangered and Candidate Species
Plants and Wildlife
Carbon County, Utah
October 2002, Updated 6/7/05**

Common Name	Scientific Name	Status	Habitat Present*
Plants			
Uinta Basin Hookless Cactus	<i>Sclerocactus glaucus</i>	T	No habitat available
Graham Beardtongue	<i>Penstemon grahamii</i>	C	No habitat available
Fish			
Humpback Chub	<i>Gila cypha</i>	E	No habitat available
Roundtail Chub**	<i>Gila robusta</i>	T	No habitat available
Bonytail	<i>Gila elegans</i>	E	No habitat available
Colorado Pikeminnow	<i>Ptychocheilus lucius</i>	E	No habitat available
Razorback Sucker	<i>Xyrauchen texanus</i>	E	No habitat available
Birds			
Bald Eagle	<i>Haliaeetus leucocephalus</i>	T	No habitat available
See Confidential Folder			
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	C	No habitat available
Ferruginous Hawk**	<i>Buteo Regalis</i>	T	No habitat available
Southwestern Willow Flycatcher**	<i>Empidonax traillii extimus</i>	E	No habitat available
Mexican Spotted Owl	<i>Strix occidentalis lucida</i>	T	See Attachment 3-2 and Appendix 3-3 (M&RP)
Mammals			
Black-footed Ferret	<i>Mustela nigripes</i>	EX	No habitat available

* Habitat availability in Carbon County/Dugout Mine/Degas Well Sites.

** Utah State Listed Species - Information verified with Bill Bates, DWR (personal communication 7/17/03)

- E = A taxon that is listed by the U.S. Fish and Wildlife Service as "endangered" with the possibility of worldwide extinction.
T = A taxon that is listed by the U.S. Fish and Wildlife Service as "threatened" with becoming endangered.
C = A taxon for which the U.S. Fish and Wildlife Service has on file sufficient information on biological vulnerability and threats to justify it being a "candidate" for listing as and endangered or threatened.

Source: Utah Division of Wildlife Resources data base - created 10/24/02

Refer to Appendix 3-3 of the M&RP for a listing of Federal and State Listed, Threatened, Endangered and Candidate Species, Plants and Wildlife of Carbon County, Utah (2003).

323.200 Elevation and Locations of Monitoring Stations

Refer to Section 323.200 of the approved M&RP.

323.300 Facilities for Protection and Enhancement

Section 333.300 and 358.500 of the approved M&RP contain additional discussion pertaining to protective measures to be taken by Dugout Canyon on behalf of wildlife.

323.400 Vegetation Type and Plant Communities

Vegetative types and plant communities are outlined in the vegetative report in Attachment 3-1. Figure 3-2 gives details of the vegetation types located adjacent to the well sites.

330 OPERATION PLAN

331 Measures Taken to Disturb the Smallest Particle Area

The well sites will be sized to disturb the smallest acreage possible and still meet the requirements for the drilling equipment. The drainage control required will be built to satisfy the environmental requirements.

332 Description of Anticipated Impacts of Subsidence

Refer to Section 525.

333 Plan to Minimize Disturbances and Adverse Impacts

General control and mitigation measures addressing potential related biological impacts will include the following:

- Minimizing the total area of disturbance,
- Design, construction, and operation of the well sites to minimize impacts
- Exclusion of wildlife from potentially hazardous areas, and
- Reclamation of disturbed areas when they are no longer needed.

All water associated with the drilling of these wells will be appropriated and hauled and/or pumped to the sites by a licensed contractor. Since the drilling of degas wells does not involve the mining of coal, the USWFS consumption requirements for underground operations do not apply (i.e., evaporation from ventilation, coal preparation, sediment pond evaporation, subsidence of springs, alluvial aquifer abstractions into the mine, postmining inflow to workings, coal moisture loss, direct diversions).

333.100 Minimize Disturbance to Endangered or Threatened Species

Dugout Canyon will apply all methods necessary to minimize disturbances or any adverse effects to threatened or endangered species. See Section 322.200.

333.200 Species and Habitats

All species and habitats within the permit area will be protected to the best of Dugout Canyon's ability.

333.300 Protective Measures

Refer to Section 333.300 of the approved M&RP.

340 RECLAMATION PLAN

341 Revegetation

Revegetation of the sites will occur in two phases at drill site G-2. The first phase is to redistribute topsoil and seed the well area not needed for access and operation of the gas exhaust blower. The second phase will consist of plugging the well and distributing the remaining topsoil and seeding on the remaining pad area. Complete final reclamation will be delayed at well sites G-2, G-5 and G-7 will be delayed. Refer to Section 242.100 for additional detail. Following drilling, sites G-3, G-4, G-5, G-6, G-7, G-8 (never constructed), G-9, G-10, G-11 and G-12 will be reclaimed in one phase due to the quantity of soil moved during the site construction.

The short-term goal of this revegetation plan is the immediate stabilization of the disturbed sites through erosion control. This objective will be achieved through controlled grading practices, proper seedbed preparation to encourage rapid plant establishment, inclusion of rapidly establishing species in the seed mixture to be planted, and mulch application.

The long-term goals are to establish useful, and productive range. These goals will be attained through the selection and placement of desirable and productive plant species and a commitment to monitor and maintain revegetated areas throughout the bond liability period.

The well sites will be fenced to discourage wildlife and livestock from grazing the reclaimed areas until bond release.

Revegetation responsibilities for well sites G-11 and G-12 will differ from the other sites, refer to Section 357 and Attachment 5-3 for additional details.

341.100 Schedule and Timetable

The reclamation timetable is shown in Figures 5-15 (G-2) and 5-26 (G-3 thru G-12) of this submittal and the reclamation monitoring schedule is found in Chapter 3, Table 3-3 of the approved M&RP.

341.200 Descriptions

Species and Amounts of Seed - The well sites will be planted with the seed mix listed on Table 3-2. The seed mix will be used in both contemporaneous and final reclamation phases. The seed will be incorporated with a small amount of wood fiber mulch and applied by hydroseeding equipment or broadcast. Refer to Section 234.200 for topsoil stockpile seeding description.

Methods Used for Planting and Seeding - The degassification sites will be graded to final contour, then ripped to relieve compaction. The depth of ripping will be from 18 to 24 inches. Following ripping, topsoil will be applied to the ripped surface and left in a gouged and roughened state.

Mulching Techniques - Wood fiber mulch will be applied on top of the seed with hydroseeding equipment at the rate of 2,000 pounds per acre and anchored with a tackifier in amounts specified by the manufacturer.

Irrigation, Pest, and Disease Control - No irrigation is planned and pesticides will not be used unless previously approved by the Division.

Measures Proposed for Revegetation Success - Refer to Section 356.

341.300 Greenhouse Studies, Field Trials or Other Equivalent Studies

Refer to the Section 341.300 of the approved M&RP.

342 Fish and Wildlife

342.100 Enhancement Measures

Post bond release enhancement measure will include the establishment of vegetation for wildlife food, cover, and the break up of large blocks of monoculture to diversify habitat. The current blocks of monoculture include large area of sagebrush and mixed brush. According to Dean Stacy, Range Management Specialist, USDA-NRCS "past management practices have allowed the shrub (mainly mountain sage brush) to surpass the 25-35%, while the herbaceous production has declined". By planting reclamation seed mixes with grasses and forbs the planted areas will breakup the monocultures and provide a future seed source.

In consultation with UDWR (Tony Wright, July 6, 2004) and UDOGM (Jerriann Ernstsens, July 6, 2004) a mitigation project was designated for the Northern Saw Whet Owl to compensate for drilling during the exclusionary period. The project will be completed prior to October 1, 2004. The project will include the construction and installation of 6 to 10 nest boxes on property owned by Canyon Fuel Company, LLC. Because of the UDWR knowledge and experience their personnel will choose the location and install the boxes. Information (goals, procedures, agencies, dates, box locations - township, range, section) concerning the owl mitigation project will be included in the annual report for 2004.

342.200 Plants Used for Wildlife Habitat

Nutritional Value - The nutritional value will be consistent with that of vegetation in the surrounding areas.

Cover - Cover will be comparable to the cover on the associated reference area.

342.300 Cropland

Cropland is not a postmining land use.

342.400 Residential, Public Service, and Industrial Land Use

No residential, industrial or public service use is planned.

350 PERFORMANCE STANDARDS

351 General Requirements

Dugout Canyon commits to conduct all operations in accordance with the plans submitted in Sections R645-301-330 through R645-301-340 of the permit application.

352 Contemporaneous Reclamation

Reclamation activities prior to final reclamation will to the extent feasible, be performed contemporaneously. Contemporaneous reclamation will be performed at the well sites following construction of the wells. Refer to Section 341 for additional details.

353 Revegetation: General Requirements

A vegetative cover will be established on all reclaimed areas to allow for the designated postmining land use of grazing. Refer to Section 411 for additional information.

353.100 Vegetative Cover

The seed mix proposed for revegetation is intended to provide vegetative cover that will be diverse, effective, and permanent. The seed mixture was selected with respect to the climate, potential

seedbed quality, erosion control, drought tolerance, and the mixture's ability for quick establishment and spreading.

Native Species - The reclamation vegetation mixture will be comprised of species indigenous to the area and capable of achieving the postmining land use. Diversity of species should allow utilization of plants by wildlife and domestic livestock. The recommended seed mix is comprised of native species.

Extent of Cover - The vegetative cover will be at least equal in extent to the cover at the designated reference areas.

Stabilizing - The vegetative cover mixture is capable of stabilizing the soil surfaces from erosion.

353.200 Reestablished Plant Species

Compatible - The reestablished plant species have been selected to insure their compatibility with the approved postmining use.

Seasonal Characteristics - The revegetation plant species will have the same growing season as the adjacent areas.

Self-Generation - The reestablished plants are species capable of self-generation and plant succession.

Compatibility - The seed mix suggested for revegetation contains plants native to the area and compatible with the plant and animal species of the permit area.

Federal and Utah Laws or Regulations - The seed mix purchased to revegetate the degassification well sites will contain no poisonous or noxious plant (see Section 234.200). No species will be introduced in the area without being approved by the Division.

Table 3-2
Reclamation Seed Mix

<u>SPECIES</u>	<u># pls/acre</u>	<u># pls/sq. ft.**</u>
Grasses, Forbs, and Shrubs		
Kentucky Bluegrass (1,390,000 seeds/lb)*	0.5	16
Mountain Brome (64,000 seeds/lb)*	2.0	3
Sandberg Bluegrass (1,100,000 seeds/lb)*	1.0	25
Bluebunch Wheatgrass (126,000 seeds/lb)*	4.0	12
Bottlebrush Squirreltail (192,000 seeds/lb)*	1.0	4
Rocky Mountain Penstemon (478,000 seeds/lb)*	1.0	11
Mountain Lupine (12,000 seeds/lb)*	3.0	1
Mtn. Snowberry (54,000 seeds/lb)*	4.0	5
Wyoming Big Sage (2,500,000 seeds/lb)*	<u>0.5</u>	<u>29</u>
TOTAL	17	106

* Native Plants

** Rounded nearest whole seed

Grass seed quantities will be doubled if the area is broadcast seeded.

353.300 Vegetative Exception

Dugout Canyon does not require vegetative exception at this time.

353.400 Cropland

The permit area contains no land designated as cropland.

354 Revegetative: Timing

Dugout Canyon will follow the recommended guidelines for revegetation and planting during the first normal period for favorable planting conditions after replacement of the topsoil. In Utah the planting period is usually Fall due to the precipitation events.

355 Revegetation: Mulching and Other Soil Stabilizing Practices

Mulch and/or other soil stabilizing practices (roughing, etc.) will be used on all areas that have been regraded and covered by topsoil (Section 341.200). Dugout Canyon Mine will exercise care to guard against erosion during and after application of topsoil.

356 Revegetation: Standards for Success

356.100 Success of Revegetation

The success of revegetation will be judged on the effectiveness of the vegetation for postmining land use, the extent of cover on each degassification well site compared to their respective reference areas.

Sampling Techniques - Dugout Canyon will comply with the standards for success, statistically valid sampling techniques for measuring success, and the approved methods outline in the Division's "Vegetation Information Guidelines, Appendix A" for sampling.

The sampling methods to be used during reclamation will be specific to the requirements at the time of reclamation. Nonetheless, according to the currently approved UDOGM guidelines, these sampling methods would be used: sample adequacy, cover (line interception), density (belt transects or plots) and productivity (clipping). The Jaccard's Community Coefficient will be used to calculate acceptable plant similarity and diversity.

Standards for Success - The standards for success will include criteria representative of undisturbed lands in the area of the degas wells as means to evaluate ground cover, production and stocking of the reclaimed site.

356.200 Standards for Success

Standards of success will be applied in accordance with the approved postmining land use as described in this section.

Grazing Land and Pasture Land - The ground cover and production of living plants on the revegetated area will be at least equal to the reference area.

Cropland - There is no area designated as cropland within the degassification well sites.

Fish and Wildlife Habitat - The postmining land use for the degas well sites will be grazing, except on pre-existing roads. Pre-existing roads will be returned to their approximate original contour and compacted.

Industrial, Commercial or Residential - The postmining land use for the permit area is not designated for industrial, commercial, or residential use.

Previously Disturbed Areas - Site G-1 (never constructed), G-4, G-6, G-7, G-8 (never constructed), G-9, G-10, G-11 and G-12 have been previously disturbed. Sites G-2, G-3, and G-5 have not been previously disturbed. Standards of success for all sites will be applied in accordance with the postmining land use of grazing as described in this section.

356.300 Siltation Structures

Siltation structures will be maintained until the disturbed areas have been stabilized and revegetated. For additional details on siltation structures, see Sections 542 and 763 of this amendment.

356.400 Removal of Siltation Structures

The land on which siltation structures are located will be revegetated in accordance with the reclamation plan discussed in Section 353 and 357. Refer to Section 763 for additional information pertaining to the removal of siltation structures.

357 Revegetation: Extended Responsibility Period

Dugout Canyon will be responsible for the success of revegetation for a period of 10 years following seeding of the reclaimed area or upon Division bond release. Well sites G-11 and G-12, will be released to the land owner once the venting has been completed and the land owner's stipulations met, relieving the mine of revegetation responsibilities. Refer to Attachment 5-3 of this amendment for a copy of the land owner's request letter.

357.100 Extended Period Begins

The period of extended responsibility will begin after disturbed areas have been reseeded.

357.200 Vegetation Parameters

Vegetation parameters will equal or exceed the approved success standard during the last 2 years of the responsibility period. The success standards are outlined in Section 356 of this application.

357.300 Husbandry Practices

The use of husbandry practices are not being requested by Dugout Canyon for the degas well sites.

358 Protection of Fish, Wildlife, and Related Environmental Values

Dugout Canyon will minimize disturbances and adverse impacts on wildlife and their related environments as outline in Section 333 of the approved M&RP and Section 342 of this submittal. See Chapter 7, Section 731.100 of the approved M&RP for methods to protect water sources in the area.

358.100 Existence of Endangered or Threatened Species

The well sites will not be constructed or operated where they might jeopardize the existence of any endangered or threatened species. Refer to Section 322.200 and Attachments 3-1, 3-2 and 3-3 for additional information pertaining to threatened, endangered, and sensitive species.

State or federally listed endangered or threatened species will be reported to the Division upon its discovery.

358.200 Bald and Golden Eagles

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, nests will be reported to the Division.

358.300 Taking of Endangered or Threatened Species

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

358.400 Replacement of Wetland or Riparian Vegetation

The sites contain no wetland or riparian vegetation.

358.500 Manmade Wildlife Protection Measure

Electric Power Lines - No utilities will exist at the well sites.

Potential Barriers - No potential barriers will exist at any of the well sites, except for the perimeter fence. No ponds exist at the well sites. Refer to Sections 231.100 and 242 for information pertaining to the mud pit.

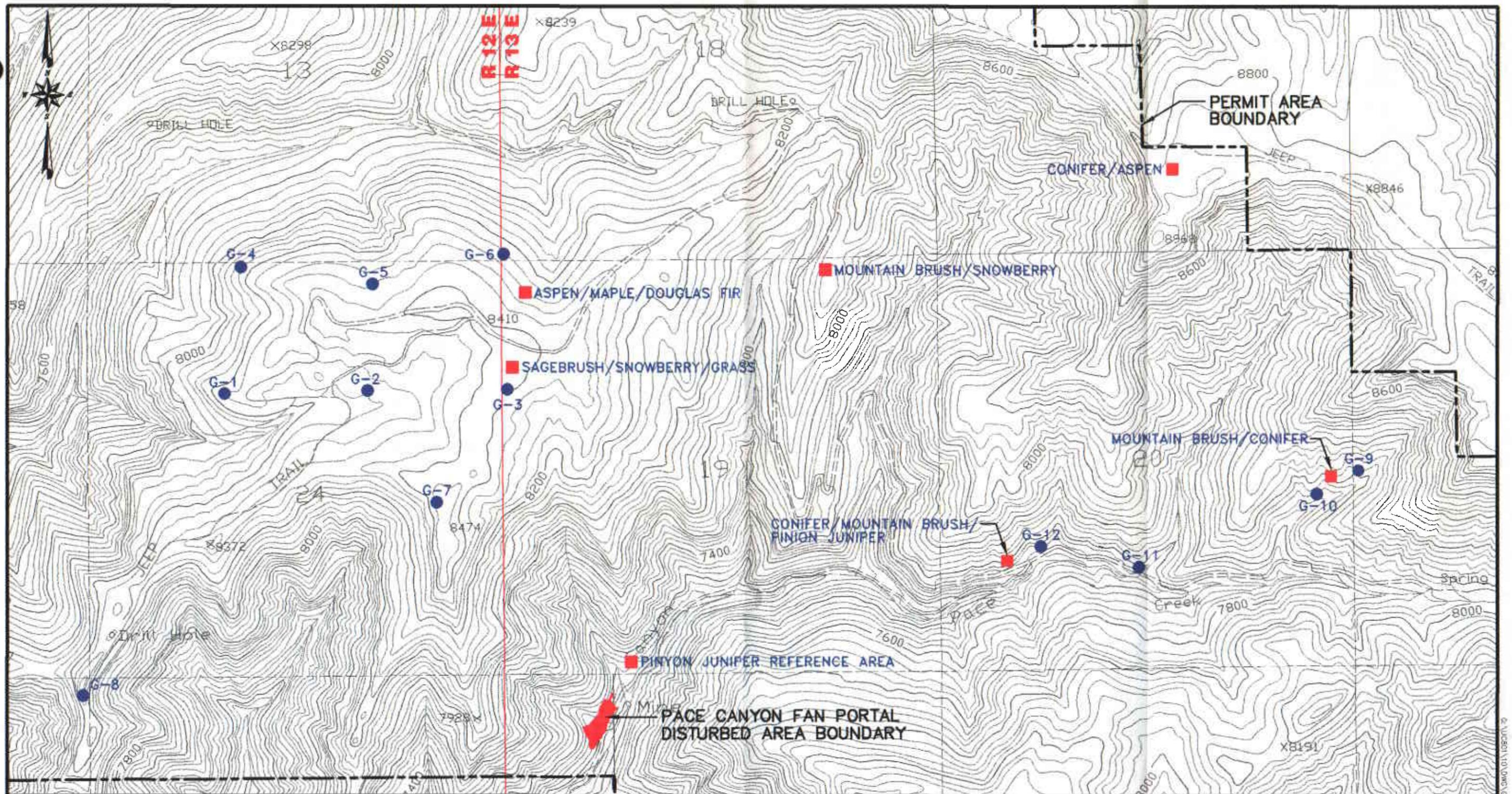


FIGURE 3-1. VEGETATION REFERENCE AREAS

ATTACHMENT 3-1
VEGETATION INVENTORY
NRCS LETTER

add to the back of existing information

United States Department of Agriculture



Natural Resources Conservation Service
540 West Price River Drive
Field Office
Price, UT 84501
(435) 637-0041
FAX (435) 637-3146

June 3, 2005

REC'D JUN - 6 2005

Ms Vicky Miller
Canyon Fuel Company, LLC
Dugout Canyon Mine
P.O. Box 1029
Wellington, UT 84542

Re: Vegetation Production of Proposed Degas Wells G7-G13 and GUG0105/DUG0205

Dear Ms Miller,

Following our visit to the proposed degas wells for Dugout Canyon Mine, I have made the following determinations for vegetative production and overall, health and trend of the sites. The three ecotypes that will be described in relation to these proposed well sites are sagebrush/grass and browse. It is noted that all of the sites have previously been disturbed (except G13) with differing levels of success in the reestablishment of the Potential Natural Community (PNC).

For a high seral (good condition) rating to be obtained in the *shallow loam sagebrush areas* (Well G7), percent air-dry weight for the primary functional groups should be as such; herbaceous 55-65%, forbs 5-15% and shrubs 25-35%. Although the site had already been disturbed, it was apparent that it was similar to the surrounding undisturbed areas of the same soil mapping unit and Ecological Site Description (ESD). It is apparent that past management practices (grazing and/or fire management) have allowed the shrub (mainly mountain sage brush) to surpass the 25-35%, while the herbaceous production has declined. Although the annual production for the site (1,200 lbs acre⁻¹) is representative of the recent climatic conditions we have experienced, there has been a slight shift in functional group composition (i.e. increase in shrub biomass with a decline in herbaceous biomass).

Well locations G9-13 & DUG0105/DUG0205 are all located in *very steep stony loam browse areas* that have all been previously disturbed (with the exception of G13) and show little resemblance to the PNC for the sites. For this reason, I will reference surrounding areas that have not historically been disturbed and use these values for production estimates. In a high seral state (good condition), this site would demonstrate the following characteristics in regards to annual production; herbaceous 20-30%, forbs 10-15% and shrubs 60-70%. Due to the nature of these sites (high shrub component) and resilience to drought (compared to sites with a higher herbaceous component), production (1,000 lbs acre⁻¹) and functional groups are more representative to the PNC.

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Well location G8 is located within *stony loam browse* that has been previously disturbed, but has shown a higher success in reaching the PNC for the site. In a high seral state (good condition), this site would demonstrate the following characteristics in regards to annual production; herbaceous 15-25%, forbs 10-15% and shrubs 65-75%. Similar to well sites G9-13, the nature of this site along with the higher success of vegetative reestablishment, production (1,200 lbs acre⁻¹) and functional groups are more representative to the PNC.

Please feel free to contact me if you have any further questions or concerns.

Sincerely,



M. Dean Stacy
Range Management Specialist
USDA-NRCS, Price FO

cc: Barry Hamilton, Assistant State Conservationist for Field Operations, Price AO
Gary Roeder, Area Resource Conservationist, Price AO
Wayne Greenhalgh, District Conservationist, Price FO

**VEGETATION OF THE
DE-GAS BOREHOLE SITES:
G-11, G-12 & REFERENCE AREAS**

**FOR THE
DUGOUT CANYON MINE**



Prepared by

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Patrick D. Collins, Ph.D.

for

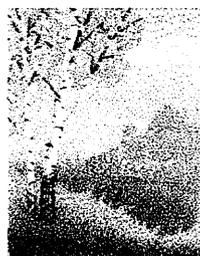
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Dugout Canyon Mine
P.O. Box 1029
Wellington, UT 84542

November 2005



VEGETATION OF THE
DE-GAS BOREHOLE SITES:
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INTRODUCTION

Recently, Canyon Fuel Company has made plans to develop borehole sites as part of a de-gasification process to facilitate coal mining operations at the Dugout Canyon Mine. Permitting of the degas drill sites 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. Earlier reports have been submitted to address the plant communities to be impacted by other drill sites. The first of these reports was called *Vegetation of the Dugout Canyon Mine De-gas Borehole Sites* (July 2003). This report quantitatively described the vegetation proposed for disturbance and reference areas chosen for future revegetation success standards on sites G-1, G-2, G-3, G-4, G-5, G-6. A report was later written for the next drill sites to be constructed called *Vegetation of the De-gas Borehole Sites: G-8, G-9, G-10 & Reference Areas* (August 2005). The report herein describes the plant communities and reference areas for the next sequence of drill sites to be permitted, or G-11 and G-12.

In order to develop the drill sites, a small amount of land has been proposed to be disturbed at each location. Each proposed borehole drill pad is approximately 200 ft. x 300 ft in size. The plant communities proposed for disturbance at each of these sites have been described and sampled with the results provided in this report. A sensitive plant species survey was also conducted at the sites.

Like the earlier developed degas borehole sites, and in an attempt to minimize disturbance to the

marked in the field using a GPS instrument. The coordinates for the proposed degas drill pads and reference areas are given below.

GPS COORDINATES FOR DUGOUT CANYON MINE DE-GAS BOREHOLE SITES G-11, G-12 & REFERENCE AREAS				
Waypoint Name	Zone	Easting	Northing	Notes
DUGG11	12	0544190	4391747	Borehole Site G-11
DUGG12	12	0543777	4391802	Borehole Site G-12
DUG9RF	12	0544946	4392087	Reference Area for G-11 (plus G-09, G-10)
DUG12R	12	0543690	4391789	Reference Area for G-12 (plus G-13, G-15)

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 boundaries included 100 ft outside the proposed drill site. The transect placement technique was employed with the goal to adequately sample a representative subset of the entire site as a whole. Once the transects were established, quadrat locations for sampling were chosen using random numbers from the transect lines with the objective to record data without preconceived bias.

Cover and Composition

Cover estimates were made using ocular methods with meter square quadrats. Species composition, cover by species, and relative frequencies were also assessed from the quadrats. Additional information recorded on the raw data sheets were: estimated precipitation, slope, exposure, grazing use, animal disturbance and other appropriate notes. Plant nomenclature follows "A Utah Flora" (Welsh et al., 2003).

Woody Species Density

Density of woody plant species for the proposed disturbed and reference areas were estimated using the point-quarter method. In this method, random points were placed on the sample sites and measured into four quarters. The distances to the nearest woody plant species were then recorded in each quarter. The average point-to-individual distance was equal to the square root of the mean area per individual. The number of individuals per acre was the end results of the calculations.

Sample Size & Adequacy

Sampling adequacy for cover and density was attempted by using the formula given below.

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

conducted. To initiate the study, appropriate agencies were consulted (e.g. *Utah Natural Heritage Program*) and other sources were reviewed (sensitive species files at *Mt. Nebo Scientific, Inc.*) for potential plant species that are known to be rare, endemic, threatened, endangered or otherwise sensitive in the study area.

Raw Data

The raw data for cover have been summarized on a spreadsheet and were included in the Appendix of this report.

RESULTS

Borehole Site G-11

As previously mentioned, to minimize impacts to the native plant communities, attempts were made by Canyon Fuel to position the degasification drill sites in areas that have been disturbed previously by other types of activities. Borehole Site G-11 was such an area. Much of this site had already been disturbed by road construction (see photographs). Therefore, in an attempt to provide vegetation data of the current conditions, half of the sample quadrats were placed in those areas already disturbed (roadsides), while the other half were placed in the adjacent undisturbed plant community. The data were later combined to provide an average of the current conditions in both areas together. However, using the raw data provided in this report, these data could be

separated to show the differences between the disturbed and undisturbed areas of G-11.

