



C/007/016 Incoming

#5450

Chris D. Hansen
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April 27, 2017

Mr. Daron R. Haddock, Coal Environmental Manager
Division of Oil, Gas, and Mining
P.O. Box 145801
Salt Lake City, Utah 84114-5801

RE: Mid-term Review Deficiencies, Task #5315
Canyon Fuel Company, LLC Gordon Creek 2, 7, and 8 Mines, Permit #
C/007/0016

Dear Mr. Haddock:

Please find enclosed with this letter completed copies of C1 and C2 forms, four redline/strikethrough copies, and four clean copies of the Canyon Fuel Company, LLC (CFC) response to the deficiencies identified in the Gordon Creek 2/7/8 Mines Mining and Reclamation Plan Mid-term Review. The majority of the deficiencies have been addressed through text changes, new text, a replacement figure, and an additional appendix that includes vegetation monitoring. *However*, we did not address the requested modifications to the CFC General Chapter 1 in this submittal. As we discussed on April 26th, we have recently gone through a reorganization of the corporate board as well as the officers. Ms. Vicky Miller is currently working on those modifications and the updates to the AVS records as the Division has requested. We should be able to submit that information by mid-May. We appreciate your patience in this matter.

We appreciate the work you and your staff have performed in identifying the deficiencies in the permit and we look forward to working with you on achieving final bond release for the mine site. If you have any questions regarding the information provided in this letter, please give me a call at (970) 261-1425.

Sincerely,

Director of Regulatory Compliance
Bowie Resource Partners, LLC

DIV. OF OIL, GAS & MINING

APR 28 2017

RECEIVED

APPLICATION FOR COAL PERMIT PROCESSING

Permit Change New Permit Renewal Exploration Bond Release Transfer

Permittee: Canyon Fuel Company, LLC

Mine: Gordon Creek 2, 7 & 8 Mines

Permit Number: C/007/0016

Title: Partial Response to Deficiencies from 2016 Mid-term Review

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

Submittal addresses deficiencies identified during the 2016 Mid-term Review of the MRP

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

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

Please attach four (4) review copies of the application. If the mine is on or adjacent to Forest Service land please submit five (5) copies, thank you. (These numbers include a copy for the Price Field Office)

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

Chris D. Hansen Chris D. Hansen, Project Mgr. 4/27/17
 Print Name Sign Name, Position, Date

Subscribed and sworn to before me this 27th day of April, 2017

Kathleen Atwood
 Notary Public

My commission Expires: _____ }
 Attest: State of Utah 12-02, 2019 } ss:
 County of Carbon

For Office Use Only:	Assigned Tracking Number:	Received by Oil, Gas & Mining <div style="text-align: center; color: blue; font-weight: bold; font-size: 1.2em;">RECEIVED</div> <div style="text-align: center; color: red; font-weight: bold; font-size: 1.1em;">APR 28 2017</div> <div style="text-align: center; color: blue; font-weight: bold; font-size: 1.1em;">DIV. OF OIL, GAS & MINING</div>
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Technical Analysis and Findings

Utah Coal Regulatory Program

PID: C0070016
TaskID: 5315
Mine Name: GORDON CREEK 2, 7 & 8 MINES
Title: MIDTERM PERMIT REVIEW

General Contents

Identification of Interest

Analysis:

The findings from this section of the midterm review do not meet the State of Utah R645 requirements for Identification of Interest R645-301-112.

The text in General Chapter one, Pages 1-1 and 1-2 and Appendix 1-1 need to be updated to coincide with the current organizational Family Tree (OFT Figure 1-1) and ownership and control (ONC) information in the Applicant Violator System (AVS). They include Galena US Holdings Inc., Cedars Energy LLC and Halos Energy LLC.

The words and etc. found in Chapter one, Page 1-2 Paragraph 3 need to be deleted or clearly explained.

Deficiencies Details:

The findings from this section of the midterm review do not meet the State of Utah R645 requirements for Identification of Interest R645-301-112.

The text in General Chapter one, Pages 1-1 and 1-2 and Appendix 1-1 need to be updated to coincide with the current organizational Family Tree (OFT) and ownership and control (ONC) information in the Applicant Violator System (AVS).

The words and etc. found in Chapter one, Page 1-2 Paragraph 3 need to be deleted or clearly explained.

Jhelfric

Response:

These deficiencies will be addressed in the submittal of General Chapter 1 for all the CFC permits by mid-May 2017. CFC's parent company is going through a reorganization of the board and corporate officers.

Violation Information

Analysis:

The midterm permit review does not meet the State of Utah R645 requirements for R645-300-132 Violation Information.

A report was generated in the Applicant/Violator System (AVS) on February 23, 2017. The report generated 12 violations. All of the listed violations are under settlement. There were no outstanding violations listed.

ssteab

Violation Information

Analysis:

The findings from this section of the midterm review do not meet the State of Utah R645 requirements for violation information R645-301-113. General Chapter one table 1-2 needs to be updated to coincide with the current violation information in the Applicant Violator System (AVS)

Deficiencies Details:

The findings from this section of the midterm review do not meet the State of Utah R645 requirements for violation information R645-301-113. General Chapter one table 1-2 needs to be updated to coincide with the current violation information in the Applicant Violator System (AVS)

Jhelfric

Response:

These deficiencies will be addressed in the submittal of General Chapter 1 for all the CFC permits by mid-May 2017. The violations will be updated in the appropriate section of the chapter.

Legal Description

Analysis:

The MRP does not meet the State of Utah R645-301-121.120 and/or R645-301-141 requirements for providing a legal description that identifies the land (on a map) subject to coal mining (and reclamation).

General Chapter 1 Right of Entry information is located in Section 114 on Page 1-6. This section refers to the MRP for Gordon Creek Mine for specific information.

Chapter 1, Section 1.2 refers to Figure 1-2 for the permit area. Figure 1-2 is an old black and white topographic map with the project boundary vaguely identified. Due to the age and quality of the map, it is difficult to ascertain exact permit boundaries. However, the permit boundary on Figure 1-2 is clearly not the permit boundary as described in the permit. (2286 +/- acres vs. 161 +/- acres)

Chapter 2, Section 2.4, page 9, refers to Tables 4-1 and 4-2 for all required leases, easements and rights to access. Tables 4-1 and 4-2 are located in Chapter 4 and identify surface and mineral ownership.

Section 2.6 (a) states the number of surface acres disturbed by the operation is 20.3 acres. In addition, some 2286.05 acres of the permit area has some potential to be affected by underground mining. The 2286.05 acres must be reconciled with the current permit area of 161 acres +/-.

The affidavit of Publication in Ch.2 (Incorporated September 11, 2013) contains a legal description different the one contained in the permit.

The Division issued Permit includes the following property as the Permit Area:

Township 13 South, Range 8 East, SLBM

Section 18: N1/2SE1/4, N1/2SW1/4SE1/4, S1/2NE1/4SW1/4, SE1/4SW1/4, SE1/4SW1/4SW1/4. (161 acres +/-)

Deficiencies Details:

The MRP does not meet the State of Utah R645-301-121.120 and/or R645-301-141 requirements for providing a legal description that identifies the land (on a map) subject to coal mining (and reclamation).

The Permittee must update Figure 1-2 to show the current permit boundary.

The Permittee must update Ch. 2, Section 2.4 and provide a legal description of the permit area.

The Permittee must update Section 2.6 to accurately describe the acreage of disturbance and permit area.

Irelnhart

CFC Response

Response:

A new Figure 1-2 has been submitted for inclusion into the MRP.

Chapter 2 Section 2.4 has been updated to include a legal description of the permit area. See updated pages 2-11 through 2-13.

Section 2.6 has been updated to include the current acreages of the permit and disturbed areas as well as indicate no mining will be occurring within the permit area. See updated pages 2-11 through 2-13.

PostMining Land Use

Analysis:

The analysis of the midterm review criteria does not meet the State of Utah R645 Requirements for PostMining Land Use R645-301-413.100

The text on page 3-59 notes that, production will not be measured, since the post-mining land-use is wildlife habitat. This is true for this type of postmining land use. However sections 3.4.1 and 3.5.5.6 state that the postmining land use is stock grazing that does require a value for production. In reality the past 17 years of post reclamation have shown that wildlife utilize the area year around where as stock grazing occurs minimally in the spring and fall when the animals are moving to and from higher elevation grazing areas.

These sections of the MRP need to be clarified.