The dominant plant species of Borehole Site G-11 were big sagebrush (*Artemisia tridentata*), Utah serviceberry (*Amelanchier utahensis*), and bindweed (*Convolvulus arvensis*). All plant species encountered in the sample quadrats are shown in Table 1. The total living cover (overstory and understory combined) of this site was estimated at 29.85% (Table 2). Forbs dominated the living cover, or composed 50.40% of it, followed by woody species at 38.93%, and grasses at 10.67% (Table 2). Total woody species density of the site was estimated at 1,170 plants per acre and was dominated by rubber rabbitbrush (*Chrysothamnus nauseosus*) and big sagebrush (Table 3).

Reference Area for G-11 (G-09/G-10)

A reference area for future standards of success was chosen in a similar plant community as the undisturbed areas of Borehole Site G-11. This community has been used for a reference area for other drill sites proposed for disturbance in previous reports (Borehole Sites G-09 and G-10). This reference area is the site of an undisturbed plant community transitional between mountain brush and conifer (see photographs).

Total living cover of this reference area was 46.75%, 15.00% of which was from overstory cover (Table 5). Also shown on Table 5, woody species dominated the composition here at 48.73%, followed by forbs (29.76%) and grasses (21.51%). The most common understory species were

Salina wildrye (*Elymus salinus*), snowberry (*Symphoricarpos oreophilus*), and Douglas Fir (*Pseudotsuga menziesii*). The most common overstory species by far was Douglas Fir (Table 4).

The total number of plants per acre in the woody species density measurements was 1,149 (Table 6) and dominated by broom snakeweed (*Gutierrezia sarothrae*) and snowberry.

Borehole Site G-12

Like the proposed borehole site described above, G-12 had already been disturbed previously by road construction activities. Sample quadrats in this area were again placed partly in the disturbed area and partly in the adjacent undisturbed plant community.

Degas Borehole Site G-12 was dominated by big sagebrush, Douglas Fir, and knotweed (*Polygonum aviculare*). A list of the other species present in the sample quadrats is shown on Table 7. The combined total living cover of this site was estimated at 52.75% (Table 8). This cover was divided by forbs at 48.87%, woody species at 44.80%, and grasses at 6.33% (Table 8). Total woody species density of the site was 1,125 individuals per acre; the dominant species in these measurements were big sagebrush, rubber rabbitbrush, and Douglas fir (Table 9).

Reference Area for G-12

A reference area was chosen near the proposed disturbed degas site to represent future standards.

Even though the degas site of which this reference area was chosen to represent was previously disturbed, the reference area was an undisturbed plant community. This community was transitional between confers, pinyon-juniper and mountain brush with dominant species including pinyon pine (*Pinus edulis*), Douglas fir, Salina Wildrye, and Utah serviceberry (Table 10). The combined total living cover was 63.40%, and was comprised of 77.37% trees and shrubs, 22.23% grasses, and 0.40% forbs (Table 11). The woody species density was estimated at 1,089 plants per acre (Table 12) and was dominated by big sagebrush, pinyon pine, Utah serviceberry, and Utah Juniper (*Juniperus osteosperma*).

Threatened & Endangered Plant Species Survey

State databases revealed only one potential sensitive species to be located in the vicinity of the proposed disturbed borehole sites. This plant was canyon vetch (*Hedysarum occidentale* var. *canone*). Each proposed disturbed area was surveyed in the field for canyon vetch (or any other unusual or sensitive plants). This survey was done prior to recording the quantitative data used to describe the major plant communities of the study areas. In addition, more searching for sensitive species was done during quantitative sampling of the areas. No rare, endemic, threatened or endangered or otherwise sensitive species were found in the study areas.

DISCUSSION

Statistical tests were employed to compare the data means of the proposed disturbed sites (G-11, G-12) with the reference areas. When the total combined cover (understory plus overstory) of G-11 was compared with its reference area, cover of the reference was significantly greater with a probability level of <0.05 (Fig. 1). A woody species density comparison suggested no significant difference between the two (Fig. 2). When the cover and density for G-12 were compared with its reference area, the results were not significantly different (Figs. 1 and 2, respectively).

With one exception (cover values of G-11) the statistical tests suggest that there were no significant differences in the proposed disturbed areas when compared with the reference areas. Closer scrutiny shows that when other parameters are reviewed, the differences may be more pronounced (e.g. desirable species present and species diversity). These differences no doubt were the result of the previous activities that caused disturbances to the native plant communities of the proposed new degas sites. Because of this many of the species present here were "weedy" exotics, or species that would not be acceptable in high quantities following final revegetation. Therefore, the reference areas chosen for revegetation success standards are in effect more demanding than they would have been if the standards were based on the existing conditions of the proposed degas drill sites. In other words, achieving these standards at the time of final revegetation would result in leaving the sites in better condition than before. Based on conversations with representatives from Canyon Fuel, this is an acceptable design plan.

Table 1: Dugout Mine Degas Site G-11. Mean percent cover, standard deviation and percent frequency by species.

	Mean Percent	Standard Deviation	Percent Frequency
OVERSTORY			
<i>Amelanchier utahensis</i>	4.00	12.00	10.00
<i>Pseudotsuga menziesii</i>	1.00	4.36	5.00
UNDERSTORY			
TREES & SHRUBS			
<i>Acer glabrum</i>	0.05	0.22	5.00
<i>Amelanchier utahensis</i>	0.25	1.09	5.00
<i>Artemisia tridentata</i>	5.35	10.43	30.00
<i>Cercocarpus montanus</i>	1.00	3.39	10.00
<i>Chrysothamnus nauseosus</i>	1.25	2.68	20.00
<i>Gutierrezia sarothrae</i>	1.50	2.67	30.00
<i>Pseudotsuga menziesii</i>	0.50	2.18	5.00
<i>Symphoricarpos oreophilus</i>	0.25	1.09	5.00
FORBS			
<i>Cirsium sp.</i>	1.15	4.02	10.00
<i>Convolvulus arvensis</i>	2.85	6.27	20.00
<i>Cryptantha flavoculata</i>	0.75	1.61	20.00
<i>Cynoglossum officinale</i>	2.55	6.76	20.00
<i>Erigeron sp.</i>	1.10	3.39	15.00
<i>Haplopappus lanceolatus</i>	0.45	1.36	10.00
<i>Hymenoxys richardsonii</i>	2.10	3.59	40.00
<i>Polygonum aviculare</i>	0.35	1.53	5.00
GRASSES			
<i>Elymus salinus</i>	1.40	2.58	30.00
<i>Elymus trachycaulus</i>	1.50	4.50	15.00
<i>Poa pratensis</i>	0.50	2.18	5.00

Table 2: Dugout Mine Degas Site G-11. Total Cover, standard deviation and sample size.

TOTAL COVER	% Mean Cover	Standard Deviation	Sample Size
Overstory	5.00	12.45	20
Understory	24.85	12.94	20
Litter	10.70	5.57	20
Bareground	36.00	23.85	20
Rock	28.45	21.44	20
Overstory + Understory	29.85	14.96	20
% COMPOSITION			
Trees & Shrubs	38.93	31.82	20
Forbs	50.40	36.46	20
Grasses	10.67	13.82	20

Table 3: Dugout Mine Site G-11. Woody species densities

Species	Individuals Per Acre
<i>Amelanchier utahensis</i>	14.62
<i>Artemisia tridentata</i>	321.67
<i>Cercocarpus montanus</i>	131.59
<i>Acer glabrum</i>	14.62
<i>Chrysothamnus nauseosus</i>	438.64
<i>Gutierrezia sarothrae</i>	160.84
<i>Pachistima mysinities</i>	
<i>Pinus edulis</i>	14.62
<i>Pseudotsuga menziesii</i>	43.86
<i>Symphoricarpos oreophilus</i>	29.24
TOTAL	1169.72

**Table 4: Dugout Mine Degas Reference Area for G-11 (also G-9/G-10).
Mean percent cover, standard deviation and percent frequency by species.**

	Mean Percent	Standard Deviation	Percent Frequency
OVERSTORY			
<i>Amelanchier utahensis</i>	1.75	5.31	10.00
<i>Cercocarpus montanus</i>	0.75	3.27	5.00
<i>Pinus edulis</i>	2.50	10.90	5.00
<i>Pseudotsuga menziesii</i>	10.00	21.51	20.00
UNDERSTORY			
TREES & SHRUBS			
<i>Agropyron cristatum</i>	0.25	1.09	5.00
<i>Amelanchier utahensis</i>	5.00	12.04	20.00
<i>Artemisia tridentata</i>	0.25	1.09	5.00
<i>Cercocarpus montanus</i>	0.50	1.50	10.00
<i>Gutierrezia sarothrae</i>	3.70	4.21	55.00
<i>Pseudotsuga menziesii</i>	4.25	10.99	20.00
<i>Symphoricarpos oreophilus</i>	4.75	9.93	30.00
FORBS			
<i>Cryptantha flavoculata</i>	0.75	1.61	20.00
<i>Cynoglossum officinale</i>	0.25	1.09	5.00
<i>Eriogonum sp.</i>	1.30	3.12	15.00
<i>Haplopappus lanceolatus</i>	3.50	4.54	55.00
<i>Machaeranthera grindelioides</i>	0.25	1.09	5.00
<i>Oenothera caespitosa</i>	0.25	1.09	5.00
GRASSES			
<i>Elymus salinus</i>	5.25	6.02	55.00
<i>Poa pratensis</i>	1.50	3.91	15.00

Table 5: Dugout Mine Degas Reference Area for G-11 (also for G-9/G-10). Total Cover, standard deviation and sample size.

TOTAL COVER	% Mean Cover	Standard Deviation	Sample Size
COVER			
Overstory	15.00	22.47	20
Understory	31.75	16.83	20
Litter	10.00	6.12	20
Bareground	36.50	21.28	20
Rock	21.75	20.33	20
Overstory + Understory	46.75	28.78	20
% COMPOSITION			
Trees & Shrubs	48.73	31.58	20
Forbs	29.76	28.01	20
Grasses	21.51	21.44	20

Table 6: Dugout Mine Degas Reference Area for G-11 (also for G-9/G-10). Woody species densities.

Species	Individuals Per Acre
<i>Amelanchier utahensis</i>	114.86
<i>Artemisia tridentata</i>	14.36
<i>Cercocarpus montanus</i>	71.78
<i>Chrysothamnus nauseosus</i>	28.71
<i>Gutierrezia sarothrae</i>	488.14
<i>Juniperus osteosperma</i>	14.36
<i>Pachistima mysinities</i>	28.71
<i>Pseudotsuga menziesii</i>	71.78
<i>Symphoricarpos oreophilus</i>	315.85
TOTAL	1148.55

Table 7: Dugout Mine Degas Site G-12. Mean percent cover, standard deviation and percent frequency by species.

	Mean Percent	Standard Deviation	Percent Frequency
OVERSTORY			
<i>Amelanchier utahensis</i>	2.50	10.90	5.00
<i>Juniperus osteosperma</i>	2.25	6.80	15.00
<i>Pinus edulis</i>	2.00	8.72	5.00
<i>Pseudotsuga menziesii</i>	6.00	18.28	10.00
UNDERSTORY			
TREES & SHRUBS			
<i>Amelanchier utahensis</i>	0.75	3.27	5.00
<i>Artemisia tridentata</i>	8.75	15.88	35.00
<i>Gutierrezia sarothrae</i>	0.25	1.09	5.00
<i>Juniperus communis</i>	1.75	7.63	5.00
<i>Juniperus osteosperma</i>	0.75	2.38	10.00
<i>Mahonia repens</i>			5.00
<i>Pinus edulis</i>	2.25	6.80	10.00
<i>Prunus virginiana</i>	0.25	1.09	5.00
<i>Pseudotsuga menziesii</i>	2.50	8.14	10.00
<i>Rosa woodsii</i>	0.25	1.09	5.00
<i>Symphoricarpos oreophilus</i>	0.75	3.27	5.00
FORBS			
<i>Antennaria microphylla</i>	0.50	2.18	5.00
<i>Artemisia dracunculus</i>	0.90	1.84	20.00
<i>Cirsium sp.</i>	0.75	3.27	5.00
<i>Convolvulus arvensis</i>	2.25	6.02	15.00
<i>Cynoglossum officinale</i>	3.25	5.76	30.00
<i>Erigeron sp.</i>	0.50	1.50	10.00
<i>Hymenoxys richardsonii</i>	1.10	2.23	20.00
<i>Iva axillaris</i>	4.75	11.45	20.00
<i>Oenothera caespitosa</i>	0.25	1.09	5.00
<i>Polygonum aviculare</i>	5.25	15.93	10.00
GRASSES			
<i>Bromus carinatus</i>	0.75	2.38	10.00
<i>Bromus tectorum</i>	0.25	1.09	5.00
<i>Elymus salinus</i>	0.50	1.50	10.00
<i>Poa pratensis</i>	0.25	1.09	5.00
<i>Stipa hymenoides</i>	0.25	1.09	5.00

Table 8: Dugout Mine Degas Site G-12. Total Cover, standard deviation and sample size.

TOTAL COVER	% Mean Cover	Standard Deviation	Sample Size
COVER			
Overstory	12.75	21.53	20
Understory	40.00	19.10	20
Litter	23.90	20.75	20
Bareground	20.15	18.55	20
Rock	15.95	14.43	20
Overstory + Understory	52.75	29.52	20
% COMPOSITION			
Trees & Shrubs	44.80	42.42	20
Forbs	48.87	40.18	20
Grasses	6.33	11.41	20

Table 9: Dugout Mine Degas Site G-12. Woody species densities.

Species	Individuals Per Acre
<i>Amelanchier utahensis</i>	14.06
<i>Artemisia tridentata</i>	562.52
<i>Acer glabrum</i>	14.06
<i>Chrysothamnus nauseosus</i>	154.69
<i>Gutierrezia sarothrae</i>	14.06
<i>Juniperus communis</i>	14.06
<i>Juniperus osteosperma</i>	70.31
<i>Pinus edulis</i>	70.31
<i>Prunus virginiana</i>	42.19
<i>Pseudotsuga menziesii</i>	112.50
<i>Rosa woodsii</i>	42.19
<i>Symphoricarpos oreophilus</i>	14.06
TOTAL	1125.03

**Table 10: Dugout Mine Degas Site Reference Area for G-12 (and G-13, G-15).
Mean percent cover, standard deviation and percent frequency by species.**

	Mean Percent	Standard Deviation	Percent Frequency
OVERSTORY			
<i>Amelanchier utahensis</i>	4.00	10.56	15.00
<i>Cercocarpus montanus</i>	0.75	3.27	5.00
<i>Juniperus osteosperma</i>	7.25	21.76	10.00
<i>Pinus edulis</i>	10.25	22.05	20.00
<i>Pseudotsuga menziesii</i>	8.75	19.99	20.00
UNDERSTORY			
TREES & SHRUBS			
<i>Amelanchier utahensis</i>	3.50	11.08	15.00
<i>Artemisia tridentata</i>	2.50	5.59	20.00
<i>Cercocarpus montanus</i>	3.50	7.76	20.00
<i>Chrysothamnus nauseosus</i>	0.40	1.74	5.00
<i>Gutierrezia sarothrae</i>	0.90	3.92	5.00
<i>Juniperus osteosperma</i>	3.75	9.86	15.00
<i>Opuntia polyacantha</i>	0.25	1.09	5.00
<i>Pinus edulis</i>	3.50	10.62	10.00
<i>Pseudotsuga menziesii</i>	5.75	16.68	15.00
<i>Symphoricarpos oreophilus</i>	2.45	5.05	25.00
FORBS			
<i>Cryptantha flavoculata</i>	0.10	0.44	5.00
GRASSES			
<i>Elymus salinus</i>	4.00	5.39	40.00
<i>Poa secunda</i>	0.80	2.38	15.00
<i>Stipa hymenoides</i>	1.00	2.55	15.00

Table 11: Dugout Mine Degas Site. Reference Area for G-12 (also for G-13, G-15). Total Cover, standard deviation and sample size.

	Mean Percent	Standard Deviation	Sample Size
TOTAL COVER			
Overstory	31.00	30.19	20
Understory	32.40	14.96	20
Litter	21.60	15.83	20
Bareground	12.25	10.06	20
Rock	33.75	20.55	20
Overstory + Understory	63.40	34.81	20
% COMPOSITION			
Trees & Shrubs	77.37	24.72	20
Forbs	0.40	1.74	20
Grasses	22.23	25.02	20

Table 12: Dugout Mine Degas Reference Area for G-12 (also G-13, G-15). Woody species densities.

Species	Individuals Per Acre
<i>Amelanchier utahensis</i>	136.07
<i>Artemisia tridentata</i>	367.40
<i>Cercocarpus montanus</i>	149.68
<i>Gutierrezia sarothrae</i>	13.61
<i>Juniperus osteosperma</i>	108.86
<i>Opuntia polyacantha</i>	13.61
<i>Pinus edulis</i>	136.07
<i>Pseudotsuga menziesii</i>	95.25
<i>Symphoricarpos oreophilus</i>	68.04
TOTAL	1088.59

FIG. 1. A statistical comparison (Student's t-tests) of the **total living cover** between the proposed disturbed borehole sites and their reference areas.

	<u>\bar{x}</u>	<u>s</u>	<u>n</u>	<u>t</u>	<u>df</u>	<u>SL</u>
Borehole Site G-11						
<u>Proposed Disturbed:</u>	29.85	14.96	20			
<u>Reference Area:</u>	46.75	28.78	20			
t-test				-2.330	38	p<.05
Borehole Site G-12						
<u>Proposed Disturbed:</u>	52.75	29.52	20			
<u>Reference Area:</u>	63.40	34.81	20			
t-test				-1.044	38	N.S.

\bar{x} = mean
 s = standard deviation
 n = sample size
 t = Student's t-value
 df = degrees of freedom
 SL = Significance Level
 N.S. = Non-Significant

FIG. 2. A statistical comparison (Student's t-tests) of the **woody species density** between the proposed disturbed borehole sites and their reference areas.

	<u>\bar{x}</u>	<u>s</u>	<u>n</u>	<u>t</u>	<u>df</u>	<u>SL</u>
Borehole Site G-11						
<u>Proposed Disturbed:</u>	1169.72	1385.36	20			
<u>Reference Area:</u>	1148.55	1113.54	20			
t-test				0.053	38	N.S.
Borehole Site G-12						
<u>Proposed Disturbed:</u>	1125.03	1069.40	20			
<u>Reference Area:</u>	1088.59	663.68	20			
t-test				0.129	28	N.S.

\bar{x} = mean
s = standard deviation
n = sample size
t = Student's t-value
df = degrees of freedom
SL = Significance Level
N.S. = Non-Significant

COLOR PHOTOGRAPHS
OF THE
STUDY AREAS



Borehole Site G-11



Reference Area for Site G-11



Borehole Site G-12



Borehole Site G-12

APPENDIX

(Raw Data)

CANYON FUELS

Dugout Mine

Site G-11

Slope: 2-32 deg

1 thru 10 Undisturbed

Exposure: S-SE

Sample Date: 5-9 July 2005

1.00 2.00 3.00 4.00 5.00 6.00 7.00 8.00

OVERSTORY

<i>Amelanchier utahensis</i>	0.00	0.00	0.00	0.00	40.00	0.00	0.00	40.00
<i>Pseudotsuga menziesii</i>	0.00	0.00	20.00	0.00	0.00	0.00	0.00	0.00

UNDERSTORY

SHRUBS

<i>Acer glabrum</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Amelanchier utahensis</i>	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00
<i>Artemisia tridentata</i>	40.00	15.00	0.00	0.00	5.00	0.00	0.00	0.00
<i>Cercocarpus montanus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00
<i>Chrysothamnus nauseosus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Gutierrezia sarothrae</i>	0.00	0.00	5.00	0.00	0.00	0.00	10.00	3.00
<i>Pseudotsuga menziesii</i>	0.00	0.00	0.00	10.00	0.00	0.00	0.00	0.00
<i>Symphoricarpos oreophilus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00

FORBS

<i>Cirsium sp.</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Convolvulus arvensis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Cryptantha flavoculata</i>	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00
<i>Cynoglossum officinale</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Erigeron sp.</i>	0.00	0.00	0.00	0.00	0.00	15.00	0.00	0.00
<i>Haplopappus lanceolatus</i>	5.00	0.00	0.00	4.00	0.00	0.00	0.00	0.00
<i>Hymenoxys richardsonii</i>	0.00	15.00	5.00	1.00	2.00	0.00	5.00	0.00
<i>Polygonum aviculare</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

GRASSES

<i>Elymus salinus</i>	0.00	0.00	5.00	0.00	3.00	0.00	3.00	2.00
<i>Elymus trachycaulus</i>	5.00	20.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Poa pratensis</i>	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

COVER

Overstory	0.00	0.00	20.00	0.00	40.00	0.00	0.00	40.00
Understory	60.00	50.00	15.00	15.00	15.00	15.00	20.00	15.00
Litter	10.00	15.00	10.00	5.00	15.00	10.00	15.00	20.00
Bareground	15.00	20.00	10.00	15.00	15.00	20.00	10.00	60.00
Rock	15.00	15.00	65.00	65.00	55.00	55.00	55.00	5.00

% COMPOSITION

Shrubs	66.67	30.00	33.33	66.67	66.67	0.00	50.00	86.67
Forbs	8.33	30.00	33.33	33.33	13.33	100.00	35.00	0.00
Grasses	25.00	40.00	33.33	0.00	20.00	0.00	15.00	13.33
Overstory + Understory	60.00	50.00	35.00	15.00	55.00	15.00	20.00	55.00

11-20 Pre Disturbed

9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	15.00	0.00	7.00	25.00	0.00
15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	10.00	5.00	5.00	0.00
0.00	5.00	0.00	0.00	0.00	5.00	2.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	7.00	20.00	20.00	0.00	0.00	0.00	0.00	0.00
5.00	3.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	3.00	3.00	0.00	20.00
5.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	5.00	0.00	0.00	0.00	4.00	0.00	0.00	5.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35.00	25.00	7.00	20.00	20.00	25.00	15.00	20.00	40.00	20.00
25.00	10.00	3.00	5.00	1.00	15.00	10.00	10.00	10.00	10.00
20.00	10.00	85.00	65.00	70.00	25.00	60.00	50.00	40.00	60.00
20.00	55.00	5.00	10.00	9.00	35.00	15.00	20.00	10.00	10.00
42.86	20.00	0.00	0.00	0.00	84.00	80.00	60.00	75.00	0.00
42.86	40.00	100.00	100.00	100.00	16.00	20.00	40.00	12.50	100.00
14.29	40.00	0.00	0.00	0.00	0.00	0.00	0.00	12.50	0.00
35.00	25.00	7.00	20.00	20.00	25.00	15.00	20.00	40.00	20.00

CANYON FUELS

Dugout Mine

Site G-11

Slope: 2-32 deg

Exposure: S-SE

Sample Date: 5-9 July 2005

19.00	20.00	Mean	SDev	Freq	
					OVERSTORY
0.00	0.00	4.00	12.00	10.00	<i>Amelanchier utahensis</i>
0.00	0.00	1.00	4.36	5.00	<i>Pseudotsuga menziesii</i>
					UNDERSTORY
					SHRUBS
0.00	0.00	0.05	0.22	5.00	<i>Acer glabrum</i>
0.00	0.00	0.25	1.09	5.00	<i>Amelanchier utahensis</i>
0.00	0.00	5.35	10.43	30.00	<i>Artemisia tridentata</i>
0.00	0.00	1.00	3.39	10.00	<i>Cercocarpus montanus</i>
0.00	5.00	1.25	2.68	20.00	<i>Chrysothamnus nauseosus</i>
0.00	0.00	1.50	2.67	30.00	<i>Gutierrezia sarothrae</i>
0.00	0.00	0.50	2.18	5.00	<i>Pseudotsuga menziesii</i>
0.00	0.00	0.25	1.09	5.00	<i>Symphoricarpos oreophilus</i>
					FORBS
0.00	18.00	1.15	4.02	10.00	<i>Cirsium sp.</i>
10.00	0.00	2.85	6.27	20.00	<i>Convolvulus arvensis</i>
0.00	0.00	0.75	1.61	20.00	<i>Cryptantha flavoculata</i>
25.00	0.00	2.55	6.76	20.00	<i>Cynoglossum officinale</i>
0.00	0.00	1.10	3.39	15.00	<i>Erigeron sp.</i>
0.00	0.00	0.45	1.36	10.00	<i>Haplopappus lanceolatus</i>
0.00	0.00	2.10	3.59	40.00	<i>Hymenoxys richardsonii</i>
0.00	7.00	0.35	1.53	5.00	<i>Polygonum aviculare</i>
					GRASSES
0.00	0.00	1.40	2.58	30.00	<i>Elymus salinus</i>
0.00	0.00	1.50	4.50	15.00	<i>Elymus trachycaulus</i>
0.00	0.00	0.50	2.18	5.00	<i>Poa pratensis</i>
					COVER
0.00	0.00	5.00	12.45		Overstory
35.00	30.00	24.85	12.94		Understory
10.00	5.00	10.70	5.57		Litter
15.00	55.00	36.00	23.85		Bareground
40.00	10.00	28.45	21.44		Rock
					% COMPOSITION
0.00	16.67	38.93	31.82		Shrubs
100.00	83.33	50.40	36.46		Forbs
0.00	0.00	10.67	13.82		Grasses
35.00	30.00	29.85	14.96		Overstory + Understory

CANYON FUELS
 Dugout Mine
 Reference Area Site G-11 (G-9, G-10)
 Conifer/ Mtn. Brush

Slope: 25 deg

Exposure: S

Sample Date: 5-9 July 2005

1.00 2.00 3.00 4.00 5.00 6.00 7.00

OVERSTORY

<i>Amelanchier utahensis</i>	0.00	0.00	0.00	0.00	0.00	20.00	0.00
<i>Cercocarpus montanus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Pinus edulis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Pseudotsuga menziesii</i>	0.00	25.00	0.00	0.00	0.00	0.00	0.00

UNDERSTORY

SHRUBS

<i>Agropyron cristatum</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Amelanchier utahensis</i>	0.00	0.00	0.00	0.00	0.00	10.00	0.00
<i>Artemisia tridentata</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Cercocarpus montanus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Gutierrezia sarothrae</i>	5.00	0.00	2.00	7.00	0.00	0.00	10.00
<i>Pseudotsuga menziesii</i>	0.00	25.00	0.00	0.00	0.00	0.00	0.00
<i>Symphoricarpos oreophilus</i>	0.00	5.00	0.00	0.00	0.00	0.00	0.00

FORBS

<i>Cryptantha flavoculata</i>	5.00	2.00	0.00	5.00	3.00	0.00	0.00
<i>Cynoglossum officinale</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Eriogonum sp.</i>	0.00	0.00	8.00	8.00	0.00	0.00	10.00
<i>Haplopappus lanceolatus</i>	5.00	3.00	0.00	5.00	7.00	5.00	0.00
<i>Machaeranthera grindelioides</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Oenothera caespitosa</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00