Deficiencies Details:

The analysis of the midterm review criteria does not meet the State of Utah R645 Requirements for PostMining Land Use R645-301-413.100

The text on page 3-59 notes that, production will not be measured, since the post-mining land-use is wildlife habitat. This is true for this type of postmining land use. However sections 3.4.1 and 3.5.5.6 state that the postmining land use is stock grazing that does require production value. In reality 17 years of post reclamation have shown that wildlife utilize the area year around where as stock grazing occurs minimally in the spring and fall when the animals are moving to and from higher elevation grazing areas.

These sections of the MRP need to be clarified.

Jhelfric

Response:

The post-mining land-use is still listed as livestock grazing. Sections 3.5.5.5 and 3.5.5.6 have been slightly modified to more clearly indicate the post mining land-use is grazing. Also, vegetation studies performed in 2009 and 2010 in anticipation of Phase III Bond Release have been included in this submittal to address concerns regarding productivity.

Revegetation Standards for Success

Analysis:

The analysis of the midterm review criteria does not meet the State of Utah R645 Requirements for Standards for Success, R645-301-323.

Chapter 3, Page 3-58 states that the Oak Shrubland Reference Area of No. 2 Mine will be used as the vegetative standard for success for all sites, including the No.8, No. 7 and No. 2 mine areas, the Sweets Pond area, and the Old Fan Portal area.

The text on page 3-59 and Chapter 9, Page 9-2 note that, In an effort to provide one standard of success for cover, the Mountain Grassland (also referred to as Mountain Brush/Grassland Community Reference Area will be used as the vegetative standard for success for all reclaimed sites. This coincides with the reference areas identified on plate 9-1.

The appropriate sections of the MRP need to be revised to clarify the differences noted in the text.

Deficiencies Details:

The analysis of the midterm review criteria does not meet the State of Utah R645 Requirements for Standards for Success, R645-301-323.

Chapter 3, Page 3-58 states that the Oak Shrubland Reference Area of No. 2 Mine will be used as the vegetative standard for success for all sites, including the No.8, No. 7 and No. 2 mine areas, the Sweets Pond area, and the Old Fan Portal area.

The text on page 3-59 and Chapter 9, Page 9-2 note that, In an effort to provide one standard of success for cover, the Mountain Grassland (also referred to as Mountain Brush/Grassland Community Reference Area will be used as the vegetative standard for success for all reclaimed sites. This coincides with the reference areas identified on plate 9-1.

The appropriate sections of the MRP need to be revised to clarify the differences noted in the text.

jhelfric

Response:

The text on page 3-58 was corrected to reflect Mountain Grassland (also referred to as Mountain Bruch/Grassland Community Reference Area) will be used as the vegetative standard.

Bonding Determination of Amount

Analysis:

The midterm review of the MRP does not meet the State of Utah R645 requirements for Determination of Bond Amount.

The Division requires an evaluation of the reclamation cost estimate during each midterm permit review. This cost estimate is then escalated for five years or until the next midterm review. In accordance with the requirements of R645-303-211, R645-301-830, and -301-830.140, it is the Permittees responsibility to provide detailed estimated cost sheets to support the reclamation cost estimate.

Deficiencies Details:

The midterm review of the amendment to update the MRP does not meet the minimum requirements of R645-301-830.140 due to missing information as that the Permittee has not submitted updated bond information in regards to the midterm review of the MRP.

The Permittee must update the unit cost data used in the 2011 Midterm Permit Review reclamation cost estimate to 2016 unit costs using the 2016 R.S. Means Heavy Construction Cost Data manual. All computation sheets for demolition, earthwork and re-vegetation must be updated and submitted to the Division so the Division can determine the required bond amount needed through 2021.

In accordance with R645-301-830.410, Division Technical Directive 007, and Office of Surface Mining Handbook for Calculation of Reclamation Bond Amounts the Permittee may utilize third party contractors for cost references when a general cost references does not adequately describe the required reclamation task. In the event the Permittee utilizes local third party contractors cost estimates within the reclamation bond amount additional information must be submitted with the application including a minimum of three individual quotes for the work. References may include items such as a letter or email transcript but must include all relevant contact information from the contractor so that the Division may contact said contractor to verify unit cost is valid in the event the Division was the hiring personal. References must be submitted at the time the reclamation bond amount is submitted to the Division. The Permittee will submit detailed cost references for all contracted costs of reclamation.

In accordance with R645-301-830.410, Division Technical Directive 007, and Office of Surface Mining Handbook for Calculation of Reclamation Bond Amounts the Permittee must utilize bare unit costs when using standardized cost reference manuals such as R.S. Means Heavy Construction. The Division applies an indirect cost of 26.8% that covers overhead and profit calculations in the indirect line items of the total sheet. The Permittee will utilize the bare unit cost when utilizing R.S. Means Heavy Construction cost reference.

The Gordon Creek 2, 7 & 8 Mines Midterm review, in accordance with R645-303-211, was commenced on December 1, 2016 by the Division. In accordance with R645-301-830.410, Division Technical Directive 007, and Office of Surface Mining Handbook for Calculation of Reclamation Bond Amounts the Permittee must utilize the dollar year for which the midterm was commenced. The escalation to the next midterm must also be amended to calculate the new escalation to the next midterm review, five years.

The total reclamation cost for the Gordon Creek 2, 7 & 8 Mines (sum of the direct and indirect costs) must be escalated from 2016 to 2021 (5 years) using an escalation factor of 0.7%.

This escalated cost is rounded to the nearest \$ 1,000 to determine the amount of required bond which must be posted with the Division by the Permittee.

FINDINGS:

R645-303-211, R645-301-830.100 through -830.140, R645-301-830.410: The Permittee must submit the detail reclamation bond estimate in 2016 Dollars.

R645-303-211, R645-301-830.100 through -830.140, R645-301-830.410: The Permittee must submit detail cost quotes from three parties to utilize a cost reference outside of published construction related cost reference manuals, e.g. R.S. Mean Heavy Construction.

R645-303-211, R645-301-830.100 through -830.140, R645-301-830.410: The Permittee will utilize R.S. Means Heavy Construction cost reference or other approved cost referencing.

R645-303-211, R645-301-830.100 through -830.140, R645-301-830.410: The permittee will add indirect and escalation to the next midterm on the Total sheet.

CFC Response

Response:

The Gordon Creek 2/7/8 Mines have received Phase I and II Bond Release. No permanent structures remain. The Jacobs Pond, while still inspected, will remain after final bond release at the request of the land owner. The new bond calculation includes soil preparation for all the 30.14 acres of disturbed lands even though not all the area would likely require such treatment. The cost of seeding the entire area and replacement of seedlings is also include, again reseeding and replanting the entire area would be extremely unlikely.

A copy of an invoice from Granite Seed for an acre's worth of seed for the Gordon Creek Mines has been included with the new bond calculations. This order and invoice was received in October 2016.

a) Permits Suspended or Revoked

None

b) Bond or Security Forfeited

None

2.3.2 Suspension, Revocation or Forfeiture.

Each application shall describe all proceedings identified under 2.3.1 and the status of any suspension, revocation or forfeiture proceedings;

None

2.3.3 Compliance Information

A list of all notices or violations received by the applicant in the past 3 years for violations pertaining to air or water environmental protection:

See Table 1-2 in the General Chapter 1 for the Canyon Fuel Company, LLC Mines.

~~2.4 Right of Entry and Operation Information.~~

~~A description of the documents upon which the applicant bases its legal right to enter and begin underground coal activities in the permit area and whether the rights are the subject of pending litigation. For Underground activities where operations involve the surface mining of coal, evidence of the right to surface mine must be provided:~~

2.4 Right of Entry and Operation Information.

A description of the documents upon which the applicant bases its legal right to enter and begin underground coal activities in the permit area and whether the rights are the subject of pending litigation. For Underground activities where operations involve the surface mining of coal, evidence of the right to surface mine must be provided:

(a) Documents Establishing Rights

See Tables 4-1 and 4-2 for all required leases, easements and right to access.

(b) Pending Litigations

None.

(c) Surface Mining Rights

None.

(d) Description of Permit Area

The permit area is described as follows:

Township 13 South, Range 8 East, SLBM, Section 18: N1/2 SE1/4, N1/2 SW1/4 SE1/4, S1/2 NE1/4 SW1/4, SE1/4 SW1/4, SE1/4 SW1/4 SW1/4. Approximately 161 acres +/-

2.5 Relationship to Areas Designated Unsuitable for Mining.

The relationship of the permit area to possible areas designated as being unsuitable for mining, whether an exemption is claimed under the regulations, and whether surface operations will be conducted within 300 feet of occupied dwellings:

(a) Areas Designated Unsuitable for Mining.