GRASSES

<i>Elymus salinus</i>	10.00	5.00	0.00	0.00	10.00	5.00	5.00
<i>Poa pratensis</i>	0.00	0.00	0.00	0.00	15.00	0.00	0.00

COVER

Overstory	0.00	25.00	0.00	0.00	0.00	20.00	0.00
Understory	25.00	40.00	10.00	25.00	35.00	20.00	25.00
Litter	10.00	10.00	5.00	5.00	25.00	15.00	5.00
Bareground	40.00	40.00	75.00	25.00	35.00	60.00	55.00
Rock	25.00	10.00	10.00	45.00	5.00	5.00	15.00

% COMPOSITION

Shrubs	20.00	75.00	20.00	28.00	0.00	50.00	40.00
Forbs	40.00	12.50	80.00	72.00	28.57	25.00	40.00
Grasses	40.00	12.50	0.00	0.00	71.43	25.00	20.00

Overstory + Understory	25.00	65.00	10.00	25.00	35.00	40.00	25.00
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8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00
0.00	0.00	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	50.00	0.00	0.00	0.00
0.00	0.00	0.00	50.00	75.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	40.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	5.00	0.00
10.00	0.00	0.00	0.00	0.00	15.00	0.00	5.00	5.00	5.00
0.00	0.00	0.00	45.00	10.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	35.00	0.00	30.00	5.00	0.00	0.00	15.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00	20.00	0.00	0.00	0.00	5.00	0.00	5.00	0.00	5.00
0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00
10.00	20.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	15.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	15.00	50.00	75.00	0.00	50.00	0.00	15.00	0.00
25.00	40.00	75.00	50.00	45.00	35.00	5.00	10.00	35.00	25.00
5.00	10.00	5.00	10.00	15.00	5.00	5.00	10.00	10.00	15.00
60.00	20.00	5.00	20.00	25.00	45.00	15.00	75.00	50.00	45.00
10.00	30.00	15.00	20.00	15.00	15.00	75.00	5.00	5.00	15.00
40.00	0.00	100.00	90.00	100.00	71.43	0.00	50.00	71.43	20.00
20.00	50.00	0.00	0.00	0.00	14.29	100.00	50.00	28.57	20.00
40.00	50.00	0.00	10.00	0.00	14.29	0.00	0.00	0.00	60.00
25.00	40.00	90.00	100.00	120.00	35.00	55.00	10.00	50.00	25.00

CANYON FUELS
Dugout Mine
Reference Area Site G-11 (G-9,
Conifer/ Mtn. Brush

Slope: 25 deg

Exposure: S

Sample Date: 5-9 July 2005

18.00	19.00	20.00	Mean	SDev	Freq	
<hr/>						OVERSTORY
0.00	0.00	0.00	1.75	5.31	10.00	<i>Amelanchier utahensis</i>
0.00	0.00	0.00	0.75	3.27	5.00	<i>Cercocarpus montanus</i>
0.00	0.00	0.00	2.50	10.90	5.00	<i>Pinus edulis</i>
0.00	0.00	50.00	10.00	21.51	20.00	<i>Pseudotsuga menziesii</i>
<hr/>						UNDERSTORY
<hr/>						SHRUBS
0.00	0.00	0.00	0.25	1.09	5.00	<i>Agropyron cristatum</i>
40.00	10.00	0.00	5.00	12.04	20.00	<i>Amelanchier utahensis</i>
0.00	0.00	5.00	0.25	1.09	5.00	<i>Artemisia tridentata</i>
0.00	0.00	0.00	0.50	1.50	10.00	<i>Cercocarpus montanus</i>
5.00	5.00	0.00	3.70	4.21	55.00	<i>Gutierrezia sarothrae</i>
0.00	0.00	5.00	4.25	10.99	20.00	<i>Pseudotsuga menziesii</i>
0.00	5.00	0.00	4.75	9.93	30.00	<i>Symphoricarpus oreophilus</i>
<hr/>						FORBS
0.00	0.00	0.00	0.75	1.61	20.00	<i>Cryptantha flavoculata</i>
0.00	0.00	0.00	0.25	1.09	5.00	<i>Cynoglossum officinale</i>
0.00	0.00	0.00	1.30	3.12	15.00	<i>Eriogonum sp.</i>
0.00	5.00	0.00	3.50	4.54	55.00	<i>Haplopappus lanceolatus</i>
0.00	0.00	0.00	0.25	1.09	5.00	<i>Machaeranthera grindelioides</i>
0.00	0.00	0.00	0.25	1.09	5.00	<i>Oenothera caespitosa</i>
<hr/>						GRASSES
15.00	0.00	0.00	5.25	6.02	55.00	<i>Elymus salinus</i>
0.00	10.00	5.00	1.50	3.91	15.00	<i>Poa pratensis</i>
<hr/>						COVER
0.00	0.00	50.00	15.00	22.47		Overstory
60.00	35.00	15.00	31.75	16.83		Understory
5.00	25.00	5.00	10.00	6.12		Litter
5.00	30.00	5.00	36.50	21.28		Bareground
30.00	10.00	75.00	21.75	20.33		Rock
<hr/>						% COMPOSITION
75.00	57.14	66.67	48.73	31.58		Shrubs
0.00	14.29	0.00	29.76	28.01		Forbs
25.00	28.57	33.33	21.51	21.44		Grasses
<hr/>						Overstory + Understory
60.00	35.00	65.00	46.75	28.78		

CANYON FUELS

Dugout Mine

Site G-12

A-7

Slope: 2-35 deg

Exposure: ENE

Sample Date: 5-9 July 2005

	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00
OVERSTORY								
<i>Amelanchier utahensis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Juniperus osteosperma</i>	25.00	0.00	0.00	0.00	20.00	0.00	0.00	0.00
<i>Pinus edulis</i>	0.00	0.00	40.00	0.00	0.00	0.00	0.00	0.00
<i>Pseudotsuga menziesii</i>	0.00	0.00	0.00	50.00	0.00	0.00	0.00	70.00
UNDERSTORY								
SHRUBS								
<i>Amelanchier utahensis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Artemisia tridentata</i>	0.00	0.00	15.00	10.00	60.00	0.00	25.00	0.00
<i>Gutierrezia sarothrae</i>	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00
<i>Juniperus communis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.00
<i>Juniperus osteosperma</i>	5.00	0.00	0.00	0.00	0.00	10.00	0.00	0.00
<i>Mahonia repens</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Pinus edulis</i>	0.00	25.00	20.00	0.00	0.00	0.00	0.00	0.00
<i>Prunus virginiana</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Pseudotsuga menziesii</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.00
<i>Rosa woodsii</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Symphoricarpos oreophilus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FORBS								
<i>Antennaria microphylla</i>	0.00	0.00	0.00	0.00	0.00	0.00	10.00	0.00
<i>Artemisia dracunculul</i>	0.00	0.00	5.00	5.00	0.00	3.00	0.00	0.00
<i>Cirsium sp.</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Convolvulus arvensis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Cynoglossum officinale</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Erigeron sp.</i>	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00
<i>Hymenoxys richardsonii</i>	0.00	0.00	5.00	0.00	0.00	7.00	5.00	0.00
<i>Iva axillaris</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Oenothera caespitosa</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Polygonum aviculare</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GRASSES								
<i>Bromus carinatus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Bromus tectorum</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Elymus salinus</i>	0.00	0.00	0.00	5.00	5.00	0.00	0.00	0.00
<i>Poa pratensis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Stipa hymenoides</i>	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00
COVER								
Overstory	25.00	0.00	40.00	50.00	20.00	0.00	0.00	70.00
Understory	5.00	25.00	45.00	20.00	65.00	30.00	45.00	70.00
Litter	85.00	45.00	40.00	55.00	10.00	45.00	25.00	28.00
Bareground	1.00	5.00	1.00	5.00	15.00	10.00	20.00	1.00
Rock	9.00	25.00	14.00	20.00	10.00	15.00	10.00	1.00
% COMPOSITION								
Shrubs	100.00	100.00	77.78	50.00	92.31	33.33	66.67	100.00
Forbs	0.00	0.00	22.22	25.00	0.00	50.00	33.33	0.00
Grasses	0.00	0.00	0.00	25.00	7.69	16.67	0.00	0.00
Overstory + Understory	30.00	25.00	85.00	70.00	85.00	30.00	45.00	140.00

9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00
0.00	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	0.00	0.00
0.00	0.00	0.00	20.00	20.00	0.00	0.00	0.00	5.00	0.00
0.00	0.00	0.00	5.00	10.00	20.00	10.00	15.00	0.00	0.00
5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	20.00	5.00	0.00	0.00	0.00	0.00	0.00	45.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	45.00	60.00	0.00
0.00	0.00	5.00	0.00	0.00	10.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50.00	30.00	25.00	35.00	35.00	35.00	10.00	75.00	65.00	45.00
5.00	25.00	5.00	5.00	10.00	25.00	20.00	5.00	25.00	5.00
10.00	10.00	55.00	45.00	45.00	35.00	5.00	15.00	5.00	45.00
35.00	35.00	15.00	15.00	10.00	5.00	65.00	5.00	5.00	5.00
70.00	100.00	0.00	0.00	14.29	0.00	0.00	0.00	0.00	0.00
30.00	0.00	80.00	85.71	85.71	57.14	100.00	100.00	100.00	100.00
0.00	0.00	20.00	14.29	0.00	42.86	0.00	0.00	0.00	0.00
50.00	80.00	25.00	35.00	35.00	35.00	10.00	75.00	65.00	45.00

CANYON FUELS

Dugout Mine

Site G-12

Slope: 2-35 deg

Exposure: ENE

Sample Date: 5-9 July 2005

19.00	20.00	Mean	SDev	Freq	
<hr/>					OVERSTORY
0.00	0.00	2.50	10.90	5.00	<i>Amelanchier utahensis</i>
0.00	0.00	2.25	6.80	15.00	<i>Juniperus osteosperma</i>
0.00	0.00	2.00	8.72	5.00	<i>Pinus edulis</i>
0.00	0.00	6.00	18.28	10.00	<i>Pseudotsuga menziesii</i>
<hr/>					UNDERSTORY
<hr/>					SHRUBS
0.00	0.00	0.75	3.27	5.00	<i>Amelanchier utahensis</i>
0.00	40.00	8.75	15.88	35.00	<i>Artemisia tridentata</i>
0.00	0.00	0.25	1.09	5.00	<i>Gutierrezia sarothrae</i>
0.00	0.00	1.75	7.63	5.00	<i>Juniperus communis</i>
0.00	0.00	0.75	2.38	10.00	<i>Juniperus osteosperma</i>
0.00	5.00			5.00	<i>Mahonia repens</i>
0.00	0.00	2.25	6.80	10.00	<i>Pinus edulis</i>
0.00	5.00	0.25	1.09	5.00	<i>Prunus virginiana</i>
0.00	0.00	2.50	8.14	10.00	<i>Pseudotsuga menziesii</i>
0.00	5.00	0.25	1.09	5.00	<i>Rosa woodsii</i>
0.00	0.00	0.75	3.27	5.00	<i>Symphoricarpos oreophilus</i>
<hr/>					FORBS
0.00	0.00	0.50	2.18	5.00	<i>Antennaria microphylla</i>
0.00	0.00	0.90	1.84	20.00	<i>Artemisia dracunculus</i>
0.00	0.00	0.75	3.27	5.00	<i>Cirsium sp.</i>
0.00	0.00	2.25	6.02	15.00	<i>Convolvulus arvensis</i>
5.00	0.00	3.25	5.76	30.00	<i>Cynoglossum officinale</i>
0.00	0.00	0.50	1.50	10.00	<i>Erigeron sp.</i>
0.00	0.00	1.10	2.23	20.00	<i>Hymenoxys richardsonii</i>
25.00	0.00	4.75	11.45	20.00	<i>Iva axillaris</i>
0.00	5.00	0.25	1.09	5.00	<i>Oenothera caespitosa</i>
0.00	0.00	5.25	15.93	10.00	<i>Polygonum aviculare</i>
<hr/>					GRASSES
0.00	0.00	0.75	2.38	10.00	<i>Bromus carinatus</i>
0.00	0.00	0.25	1.09	5.00	<i>Bromus tectorum</i>
0.00	0.00	0.50	1.50	10.00	<i>Elymus salinus</i>
0.00	0.00	0.25	1.09	5.00	<i>Poa pratensis</i>
0.00	0.00	0.25	1.09	5.00	<i>Stipa hymenoides</i>
<hr/>					COVER
0.00	0.00	12.75	21.53		Overstory
30.00	60.00	40.00	19.10		Understory
5.00	10.00	23.90	20.75		Litter
55.00	20.00	20.15	18.55		Bareground
10.00	10.00	15.95	14.43		Rock
<hr/>					% COMPOSITION
0.00	91.67	44.80	42.42		Shrubs
100.00	8.33	48.87	40.18		Forbs
0.00	0.00	6.33	11.41		Grasses
<hr/>					
30.00	60.00	52.75	29.52		Overstory + Understory

CANYON FUEL
 Dugout Mine
 Site G-12, G-13 Reference Area
 Conifer/ Mtn. Brush/PJ

Slope: 35-38 deg

Exposure: SE

Sample Date: 5-9 July 2005

	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00
OVERSTORY								
<i>Amelanchier utahensis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00
<i>Cercocarpus montanus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Juniperus osteosperma</i>	0.00	0.00	0.00	0.00	75.00	70.00	0.00	0.00
<i>Pinus edulis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Pseudotsuga menziesii</i>	65.00	0.00	0.00	0.00	0.00	0.00	60.00	0.00
UNDERSTORY								
SHRUBS								
<i>Amelanchier utahensis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Artemisia tridentata</i>	0.00	15.00	0.00	5.00	0.00	0.00	0.00	0.00
<i>Cercocarpus montanus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Chrysothamnus nauseosus</i>	0.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Gutierrezia sarothrae</i>	0.00	0.00	18.00	0.00	0.00	0.00	0.00	0.00
<i>Juniperus osteosperma</i>	0.00	0.00	0.00	0.00	0.00	20.00	0.00	0.00
<i>Opuntia polyacantha</i>	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00
<i>Pinus edulis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Pseudotsuga menziesii</i>	35.00	0.00	0.00	0.00	0.00	0.00	70.00	0.00
<i>Symphoricarpos oreophilus</i>	0.00	0.00	0.00	0.00	5.00	0.00	0.00	9.00
FORBS								
<i>Cryptantha flavoculata</i>	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00
GRASSES								
<i>Elymus salinus</i>	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00
<i>Poa secunda</i>	0.00	0.00	0.00	0.00	0.00	5.00	0.00	1.00
<i>Stipa hymenoides</i>	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00
COVER								
Overstory	65.00	0.00	0.00	0.00	75.00	70.00	60.00	10.00
Understory	35.00	25.00	18.00	15.00	10.00	25.00	70.00	10.00
Litter	35.00	5.00	12.00	15.00	60.00	25.00	15.00	15.00
Bareground	5.00	15.00	15.00	20.00	5.00	5.00	5.00	5.00
Rock	25.00	55.00	55.00	50.00	25.00	45.00	10.00	70.00
% COMPOSITION								
Shrubs	100.00	92.00	100.00	66.67	50.00	80.00	100.00	90.00
Forbs	0.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00
Grasses	0.00	0.00	0.00	33.33	50.00	20.00	0.00	10.00
Overstory + Understory	100.00	25.00	18.00	15.00	85.00	95.00	130.00	20.00

9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00
35.00	0.00	0.00	0.00	0.00	0.00	35.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	30.00	0.00	45.00	0.00	0.00	0.00	80.00	50.00	0.00
40.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00
10.00	0.00	10.00	0.00	0.00	0.00	50.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	15.00	0.00	0.00	10.00	30.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	15.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	40.00	0.00	30.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20.00	0.00	5.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.00	0.00	10.00	5.00	10.00	15.00	0.00	15.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	0.00	0.00
0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	0.00
75.00	30.00	0.00	45.00	10.00	0.00	35.00	80.00	50.00	15.00
40.00	45.00	35.00	45.00	20.00	45.00	50.00	25.00	20.00	30.00
25.00	20.00	15.00	40.00	5.00	10.00	5.00	60.00	25.00	10.00
30.00	30.00	15.00	10.00	5.00	5.00	5.00	5.00	5.00	40.00
5.00	5.00	35.00	5.00	70.00	40.00	40.00	10.00	50.00	20.00
75.00	88.89	71.43	88.89	50.00	66.67	100.00	0.00	50.00	100.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25.00	11.11	28.57	11.11	50.00	33.33	0.00	100.00	50.00	0.00
115.00	75.00	35.00	90.00	30.00	45.00	85.00	105.00	70.00	45.00

CANYON FUELS
 Dugout Mine
 Site G-12, G-13 Reference Area
 Conifer/ Mtn. Brush/PJ

Slope: 35-38 deg
 Exposure: SE
 Sample Date: 5-9 July 2005

19.00	20.00	Mean	SDev	Freq	
					OVERSTORY
0.00	0.00	4.00	10.56	15.00	<i>Amelanchier utahensis</i>
0.00	0.00	0.75	3.27	5.00	<i>Cercocarpus montanus</i>
0.00	0.00	7.25	21.76	10.00	<i>Juniperus osteosperma</i>
0.00	0.00	10.25	22.05	20.00	<i>Pinus edulis</i>
0.00	0.00	8.75	19.99	20.00	<i>Pseudotsuga menziesii</i>
					UNDERSTORY
					SHRUBS
0.00	0.00	3.50	11.08	15.00	<i>Amelanchier utahensis</i>
0.00	20.00	2.50	5.59	20.00	<i>Artemisia tridentata</i>
0.00	15.00	3.50	7.76	20.00	<i>Cercocarpus montanus</i>
0.00	0.00	0.40	1.74	5.00	<i>Chrysothamnus nauseosus</i>
0.00	0.00	0.90	3.92	5.00	<i>Gutierrezia sarothrae</i>
40.00	0.00	3.75	9.86	15.00	<i>Juniperus osteosperma</i>
0.00	0.00	0.25	1.09	5.00	<i>Opuntia polyacantha</i>
0.00	0.00	3.50	10.62	10.00	<i>Pinus edulis</i>
0.00	0.00	5.75	16.68	15.00	<i>Pseudotsuga menziesii</i>
0.00	0.00	2.45	5.05	25.00	<i>Symphoricarpos oreophilus</i>
					FORBS
0.00	0.00	0.10	0.44	5.00	<i>Cryptantha flavoculata</i>
					GRASSES
0.00	10.00	4.00	5.39	40.00	<i>Elymus salinus</i>
0.00	0.00	0.80	2.38	15.00	<i>Poa secunda</i>
0.00	0.00	1.00	2.55	15.00	<i>Stipa hymenoides</i>
					COVER
0.00	0.00	31.00	30.19		Overstory
40.00	45.00	32.40	14.96		Understory
10.00	25.00	21.60	15.83		Litter
10.00	10.00	12.25	10.06		Bareground
40.00	20.00	33.75	20.55		Rock
					% COMPOSITION
100.00	77.78	77.37	24.72		Shrubs
0.00	0.00	0.40	1.74		Forbs
0.00	22.22	22.23	25.02		Grasses
40.00	45.00	63.40	34.81		Overstory + Understory

Canyon Fuel Company, LLC
Dugout Canyon Mine

Methane Degassification Amendment
March 13, 2006

CHAPTER 4
LAND USE AND AIR QUALITY

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LIST OF ATTACHMENTS

Attachment 4-1 Information Moved to Confidential Folder in 2005
Attachment 4-2 Surface Land Owner Agreement

410 LAND USE

411 Environmental Description

A statement of the conditions and capabilities of the land to be affected by mining and reclamation operations follows in this section.

411.100 Premining Land Use

The area is utilized for the landowners private use, including hunting and as open range for livestock and wildlife.

411.110 Land Use Map and Narrative

Refer to the same section of the approved M&RP.

411.120 Land Capability

The major plant communities at the well sites are identified in Section 321. No cultivated lands lie within the well boundaries, due to the limiting terrain and lack of water for irrigation. Refer to Section 321.200, Table 3-1 of this submittal for forage production per acre for each well site.

The well site areas are located on the flatter mesa tops and rolling terrain. This type of terrain receives heavier pressure because of more available forage and easier movement by livestock.

411.130 Land Use Description

The wells are located on land administered by Milton & Ardith Thayn Trust and zoned by Carbon County for mining and grazing (MG-1).

No industrial or municipal facilities are located on or immediately adjacent to the well sites.

411.140 Cultural and Historic Resources Information

Cultural and Historic Resource Maps - Archaeological surveys were conducted in 2003 of the well sites G-1 through G-6. Nothing was found that required future investigation. There are no cemeteries, public parks, or units of the National System of Trails or the Wild and Scenic Rivers System located within the well site boundaries. The reports can be found in Attachment 4-1 of this submittal, Appendix 4-1 and 4-3 of the M&RP and in the Confidential Folder. Well site G-7 and G-8 were inventoried by AERC in 1980 (see below), a letter from John Senulis of Senco-Phenix to SHPO has been written requesting proof of clearance for the G-7 and G-8 sites. A copy of the Senco-Phenix letter is included in the confidential folder.

Previous research in 1980 by "AERC surveyed several sample blocks in Sections 13 and 24, T13S, R12E and Sections 18, 19 and 30 T13S, R13E. They also surveyed the access road into the Snow Mine site. One archeological site (42CB292) was located. The site was described as "Coal mine located in Pace Canyon consists of one known mine portal which has been closed. Site of historic Snow Mine in Pace Canyon which was active in 1906 but had its primary production period from 1932-1940." The site was relatively pristine at the time and still contained a standing coal loadout and foundation with depth potential. Avoidance was recommended pending further historic research. As noted the site has since been extensively modified" (Attachment 4-1, Senco-Phenix, June 24, 2003, SPUT-455, page 2).

Access to the degas holes will not impact or disturb what remains of the archeological site (42CB292). The road in the bottom of Pace Canyon passes the archeological site, but the closed portal is not visible from the road, therefore there is nothing to draw attention to the site. The loadout referenced in the survey no longer exist at the site.

During June 2005 a Class III intensive walkover survey was performed of the access roads and degas well sites G-9 thru G-13 and site DUG0105/DUG0205 (G-14) by Senco-Phenix. The well sites are being permitted in groups. Wells G-8 thru G-10 are the group currently being presented for consideration for approval. Site 42CB2435 is in the canyon where degas well sites G-9 and G-10 are located. The major portion of the site has been removed and there is little potential for further information. The site is not considered eligible for the NRHP. Reference the Confidential Binder for further information pertaining to the aforementioned survey. Per the survey "No other cultural resources were located and the potential for undetected remains is remote. A finding of no effect is appropriate and archeological clearance without stipulations is recommended" by Senco-Phenix to SHPO for the G-8 thru G-11 degas well sites. Site 42CB1595 located adjacent to degas well site G-12 was recommended for archeological clearance without stipulations by Senco-Phenix to SHPO.

Dugout Canyon agrees to notify the Division and State Historical Preservation Office (SHPO) of previously unidentified cultural resources discovered in the course of operations. Dugout Canyon also agrees to have any such cultural resources evaluated in terms of NRHP eligibility criteria. Protection of eligible cultural resources will be in accordance with Division and SHPO requirements. Dugout Canyon will also instruct its employees that it is a violation of federal and state law to collect individual artifacts or to otherwise disturb cultural resources.

411.200 Previous Mining Activity

Dugout Canyon has no knowledge of the removal of coal or other minerals in the well site areas.

412 Reclamation Plan

412.100 Postming Land-Use Plan

All uses of the land prior to the wells construction/operation and the capacity of the land to support prior alternate uses will remain available throughout the life of the sites.

Dugout Canyon intends the postmining land use to be livestock and wildlife grazing and other uses as dictated by the land owner (hunting, roads, etc.). Final reclamation activities will be completed in a manner to provide the lands able to parallel the premining land use.

A post mining land use change application will be filed with the Division for well sites G-11 and G-12, allowing the released to the land owner once the venting has been completed and the land owner's stipulations met, relieving the mine of revegetation responsibilities. Refer to Attachment 5-3 of this amendment for a copy of the land owner's request letter.

412.200 Land Owner or Surface Manager Comments

Milton & Ardith Thayn Trust is the landowner. Canyon Fuel Company, LLC has a surface land owner agreement with the Thayne Trust for the drilling of degassification holes (Attachment 4-2). Prior to drilling the landowner will be contacted and the requirements related to drilling as outlined in the surface land owner agreement will be met. A copy of the letter will be included in Attachment 4-2.

413 Performance Standards

413.100 Postmining Land Use

Postmining land uses are discussed in Section 412.100. The postmining lands will be reclaimed in a timely manner and capable of supporting such uses (see Chapters 2, 3, 5, and 7).

413.200 Determining Premining Uses of Land

Refer to Section 411.100.

413.300 Criteria for Alternative Postmining Land Uses

No alternative postmining land uses have been planned.

414 Alternative Land Use

No alternative postmining land uses have been planned.

420 AIR QUALITY

421 Air Quality Standards

Dugout Canyon activities will be conducted in compliance with the requirements of the Federal Clean Air Act and the Utah Air Conservation Rules.

422 Compliance Efforts

See Fugitive Dust Control Plan, Section 424.

423 Monitoring Program

Refer to the same section in the approved M&RP.

424 Fugitive Dust Control Plan

Operational areas that are used by mobile equipment will be water sprayed to control fugitive dust. The application of water will be of sufficient frequency and quantity to maintain the surface material in a damp/moist condition unless it is below freezing.

425 Additional Division Requirements

Refer to the same section of the approved M&RP.

Canyon Fuel Company, LLC
Dugout Canyon Mine

Methane Degassification Amendment
March 13, 2006

ATTACHMENT 4-1

Confidential Folder 2006

Canyon Fuel Company, LLC
Dugout Canyon Mine

Methane Degassification Amendment
March 13, 2006

ATTACHMENT 4-2
SURFACE LAND OWNER AGREEMENT

add to the back of existing information

MEMOS SENT TO THAYN TRUST AS NOTIFICATION OF PROPOSED ACTIVITIES

March 10, 2005

Subject: 2005 Drilling Activities on Thayn Lands

In 2005 the Dugout Canyon Mine currently plans to conduct exploration, de-gassing, and permitting activities on the Thayn Lands.

As many as two (2) exploration bore holes will be drilled on the Thayn Lands, see enclosed map. The current plan is to drill both holes from the same surface site due to surface access restrictions. In addition, Dugout would like to complete these holes as Methane Drainage Holes. This will save future costs, permitting efforts, and reduce surface disturbance. These holes will require grading of the access roads, preparation/building of the drill sites, and reclamation of the drill sites and roads as directed by the landowner and permit regulations. In addition, the drilling activities will require obtaining and hauling water from various streams and locations on the Thayn Lands, see map.

As many as nine (9) Methane Drainage Holes will be drilled to remove methane and other gases from the longwall panel gob areas, see map. As shown on the map several of these sites will have one or more holes drilled from the same site. This is due to limited surface access. Similar to the exploration drilling, these boreholes will require road grading/improvements, site building/preparation, reclamation, and water hauling. Permitting activities similar to those required for the exploration drilling will also be conducted in association with the degas drilling. It has not been determined if all nine (9) of the degas boreholes will be drilled or when. However, the G-7 hole may be drilled as early as May, 2005. The remaining holes, including the exploration holes, will be drilled later in the year depending on permitting and drill rig availability.

In conjunction with the exploration activities listed above, there will be permitting activities including, but not limited to, endangered plant and animal surveys, environmental assessment activities, and cultural surveys. All of these activities will be conducted by third party contractors and require no surface disturbance.

Associated with the degas activities will be the installation of one or more exhaustor-blower units on the degas sites to remove the gases from the mine. The number and duration of the installations are unknown at this time. While the exhaustor-blower units are in operation, the units will require frequent inspections to maintain the units. These inspections may range from daily to weekly depending on the effort required to maintain the units.

The Dugout Mine is planning to install a mine ventilation fan in the Pace Canyon. While the fan installation site is located on BLM surface, access to the fan site follows the main road access to the general area and crosses the Thayn Lands. The Dugout Mine currently expects to begin construction of the site in April 2005. These activities may include upgrades and enhancements to the access road that crosses Thayn Lands.

February 16, 2006

Subject: 2006 Dugout Canyon Mine Activities on Thayn Lands

In 2006 the Dugout Canyon Mine currently plans to conduct exploration, methane drainage, permitting activities, and other mining related activities on the Thayn Lands.

Exploration

As many as two (2) exploration bore holes will be drilled on the Thayn Lands, see enclosed map. The current plan includes drilling both holes from the same surface site due to surface access restrictions. In addition, Dugout will complete these holes as Methane Drainage Holes. These holes will require surveying, grading of the access roads, preparation/building of the drill sites, and reclamation of the drill sites and roads as directed by the landowner and permit regulations. In addition, the drilling activities will require obtaining and hauling water from various streams and locations on the Thayn Lands, see map.

Associated with exploration and as has been discussed with the land owner in 2005, Dugout will relocate a portion of a surface road used by various land owners and Dugout, see map. The road will be relocated from Conover Lands to Thayn Lands.

Methane Drainage

As many as eight (8), Methane Drainage Holes (2 are converted exploration holes) will be completed to remove methane and other gases from the longwall panel gob areas, see map. As shown on the map several of these sites will have one or more holes drilled from the same site due to limited surface access. Similar to the exploration drilling, these boreholes will require surveying, road grading/improvements, site building/preparation, reclamation, and water hauling. Permitting activities similar to those required for the exploration drilling will also be conducted in association with the degas drilling

Drilling of the methane drainage holes is expected to begin within the first two weeks of June.

In addition to drilling and installing methane drainage wells, Dugout will also be plugging and reclaiming a minimum of two (2) methane drainage wells—G3 and G6.

Permitting Activities

In conjunction with the exploration activities listed above, there will be permitting activities including, but not limited to, plant and animal surveys, environmental assessment activities, and cultural surveys. All of these activities will be conducted by third party contractors and require minimal surface disturbance (soil test pits).

In addition, Dugout is required by regulatory permits to conduct water monitoring surveys for both quantity and quality. The Dugout Canyon Mine will also conduct an annual stream geomorphology study of Pace Creek to determine if subsidence may impact the stream channel.

Miscellaneous Activities

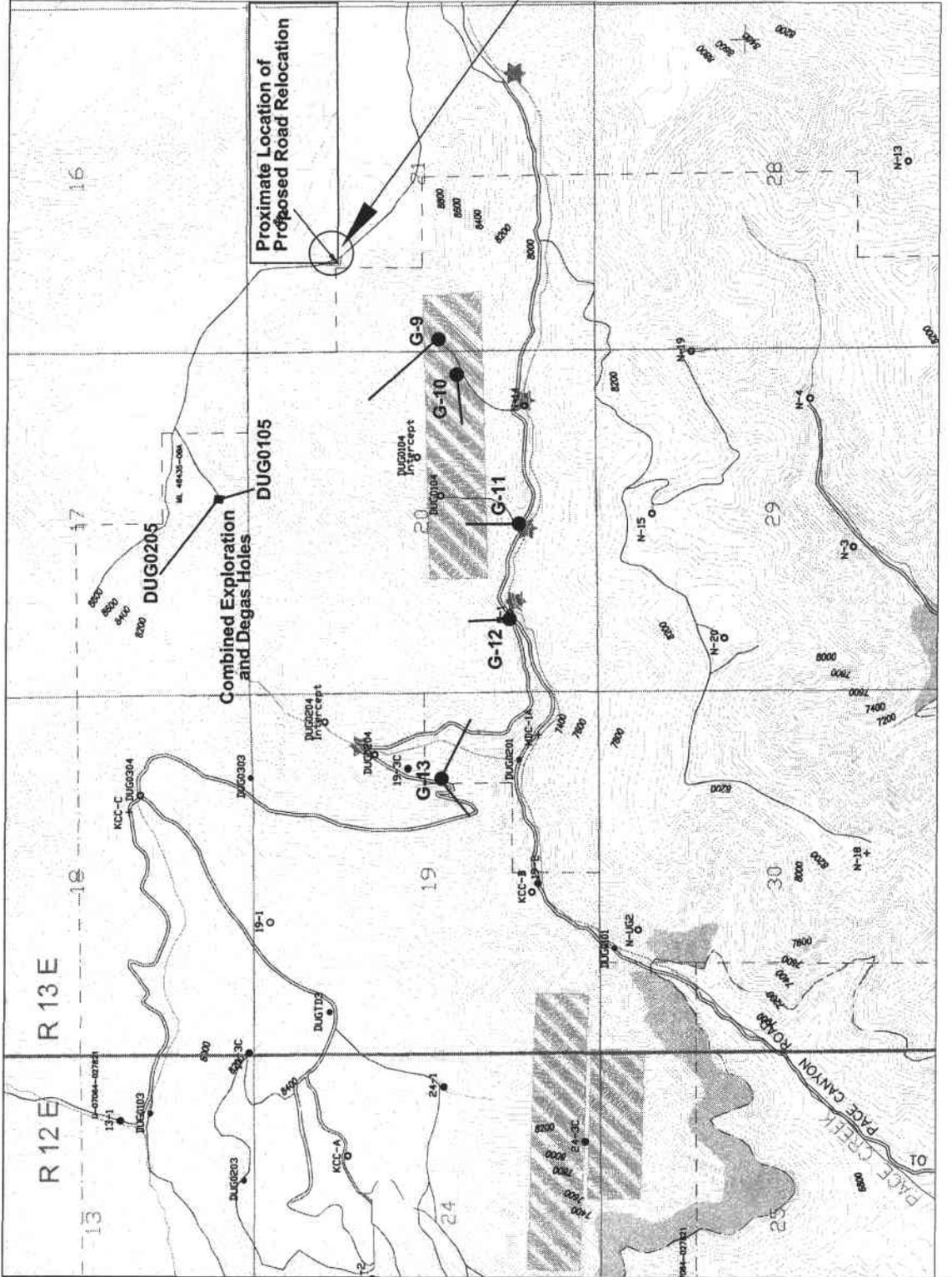
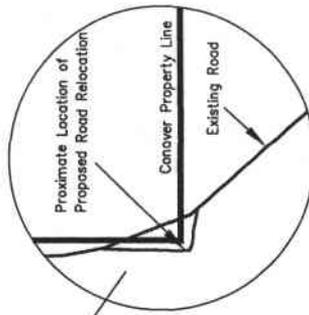
The Dugout Mine will also be conducting the following activities:

- Installation and monitoring of one or more exhaustor-blower units on the degas sites to remove the gases from the mine. The number and duration of the installations are unknown at this time.
- Fault investigations to determine the surface location and characteristics of several faults associated with the Dugout Canyon Mine. This may include digging trenches in select locations on existing roads. The locations are currently undecided, but will be approved by the land owner before digging commences.
- Monitoring and removing noxious weeds, in accordance with the existing land use agreement.
- Locating and surveying section corners and lease/property lines. This surveying may be completed either by private or government surveyors.
- Surveying subsidence monitoring points.

In addition, the attached map also identifies the areas where longwall mining will occur beneath the Thayn Lands.

- EXPLANATION**
- Existing Road
 - No Upgrade
 - Existing Road Requires Upgrade
 - Newly Constructed Road
 - Trail
 - Lease Boundary
 - Degas Bore Holes
 - Water Locations
 - Burn
 - 2006 Longwall Mining

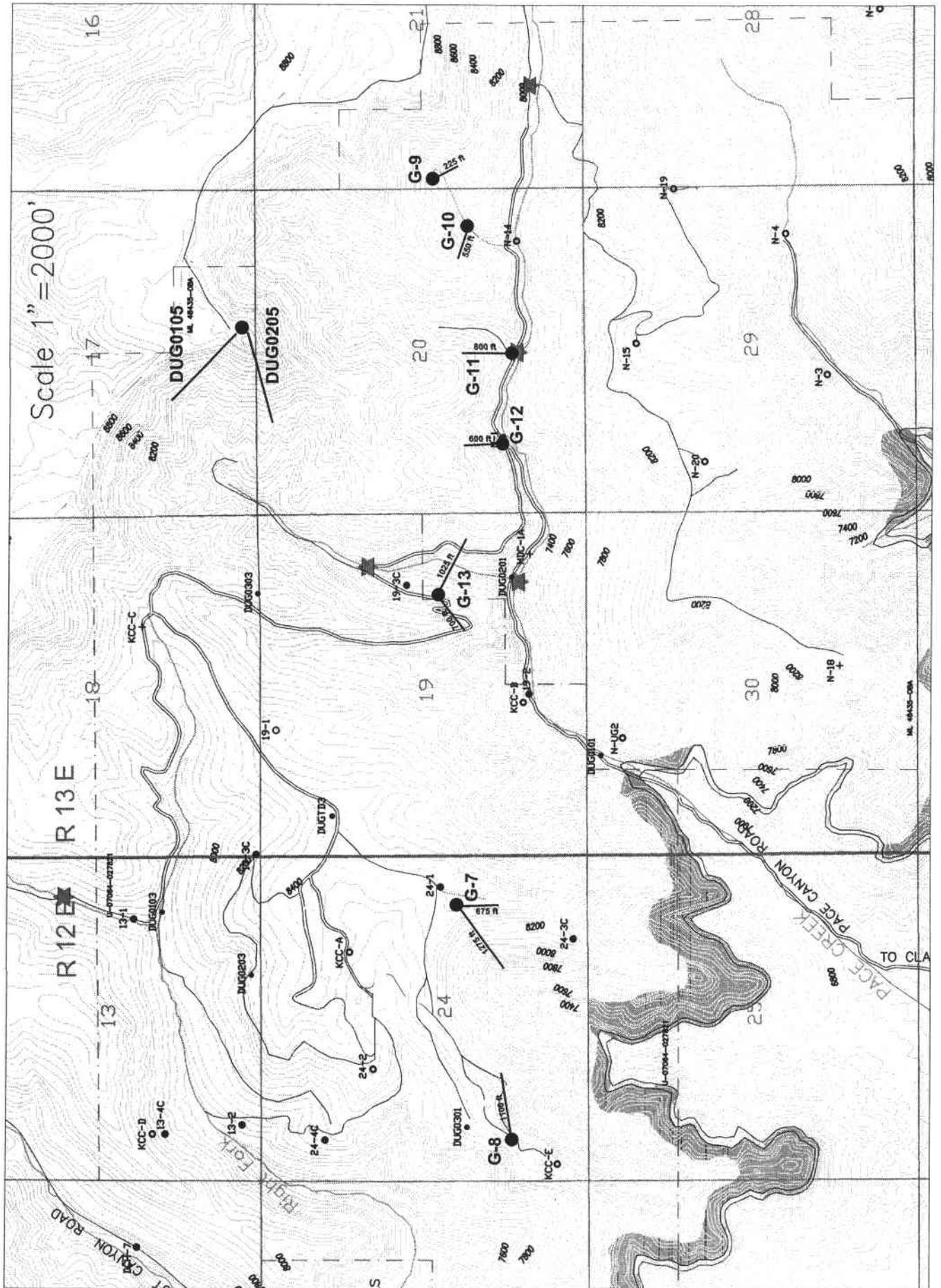
Scale: 1" = 1500'



CF Canyon Fuel Co., LLC.
Dugout Canyon Mine

Thayn Lands
Planned Activities in 2006

FILE NO. 100-000000-0000
DATE: 10-24-2006



Canyon Fuel Company, LLC
Dugout Canyon Mine

Methane Degassification Amendment
March 13, 2006

CHAPTER 5
ENGINEERING

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510 INTRODUCTION

This chapter provides a discussion of general engineering aspects, an operation plan, a reclamation plan, design criteria, and performance standards related to the degassification well sites. The activities associated with the construction and reclamation of the well sites have been or will be designed, located, constructed, maintained, and reclaimed in accordance with the operation and reclamation plans.

511 General Requirements

The permit application includes descriptions of construction, maintenance, and reclamation operations of the proposed well sites with maps and plans. Potential environmental impact as well as methods and calculations utilized to achieve compliance with the design criteria are also presented.

512 Certification

Where required by the regulations, cross sections and maps in this permit application have been prepared by or under the direction of, and certified by, qualified registered professional engineers or land surveyors. As appropriate, these persons were assisted by experts in the fields of hydrology, geology, biology, etc.

512.100 Cross Sections and Maps

Cross sections for the degassification well pads are shown on Figures 5-2, 5-6, 5-10, 5-18, 5-21, 5-24 and typical road cross sections are shown on Figures 5-13 and 5-14. Cross sections for the degassification well pads G-8, G-9, G-10, G-11 and G-12 are shown on figures located in Attachment 5-1.

512.200 Plans and Engineering Designs

Excess Spoil - No excess spoil will be generated from the well sites.

Durable Rock Fills - No durable rock fills will exist at the well sites.

Coal Mine Waste - No coal mine waste will exist at the well sites.

Impoundments - Refer to Section 733.200 of this submittal.

Primary Roads - Short sections of road are required to access well sites G-2 and G-5. These access roads are classified as primary roads. Topsoil will be stripped from the road alignment and either wind rowed adjacent to the road or stored with the topsoil stripped from the pad area prior to grading the new access road. Well sites G-1(not drilled), G-3 thru G-12, are on existing roads, no access roads will be constructed.

Variance from Approximate Original Contour - No variance from approximate original contour is required for the well sites.

513 Compliance with MSHA Regulations and MSHA Approval

513.100 Coal Processing Waste Dams and Embankments

No coal processing waste dams and embankments will exist at the well sites.

513.200 Impoundments and Sedimentation Ponds

Refer to Section 733.200 of this submittal.

513.300 Underground Development Waste, Coal Processing Waste, and Excess Spoil

No underground waste, coal processing waste, and excess spoil will exist at the well sites.

513.400 Refuse Piles

No refuse piles will exist at the well sites.

513.500 Underground Openings to the Surface

The well will be equipped with a valve that will be closed and locked when not in use. A typical well head is shown in Figure 5-16.

513.600 Discharge to Underground Mine

No discharge to the underground mine will occur at the well sites.

513.700 Surface Coal Mining and Reclamation Activities

No surface coal mining, or reclamation activities associated with surface coal mining will occur at the well sites.

513.800 Coal Mine Waste Fire

No coal waste will be developed, therefore, no coal waste fires will occur at the well sites.

514 Inspection

514.100 Excess Spoil

No excess spoil will be stored at the well sites.

514.200 Refuse Piles

No refuse piles will exist at the well sites.

514.300 Impoundments

Refer to Section 733.200 of this submittal.

515 Reporting and Emergency Procedures

515.100 Slides

Refer to Section 515.100 in the approved M&RP.

515.200 Impoundments Hazards

No impoundments will exist at the well sites.

515.300 Temporary Cessation of Operations

If temporary cessation of the mining operations does occur, the wells will remain open. Once liberation of the methane gas is completed, the wells will be sealed as discussed in Section 542.700 of this submittal.

520 OPERATION PLAN

521 General

See Figures 5-1, 5-5, 5-9, 5-17, 5-20, 5-23, 5-27 and Attachment 5-1 (G-8 thru G-12) for the contour map showing pre-disturbance and drilling phase contours. These figures also show the disturbed area boundary and the new access road contours. Figures 5-3, 5-7, 5-11, 5-19, 5-22, 5-25, 5-29 and Attachment 5-1 (G-8 thru G-12) show the layout of the well sites during the drilling phase. Figures 5-4, 5-8, 5-12 show the layout of the well sites during the operational phase and the area to be reclaimed at the completion of drilling. Cross sections for each site can be found on Figures 5-2, 5-6, 5-10, 5-18, 5-21, 5-24, 5-28 and Attachment 5-1 (G-8 thru G-12).

521.100 Cross Sections and Maps

Existing Surface and Subsurface Facilities Features - No buildings are located on or within 1,000 feet of any of the well sites.

Landowner, Right-of-Entry, and Public Interest - The land which the wells will be drilled on is owned by the Milton and Ardith Thayn Trust. Canyon Fuels, LLC has reached an agreement with the Thayn trustees to allow access for the construction and drilling of the wells (see Attachment 4-2).

Mining Sequence and Planned Subsidence - Refer to Section 525. Mining sequence maps showing the location of drilled degas wells are submitted to the BLM and UDOGM as part of their annual reports.

Land Surface Configuration - Surface contours of undisturbed well sites are included in Figures 5-1, 5-5, 5-9, 5-17, 5-20, 5-23, 5-27 and Attachment 5-1 (G-8 thru G-12).

Surface Facilities - No permanent surface facilities will exist at the well sites.

521.200 Signs and Markers

Mine and Permit Identification Signs - A mine and permit identification sign will be displayed at each well site. This sign will be a design that can be easily seen and read, will be made of durable material, will conform to local regulations, and will be maintained until after the release of all bonds for the well site areas. The sign will contain the following information:

- Mine name,
- Company name,
- Company address and telephone number
- MSHA identification number, and
- Permanent program permit identification number

Perimeter Markers - The perimeter of all areas affected will be clearly marked before beginning mining activities. The markers will be a design that can be easily seen and read, will be made of durable material, will conform to local regulations, and will be maintained until after the release of all bonds for the permit area.

Buffer Zone Markers - Stream buffer zone markers will not be required at the G-3 thru G-10 well sites. Stream buffer zone markers will be placed at G-11 and G-12.

Topsoil Markers - Markers will be placed on all topsoil stockpiles. These markers will be a design that can be easily seen and read, will be made of durable material, will conform to local regulations, and will be maintained until topsoil is redistributed on the well sites.

Construction Markers - Not applicable.

Hazard Signs - Signs will be placed at the degas wells declaring danger, no smoking, etc.

522 Coal Recovery

No coal recovery will be performed at the well sites. The operator has been contacted by the BLM, in reference to changes in Operator's R2P2 associated with Federal Regulation 43 CFR Chapter 11, Subpart 3484. Degas wells G-11 and G-12 are on the SITLA lease and not on a federal lease, therefore changes in the R2P2 are not required.

523 Mining Methods

No mining will be performed at the well sites.

524 Blasting and Explosives

No explosives are to be used at the well sites.

525 Subsidence

No subsidence will occur at the well sites, as a result of drilling and development of the degassification well sites. Subsidence could occur at the well site because of underground mining see Section 525 of the approved M&RP.

526 Mine Facilities

526.100 Mine Structures and Facilities

No buildings exist or are proposed at the well sites; therefore, no existing building will be used in connection with or to facilitate this proposed coal mining and reclamation plan.

526.200 Utility Installation and Support Facilities

No utilities are to be installed at the well sites. A portable methane exhaust unit will be temporarily installed to draw methane to the surface from the mined panel. The exhaust blower will be started by using propane from portable tanks. Once started and running, the unit will be powered by burning the extracted methane gas. The level of extracted methane required to operate the exhaust blower is greater than 30%. Excess methane will be vented to the atmosphere. The blower is approximately 12-feet long by 6-feet wide and about 10-feet tall. It is not known how long the degassification of the longwall panel will take.

527 Transportation Facilities

527.100 Road Classification

Well sites will be developed near existing private roads as shown on Figures 1-1, 5-1, 5-5, 5-9, 5-17, 5-20, 5-23, 5-27 and Attachment 5-1 (G-8 thru G-12). The new access roads will be classified as primary roads and will be maintained by the permittee (see Figure 5-14).

527.200 Description of Transportation Facilities

The well sites were chosen close to existing roads in the area to limit surface disturbance. The existing roads were constructed and are maintained by the land owner. The existing roads are

approximately 20 feet wide and are shown on Figures 5-1, 5-5, 5-9, 5-17, 5-20, 5-23, 5-27 and Attachment 5-1 (G-8 thru G-12). See Figure 5-13 for a typical cross section of the existing roads.

528 Handling and Disposal of Coal, Excess Spoil, and Coal Mine Waste

No disposal of coal, excess spoil, and coal mine waste will occur at the well sites.

529 Management of Mine Openings

The perimeter of the sites, including the topsoil stockpiles will be fenced with gates on the access roads. The well casing will have a valve that is closed and locked. The valve will also prevent access by animals or other material. Mine openings will be monitored in accordance with Federal and State Regulations.

During the life of the methane wells, the sites will be inspected as needed by mine personnel to verify the continued operation of the pumping equipment and general site conditions. Motorized vehicles to access the methane wells may include trucks, four-wheelers, a snow cat, snowmobiles and etc.

530 OPERATIONAL DESIGN CRITERIA AND PLANS

531 General

This section contains the general plans for the construction of sediment controls and general construction and maintenance of the well sites.

The decision to construct each well will be based on the amount of methane encountered during mining. If small amounts of methane are encountered and the mine's ventilation system can dilute the methane, no well will be drilled. The proposed well site locations are shown on Figure 1-1.

The topography above the Dugout Canyon Mine severely limits the selection of methane drainage drill sites (degas wells). Various other factors also affect the drill site locations. These include proximity to the mining area, existing access verses new access, site slope, meeting reclamation success standards, etc. Sites with exiting access are given preference over sites without, where possible sites are located along existing roads and at other pre-disturbed areas. In addition, drill methods are often modified (using directional drilling methods vs. conventional vertical drilling methods) to allow drilling along existing access and to reduce environmental impacts. Directional drilling methods allow the surface site to be located as described yet allow the bottom of the hole to be completed in the required mining area.

532 Sediment Control

Sediment control measures for the well sites are described in Sections 732 and 742 of this submittal. Runoff control structures at the well sites have been designed to convey runoff in a non-erosive manner. Sediment yields in the well permit area are minimized by:

- Disturbing the smallest practicable area during the construction of the well site and
- Contemporaneously reclaiming areas suitable for such reclamation.

533 Impoundments

No impoundments will exist at the well sites.

534 Roads

Refer to Section 527 of this submittal.

535 Spoil

No spoil will be generated at the well sites.

536 Coal Mine Waste

No coal mine waste will be stored at the well sites.

537 Regraded Slopes

537.100 Division Approval

No mining or reclamation activities will be conducted in the permit area that requires approval of the Division for alternative specifications or for steep cut slopes.

537.200 Regrading of Settled and Revegetated Fills

Upon completion of the well site, the areas not required for the exhaust blower will be regraded to approximate original contour. Because of the nature of the well site, settling is not anticipated. However, if settlement does occur, these areas will be regraded.

540 RECLAMATION PLAN

541 General

541.100 Commitment

Upon the permanent cessation of methane venting, Dugout Canyon Mine will seal the wells and permanently reclaim all affected areas in accordance with the R645 regulations and this reclamation plan.

541.200 Surface Coal Mining and Reclamation Activities

Not applicable.

541.300 Underground Coal Mining and Reclamation Activities

Upon completion of the methane venting activities the wells will be reclaimed.

541.400 Environmental Protection Performance Standards

The plan presented is designed to meet the requirements of R645-301 and the environmental protection performance standards of the State Program.

542 Narratives, Maps, and Plans

542.100 Reclamation Timetable

A timetable for the completion of each major step in the reclamation plan is presented in Figure 5-15 (G-2 and G-5) and 5-26 (G-3, G-4, G-6 thru G-12). Per Task ID #2408, "the Division requires notification and a reasonably specific time to initiate the reclamation activities associated with degassification well sites". In addition to the two figures referenced above, information pertaining to reclamation timing for methane degas wells is provided in Attachment 5-2 of this amendment.

542.200 Plan for Backfilling, Soil Stabilization, Compacting, and Grading

Following completion of the venting activities, the well site will be prepared for contouring and soil distribution. Details regarding topsoil placement and revegetation are provided in Section 242 and Section 353, respectively.

Sedimentation Pond Removal and Interim Sediment Control - See Section 542.500 of this submittal.

542.300 Final Surface Configuration Maps and Cross Sections

The sites will be regraded to the approximate original contour, the contours representing the pre-disturbance topography also represent the reclamation topography. Refer to Figures 5-2, 5-6, 5-10, 5-18, 5-21, 5-24, 5-28 and Attachment 5-1 (G-8 thru G-12) to see cross sections representing the final surface configuration.

542.400 Removal of Temporary Structures

The well sites will not have surface structures.

542.500 Removal of Sedimentation Pond

No sediment pond will be constructed at the well sites.

542.600 Roads

The roads which existed prior to the drilling program will be retained after reclamation. The access roads established during the drilling program will be reclaimed after methane extraction has been completed. See Section 242 for additional detail concerning the reclamation plan.

542.700 Final Abandonment of Mine Openings and Disposal Areas

Degas drill holes G-9 thru G-12 will be sealed in accordance with Federal Regulations 43 CFR Ch. 11, Subpart 3484, (3) per a decision by the BLM and UDOGM.

The casings on degas well sites G-2 thru G-7 will be plugged at the bottom to hold concrete. A lean concrete mixture will be poured into the casing until the concrete is within five (5) feet of the surface. At that time the casing will be cut off at ground level and the rest of the casing will be filled with lean concrete. The concrete will be allowed to harden before final reclamation is completed.

A copy of 43 CFR Ch. 11, Subpart 3484, (3) is contained in Attachment 5-2.

542.800 Estimated Cost of Reclamation

Refer to the Appendix 5-6 of the existing M&RP. It is anticipated that the cost of reclamation of the well sites is adequately covered by the Dugout Canyon Reclamation Bond, refer to Chapter 8 for additional detail.

550 RECLAMATION DESIGN CRITERIA AND PLANS

551 Casing and Sealing of Underground Openings

Permanent sealing is described in Section 542.700.

552 Permanent Features

552.100 Small Depressions

No permanent small depressions will be created as part of the well site construction and reclamation.

552.200 Permanent Impoundments

See Section 515.200 of this submittal.

553 Backfilling and Grading

553.100 Disturbed Area Backfilling and Grading

Approximate Original Contour - The well sites will be returned to their approximate original contour after reclamation is completed.

Erosion and Water Pollution - Sediment controls will consist of gouging the surface to create depressions and mounds which store and impede the movement of water. As vegetation becomes established on the reclaimed surface, erosion potential will be further minimized.

Post-Mining Land Use - The disturbed area will be reclaimed in a manner that supports the approved post-mining land use. Refer to Sections 411 and 412 for additional detail.