The proposed permit area is not within an area designated unsuitable for the surface effects of underground coal mine activities under the R645 regulations. Neither is the proposed permit area under study for designation in an administrative proceeding initiated under those parts. Mining would not affect renewable resource lands and would not result in substantial loss of food, fiber, or water supply. The permit area contains no prime farmland or merchandisable timber. Mining would not affect natural hazard lands and thereby endanger life and property. In addition, the permit area includes no cemeteries, no national trails, no wild and scenic rivers, no wilderness or wilderness study areas, and no sufficient harvestable forest cover.

(b) Exemption

The applicant does not claim exemption.

(c) Dwellings

There are no occupied dwellings within 5 miles of the proposed permit areas.

2.6 Permit Term Information

The number of surface acres to be affected and the horizontal and vertical extent of the workings:

(a) Surface Acres Affected

The number of surface acres disturbed by the operation is 30.14 acres. ~~20.3 acres.~~
~~In addition, some 2286.05 acres of the permit area has some potential to be affected by underground mining.~~ There are no plans for additional surface disturbance for this operation. Mining is completed at this operation.

(b) Horizontal Extent of Underground Workings.

~~All 2286.05 acres of the permit area may be affected by underground development.~~ No further mining is anticipated within the permit area.

a) Permits Suspended or Revoked

None

b) Bond or Security Forfeited

None

2.3.2 Suspension, Revocation or Forfeiture.

Each application shall describe all proceedings identified under 2.3.1 and the status of any suspension, revocation or forfeiture proceedings;

None

2.3.3 Compliance Information

A list of all notices or violations received by the applicant in the past 3 years for violations pertaining to air or water environmental protection:

See Table 1-2 in the General Chapter 1 for the Canyon Fuel Company, LLC Mines.

2.4 Right of Entry and Operation Information.

A description of the documents upon which the applicant bases its legal right to enter and begin underground coal activities in the permit area and whether the rights are the subject of pending litigation. For Underground activities where operations involve the surface mining of coal, evidence of the right to surface mine must be provided:

(a) Documents Establishing Rights

See Tables 4-1 and 4-2 for all required leases, easements and right to access.

(b) Pending Litigations

None.

(c) Surface Mining Rights

None.

(d) Description of Permit Area

The permit area is described as follows:

Township 13 South, Range 8 East, SLBM, Section 18: N1/2 SE1/4, N1/2 SW1/4 SE1/4, S1/2 NE1/4 SW1/4, SE1/4 SW1/4, SE1/4 SW1/4 SW1/4. Approximately 161 acres +/-

2.5 Relationship to Areas Designated Unsuitable for Mining.

The relationship of the permit area to possible areas designated as being unsuitable for mining, whether an exemption is claimed under the regulations, and whether surface operations will be conducted within 300 feet of occupied dwellings:

(a) Areas Designated Unsuitable for Mining.

The proposed permit area is not within an area designated unsuitable for the surface effects of underground coal mine activities under the R645 regulations. Neither is the proposed permit area under study for designation in an administrative proceeding initiated under those parts. Mining would not affect renewable resource lands and would not result in substantial loss of food, fiber, or water supply. The permit area contains no prime farmland or merchandisable timber. Mining would not affect natural hazard lands and thereby endanger life and property. In addition, the permit area includes no cemeteries, no national trails, no wild and scenic rivers, no wilderness or wilderness study areas, and no sufficient harvestable forest cover.

(b) Exemption

The applicant does not claim exemption.

(c) Dwellings

There are no occupied dwellings within 5 miles of the proposed permit areas.

2.6 Permit Term Information

The number of surface acres to be affected and the horizontal and vertical extent of the workings:

(a) Surface Acres Affected

The number of surface acres disturbed by the operation is 30.14 acres. There are no plans for additional surface disturbance for this operation. Mining is completed at this operation.

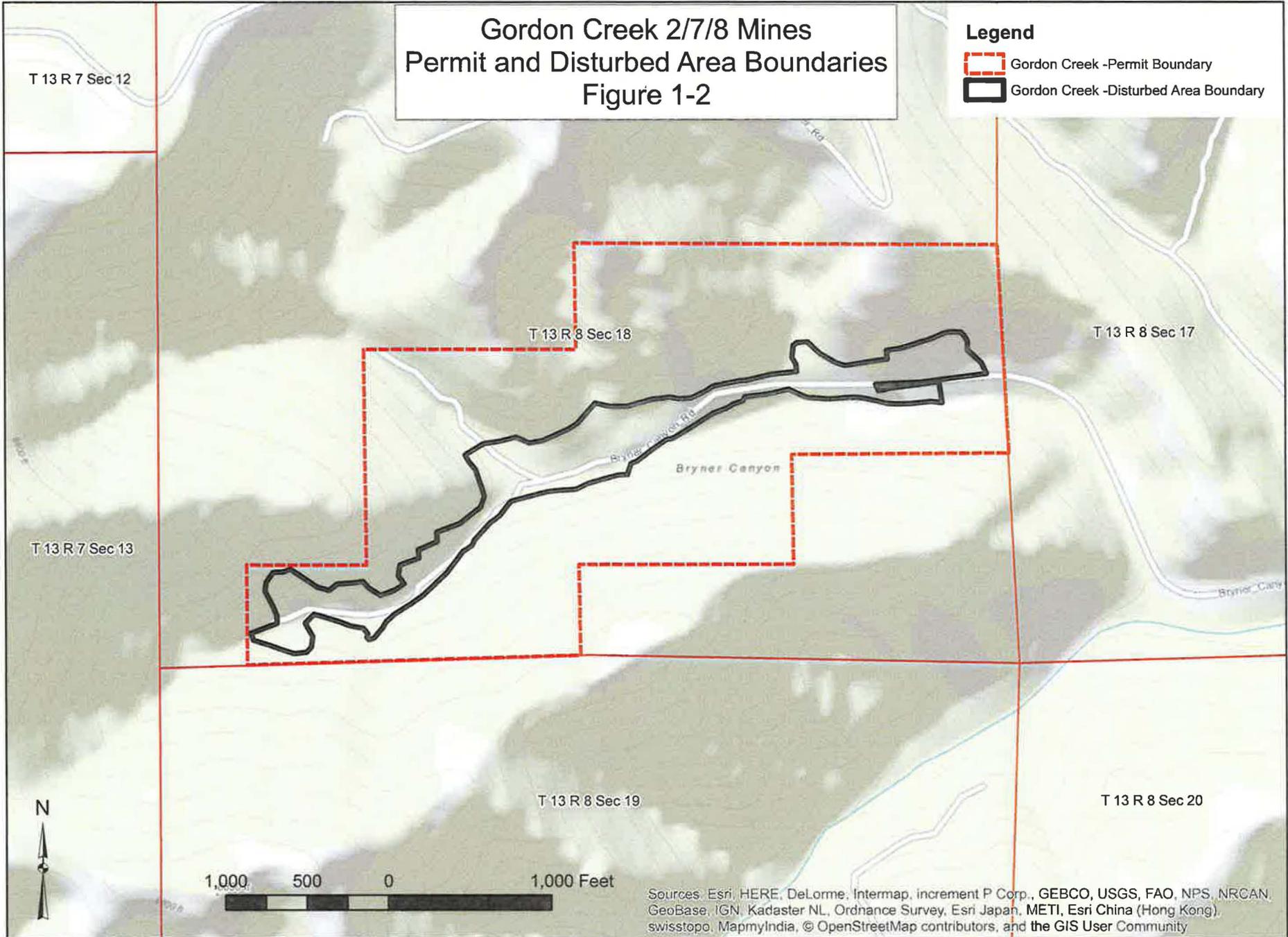
(b) Horizontal Extent of Underground Workings.

No further mining is anticipated within the permit area.

Gordon Creek 2/7/8 Mines Permit and Disturbed Area Boundaries Figure 1-2

Legend

-  Gordon Creek -Permit Boundary
-  Gordon Creek -Disturbed Area Boundary



Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

CHAPTER 3

OPERATION AND RECLAMATION PLAN

3.1 Scope

This section outlines the scope of environmental control and reclamation activities that will occur under the terms of the permit. The purpose of this plan is to provide the regulatory authority with comprehensive and reliable information which ensures that proposed activities will be conducted in compliance with the Act, regulations, and guidelines of the permanent regulatory program.