553.200 Spoil and Waste

Spoil - No spoil will be generated within the well sites.

Coal Processing Waste - No coal processing waste will be generated within the well sites.

553.250 Refuse Piles

No refuse piles will exist at the well sites.

553.300 Exposed Coal Seams, Acid and Toxic Forming Materials and Combustible Materials

No coal seams will be left exposed at the well sites. All wells will be sealed according to Federal and State regulations.

553.400 Cut and Fill Terraces

No cut and fill terraces will be constructed at the well sites.

553.500 Highwall From Previously Mined Areas

No highwalls exist or will be built at the well sites.

553.600 Previously Mined Area

No previously mined areas exist at the well sites.

553.700 Backfilling and Grading - Thin Overburden

No surface mining and reclamation activities involving thin overburden will occur at the well sites.

553.800 Backfilling and Grading - Thick Overburden

No surface mining and reclamation activities involving thick overburden will occur at the well sites.

553.900 Regrading of Settled and Revegetated Rills

If settlement or rills occur at the well sites, they will be regraded and revegetated. Refer to Section 244.300.

560 PERFORMANCE STANDARDS

Dugout Canyon Mine well sites will be conducted in accordance with the approved permit and the requirements of R645-301-510 through R645-301-553.

FIGURE 5-15
Degassification Well Reclamation Schedule - Wells G-2 and G-5

Task	Weeks to Complete from Start of Activities			
	1	2	3	4
PHASE ONE - Partial Site Reclamation				
Reclaim to Original Contours Where Possible				
Rip Subsoil				
Place Topsoil and Roughen				
Seed and Mulch				
PHASE TWO - Complete Site Reclamation				
Plug Well				
Reclaim to Original Contours Where Not Done in Phase One				
Rip Subsoil				
Place Topsoil and Roughen				
Seed and Mulch				
The schedule assumes that weather conditions are conducive. Schedule is for each individual well not wells collectively. If necessary the timing may be extended.				

Phase 1 may be completed years before Phase 2 begins, depending upon the mine's need for venting.

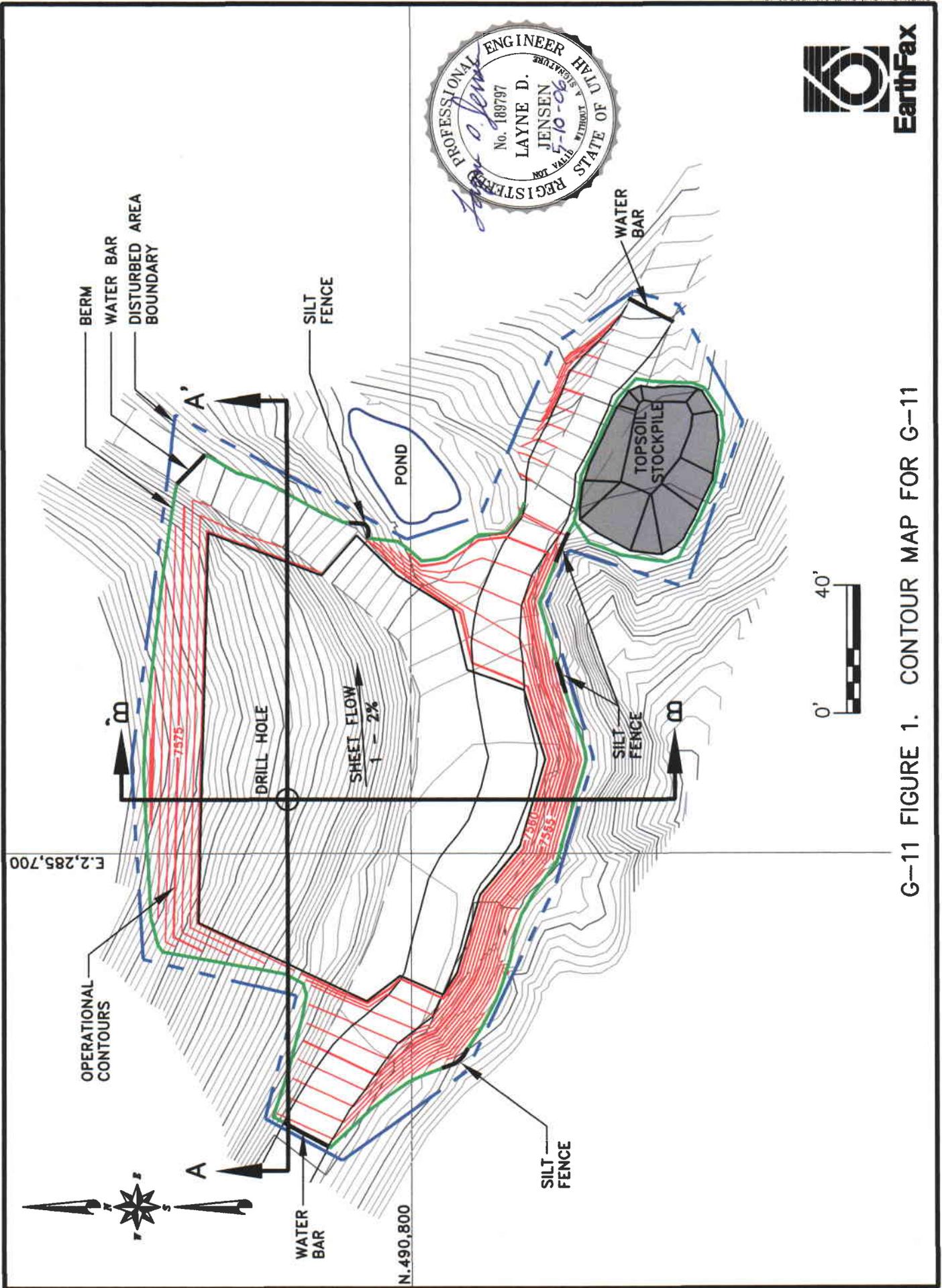
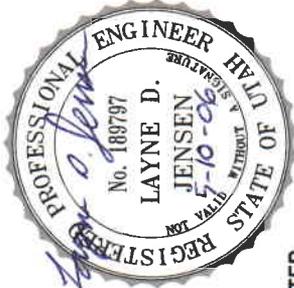
FIGURE 5-26
Reclamation Schedule - Wells G-3, G-4, G-6 thru G-12

Task	Weeks to Complete from Start of Reclamation Activities		
	1	2	3
Plug Well			
Regrade Site to Original Contour			
Rip Subsoil			
Place Topsoil and Roughen			
Seed and Mulch			
<p>The schedule assumes that weather conditions are conducive. Schedule is for each individual well not wells collectively. If necessary the timing may be extended.</p>			

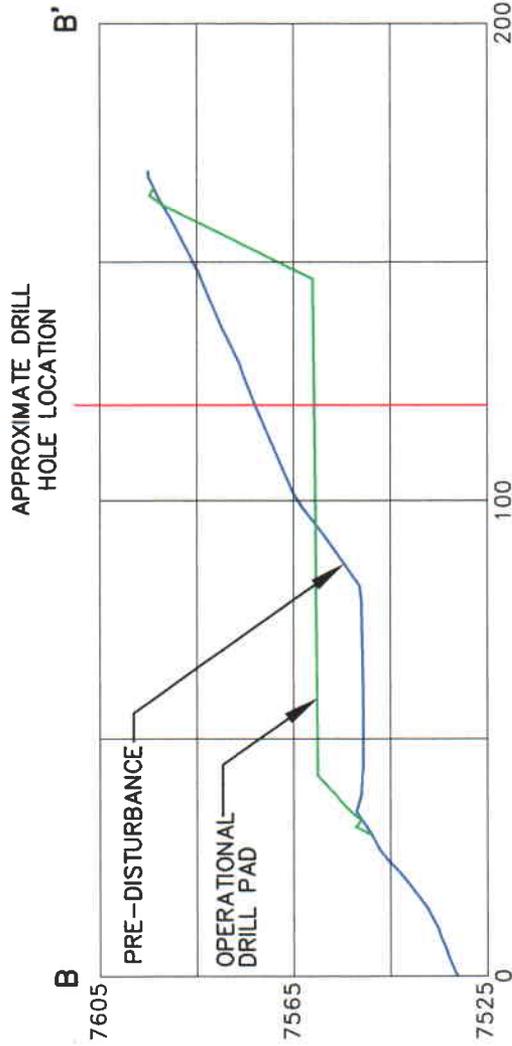
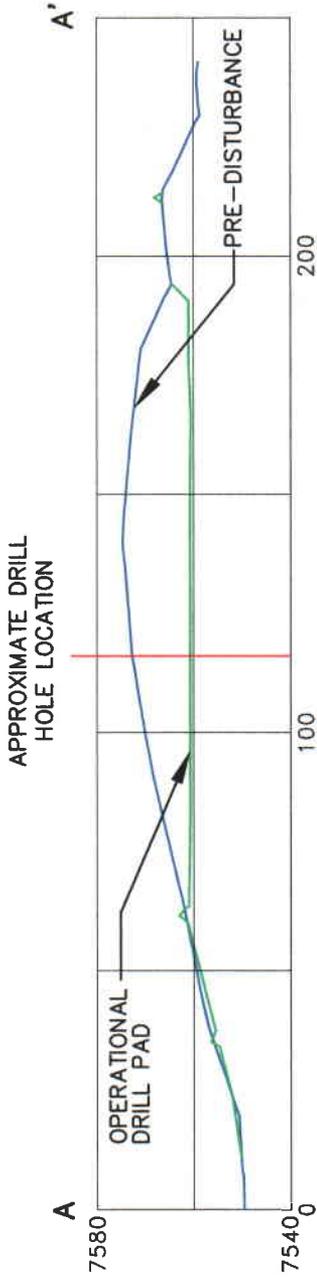
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Dugout Canyon Mine

Methane Degassification Amendment
March 13, 2006

ATTACHMENT 5-1
Degas Wells G-8 thru G-12



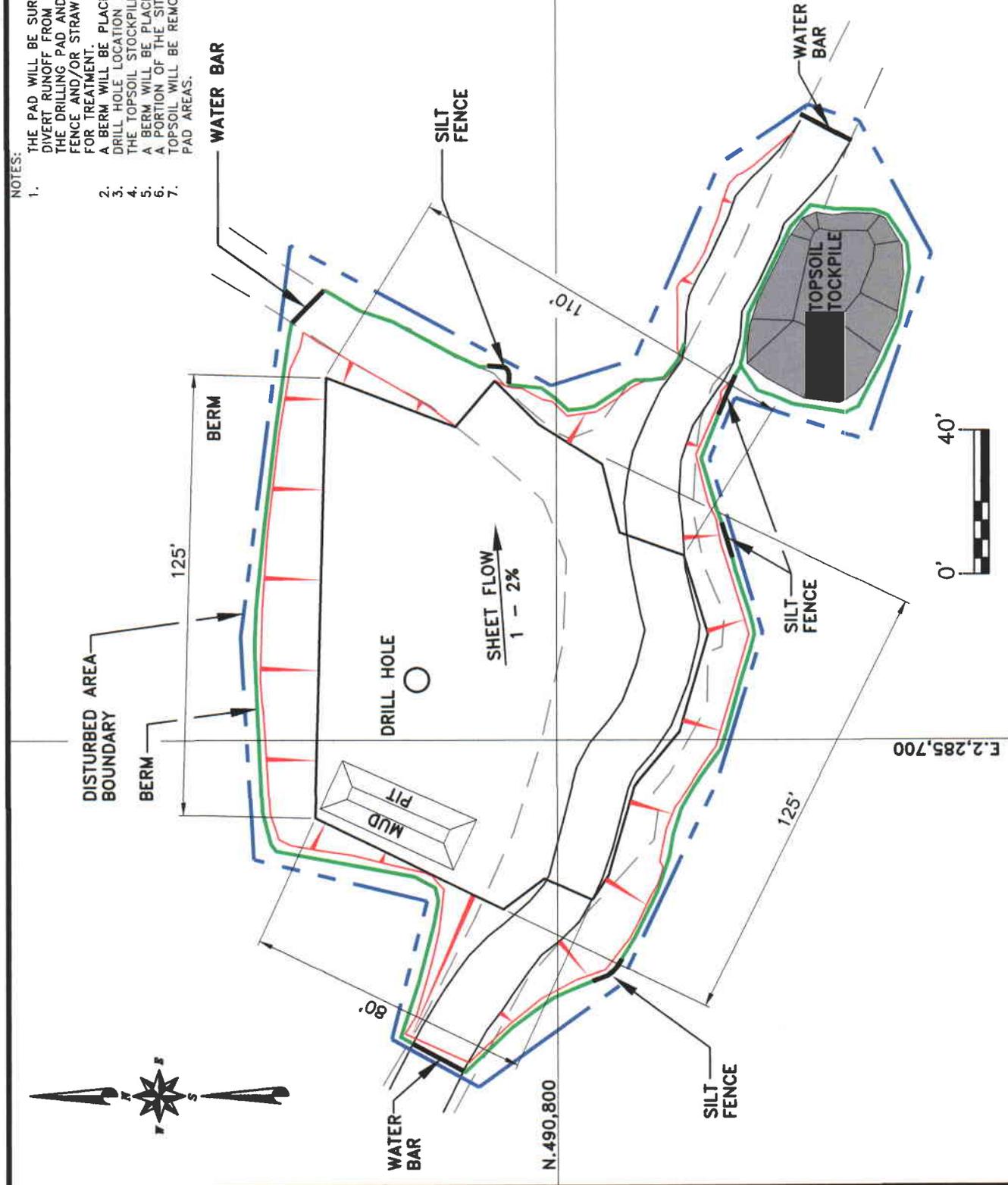
G-11 FIGURE 1. CONTOUR MAP FOR G-11



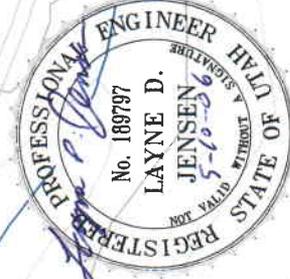
G-11 FIGURE 2. TYPICAL CROSS-SECTIONS FOR G-11



- NOTES:
1. THE PAD WILL BE SURROUNDED BY A BERM WHICH WILL DIVERT RUNOFF FROM UNDISTURBED AREAS AWAY FROM THE DRILLING PAD AND DIRECT PAD RUNOFF TO A SILT FENCE AND/OR STRAW BALE DIKE, AT THE LOWEST POINT FOR TREATMENT.
 2. A BERM WILL BE PLACED AT THE TOE OF THE FILL SLOPES.
 3. DRILL HOLE LOCATION MAY VARY.
 4. THE TOPSOIL STOCKPILE AREA WILL BE FENCED.
 5. A BERM WILL BE PLACED AROUND THE TOPSOIL STOCKPILE.
 6. A PORTION OF THE SITE HAS BEEN PREVIOUSLY DISTURBED.
 7. TOPSOIL WILL BE REMOVED FROM THE NON-ROAD AND PAD AREAS.

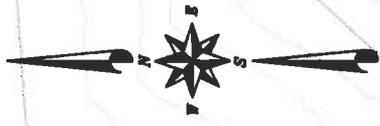
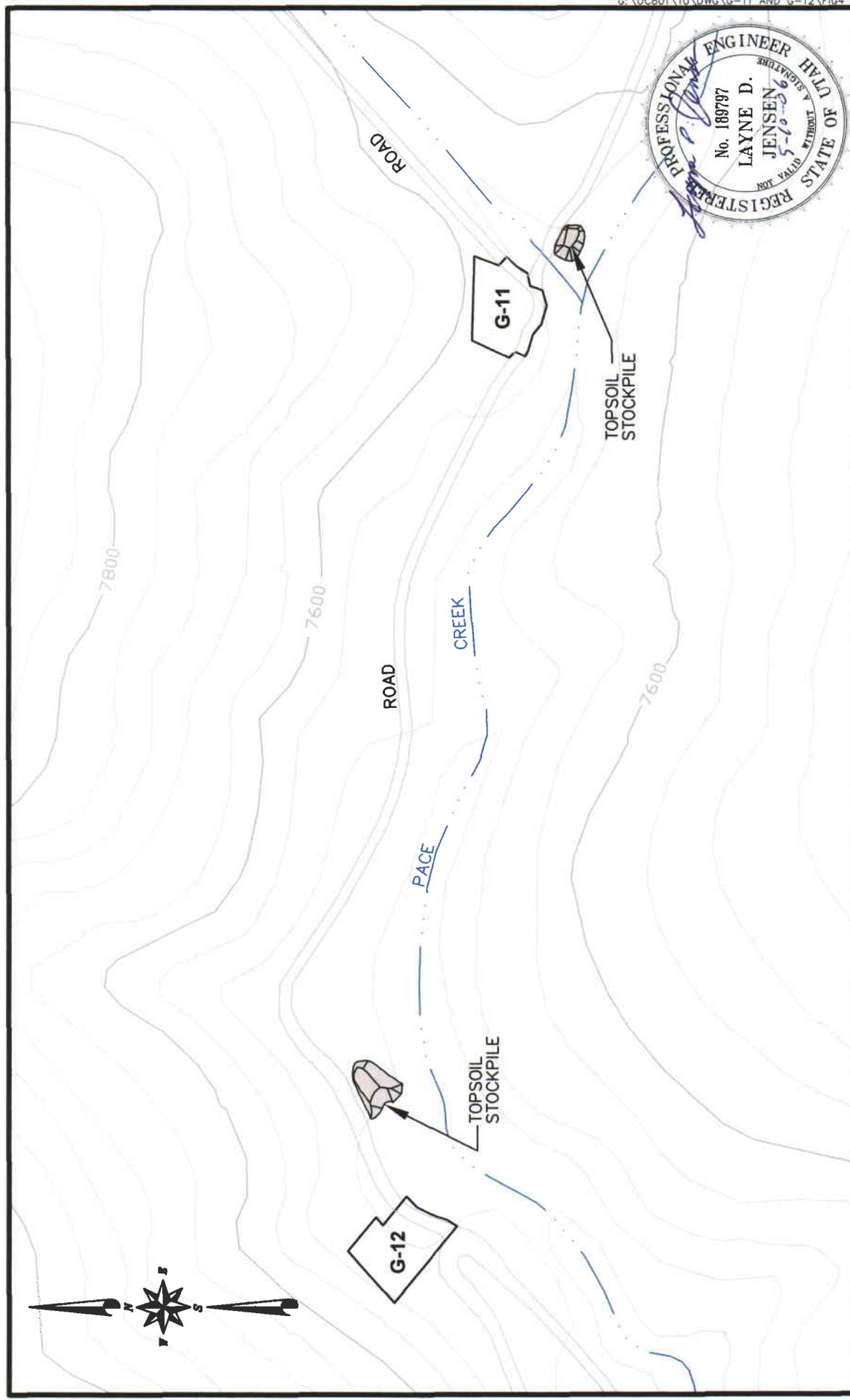


G-11 FIGURE 3. APPROXIMATE DRILLING LAYOUT FOR G-11



TOWNSHIP 13 SOUTH, RANGE 13 EAST, SECTION 20

G-11 AND G-12 FIGURE 4. DEGAS SITES ADJACENT TO PACE CREEK

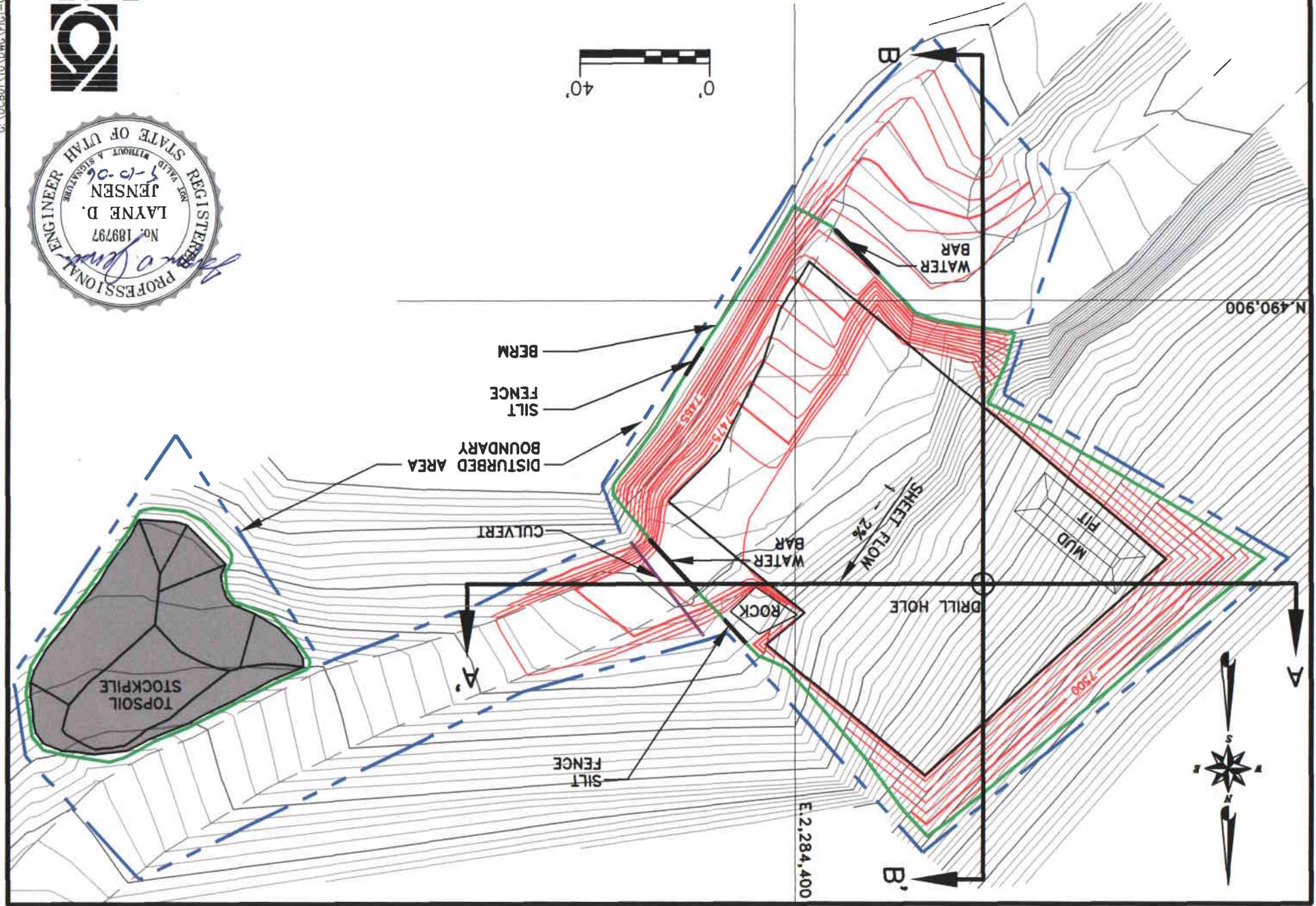


G:\UC801\10\DWG\FIG-G-12.DWG

EarthFax



G-12 FIGURE 1. CONTOUR MAP FOR G-12



E.2,284,400

N.490,900

BERM
SILT FENCE
BOUNDARY
DISTURBED AREA

CULVERT

TOPSOIL STOCKPILE

SILT FENCE

ROCK

DRILL HOLE

MUD PIT

WATER BAR

WATER BAR

SHEET FLOW
2%

B

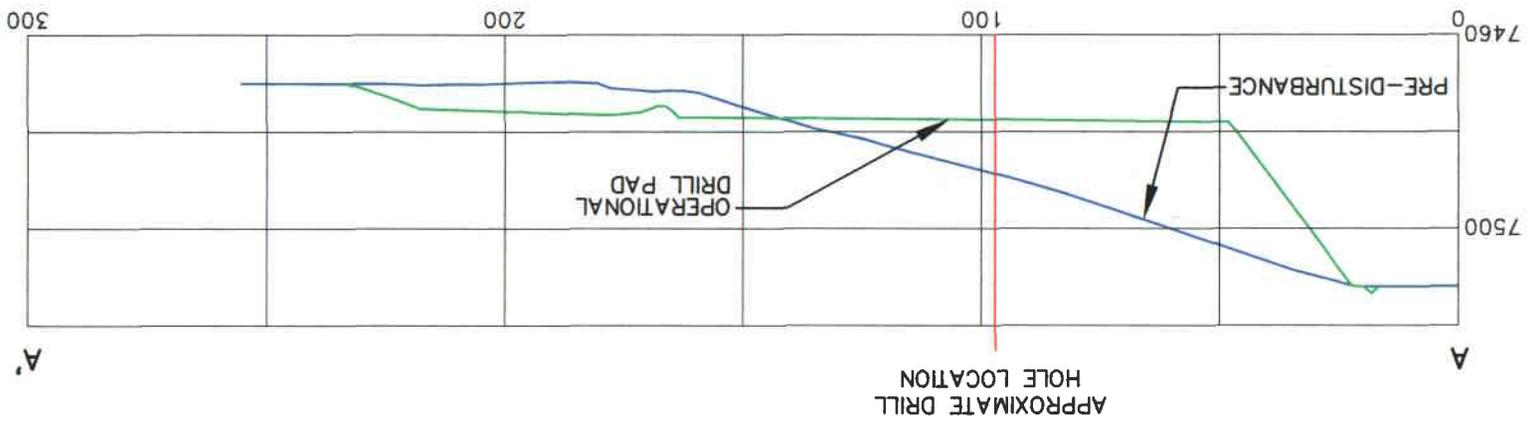
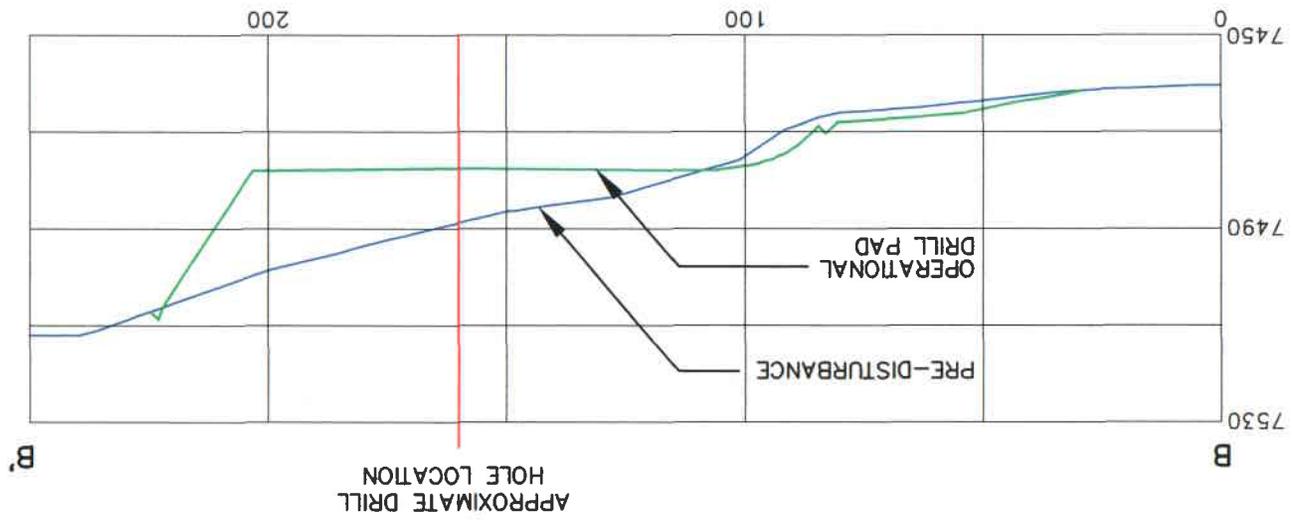
B'