Mining is completed at this operation, and all structures have been removed. ~~except for the hydrologic control and access roads.~~ The Sweet's Pond disturbed area has been removed from the permit area after Phase III bond release was granted in October 2003. Phase II bond release was granted for the entire remaining disturbed areas in March 2007.

Updated bond calculations that were completed in April 2017 and supersede previous bond calculations have been included following page 3-77 of this chapter.

CHAPTER 3

OPERATION AND RECLAMATION PLAN

3.1 Scope

This section outlines the scope of environmental control and reclamation activities that will occur under the terms of the permit. The purpose of this plan is to provide the regulatory authority with comprehensive and reliable information which ensures that proposed activities will be conducted in compliance with the Act, regulations, and guidelines of the permanent regulatory program.

Mining is completed at this operation, and all structures have been removed. The Sweet's Pond disturbed area has been removed from the permit area after Phase III bond release was granted in October 2003. Phase II bond release was granted for the entire remaining disturbed areas in March 2007.

Updated bond calculations that were completed in April 2017 and supersede previous bond calculations have been included following page 3-77 of this chapter.

The reclaimed areas will also be quantitatively sampled for cover in order to evaluate how well the goals of reclamation are being met. As part of this evaluation program, the reference areas will be sampled in order to provide comparative data. With this program, it will be possible to determine if the bond release requirements of cover are being attained. The actual magnitude and frequency of the quantitative sampling program is outlined in vegetative guidelines from UDOGM Revised, 1989.

Demonstration of successful reclamation on temporary sites has served as justification for the use of the permanent mix. Vegetation success will be achieved when ground cover and density are not less than 90% of the approved success standard when tested at a 90% confidence interval. ~~A success standard of 2000 shrubs or trees per acre will also be required for bond release.~~ Final bond release will, in part, be based on the successful revegetation of the site as described in ~~as discussed under~~ Section 3.5.5.7 of this Chapter.

It is proposed to use the ~~Oak Shrubland Reference Area Mountain Grassland (also referred to as "Mountain Brush/Grassland Community) of No. 2 Mine~~ as the vegetative standard for success for all sites, including the No. 8, No. 7 and No. 2 Mine areas, the Sweets Pond area, and the Old Fan Portal area.

Vegetation monitoring of the Gordon Creek 2, 7 & 8 Mines site for Phase III Bond Release was completed in the years 2009 and 2010. Productivity was measured during those studies. Copies of the vegetation monitoring reports, "Vegetation Monitoring for Phase III Bond Release at the Gordon Creek 2/7/8 Mines – Year 1: 2009" and Vegetation Monitoring for Phase III Bond Release at the Gordon Creek 2/7/8 Mine Site Year 2: 2010" are included in Appendix 3-10.

3.5.5.6 Establishment of Wildlife Habitat

Although the post-mining land use is stock grazing, reclamation is also particularly important as a means of controlling erosion and restoring disturbed areas to productive wildlife habitat. Mountain Coal will use one or more the following procedures in achieving the reclamation goal: (1) Planting a diverse mixture of native grasses, forbs, and (where appropriate), woody species, (2) using seedling stock rather than relying solely on seeds for trees or shrubs, (3) planting vegetation to create an edge effect by clumping selected shrub or tree species, (4) leaving islands of natural vegetation within the new disturbed sites, which were saved during the initial construction of the mine site (No. 8 Mine). Section 10.5 provides a detailed discussion of the reclamation, mitigation and management plans of terrestrial habitats and wildlife.

3.5.5.7 Revegetation Standards for Success

Standards for revegetation success will follow DOGM guidelines and be consistent with those described in R645=301-356. The standards will include criteria representative of unmined lands. Reference areas have been sampled to provide adequate standards for success. Total living cover and biomass production will be considered when they are at least 90% of the standards described below.

Gordon Creek No. 2 Mine Area

As described in Chapter 9, one area (shown on Plate 9-1) was sampled to be used for the standard of success at the time of final reclamation. The community type is mountain grasslands.

The reclaimed areas will also be quantitatively sampled for cover in order to evaluate how well the goals of reclamation are being met. As part of this evaluation program, the reference areas will be sampled in order to provide comparative data. With this program, it will be possible to determine if the bond release requirements of cover are being attained. The actual magnitude and frequency of the quantitative sampling program is outlined in vegetative guidelines from UDOGM Revised, 1989.

Demonstration of successful reclamation on temporary sites has served as justification for the use of the permanent mix. Vegetation success will be achieved when ground cover and density are not less than 90% of the approved success standard when tested at a 90% confidence interval. Final bond release will, in part, be based on the successful revegetation of the site as described in Section 3.5.5.7 of this Chapter.

It is proposed to use the Mountain Grassland (also referred to as "Mountain Brush/Grassland Community) as the vegetative standard for success for all sites, including the No. 8, No. 7 and No. 2 Mine areas, the Sweets Pond area, and the Old Fan Portal area.

Vegetation monitoring of the Gordon Creek 2, 7 & 8 Mines site for Phase III Bond Release was completed in the years 2009 and 2010. Productivity was measured during those studies. Copies of the vegetation monitoring reports, "Vegetation Monitoring for Phase III Bond Release at the Gordon Creek 2/7/8 Mines – Year 1: 2009" and Vegetation Monitoring for Phase III Bond Release at the Gordon Creek 2/7/8 Mine Site Year 2: 2010" are included in Appendix 3-10.

3.5.5.6 Establishment of Wildlife Habitat

Although the post-mining land use is stock grazing, reclamation is also particularly important as a means of controlling erosion and restoring disturbed areas to productive wildlife habitat. Mountain Coal will use one or more the following procedures in achieving the reclamation goal: (1) Planting a diverse mixture of native grasses, forbs, and (where appropriate), woody species, (2) using seedling stock rather than relying solely on seeds for trees or shrubs, (3) planting vegetation to create an edge effect by clumping selected shrub or tree species, (4) leaving islands of natural vegetation within the new disturbed sites, which were saved during the initial construction of the mine site (No. 8 Mine). Section 10.5 provides a detailed discussion of the reclamation, mitigation and management plans of terrestrial habitats and wildlife.

3.5.5.7 Revegetation Standards for Success

Standards for revegetation success will follow DOGM guidelines and be consistent with those described in R645=301-356. The standards will include criteria representative of unmined lands. Reference areas have been sampled to provide adequate standards for success. Total living cover and biomass production will be considered when they are at least 90% of the standards described below.

Gordon Creek No. 2 Mine Area

As described in Chapter 9, one area (shown on Plate 9-1) was sampled to be used for the standard of success at the time of final reclamation. The community type is mountain grasslands.

Bonding Calculations

Direct Costs

Subtotal Demolition and Removal	\$0
Subtotal Backfilling and Grading	\$0
Subtotal Revegetation	\$119,788
Direct Costs Subtotal	\$119,788

Indirect Costs

Mob/Demob	\$11,979	10.0%
Contingency	\$5,989	5.0%
Engineering Redesign	\$2,995	2.5%
Main Office Expense	\$8,146	6.8%
Project Management Fee	\$2,995	2.5%
Subtotal Indirect Costs	\$32,104	26.8%

Total Cost 2014	\$151,892	
------------------------	------------------	--

<i>Escalation factor</i>		5
<i>Number of years</i>		0.007
<i>Escalation</i>	\$5,391	

Reclamation Cost Escalated	\$168,130
----------------------------	-----------

Reclamation Bond Amount (rounded to nearest \$1,000) 2021 Dollars	\$168,000
--	------------------

Current Bond Amount	\$171,000
---------------------	-----------

Difference Between Cost Estimate and Bond	\$3,000
Percent Difference	1.75%



INVOICE

Invoice Date:
17-Oct-16

Invoice Number: **1-41560**

1697 West 2100 North
Lehi, Utah 84043
(801) 768-4422 / (801) 531-1456
Fax (801) 768-3967

(please show this invoice number on all payments)

Project: Gordon Creek Seed Mix

Customer Number: GS157287

Sold To:
Canyon Fuel Company LLC
Dugout Mine
PO Box 1029
Wellington, UT 84542

BRP
Dugout Mines
Approval *Chris Hansen* *10-21-16*
Code *1001-61105*
1313

Will Call:
Canyon Fuel Company LLC

Terms: Net 30	Customer P.O. 093016	Ordered By: Chris hansen	Phone Number: 970-263-5132	
Shipper: Will Call	Freight: Prepaid/Collect	FOB:	Sales Rep: Josh Buck	Date Shipped: 14-Oct-16