A

A'

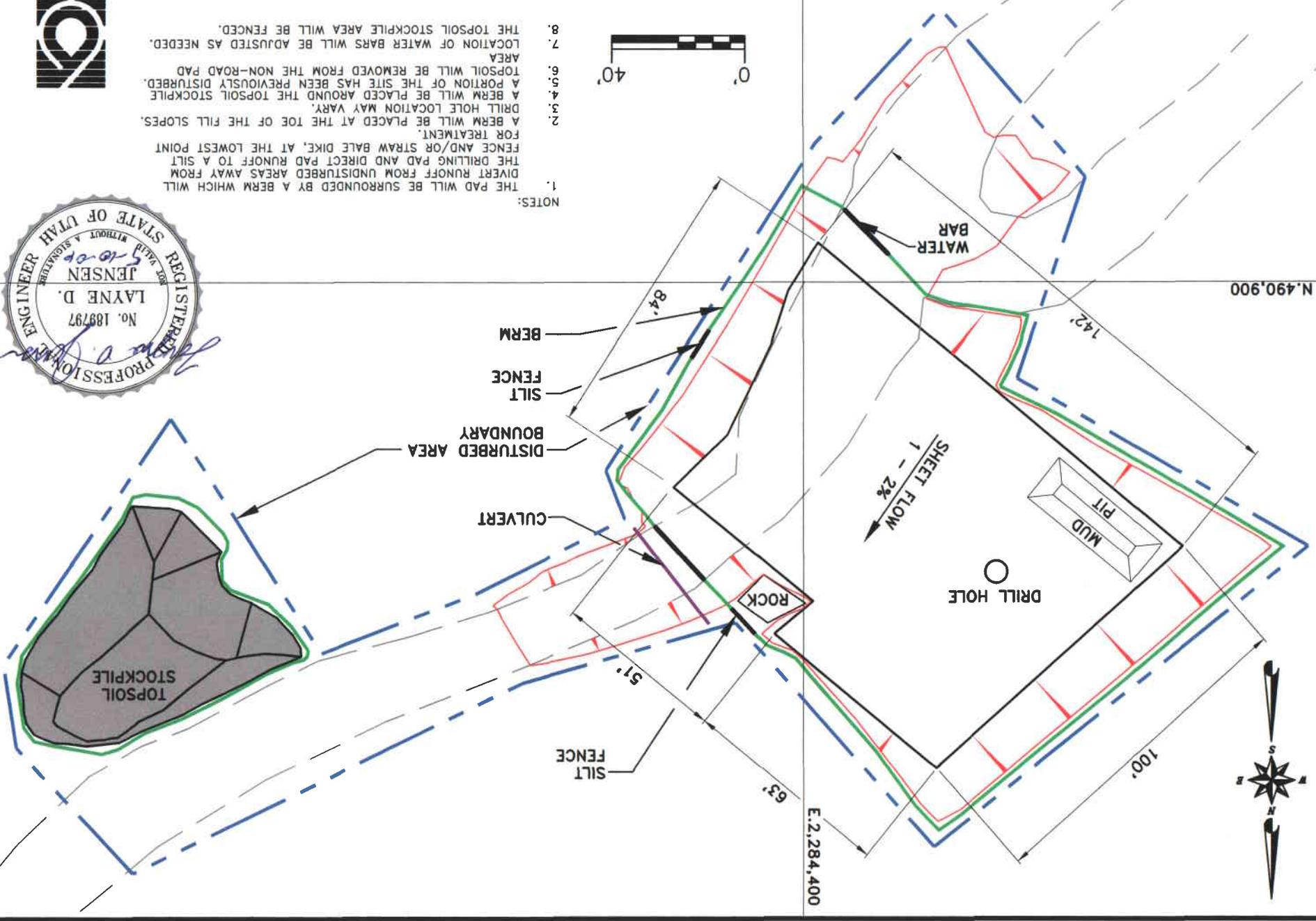


G-12 FIGURE 2. TYPICAL CROSS-SECTIONS FOR G-12



G-12 FIGURE 3. APPROXIMATE DRILLING LOCATION FOR G-12

- NOTES:
1. THE PAD WILL BE SURROUNDED BY A BERM WHICH WILL DIVERT RUNOFF FROM UNDISTURBED AREAS AWAY FROM THE DRILLING PAD AND DIRECT PAD RUNOFF TO A SILT FENCE AND/OR STRAW BALE DIKE, AT THE LOWEST POINT FOR TREATMENT.
 2. A BERM WILL BE PLACED AT THE TOE OF THE FILL SLOPES.
 3. DRILL HOLE LOCATION MAY VARY.
 4. A BERM WILL BE PLACED AROUND THE TOPSOIL STOCKPILE.
 5. A PORTION OF THE SITE HAS BEEN PREVIOUSLY DISTURBED.
 6. TOPSOIL WILL BE REMOVED FROM THE NON-ROAD PAD AREA.
 7. LOCATION OF WATER BARS WILL BE ADJUSTED AS NEEDED.
 8. THE TOPSOIL STOCKPILE AREA WILL BE FENCED.



Canyon Fuel Company, LLC
Dugout Canyon Mine

Methane Degassification Amendment
March 13, 2006

ATTACHMENT 5-2
Methane Degassification

Attachment 5-2

43 CFR Ch. 11, Subpart 3484.1 , (3)

“(3) All exploration drill holes must be capped with at least 5 feet of cement and plugged with a permanent plugging material that is unaffected by water and hydrocarbon gasses and will prevent the migration of gases and water in the drill hole under normal hole pressures. For exploration holes drilled deeper than stripping limits, the operator/lessee, using cement or other suitable plugging material approved by the authorized officer, shall plug the hole through the thickness of the coal beds or mineral deposits and through aquifers for a distance of at least 50 feet above and below the coal beds or mineral deposits and aquifers, or to the bottom of the drill hole. A lesser cap or plug may be approved by the authorized officer. Exploration activities shall be managed to prevent water pollution and mixing of ground and surface waters and ensure the safety of people, livestock and wildlife.”

Attachment 5-2

Methane and How it is Removed from a Mine.

Methane is the principal constituent of natural gas and is created through decomposition of organic matter. Methane is found throughout the world in various types of geologic formations. Coalbed methane is the name given to methane found in coal seams. It is formed during the process of transforming plant material into coal.

Coal mine methane is a subset of coalbed methane and is released from the coal seam during the process of coal mining/coal extraction. Coal mine methane is explosive and poses a danger to the mine and mine personnel. When the methane is in high volumes and concentrations, it limits the mine's productivity. By removing the coal mine methane, mine safety and productivity are improved. Methane can be contained in fractures and in pore space in the coal and may travel with the coal as it is removed and transported to the surface.

Methane is removed from underground coal mines by large ventilation fans and degassification systems (i.e., in-mine boreholes, surface boreholes, etc.). Degassification systems may remove methane in advance of mining, during mining activities or after mining has occurred.

When removed in advance of mining, the methane is drained through vertical boreholes drilled into the coal seam or horizontal boreholes within the seam or surrounding rock usually occurring years ahead of the mining activities. Degassification may also occur after mining has commenced, with gas being removed either before or after the coal is mined.

Dugout currently used a system of vertical surface boreholes and exhaustor-blowers to remove methane from the longwall gob. The holes are completed in the formation above the coal seam and not in the coal seam itself. When mining occurs, the formation above the coal seam fractures and releases methane that may be in the formation. In addition, methane is released from the coal seam during mining. The boreholes are used to collect the methane and remove it from the gob, thus, preventing the build up of methane to dangerous levels and reducing production delays.

Once the coal is removed, the roof collapses and debris from the strata around the empty coal seam fill the void. The debris is referred to as the gob, and the gob contains methane. Vertical and/or horizontal wells are drilled to either release or recover the gas within the gob.

Once mining of the area is complete and the area is sealed, methane can continue to be released from the gob and build up to pressures that can cause methane and other gob gases to leak into the current mine area. Both the gases behind the seals and the gas invading the working area are considered to be safety hazards by the Mine Safety and Health Administration. To prevent the buildup and leakage of methane and other gob gases, the operator plans to use the methane drainage wells to remove gob gases from the sealed areas.

Plugging and Reclaiming

The time line for reclaiming degas wells will be unique to each well. Factors which will contribute to the determination of when to plug and reclaim are as follows:

Timing of mining

Location of well in mining panel

Season of year

Access to site

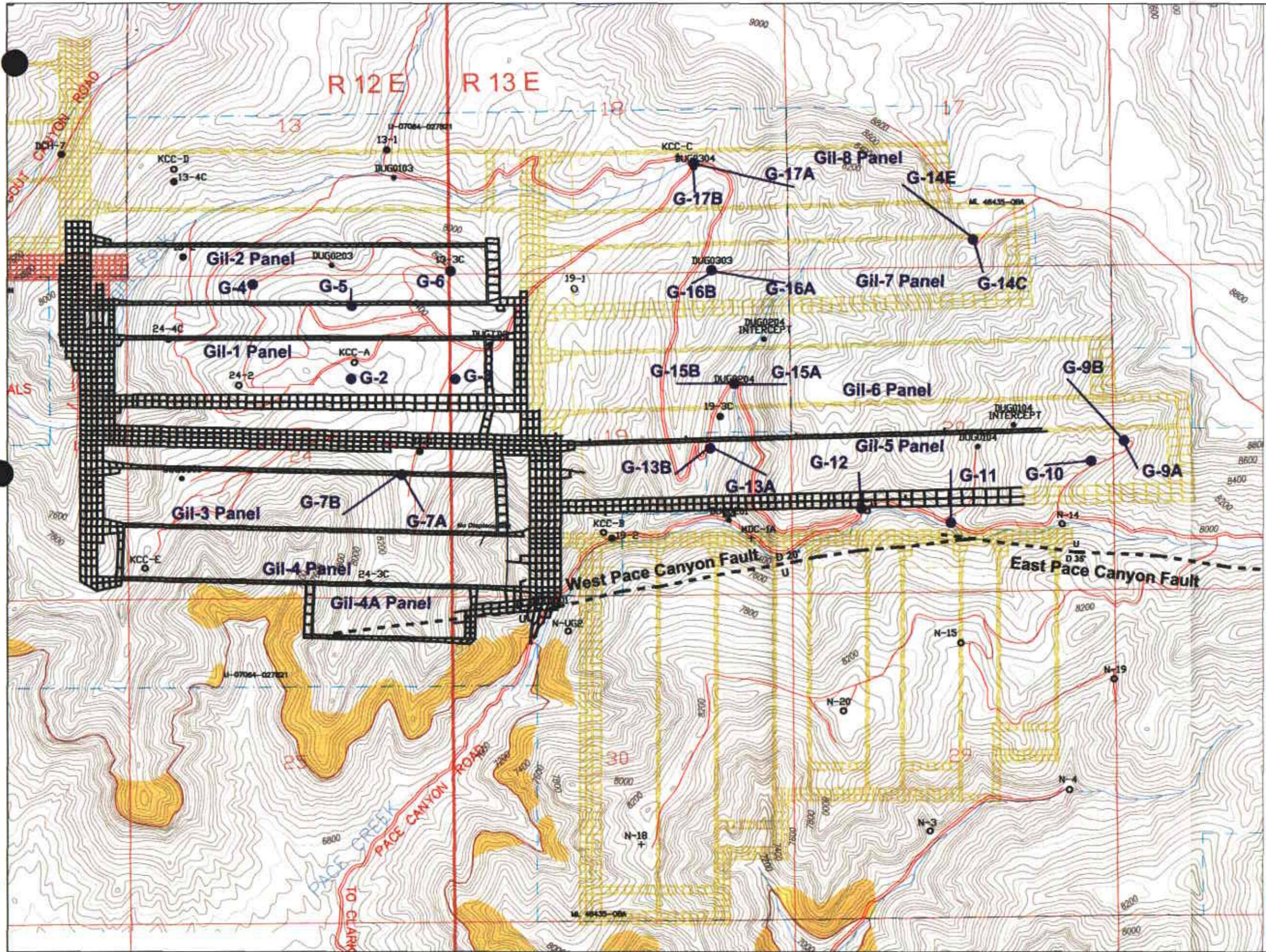
Safety

With the mine misfortunes the last few years, it is evident to the operator that the benefits of leaving a surface access to gob area has more benefits than drawbacks. For that reason and for the reasons listed previously, the operator plans to leave one degas hole open in each panel. The surface will be reclaimed, the degas hole will be capped, but the hole will not be plugged until mining issues have been considered and resolved.

To date, wells G-2, G-5 and G-7 will remain open. G-2 is in the Gil -1 Panel, G-5 is in the Gil-2 Panel and G-7 is in the Gil-3 Panel.

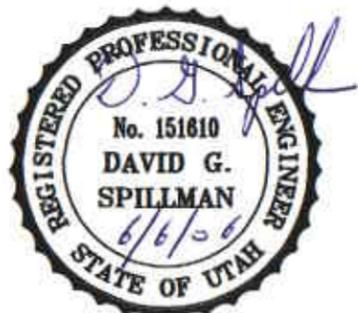
Well No.	Year Constructed		Year Plugged		Contemporaneous Reclamation		Final Reclamation	
	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
G-2		2004			2006			
G-3		2004		2005		2005	2006	
G-4		2004		2005				2005
G-5		2004			2006			
G-6		2004		2005			2006	
G-7		2005			2007			
G-9		2005			2008			
G-10	2006							
G-11	2006							
G-12	2006							
G-13	2006							
G-14	2006							
G-15	2007							
G-16	2007							
G-17	2007							

Dates are approximate, all events are subject to availability of contractors, weather, mining needs, etc.
 Although permitted, wells G-1 and G-8 were never drilled/constructed.



EXPLANATION

- Existing Road
- Lease Boundary
- Methane Drainage Wells
- Burn



CF	Canyon Fuel Co., LLC. Dugout Canyon Mine
	Location of Methane Drainage Wells
P.O. BOX 1088 WELLINGTON, UTAH 84643	DATE: 19-March-2006 WELL LOC BY: MINE PLAN. DIV.

Canyon Fuel Company, LLC
Dugout Canyon Mine

Methane Degassification Amendment
March 13, 2006

ATTACHMENT 5-3
Land Owner Correspondence

February 16, 2006

Ms. Pamela Grubaugh-Littig
Department of Natural Resources
Division of Oil, Gas and Mining
1594 West North Temple
Suite 1210
Salt Lake City, UT 84114-5801

RE: Reclamation of Degas Well Sites G-11 and G-12

Dear Ms. Grubaugh-Littig:

Per a discussion with Dugout Canyon Mine, we the landowners of the property (Milton and Ardith Thayn Trust) affected by the construction of degas wells G-11 and G-12 request that the pad areas remain as constructed, with the following stipulations:

Once the use of the well sites is completed the mud pits will be filled and the area leveled,

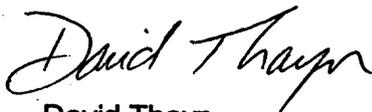
The topsoil will be replaced on the areas disturbed, except for the road areas,

The areas receiving topsoil will be seeded with native grasses, and

Topsoil storage areas will be pocked, gouged and then seeded.

We have alternative plans for the use of these areas. Please contact David Thayn at (435) 636-0220, if you have questions.

Sincerely,



David Thayn

Cc: Vicky S. Miller

MEMOS SENT TO THAYN TRUST AS NOTIFICATION OF PROPOSED ACTIVITIES

March 10, 2005

Subject: 2005 Drilling Activities on Thayn Lands

In 2005 the Dugout Canyon Mine currently plans to conduct exploration, de-gassing, and permitting activities on the Thayn Lands.

As many as two (2) exploration bore holes will be drilled on the Thayn Lands, see enclosed map. The current plan is to drill both holes from the same surface site due to surface access restrictions. In addition, Dugout would like to complete these holes as Methane Drainage Holes. This will save future costs, permitting efforts, and reduce surface disturbance. These holes will require grading of the access roads, preparation/building of the drill sites, and reclamation of the drill sites and roads as directed by the landowner and permit regulations. In addition, the drilling activities will require obtaining and hauling water from various streams and locations on the Thayn Lands, see map.

As many as nine (9) Methane Drainage Holes will be drilled to remove methane and other gases from the longwall panel gob areas, see map. As shown on the map several of these sites will have one or more holes drilled from the same site. This is due to limited surface access. Similar to the exploration drilling, these boreholes will require road grading/improvements, site building/preparation, reclamation, and water hauling. Permitting activities similar to those required for the exploration drilling will also be conducted in association with the degas drilling. It has not been determined if all nine (9) of the degas boreholes will be drilled or when. However, the G-7 hole may be drilled as early as May, 2005. The remaining holes, including the exploration holes, will be drilled later in the year depending on permitting and drill rig availability.

In conjunction with the exploration activities listed above, there will be permitting activities including, but not limited to, endangered plant and animal surveys, environmental assessment activities, and cultural surveys. All of these activities will be conducted by third party contractors and require no surface disturbance.

Associated with the degas activities will be the installation of one or more exhaustor-blower units on the degas sites to remove the gases from the mine. The number and duration of the installations are unknown at this time. While the exhaustor-blower units are in operation, the units will require frequent inspections to maintain the units. These inspections may range from daily to weekly depending on the effort required to maintain the units.

The Dugout Mine is planning to install a mine ventilation fan in the Pace Canyon. While the fan installation site is located on BLM surface, access to the fan site follows the main road access to the general area and crosses the Thayn Lands. The Dugout Mine currently expects to begin construction of the site in April 2005. These activities may include upgrades and enhancements to the access road that crosses Thayn Lands.

February 16, 2006

Subject: 2006 Dugout Canyon Mine Activities on Thayn Lands

In 2006 the Dugout Canyon Mine currently plans to conduct exploration, methane drainage, permitting activities, and other mining related activities on the Thayn Lands.

Exploration

As many as two (2) exploration bore holes will be drilled on the Thayn Lands, see enclosed map. The current plan includes drilling both holes from the same surface site due to surface access restrictions. In addition, Dugout will complete these holes as Methane Drainage Holes. These holes will require surveying, grading of the access roads, preparation/building of the drill sites, and reclamation of the drill sites and roads as directed by the landowner and permit regulations. In addition, the drilling activities will require obtaining and hauling water from various streams and locations on the Thayn Lands, see map.

Associated with exploration and as has been discussed with the land owner in 2005, Dugout will relocate a portion of a surface road used by various land owners and Dugout, see map. The road will be relocated from Conover Lands to Thayn Lands.

Methane Drainage

As many as eight (8), Methane Drainage Holes (2 are converted exploration holes) will be completed to remove methane and other gases from the longwall panel gob areas, see map. As shown on the map several of these sites will have one or more holes drilled from the same site due to limited surface access. Similar to the exploration drilling, these boreholes will require surveying, road grading/improvements, site building/preparation, reclamation, and water hauling. Permitting activities similar to those required for the exploration drilling will also be conducted in association with the degas drilling

Drilling of the methane drainage holes is expected to begin within the first two weeks of June.

In addition to drilling and installing methane drainage wells, Dugout will also be plugging and reclaiming a minimum of two (2) methane drainage wells—G3 and G6.

Permitting Activities

In conjunction with the exploration activities listed above, there will be permitting activities including, but not limited to, plant and animal surveys, environmental assessment activities, and cultural surveys. All of these activities will be conducted by third party contractors and require minimal surface disturbance (soil test pits).

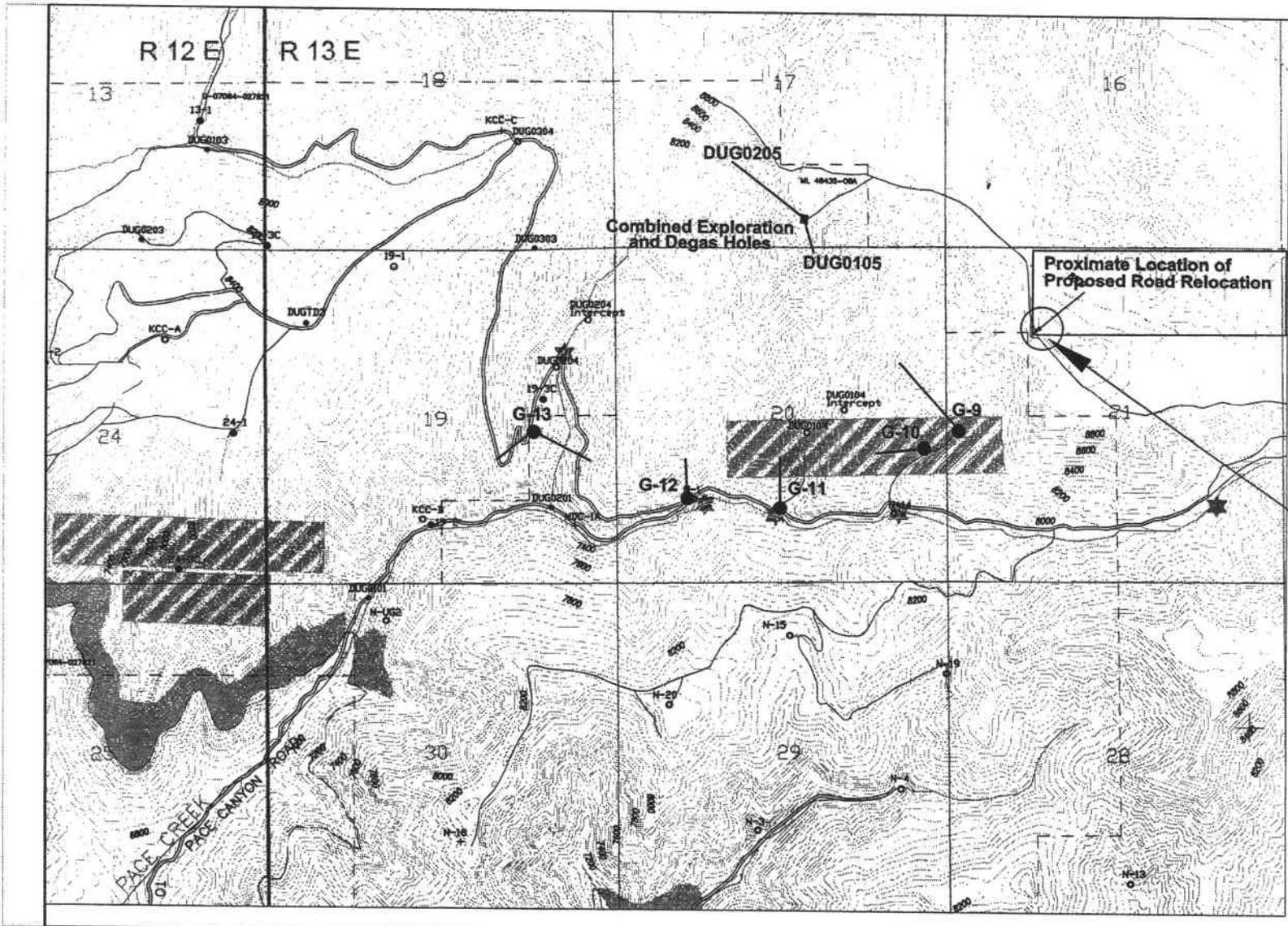
In addition, Dugout is required by regulatory permits to conduct water monitoring surveys for both quantity and quality. The Dugout Canyon Mine will also conduct an annual stream geomorphology study of Pace Creek to determine if subsidence may impact the stream channel.

Miscellaneous Activities

The Dugout Mine will also be conducting the following activities:

- Installation and monitoring of one or more exhaustor-blower units on the degas sites to remove the gases from the mine. The number and duration of the installations are unknown at this time.
- Fault investigations to determine the surface location and characteristics of several faults associated with the Dugout Canyon Mine. This may include digging trenches in select locations on existing roads. The locations are currently undecided, but will be approved by the land owner before digging commences.
- Monitoring and removing noxious weeds, in accordance with the existing land use agreement.
- Locating and surveying section corners and lease/property lines. This surveying may be completed either by private or government surveyors.
- Surveying subsidence monitoring points.

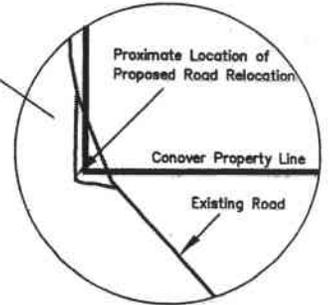
In addition, the attached map also identifies the areas where longwall mining will occur beneath the Thayn Lands.



EXPLANATION

- Existing Road
- No Upgrade
- Existing Road Requires Upgrade
- Newly Constructed Road
- Trail
- Lease Boundary
- Degas Bore Holes
- Water Locations
- Burn
- 2006 Longwall Mining

Scale: 1" = 1500'



	Canyon Fuel Co., LLC. Dugout Canyon Mine
	Thayn Lands Planned Activities in 2006
P.D. SHEET 1029 WELLINGTON, UTAH 84042	DATE: 10-24-2005

Canyon Fuel Company, LLC
Dugout Canyon Mine

Methane Degassification Amendment
March 13, 2006

CHAPTER 7
HYDROLOGY

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LIST OF ATTACHMENTS

Attachment 7-1 Hydrology Calculations

710 INTRODUCTION

711 General Requirements

This chapter presents a description of the following:

- Proposed operations and the potential impacts to the hydrologic balance;
- Methods of compliance with design criteria and the calculations utilized to show compliance; and
- Applicable hydrologic performance standards.

712 Certification

All maps, plans, and cross sections presented in this chapter have been certified by a qualified, registered professional engineer.

713 Inspection

Inspections are not required since no permanent impoundments will exist at the well sites.

720 ENVIRONMENTAL DESCRIPTION

721 General Requirements

The application will include a description of the existing premining hydrologic resources with the proposed permit and adjacent areas that may be affected or impacted by the proposed coal mining and reclamation operations.

722 Cross Sections and Maps

722.100 Location and Extent of Subsurface Water

Figure 7-1 in the approved M&RP shows a generalized hydrostratigraphic cross section of the permit and adjacent areas including the well sites. Section 724.100 of the approved M&RP provides baseline groundwater conditions.

722.200 Location of Surface Water Bodies

Plate 7-2 in the approved M&RP shows the locations of surface-water bodies and existing or pending water rights. Section 724.200 of the approved M&RP provides baseline surface water conditions.

722.300 Locations of Monitoring Stations

Plate 7-1 in the approved M&RP shows the location of surface water and groundwater monitoring stations.

722.400 Locations and Depth of Water Wells

Refer to Section 722.400 and Plate 7-1 of the approved M&RP for information pertaining to the groundwater monitoring wells. Refer to Appendix 7-9 of approved M&RP for details pertaining to the Gilson well.