Price By	Quantity Shipped	PLS	Bulk	Description	Variety	Price	Total
*** MIX # 172240 GORDON CREEK SEED MIX ***							
PLS #	2.73	2.84		Elymus lanceolatus ssp. psammophilus Streambank wheatgrass	Sodar		
PLS #	1.50	1.59		Pseudoroegneria spicata ssp. spicata Bluebunch, Wheatgrass	Goldar		
PLS #	2.63	2.91		Elymus trachycaulus ssp. trachycaulus Slender wheatgrass	Pryor		
PLS #	1.50	1.57		Achnatherum hymenoides Indian ricegrass	Rimrock		
PLS #	3.00	3.28		Leymus cinereus Wildrye, Great Basin	Trailhead		
PLS #	2.00	2.10		Bromus carinatus Bromegrass, California	VNS		
PLS #	1.50	1.74		Poa pratensis Bluegrass, Kentucky	Ginger		
PLS #	0.75	0.82		Hedysarum boreale Utah northern sweetvetch	Timp		
PLS #	1.50	1.58		Astragalus cicer Milkvetch, Cicer	Lutana		
PLS #	1.50	1.55		Helianthus annuus Sunflower, Annual	VNS		
PLS #	0.25	0.27		Penstemon strictus Penstemon, Rocky Mountain	Bandera		
PLS #	0.75	0.82		Medicago sativa Alfalfa	Ladak		
PLS #	1.50	1.70		Purshia tridentata Bitterbrush, Antelope	VNS		
PLS #	1.00	1.09		Cercocarpus ledifolius CURL LEAF MTN MAHOGANY	VNS		

RECEIVED
OCT 20 2016

FY:

Please read the reverse side of this form carefully. The terms and conditions of sale set forth on both sides of this form constitute the entire agreement between Seller and Buyer. All purchases of products by Buyer shall be governed and subject to the terms and conditions of sale set forth on the reverse side hereof, as in effect from time to time, and nothing contained in any product order of Buyer shall in any way modify such terms and conditions of sale or add any additional terms and conditions unless agreed upon in writing by a corporate officer of Granite Seed. Any additional or inconsistent terms and conditions of any product order of Buyer shall be deemed stricken from such order and each product order shall be deemed to incorporate all of these terms and conditions of sale. Acceptance by Buyer of these terms and conditions is acknowledged by either (1) Buyer's signature set forth herein, or (2) receipt by Buyer of delivery of the products described herein and failure by Buyer to return such products within five (5) days following such delivery.



INVOICE

Invoice Date:
17-Oct-16

Invoice Number: 1-41560

(please show this invoice number on all payments)

1697 West 2100 North
 Lehi, Utah 84043
 (801) 768-4422 / (801) 531-1456
 Fax (801) 768-3967

Project: Gordon Creek Seed Mix

PLS #	0.75	1.30	Symphoricarpos albus Common snowberry	VNS
PLS #	0.10	0.40	ARTEMISIA TRI. VASEYANA Sagebrush, Mountain Big	VNS

MIX SUBTOTAL (1 Acre @ \$ 385.1400 Per Acre): \$ 385.14

Notes:

Subtotal:	\$ 385.14
Freight:	\$ 0.00
Sales Tax:	\$ 26.00
GRAND TOTAL:	\$ 411.14
<small>PLEASE PAY PER THIS INVOICE NO STATEMENT WILL BE SENT.</small>	

Please read the reverse side of this form carefully. The terms and conditions of sale set forth on both sides of this form constitute the entire agreement between Seller and Buyer. All purchases of products by Buyer shall be governed and subject to the terms and conditions of sale set forth on the reverse side hereof, as in effect from time to time, and nothing contained in any product order of Buyer shall in any way modify such terms and conditions of sale or add any additional terms and conditions unless agreed upon in writing by a corporate officer of Granite Seed. Any additional or inconsistent terms and conditions of any product order of Buyer shall be deemed stricken from such order and each product order shall be deemed to incorporate all of these terms and conditions of sale. Acceptance by Buyer of these terms and conditions is acknowledged by either (1) Buyer's signature set forth herein, or (2) receipt by Buyer of delivery of the products described herein and failure by Buyer to return such products within five (5) days following such delivery.

APPENDIX 3-10
VEGETATION MONITORING FOR PHASE III BOND RELEASE
AT THE GORDON CREEK 2/7/8 MINES
YEARS 1:2009
YEARS 2:2010

**VEGETATION MONITORING
FOR PHASE III BOND RELEASE
AT THE GORDON CREEK 2/7/8 MINES
YEAR 1: 2009**

**FOR
MOUNTAIN COAL COMPANY, LLC**



Prepared by

MT. NEBO SCIENTIFIC, INC.

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Springville, Utah 84663

(801) 489-6937

by

Patrick Collins, Ph.D.

for

BLACKHAWK ENGINEERING, INC.

1056 West 2060 North

Helper, Utah 84526

and

MOUNTAIN COAL COMPANY

HC35 Box 380

Helper, Utah 84526

May 2010



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INTRODUCTION

General Site Description

The Gordon Creek 2/7/8 Mine site is located in the Bryner Canyon and Beaver Creek area of Carbon County, Utah. Elevation of the area is about 8,000 ft above sea level. The study area is shown on the Jump Creek USGS 7.5 minute series quadrangle map in Section 18, Township 13 South, Range 8 East (Figure 1). General plant communities surrounding the area include Mountain Brush/Grass, Oak Shrubland, Sagebrush/Grass, Aspen, and Douglas Fir.

Gordon Creek 2/7/8 is an area where coal mining had been conducted for many years. More recently, the area has been reclaimed and the land restored to a condition that is consistent with the pre-mining and post-mining land uses, or primarily livestock grazing. The post-mining land use of the site following final reclamation was determined by the landowner.

Once the mine portals were sealed during reclamation activities, earthwork operations began to return the area back to its approximate original topography. Final seeding was accomplished using seeds of native and approved introduced plant species (see Figure 2). Final seedbed preparations and seeding for most of the area occurred in October 1998 with follow-up seeding on the regraded roads in October 1999.

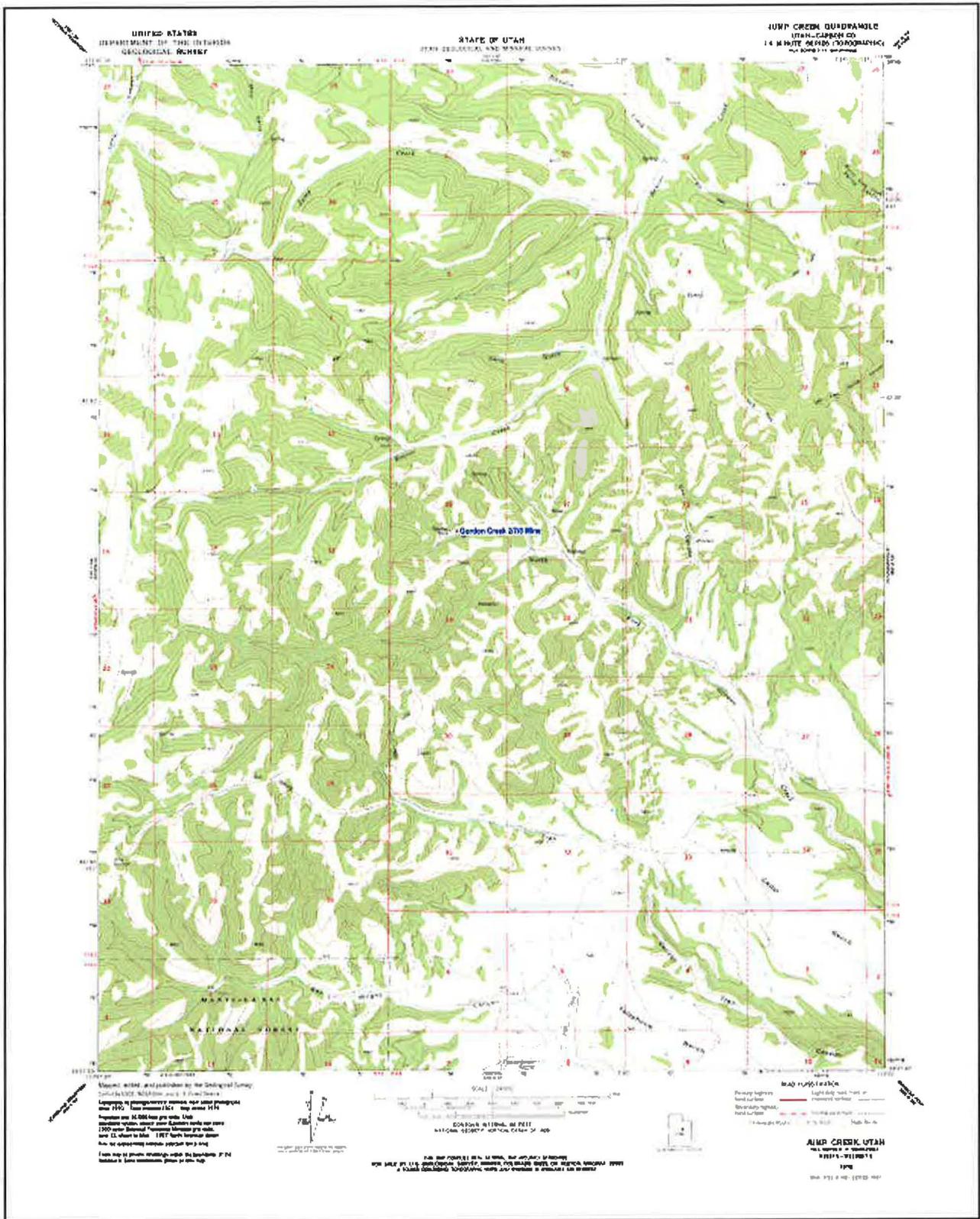


Figure 1: Gordon Creek 2/7/8 Mine Study Area

Study Objectives

This report describes the findings of quantitative sampling the vegetation at Gordon Creek 2/7/8 Mine site in 2009. The site has been reclaimed long enough that the “*Responsibility Period*” of the mine operator has passed. This means that theoretically enough time has passed for vegetation to become adequately establishment on reclaimed land.

After that time period, an application for bond release can be initiated. Thus, Mountain Coal Company may soon submit the application for *Final* or *Phase III Bond Release* through the State of Utah, Division of Oil, Gas and Mining (DOGM). Vegetation sampling in 2009 was conducted with that in mind. Because sample adequacy and statistical analyses meet the required levels, this dataset can be used as “**Year 1**” of the two consecutive years of vegetation monitoring required to apply for final bond release.

<u>COMMON NAME</u>	<u>SCIENTIFIC NAME</u>
SHRUBS	
Bitterbrush	(<i>Purshia tridentata</i>)
Mtn. Mahogany	(<i>Cercocarpus ledifolius</i>)
Rubber rabbitbrush	(<i>Chrysothamnus nauseosus</i>)
Blue elderberry	(<i>Sambucus caerulea</i>)
Snowberry	(<i>Symphoricarpos albus</i>)
Sagebrush	(<i>Artemisia tridentata</i> ssp. <i>vaseyana</i>)
FORBS	
Northern sweetvetch	(<i>Hedysarum boreale</i>)
Cicer milkvetch	(<i>Astragalus cicer</i>)
Purple daisy fleabane	(<i>Erigeron corymbosus</i>)
Little sunflower	(<i>Helianthella uniflora</i>)
Rocky Mt. penstemon	(<i>Penstemon strictus</i>)
Yellow sweet clover	(<i>Melilotus officinalis</i>)
Alfalfa (Ladak)	(<i>Medicago sativa</i>)
Pacific Aster	(<i>Aster chilensis</i>)
GRASSES	
Thickspike wheatgrass	(<i>Elymus lanceolatus</i>)
Bluebunch wheatgrass	(<i>Elymus spicatus</i>)
Slender wheatgrass	(<i>Elymus trachycaulus</i>)
Indian ricegrass	(<i>Stipa hymenoides</i>)
Gt. Basin wildrye	(<i>Elymus cinereus</i>)

Figure 2: Final Seed Mixture for the Gordon Creek 2/7/8 Mine Site

Reference Area

A reference area, or a native undisturbed Mountain Brush/Grass plant community that was previously chosen to be represent success standards for final revegetation has also been sampled. These data have been compared with the reclaimed areas of the Gordon Creek 2/7/8 Mine site.

METHODS

Quantitative and qualitative data were taken from the vegetation of the reclaimed areas at the Gordon Creek 2/7/8 Mine site as well as the Mountain Brush/Grass Reference Area. Sampling was conducted September 6-9, 2009. Methodologies used for sampling were performed in accordance with the *Vegetation Information Guidelines* supplied by DOGM.

Transect and Quadrat Placement

Random/regular placement of sample quadrats were designed in an attempt to provide unbiased accuracy of the data compiled. This was accomplished by establishing transect lines the entire length of the reclaimed and reference areas. At regular intervals along the transect lines, random numbers were generated and used to measure distances at right angles to determine sample locations. Whether these random numbers were odd or even determined which side of the transect a given quadrat was placed. The random number selected would be high enough to place quadrats to the lateral limits of the sample areas and all areas in-between. This insured that

the sample quadrats were placed randomly over the entire study area in an attempt to adequately represent the site as a whole

Cover, Frequency and Composition

Cover estimates were made using ocular methods with meter square quadrats. Species composition 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. 2008).

Production

Total annual biomass production was estimated by clipping, drying and weighing current annual growth in each sample quadrat. "Double sampling" methods were employed by placing four additional quadrats around the clipped quadrat, then estimating the production of them relative to the clipped plot. Herbaceous and woody species production weights were recorded separately.

Sample Size & Adequacy

Sampling adequacy was calculated using the formula given below.

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

where,

nMIN = minimum adequate sample
t = appropriate confidence t-value
s = standard deviation
x = sample mean
d = desired change from mean

The values used for “t” and “d” insured that sample adequacy was met with 90% confidence within a 10% deviation from the true mean.

Diversity Indices

MacArthur's Diversity Index is an effective diversity measurement and is computed using the following equation:

$$1/\sum pi^2$$

where,

pi is the proportion of sum frequency contributed by the *i*th species in the sample area of concern.

The proportional contribution of each species is then squared and the values for all species in the sample areas are summed. This index integrates the number of species and the degree to which frequency of occurrence was equitably distributed among those species.

Another diversity measurement was provided that shows the average number of species encountered at each quadrat. Finally, a third measure of diversity or “richness” is simply the total number of species encountered in the quadrats.

Photographs

Color photographs of the sample areas were taken at the time of sampling and have been included within this report.

Raw Data

The raw data for total cover, cover by species, frequency and composition are available upon request from DOGM or Mountain Coal Company.

RESULTS

Reclaimed Areas

The reclaimed areas were greatly dominated by the forb species, alfalfa (*Medicago sativa*), however, there were also several grasses that were well-represented including Gt. Basin wildrye (*Elymus cinereus*), thickspike wheatgrass (*E. lanceolatus*), western wheatgrass (*E. smithii*), bluebunch wheatgrass (*E. spicatus*) and Kentucky bluegrass (*Poa pratensis*). For a list of all species present in the sample quadrats, refer to Table 1.

Table 1: Gordon Creek 2/7/8 Mine. Total cover, standard deviation and frequency by species (2009).

Reclaimed Areas (n=150)	Mean Percent	Standard Deviation	Percent Frequency
SHRUBS			
<i>Artemisia tridentata</i>	0.30	2.33	2.00
<i>Chrysothamnus nauseosus</i>	1.70	7.52	5.33
<i>Gutierrezia sarothrae</i>	0.17	1.46	1.33
<i>Purshia tridentata</i>	0.13	1.63	0.67
<i>Symphoricarpos oreophilus</i>	0.27	1.98	2.00
FORBS			
<i>Astragalus cicer</i>	2.63	10.86	12.00
<i>Cynoglossum officinale</i>	0.80	3.52	6.00
<i>Hedysarum boreale</i>	0.13	1.15	1.33
<i>Linum lewisii</i>	0.07	0.81	0.67
<i>Medicago sativa</i>	33.53	29.18	72.00
<i>Penstemon strictus</i>	1.27	4.59	9.33
GRASSES			
<i>Agropyron cristatum</i>	1.17	5.58	5.33
<i>Bromus carinatus</i>	0.13	1.15	1.33
<i>Bromus tectorum</i>	0.03	0.41	0.67
<i>Dactylis glomeratus</i>	0.27	2.37	1.33
<i>Elymus cinereus</i>	7.77	15.52	29.93
<i>Elymus lanceolatus</i>	6.53	12.83	26.67
<i>Elymus salinus</i>	1.43	6.36	6.00
<i>Elymus smithii</i>	5.55	14.13	19.33
<i>Elymus spicatus</i>	4.31	11.17	16.67
<i>Poa pratensis</i>	3.57	10.84	12.67

Total living cover of the reclaimed areas was estimated at 71.77%, all of which came from understory cover (Table 2-A). Although much the composition (51.98%) was comprised of forb species (mostly due to alfalfa), grasses were ranked close behind (44.09%). Shrubs followed at a distant 3.93% of the composition (Table 2-B).