722.500 Surface Topography

Surface topography features at the well sites and adjacent areas are shown on Figures 1-1, 5-1, 5-5, 5-9, 5-17, 5-20, 5-23, 5-27 and in Attachment 5-1 for Degas Wells G-8 thru G-12. Refer to Plate 1-4 in the M&RP for well locations.

723 Sampling and Analysis

Refer to Section 723 of the approved M&RP.

724 Baseline Information

Refer to Section 724 of the approved M&RP.

724.100 Groundwater Information

Refer to Section 724.100 of the approved M&RP.

724.200 Surface Water Information

Refer to Section 724.200 of the approved M&RP.

724.300 Geologic Information

Geologic information related to the well sites and adjacent areas is presented in Chapter 6 of this submittal and in the approved M&RP.

724.400 Climatological Information

Climatological data are summarized in Appendix 4-1 behind the Air Quality Permit of the approved M&RP and RA Attachment 7-5 of the Refuse Pile Amendment.

724.500 Supplemental Information

Refer to Section 724.500 of the approved M&RP.

724.600 Survey of Renewable Resource Lands

Refer to Section 724.600 of the approved M&RP.

724.700 Alluvial Valley Floor Requirements

Information regarding the presence or absence of alluvial valley floors in the well sites and adjacent areas is presented in Chapter 9 of this submittal and the approved M&RP.

725 Baseline Cumulative Impact Area Information

The CHIA currently in place for the Dugout Canyon Mine covers the well sites. The hydrologic and geologic information required for the Division to develop a Cumulative Hydrologic Impact Assessment (CHIA) is presented in the approved M&RP.

726 Modeling

No groundwater or surface water modeling was conducted in support of this submittal.

727 Alternative Water Source Information

Not applicable.

728 Probable Hydrologic Consequences

This section addresses the probable hydrologic consequences of construction and reclamation operations at the well sites. Mitigation measures are discussed generally in this section and in detail in Section 730 of the approved M&RP.

728.100 Potential Impacts of Surface and Groundwater

Potential impacts of the well sites in this area on the quality and quantity of surface and groundwater flow may include contamination from materials associated with the drilling of the wells. The potential impact is addressed in Section 728.300 of this submittal and the approved M&RP.

728.200 Baseline Hydrologic and Geologic Information

Baseline geologic information is presented in Chapter 6 of the approved M&RP. Baseline hydrologic information is presented in Section 724.100 and 724.200 of the approved M&RP.

728.300 PHC Determination

Potential Impacts to the Hydrologic Balance - Potential impacts of the Dugout Canyon Mine on the hydrologic balance of the well sites and adjacent areas are addressed in the subsections of this submittal and the approved M&RP.

Acid and Toxic Forming Materials - No acid or toxic forming materials have been identified in the soils or strata of the Dugout Canyon Mine (Chapter 6, Section 623 of this submittal). Additional information is located in Appendix 6-2 of the approved M&RP.

Groundwater - During drilling of the wells, the groundwater encountered will be affected. Drilling mud will be used to seal the groundwater aquifers. Once drilling is completed, the casing will be grouted in the well hole. This will seal the aquifers to prevent any groundwater from migrating down the outside of the casing into the mine. Should water inflow greater than 15 gallon per minute be encountered during the drilling of the degas wells the depth and volume will be recorded and included in Attachment 7-1.

Potential Hydrocarbon Contamination - Hydrocarbon products will not be stored at the well sites, however fuels, greases, and other oils may leak from equipment during drilling operations.

Absorbent materials will be used for the collection of leaked fuels, greases, and other oils. The saturated absorbent materials will be disposed of at an appropriate landfill facility.

729 Cumulative Hydrologic Impact Assessment (CHIA)

The Cumulative Hydrologic Impact Assessment currently in place for the Dugout Canyon Mine includes the well sites and adjacent areas.

730 OPERATION PLAN

731 General Requirements

731.100 Hydrologic - Balance Protection

Groundwater Protection - The effect on groundwater at the well sites is expected to be minimal. Groundwater encountered during drilling will be sealed off, refer to Section 728.300.

Surface Water Protection - To protect the hydrologic balance, construction, maintenance, and reclamation operations will be conducted to handle earth materials and runoff in a manner that prevents, to the extent possible, additional contributions of suspended solids to stream flow outside the permit area, and otherwise prevent water pollution.

During initial drilling, the sites will be graded to ensure that storm runoff will flow towards the berms surrounding the drilling pad area. The berms will direct the runoff to the lowest point(s) within the pad area where a silt fence and/or straw bale dike(s) will treat the runoff (see Figures 5-1, 5-5, 5-9, 5-17, 5-20, 5-23, 5-27 and Attachment 5-1). The berm placed at the top of the drilling pad cut slopes will divert runoff around the drilling pad. Thus reducing the runoff affected by the drilling pad. The pad will be re-graded to cause the storm runoff to sheet flow towards a silt fence and/or straw bale dike. A berm will be placed at the top of the fill slope to direct any runoff from the operational pad to the silt fence and/or straw bale dike(see Figures 5-4, 5-8, 5-12, 5-19, 5-22, 5-25, 5-29 and

Attachment 5-1). The silt fences and/or straw bale dikes will be periodically inspected, and accumulated sediment will be removed as needed to maintain functionality. The sediment from the silt fence and/or straw bale dikes will be piled on the pad and will be used for fill during final reclamation of the well site. During the drilling phase a berm and silt fence will be installed at the toe of the fill slope as shown on Figures 5-1, 5-5, 5-9, 5-17, 5-20, 5-23, 5-27 and Attachment 5-1 to treat any runoff from the drilling pad.

731.200 Water Monitoring

No water monitoring will be conducted at the degas well sites. Refer to approved M&RP for a description of water monitoring.

731.300 Acid or Toxic Forming Materials

No acid or toxic forming materials are anticipated at the well sites (see Section 728.300).

731.400 Transfer of Wells

Refer to Section 731.400 of the approved M&RP.

731.500 Discharge

No discharges to underground workings.

731.600 Stream Buffer Zones

Stream Channel Diversions - No stream channel diversions are planned at the well sites.

Buffer Zone Designation - When drilling sites are adjacent to a perennial stream, a stream buffer zone will be established.

731.700 Cross Section and Maps

Not applicable.

731.800 Water Rights and Replacement

Refer to Sections 728.300 and 731.800 of the approved M&RP.

732 Sediment Control Measures

The sediment control measures within the well sites have been designed to prevent additional contributions of sediment to stream flow or to runoff outside the well sites. In addition, the well sites have been designed to minimize erosion to the extent possible.

The structures to be used for runoff control at the well sites are berms, silt fences and/or straw bale dikes.

732.100 Siltation Structures

Berms, silt fences and straw bales dikes will be used to treat runoff.

732.200 Sedimentation Pond

The drilling sites will not have sedimentation ponds.

732.300 Diversions

Refer to Section 731.100 of this submittal.

732.400 Road Drainage

No diversion ditches will be constructed along the primary roads leading to the well sites. See Figures 5-13 and 5-14 for typical road cross sections. Where needed roads accessing the drill sites will have a water bar constructed at the base of the road to divert water off the road prior to the runoff reaching the drilling pad.

733 Impoundments

733.100 General Plans

Not applicable.

733.200 Permanent and Temporary Impoundments

No permanent impoundments will exist at the well sites.

734 Discharge Structures

A berm will surround the entire drill pad at each well site during the drilling phase (excepted as noted). The berm will divert undisturbed runoff around the drilling pad and direct runoff from the pad to a silt fence/straw bale dike at the lowest point within the well pad disturbed area. A silt fence and/or straw bale dike will be the discharge structure for each of the well sites during the operational phase.

735 Disposal of Excess Spoil

There will be no excess spoil generated at the well sites.

736 Coal Mine Waste

There will be no coal mine waste generated or stored at the well sites.

737 Non-Coal Mine Waste

There will be no non-coal mine waste disposed at the well sites.

738 Temporary Casing and Sealing of Wells

Refer to Section 542.700 of this submittal.

740 DESIGN CRITERIA AND PLANS

741 General Requirements

This submittal includes general well site plans that incorporate design criteria for the control of drainage.

742 Sediment Control Measures

742.100 General Requirements

Design - Sediment control measures have been formulated to prevent additional contributions of sediment to stream flow or to runoff outside the well site area; and minimize erosion to the extent possible.

Measures and Methods - Sediment control methods will include silt fences, berms, and straw bales to reduce runoff and trap sediment.

742.200 Siltation Structures

General Requirements - Additional contributions of suspended solids and sediment or runoff outside the well site area will be prevented to the extent possible using silt fences, berms, and straw bale dikes. Construction activities will not occur during major precipitation events.

Design - All hydrology calculations were made using the 10-year, 24-hour precipitation event. Hydrology calculations are in Attachment 7-1. Locations of the berms and silt fences are shown on Figures 5-1, 5-4, 5-5, 5-8, 5-9, 5-12, 5-17, 5-20, 5-23, 5-27 and Attachment 5-1.

742.300 Diversions

No diversion ditches will be constructed as part of the drilling or operational phases.

742.400 Road Drainage

Refer to Section 732.400 of this submittal.

743 Impoundments

No impoundments will exist at the well sites.

744 Discharge Structures

No discharge structures have been planned or designed.

745 Disposal of Excess Spoil

There will be no excess spoil generated at the well sites.

746 Coal Mine Waste

746.100 General Requirements

There will be no coal mine waste used at the well sites.

746.200 Refuse Piles

There will be no refuse piles at the well sites.

746.300 Impounding Structures

Refer to Section 733.200 of this submittal.

746.400 Return of Coal Processing Waste to Abandoned Underground Workings

No coal processing waste will be generated at the well sites.

747 Disposal of Non-Coal Mine Waste

All non-coal mine waste will be disposed of at an approved landfill.

748 Casing and Sealing Wells

Refer to Section 542.700 of this submittal.

750 PERFORMANCE STANDARDS

751 Water Quality Standards and Effluent Limitations

Water encountered during drilling and runoff water will be treated using silt fence and/or straw bale dikes prior to leaving the site. Should it become necessary the water encountered during drilling will be pumped into a tank and hauled from the site for disposal at a licensed facility.

752 Sediment Control Measures

All sediment control measures will be located, maintained, constructed and reclaimed according to plans and designs presented in Section 732, 742, and 760 of this submittal.

752.100 Siltation Structures and Diversions

Siltation structures will be located, maintained, constructed and reclaimed according to plans and designs presented in Section 732, 742, and 763 of the submittal.

752.200 Road Drainage

Refer to Section 732.400 of this submittal.

753 Impoundments and Discharge Structures

Refer to Section 733.200 of this submittal.

754 Disposal of Excess Spoil, Coal Mine Waste and Non-Coal Mine Waste

There will be no excess spoil or coal mine waste generated at the well sites. Refer to Section 747 of this submittal regarding non-coal waste disposal.

755 Casing and Sealing

Refer to Section 542.700 of this submittal.

760 RECLAMATION

761 General Requirements

A detailed reclamation plan for the well sites is presented in Section 540. No structures will exist at the well sites.

762 Roads

Refer to Section 542.600.

762.100 Restoring the Natural Drainage Patterns

The natural drainage patterns will be restored after degassification is completed.

762.200 Reshaping Cut and Fill Slopes

Cut and fill slopes will be reshaped at the well sites.

763 Siltation Structures

763.100 Maintenance of Siltation Structures

All siltation structures will be maintained until removed in accordance with the approved reclamation plan.

763.200 Removal of Siltation Structures

When a siltation structure is removed, the land on which the siltation structure was located will be regraded and revegetated in accordance with the reclamation plan presented in Section 540.

764 Structure Removal

A timetable for the reclamation of the sites is presented in Figures 5-15 (G-2 and G-3) and 5-26 (G-4 thru G-12).

765 Permanent Casing and Sealing of Wells

Refer to Section 542.700 of this submittal.

Canyon Fuel Company, LLC
Dugout Canyon Mine

Methane Degassification Amendment
March 13, 2006

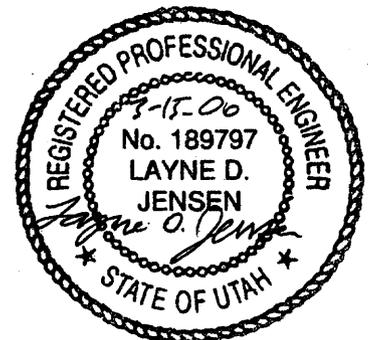
**ATTACHMENT 7-1
HYDROLOGY CALCULATIONS**

add to the back of existing information

Canyon Fuel Company, LLC
Dugout Canyon Mine

Methane Degassification Amendment
March 16, 2006

**ATTACHMENT 7-1
HYDROLOGY CALCULATIONS**



SILT FENCE DESIGN

To control sediment yield from the degas hole drilling pads a combination of berms and silt fences will be used. Berms will be placed around the entire drilling pad including the cut slopes and fill slopes. These berms will have two purposes. The first is to divert runoff from undisturbed areas from flowing onto the drilling pad. The second is to divert runoff from the drilling pad to one or more silt fences to be treated before discharge. These calculations will determine the minimum surface area of silt fence needed to handle a 10-year 24-hour storm event.

The peak flow calculations will be made assuming that the entire area within the berms has a curve number of 90. This value is from professional judgment taking into consideration that a dirt road in an area with hydrologic soil group D has a curve number of 89. Hence this should be a conservative estimate.

Silt fences are manufactured to have a wide variety of water flow rates. I have seen water flow rates as low as 4 gpm/ft² to flow rates as high as 35 gpm/ft². However, the typical water flow rate for silt fences is 10 gpm/ft². This design will be based on this typical water flow rate. Any silt fence used at the degas hole sites should have a water flow rate of approximately 10 gpm/ft².

Assuming a silt fence height of 2 ft a minimum length of silt fence will be specified based on the peak flow to be treated and the typical water flow rate of 10 gpm/ft².

G-11

Peak flow = 0.56 cfs = 251.3 gpm

Required silt fence surface area = $251 \text{ gpm} / 10 \text{ gpm/ft}^2 = 25.13 \text{ ft}^2$

Assuming a silt fence height of 2 ft.

Minimum total length of silt fence required = $25.13 \text{ ft}^2 / 2 \text{ ft} = 12.6 \text{ ft}$

G-12

Peak flow = 0.48 cfs = 215.4 gpm

Required silt fence surface area = $215.4 \text{ gpm} / 10 \text{ gpm/ft}^2 = 21.54 \text{ ft}^2$

Assuming a silt fence height of 2 ft.

Minimum total length of silt fence required = $21.54 \text{ ft}^2 / 2 \text{ ft} = 10.8 \text{ ft}$

Note: The minimum total length of silt fence required is the combined length of silt fence from multiple places at the site or a single silt fence depending on the sites configuration.

G-13

Peak flow = 1.08 cfs = 484.7 gpm

Required silt fence surface area = $484.7 \text{ gpm} / 10 \text{ gpm/ft}^2 = 48.47 \text{ ft}^2$

Assuming a silt fence height of 2 ft.

Minimum total length of silt fence required = $48.47 \text{ ft}^2 / 2 \text{ ft} = 24.2 \text{ ft}$

G-14

Peak flow = 0.93 cfs = 417.4 gpm

Required silt fence surface area = $417.4 \text{ gpm} / 10 \text{ gpm/ft}^2 = 41.74 \text{ ft}^2$

Assuming a silt fence height of 2 ft.

Minimum total length of silt fence required = $41.74 \text{ ft}^2 / 2 \text{ ft} = 20.9 \text{ ft}$

G-15

Peak flow = 0.81 cfs = 363.6 gpm

Required silt fence surface area = $363.6 \text{ gpm} / 10 \text{ gpm/ft}^2 = 36.36 \text{ ft}^2$

Assuming a silt fence height of 2 ft.

Minimum total length of silt fence required = $36.36 \text{ ft}^2 / 2 \text{ ft} = 18.2 \text{ ft}$

Note: The minimum total length of silt fence required is the combined length of silt fence from multiple places at the site or a single silt fence depending on the sites configuration.

G-16

Peak flow = 0.67 cfs = 300.7 gpm

Required silt fence surface area = $300.7 \text{ gpm} / 10 \text{ gpm/ft}^2 = 30.07 \text{ ft}^2$

Assuming a silt fence height of 2 ft.

Minimum total length of silt fence required = $30.07 \text{ ft}^2 / 2 \text{ ft} = 15.0 \text{ ft}$

G-17

Peak flow = 0.53 cfs = 237.9 gpm

Required silt fence surface area = $237.9 \text{ gpm} / 10 \text{ gpm/ft}^2 = 23.79 \text{ ft}^2$

Assuming a silt fence height of 2 ft.

Minimum total length of silt fence required = $23.79 \text{ ft}^2 / 2 \text{ ft} = 11.9 \text{ ft}$

Note: The minimum total length of silt fence required is the combined length of silt fence from multiple places at the site or a single silt fence depending on the sites configuration.

**Summary of Watershed Data
Degas Well Sites G-11 through G-12**

Degas Hole Area	Drainage Area (ac)	Curve Number	S (in)	Y (%)	I (ft)	L (hr)	Time of Conc. (hr)	Peak Flow (cfs)	Peak Flow (gpm)
G-11	0.49	90	1.111	32	190	0.010	0.017	0.56	251.3
G-12	0.42	90	1.111	30	205	0.011	0.019	0.48	215.4
G-13	0.95	90	1.111	19	385	0.024	0.040	1.08	484.7
G-14	0.83	90	1.111	12	370	0.029	0.049	0.93	417.4
G-15	0.71	90	1.111	32	330	0.016	0.027	0.81	363.6
G-16	0.59	90	1.111	16	240	0.018	0.030	0.67	300.7
G-17	0.47	90	1.111	13	260	0.021	0.035	0.53	237.9

Notes

S = 1000/CN - 10

Y = average watershed slope = (length of contour lines)(contour interval)/(watershed area)

I = hydraulic length

L = watershed lag = $(190.8(S+1)^{0.7}) / (1900(Y)^{0.5})$

Time of Concentration + 1.67L

Peak Flow is based on a 10-yr 24-hr storm event

Triangular Hydrograph Calculations using
SCSHYDRO Program

Watershed I.D.:
G-11

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 0.49 acres
Depth = 2.00 inches	CN = 90.00
Duration = 24.0 hrs	Time conc.= 0.02 hrs

OUTPUT SUMMARY

Runoff depth: 1.094 inches
Initial abstr: 0.222 inches
Peak flow: 0.56 cfs (1.133 iph)
at time: 12.002 hrs

Triangular Hydrograph Calculations using
SCSHYDRO Program

Watershed I.D.:
G-12

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 0.42 acres
Depth = 2.00 inches	CN = 90.00
Duration = 24.0 hrs	Time conc.= 0.02 hrs

OUTPUT SUMMARY

Runoff depth: 1.094 inches
Initial abstr: 0.222 inches
Peak flow: 0.48 cfs (1.131 iph)
at time: 12.000 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:

G-13

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 0.95 acres
Depth = 2.00 inches	CN = 90.00
Duration = 24.0 hrs	Time conc.= 0.04 hrs

OUTPUT SUMMARY

Runoff depth: 1.094 inches
Initial abstr: 0.222 inches
Peak flow: 1.08 cfs (1.123 iph)
at time: 12.005 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:

G-14

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 0.83 acres
Depth = 2.00 inches	CN = 90.00
Duration = 24.0 hrs	Time conc.= 0.05 hrs

OUTPUT SUMMARY

Runoff depth: 1.094 inches
Initial abstr: 0.222 inches
Peak flow: 0.93 cfs (1.117 iph)
at time: 12.002 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:

G-15

INPUT SUMMARY

STORM :

Dist. = SCS Type II
Depth = 2.00 inches
Duration = 24.0 hrs

WATERSHED :

Area = 0.71 acres
CN = 90.00
Time conc. = 0.03 hrs

OUTPUT SUMMARY

Runoff depth: 1.094 inches
Initial abstr: 0.222 inches
Peak flow: 0.81 cfs (1.128 iph)
at time: 12.002 hrs

Triangular Hydrograph Calculations using
SCSHYDRO Program

Watershed I.D.:
G-16

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 0.59 acres
Depth = 2.00 inches	CN = 90.00
Duration = 24.0 hrs	Time conc.= 0.03 hrs

OUTPUT SUMMARY

Runoff depth: 1.094 inches
Initial abstr: 0.222 inches
Peak flow: 0.67 cfs (1.127 iph)
at time: 12.004 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
G-17

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 0.47 acres
Depth = 2.00 inches	CN = 90.00
Duration = 24.0 hrs	Time conc.= 0.04 hrs

OUTPUT SUMMARY

Runoff depth: 1.094 inches
Initial abstr: 0.222 inches
Peak flow: 0.53 cfs (1.124 iph)
at time: 12.003 hrs

product

Prefabricated Silt Fence Structures for Sedimentation Control

Silt Fence Technical Data (All values are minimum average roll values)

PROPERTY	TEST METHOD	UNITS	SILT FENCE (100X) MINIMUM AVERAGE ROLL VALUES	ENVIROFENCE® (100X) MINIMUM AVERAGE ROLL VALUES
Grab Tensile Strength (machine direction)*	ASTM D 4632	N (lbs)	550 (124)	550 (124)
Grab Tensile Strength (cross-machine direction)*	ASTM D 4632	N (lbs)	550 (124)	550 (124)
Grab Tensile Elongation	ASTM D 4632	%	15/15	15/15
Mullen Burst Strength	ASTM D 3786	kPa (psi)	2060 (300)	2060 (300)
Trapezoid Tear Strength	ASTM D 4533	N (lbs)	290 (65)	290 (60)
Permittivity	ASTM D 4491	sec ⁻¹	0.10	0.10
Water Flow Rate	ASTM D 4491	l/min/m ² (gal/min/ft ²)	405 (10)	405 (10)
Ultraviolet Stability	ASTM D 4355	%	70	70

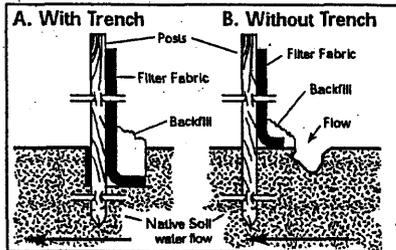
* Envirofence working strength is enhanced further by the incorporation of a polymeric mesh providing a tensile strength of 140 lbs/ft (typical) in both machine and cross machine directions.

Silt Fence Packaging

SILT FENCE TYPE	LENGTH m (ft)	FABRIC WIDTH m (ft)	POST LENGTH m (ft)	POST SPACING m (ft)	SHIPPING WEIGHTS kg (lbs)
Miraf® Silt Fence	30.5 (100)	0.9 (3)	1.22 (4)	2.5 (8.3)	23 (50)
	30.5 (100)	0.9 (3)	1.22 (4)	3.0 (10)	20 (45)
Miraf® Envirofence®	30.5 (100)	0.9 (3)	1.22 (4)	2.5 (8.3)	25 (55)
100CX (Fabric Only)	varies	0.9 (3)	—	—	varies
100X (Fabric Only)	100.6 (330)	0.9 (3)	—	—	12 (26)

Silt Fence Installation Guidelines

Toe-In Methods



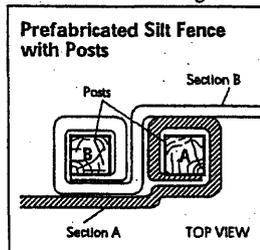
A. With Trench

- Excavate a 15.2 cm x 15.2 cm (6" x 6") trench along lower perimeter of site.
- Unroll silt fence one section at a time. Posts should be positioned on downstream side of fence.
- Drive post into ground and lay the toe-in fabric flap in bottom of trench. Backfill trench, and tamp ground as shown in diagram above.

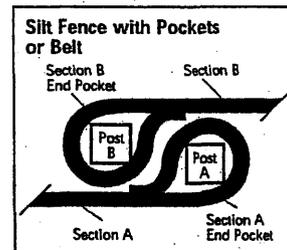
B. Without Trench

- Toe-in can also be accomplished by laying the fabric flap on untrenched ground and piling and tamping soil over the flap at the base of structure.

Joining Sections of Silt Fences



- Position posts to overlap as shown in diagram above, making certain that fabric folds around each post one full turn.
- Drive posts tightly together and secure tops of posts by tying off with cord or wire to prevent flow-through of built-up sediment at joint.



- Overlap posts as shown in previous section to prevent flow-through.
- Drive posts firmly together and tie off tops of posts to prevent separation.

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LT.PDS.SF.0304

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Ten Cate Nicolon

G-12

Topsoil stockpile containment Calculation.

Using the same conservative assumptions as for G-11.

Area within the berm = 3897 ft^2

Runoff volume = $(3897 \text{ ft}^2)(1.03/12) = 334.5 \text{ ft}^3$

The stockpile will be gonged to prevent runoff and thus eliminate erosion.

The same volume of each gong will be assumed as for the G-11 calculations. i.e. Gong Vol = 7 ft^3

Total gong capacity = $((3897 \text{ ft}^2)/80) 7 \text{ ft}^3 = 341.0 \text{ ft}^3$

$341.0 > 334.5 \text{ ft}^3 \therefore \text{ok}$

Although the gongs should prevent runoff the topsoil stockpile will be surrounded by a berm at least 1.5' tall which will provide additional storage.

6-11

Topsoil stockpile containment calculation

The volume of runoff to be contained will be based on the 10-yr 24-hr storm event of 2.0". A Hydrologic soil group of D will be assumed to be conservative.

CN = 89 (Dirt road) (very conservative since stockpile will be gouged and seeded)

$$\text{Runoff Depth} = \frac{(P - 0.2S)^2}{P + 0.8(S)}$$

$$S = 1000 / CN - 10 = 1000 / 89 - 10 = 1.24$$

$$\text{Runoff Depth} = \frac{(2.0 - 0.2(1.24))^2}{2.0 + 0.8(1.24)} = 1.07''$$

$$\text{Area within the berm} = 1935 \text{ ft}^2$$

$$\text{Runoff Volume} = (1935 \text{ ft}^2 \times 1.07 / 12) = 166.1 \text{ ft}^3$$

The stockpile will be gouged to retain all runoff on the stockpile thus, eliminating erosion.

To quantify the storage volume of each gouge a 2' x 3' x 2' deep depression will be assumed for every 80 ft². Assume a 1 ft² bottom for the depression.

$$\text{Gouge Vol} = 1/2((2' \times 3') + 1)(2) = 7 \text{ ft}^3 \quad (\text{Using Average end Area method})$$

$$\text{Total gouge capacity} = ((1935) / 80)(7 \text{ ft}^3) = 169.3 \text{ ft}^3$$

$$169.3 > 166.1 \text{ ft}^3 \therefore \text{OK}$$

Although the gouges should prevent runoff a berm will also provide additional storage.