Table 2: Gordon Creek 2/7/8 Mine. Total cover, standard deviation and sample size (2009).

Reclaimed Areas (n=150; nMIN= 6.31)	Mean Percent	Standard Deviation
A. TOTAL COVER		
Understory	71.77	10.96
Litter	9.84	5.78
Bareground	9.25	6.12
Rock	9.14	6.35
B. % COMPOSITION		
Shrubs	3.93	12.77
Forbs	51.98	34.17
Grasses	44.09	31.29
nMIN = Sample Adequacy n= Sample Size		

Total annual biomass production of the reclaimed areas was estimated at 1,164.24 pounds per acre of which 1,138.88 pounds came from herbaceous species (forbs and grasses) and only 25.26 pounds came from woody plants (Table 3).

Table 3: Production at Gordon Creek 2/7/8 (2009).

Reclaimed Areas (n=150; nMIN=40.12)		
	Pounds/Acre	
LIFEFORM	MEAN	STD. DEV.
Herbaceous	1138.88	471.59
Woody	25.36	114.03
TOTAL	1164.24	448.29

Reference Area

The dominant plant by cover and frequency at the Mountain Brush/Grass Reference Area was the grass species Salina wildrye (*Elymus salinus*). There were four shrub species that were also

relatively common here including alder-leaf mountain-mahogany (*Cercocarpus montanus*), corymb buckwheat (*Eriogonum corymbosum*), broom snakeweed (*Gutierrezia sarothrae*) and antelope bitterbrush (*Purshia tridentata*). Forb species were relatively uncommon in the reference area (Table 4).

Table 4: Gordon Creek 2/7/8 Mine. Total cover, standard deviation and frequency by species (2009).

Mountain Brush/Grass Reference Area (n=90; nMIN= 23.37)	Mean Percent	Standard Deviation	Percent Frequency
OVERSTORY			
<i>Cercocarpus montanus</i>	0.22	2.10	1.11
UNDERSTORY			
SHRUBS			
<i>Amelanchier utahensis</i>	1.11	4.82	7.78
<i>Artemisia frigida</i>	0.11	1.05	1.11
<i>Artemisia tridentata</i> var. <i>vaseyana</i>	0.72	4.69	3.33
<i>Cercocarpus montanus</i>	3.17	7.17	20.00
<i>Eriogonum corymbosum</i>	2.83	8.43	15.56
<i>Gutierrezia sarothrae</i>	1.56	2.95	23.33
<i>Purshia tridentata</i>	1.22	4.55	11.11
<i>Symphoricarpos oreophilus</i>	0.17	1.57	1.11
FORBS			
<i>Eriogonum jamesii</i>	0.56	1.89	8.89
<i>Machaeranthera grindelioides</i>	0.11	0.74	2.22
<i>Stanleya pinnata</i>	0.17	0.90	3.33
GRASSES			
<i>Elymus salinus</i>	28.72	11.04	98.89
<i>Stipa hymenoides</i>	0.44	4.19	1.11

The total living cover for the Reference Area was 41.11% (Table 5-A). Most of this cover was understory cover (there was only 0.22% cover that consisted of overstory). The understory cover was comprised of 73.65% grasses, 24.00% shrubs and 2.35% grasses (Table 5-B).

Table 5: Gordon Creek 2/7/8 Mine. Total cover, standard deviation and sample size (2009).

Mountain Brush/Grass Reference Area (n=90 nMIN= 33.91)	Mean Percent	Standard Deviation
A. TOTAL COVER		
Overstory (o)	0.22	2.10
Understory (u)	40.89	11.73
Litter	14.33	5.44
Bareground	21.44	11.84
Rock	23.33	12.32
o + u	41.11	12.08
B. % COMPOSITION		
Shrubs	24.00	23.56
Forbs	2.35	6.17
Grasses	73.65	23.85

Total annual biomass production of the reference area was estimated at 850.05 pounds per acre of which 603.39 pounds came from herbaceous species and 246.66 came from woody plants (Table 6).

Table 6: Production at Gordon Creek 2/7/8 (2009).

Mountain Brush/Grass Reference Area (n=90)		
	Pounds/Acre	
LIFEFORM	MEAN	STD. DEV.
Herbaceous	603.39	222.68
Woody	246.66	252.20
TOTAL	850.05	300.91

Dataset Comparisons

Comparisons were made between the datasets of the reclaimed areas at Gordon Creek 2/7/8 and the Mountain Brush/Grass Reference Area . To begin, statistical tests were implemented comparing the total living plant cover of the two areas. A Student's t-test analysis suggested that the reclaimed area's total living cover was significantly greater statistically when it was compared to the reference area (Figure 3).

FIGURE 3. STUDENT'S T TEST - A total living cover comparison between the reclaimed area at Gordon Creek 2/7/8 and its reference area (2009).

Reclaimed Area: $\bar{x}=71.77$; $s=10.96$; $n=150$

Reference Area: $\bar{x}=41.11$; $s=12.08$; $n=90$

$t = 20.186$; $df = 238$, $SL= p<0.01$

When total annual biomass production of the reclaimed area was statistically compared to that of the reference area, results also suggested there was significantly more in the former (Figure 4).

FIGURE 4. STUDENT'S T TEST - A total annual biomass production comparison between the reclaimed area at Gordon Creek 2/7/8 and its reference area (2009).

Reclaimed Area: $\bar{x}=1164.24$; $s=448.29$; $n=150$

Reference Area: $\bar{x}=850.05$; $s=300.91$; $n=90$

$t = 5.897$; $df = 238$, $SL= p<0.01$

MacArthur's Diversity Index was also employed to the datasets of the reclaimed and reference areas. A comparison of the values between these two areas suggested that the total diversity of the reclaimed area was greater than

that of the reference area by quite a wide margin (Figure 5).

Another method of comparing species diversity of the two areas was to simply calculate the mean number of species present in the sample quadrats. Results from this method also suggested that the reclaimed area was more diverse with respect to species when compared to the reference area (Figure 6).

FIGURE 5. MacARTHUR'S INDEX - A **diversity** comparison between the reclaimed area at Gordon Creek 2/7/8 and its reference area (2009).

$$1/\sum p_i^2 =$$

Reclaimed Area: 6.780

Reference Area: 3.474

FIGURE 6. AVERAGE NUMBER OF SPECIES PER SQUARE METER - A **diversity** comparison between the reclaimed area at Gordon Creek 2/7/8 and its reference area (2009).

$$\bar{x} \text{ NO. SPP/M}^2 =$$

Reclaimed Area: 2.33

Reference Area: 1.98

Finally, another diversity-type computation, the total number of species encountered in the sample quadrats, were compared. Again, the reclaimed area value was greater when compared to the reference area (Figure 7).

FIGURE 7. TOTAL SPECIES PRESENT -
A **diversity** comparison between the
reclaimed area at Gordon Creek 2/7/8 and its
reference area (2009).

Reclaimed Area: 21

Reference Area: 13

DISCUSSION & CONCLUSIONS

Subsequent to final reclamation, the primary post-mining land use as determined by the land owner, will primarily be that of grazing by domestic livestock. Consequently, Gordon Creek's Mining and Reclamation (MRP) identifies "*stock grazing*" as the post-mining land use, but it also mentions that "*reclamation is also particularly important as a means of controlling erosion and restoring disturbed areas to productive wildlife habitat*".

Because the primary post-mining land was to be focused on livestock grazing, the parameters to be used for final revegetation success standards dictated in the MRP were **total living cover** and **annual biomass productivity**. Sample results in 2009 show that the total living cover and biomass productivity of the reclaimed area exceeded that of the reference area.

Although they were not specifically called for in the MRP, other parameters were also compared herein to evaluate specific wildlife habitat qualities of the reclaimed land when compared to the reference area. These parameters were diversity indices because species and habitat diversity are important components for restoring wildlife habitat. The diversity indices employed to the datasets suggest that the reclaimed area was more diverse than the reference area in 2009.