The berm should have a minimum ht of 1.5'

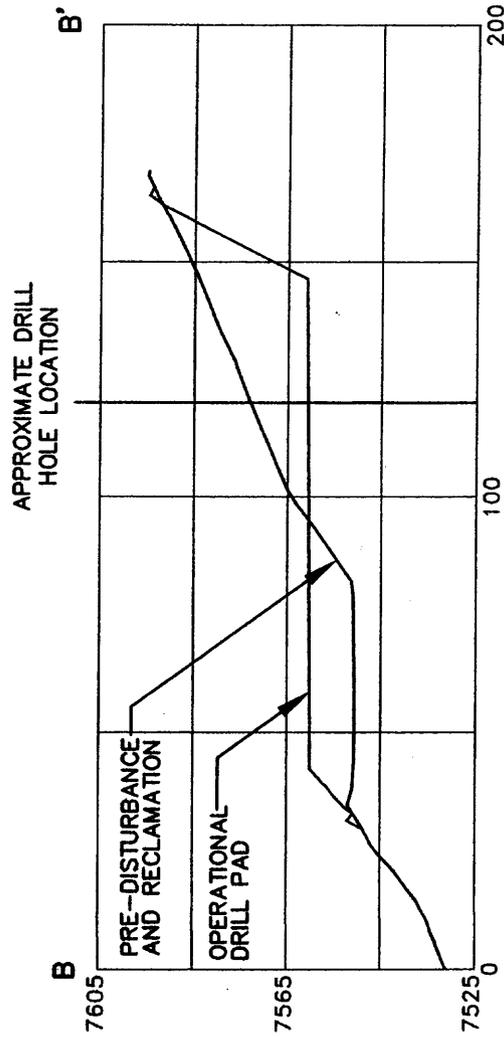
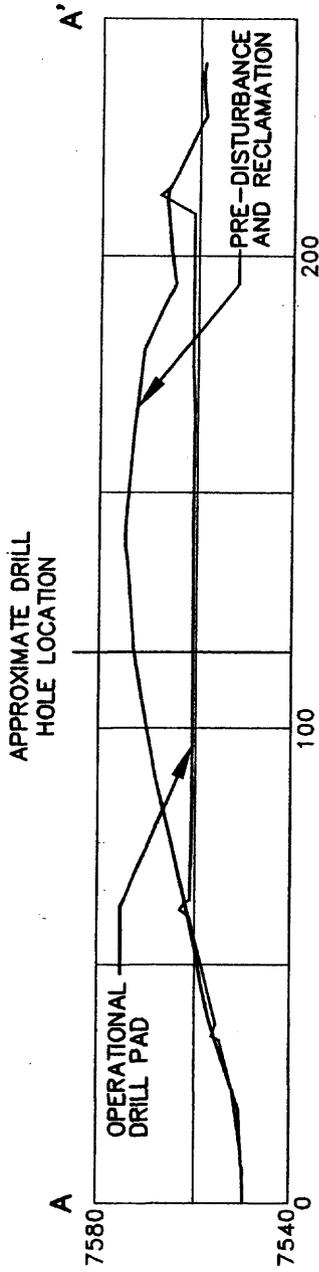
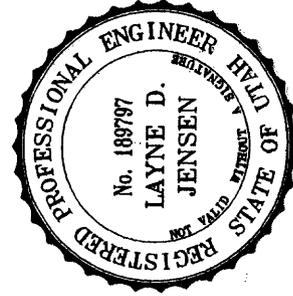


FIGURE 2. TYPICAL CROSS-SECTIONS FOR G-11

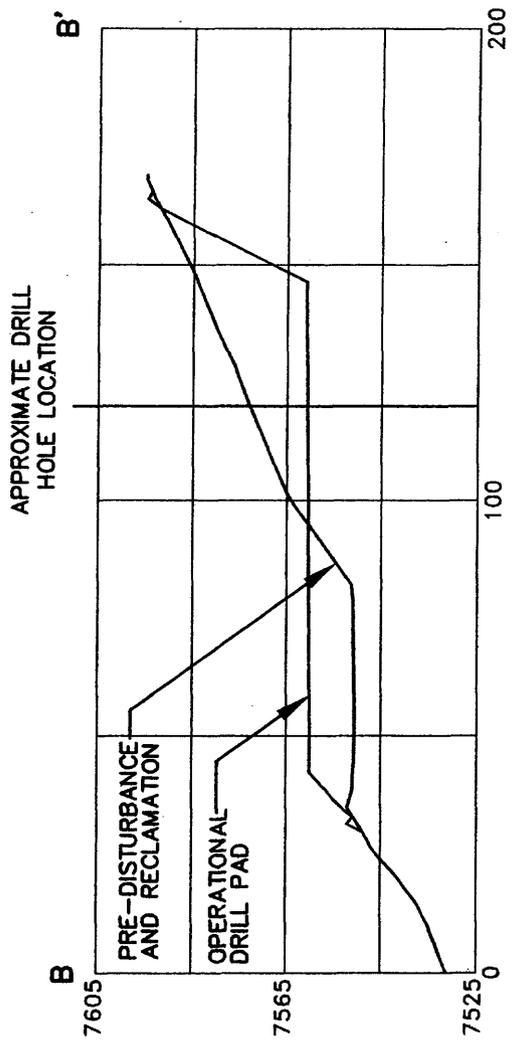
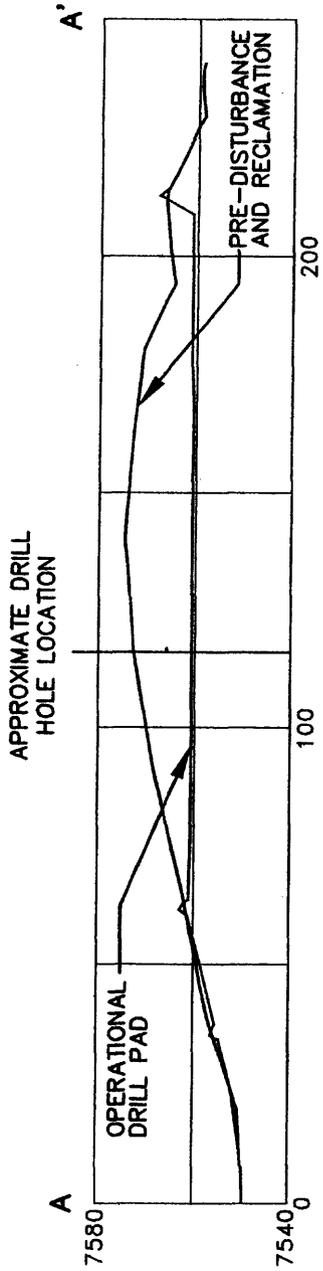
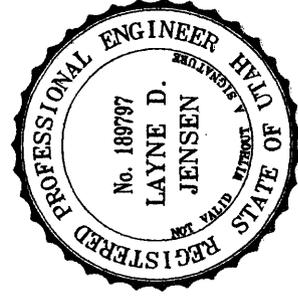


FIGURE 2. TYPICAL CROSS-SECTIONS FOR G-11

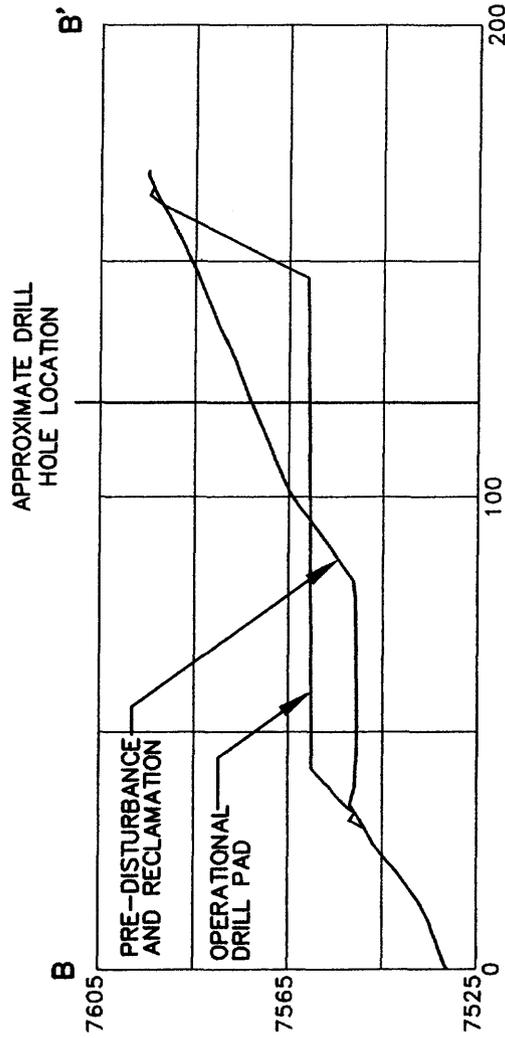
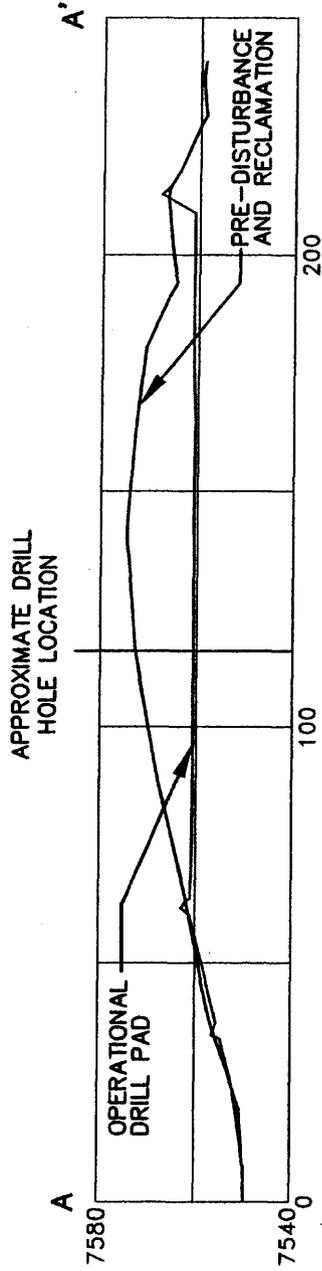
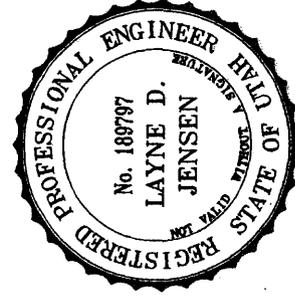


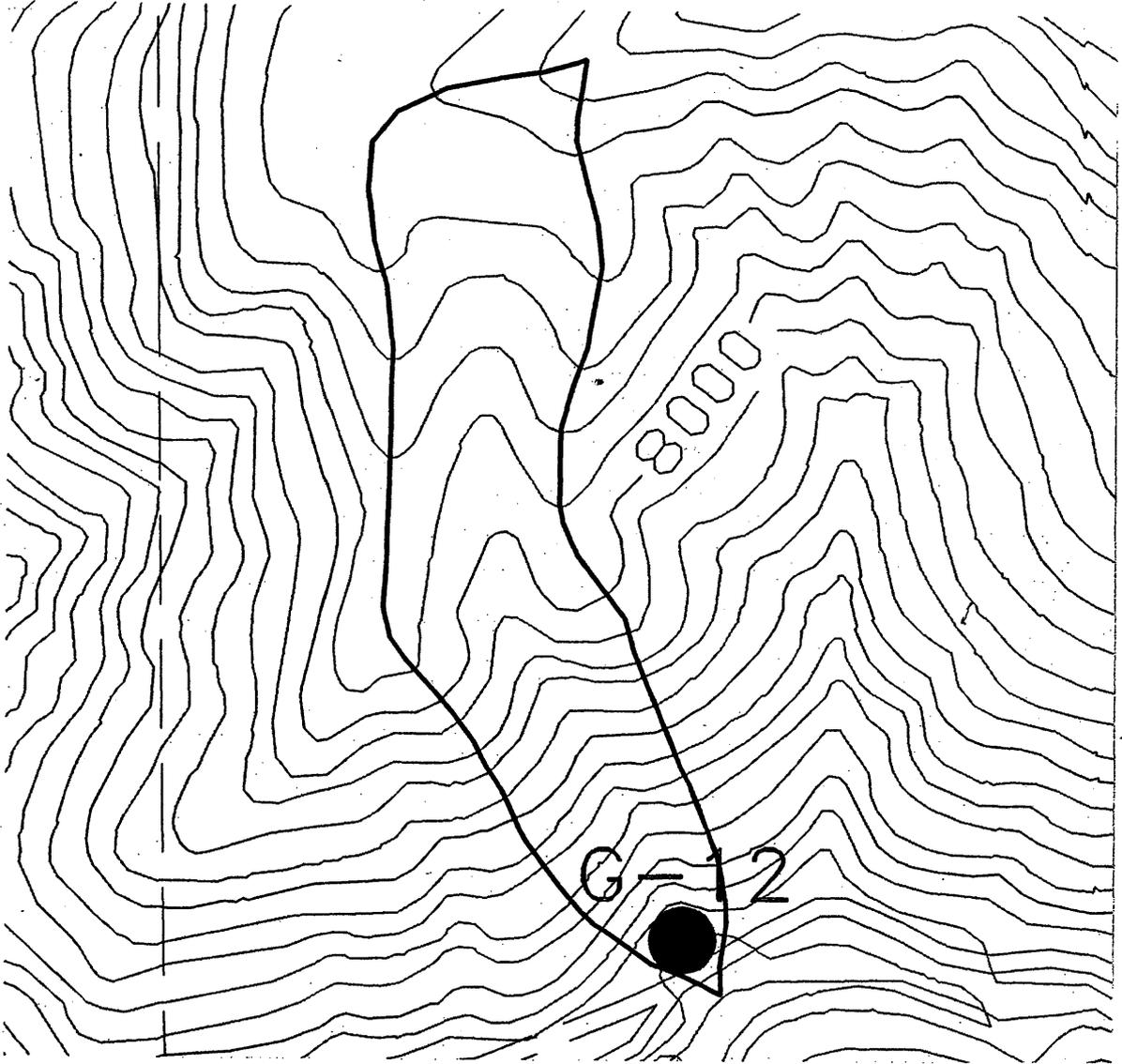
FIGURE 2. TYPICAL CROSS-SECTIONS FOR G-11



G-12 culvert

To build the pad for drill hole G-12 the road will be raised. The raised road will make a culvert necessary.

The watershed area is shown below.



Scale 1" : 400'

Curve Number

Soils within the watershed area have a Hydrologic soil group of C

Vegetation type is approximately 50% mixed Conifer and 50% sage-grass. The vegetation is in a fair to good condition.

Curve number (cont.)

Mixed conifer (similar to Pinyon-Juniper) CN = 73

Sagebrush with grass CN = 63

Area weighted Average = 68

G-12 Culvert Design

Peak flow = 0.28 cfs

use at least an 18" culvert although a 12" will work.

Without developing a headwater an 18" culvert can handle a flow of 5.5 cfs (see pg 9)

Check culvert capacity and outlet velocity

Slope $3/37' = 8.1\%$

Culvert Capacity = 16.19 cfs

Outlet Velocity = 3.47 fps < 5.0 fps

No outlet riprap is required.

Reclamation Swale

The site will be returned to current conditions with the exception that a swale will replace the culvert. Currently there is neither a culvert or a swale to convey runoff through the road.

The swale will have the same slope as the culvert slope = 8.1%

Bottom width = 0'

Side Slopes = 7.5:1

Depth = 1'

Riprap = None

Max Depth = 0.13'

Max Velocity = 2.25 fps.

See page 7 for calculations and page 8 for a channel cross-section

Watershed Area a	Drainage Area (ac)	Curve Number	S (in)	Y (%)	I (ft)	L (hr)	Time of Conc. (hr)	Peak Flow (cfs)
G-12 WS	19.62	68	4.706	45.6	2230	0.126	0.210	0.28

Notes

S = 1000/CN - 10

Y = average watershed slope = (length of contour lines)/(contour interval)/(watershed area)

I = hydraulic length

L = watershed lag = $(1.48(S+1)^{0.7}) / (1900(Y)^{0.5})$

Time of Concentration + 1.67L

Peak Flow is based on a 10-yr 6-hr storm event

Table 2-2d.—Runoff curve numbers for arid and semiarid rangelands¹

Cover description		Curve numbers for hydrologic soil group—			
Cover type	Hydrologic condition ²	A ^a	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

¹Average runoff condition, and $L_e = 0.28$. For range in humid regions, use table 2-2c.

²Poor <30% ground cover (litter, grass, and brush overstory)
 Fair 30 to 70% ground cover.
 Good >70% ground cover.

^aCurve numbers for group A have been developed only for desert shrub.

Triangular Hydrograph Calculations using
SCSHYDRO Program

Watershed I.D.:
G-12 Watershed

INPUT SUMMARY

STORM :	WATERSHED :
Dist. = SCS Type 'b'	Area = 19.62 acres
Depth = 1.35 inches	CN = 68.00
Duration = 6.0 hrs	Time conc. = 0.21 hrs

OUTPUT SUMMARY

Runoff depth: 0.033 inches
Initial abstr: 0.941 inches
Peak flow: 0.28 cfs (0.014 iph)
at time: 5.572 hrs

G-12 Culvert Worksheet for Circular Channel

Project Description	
Worksheet	Dugout Mine
Flow Element	Circular Chann
Method	Manning's Forr
Solve For	Channel Depth

Input Data	
Mannings Coeffc	0.024
Slope	081000 ft/ft
Diameter	18 in
Discharge	0.28 cfs

Results	
Depth	0.14 ft
Flow Area	0.1 ft ²
Wetted Perime	0.92 ft
Top Width	0.86 ft
Critical Depth	0.20 ft
Percent Full	9.1 %
Critical Slope	0.018473 ft/ft
Velocity	3.47 ft/s
Velocity Head	0.19 ft
Specific Energ	0.32 ft
Froude Numbe	2.01
Maximum Disc	17.42 cfs
Discharge Full	16.19 cfs
Slope Full	0.000024 ft/ft
Flow Type	Supercritical

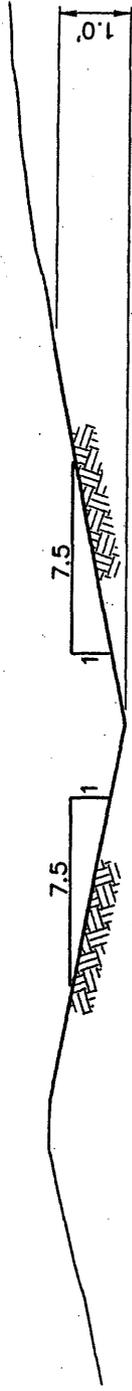
< 5 for ... no riprap

G-12 Reclamation Swale Worksheet for Triangular Channel

Project Description	
Worksheet	Dugout Mine
Flow Element	Triangular Char
Method	Manning's Form
Solve For	Channel Depth

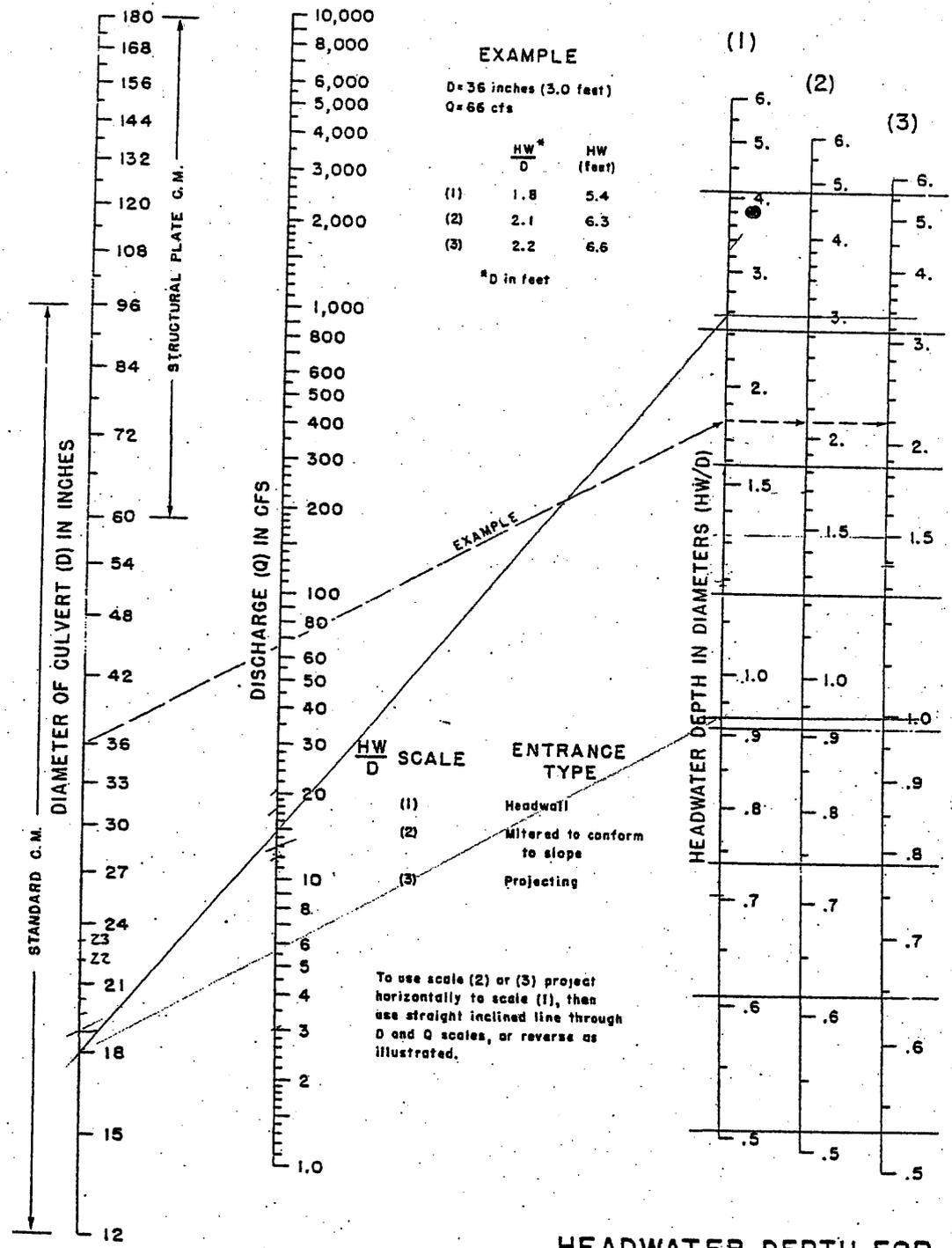
Input Data	
Mannings Coeff	0.030
Slope	081000 ft/ft
Left Side Slope	7.50 H : V
Right Side Slope	7.50 H : V
Discharge	0.28 cfs

Results	
Depth	0.13 ft << 1.0' ok
Flow Area	0.1 ft ²
Wetted Perim	1.95 ft
Top Width	1.93 ft
Critical Depth	0.15 ft
Critical Slope	0.031189 ft/ft
Velocity	2.25 ft/s < 5.0 fps :: no riprap
Velocity Head	0.08 ft
Specific Energy	0.21 ft
Froude Numb.	1.56
Flow Type	supercritical



G-12 RECLAMATION SWALE

CHART 5



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

5-25

Ref (U.S. Dept. of Transportation, 1977)

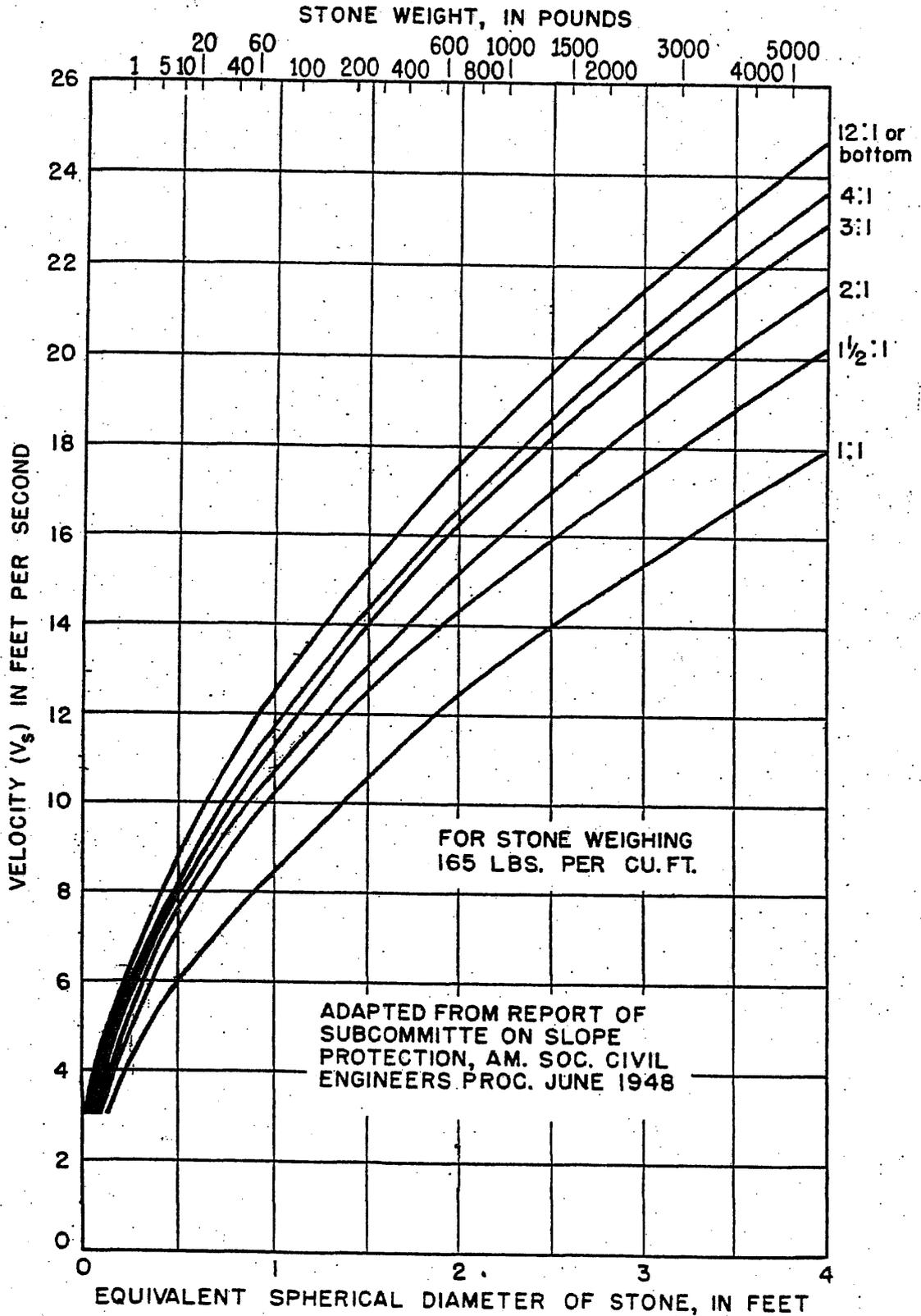


FIG. 2-SIZE OF STONE THAT WILL RESIST DISPLACEMENT FOR VARIOUS VELOCITIES AND SIDE SLOPES

Searcy, J.K. 1967. Use of Riprap for Bank Protection, U.S. Dept. of Transportation, Bureau of Public Roads, U.S. Government Printing Office, Washington D.C.