SUMMARY

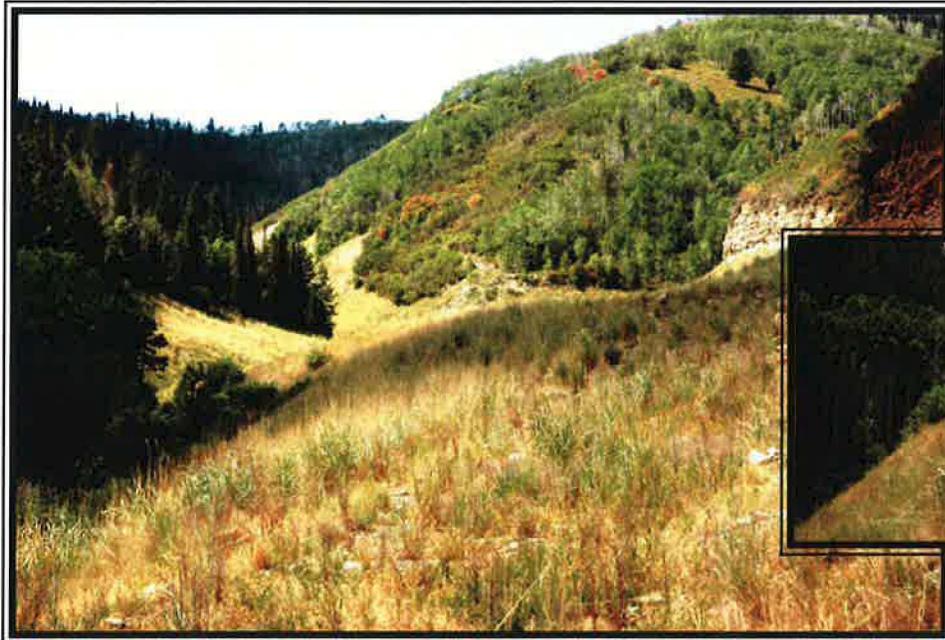
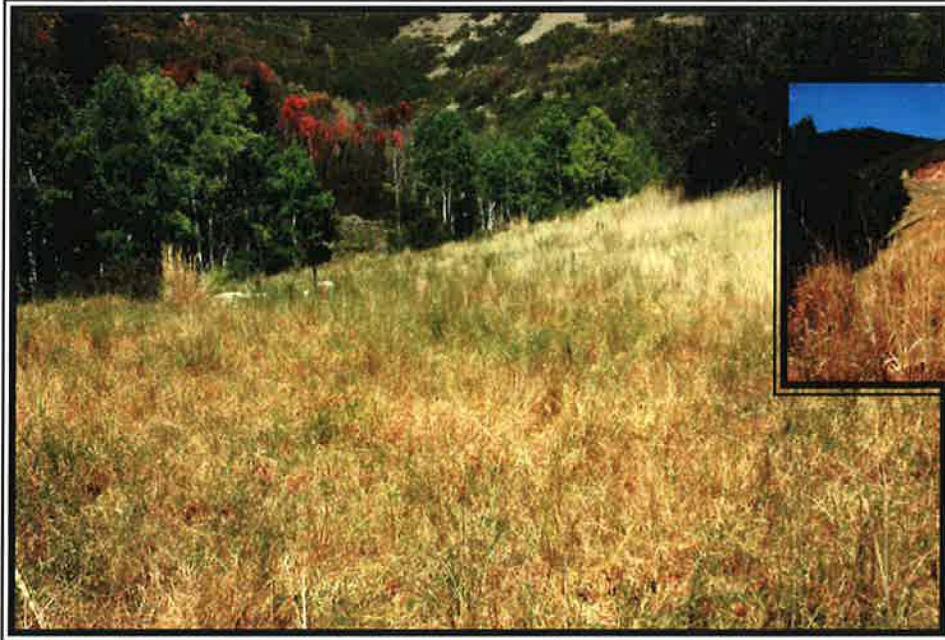
This document reports the results of quantitative sampling the vegetation of the reclaimed area at the Gordon Creek 2/7/8 Mine site. The datasets in this report represent **Year 1** of the two consecutive years required for an application for final bond release to be submitted through the State of Utah, Division of Oil, Gas & Mining (DOG M). A reference area was chosen early in the process to one day provide an area for comparison for future revegetation success standards. This Mountain Brush/Grass Reference Area was also sampled and the results were reported in this document.

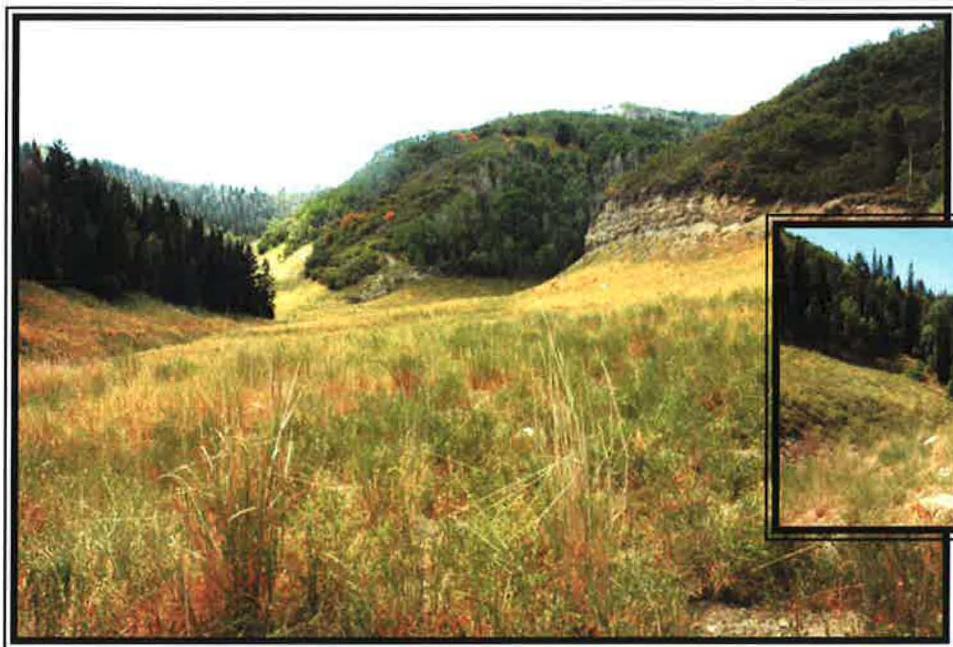
For **Year 1** (2009), when the total living cover, annual biomass production, MacArthur's Divisity Index, average number of species per quadrat and the total number of species of the reclaimed areas were compared with the reference area, all analyses suggested the reclaimed areas met or exceeded those parameters.

Year 2 (2010) sample period will be conducted to meet the required number of sample years for a Phaze III Bond Release application.

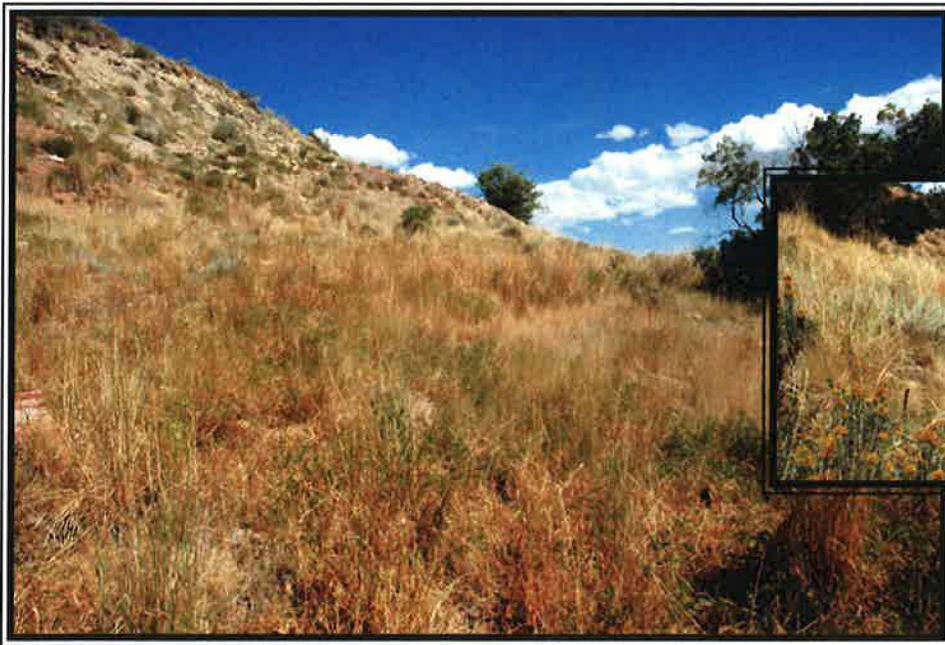
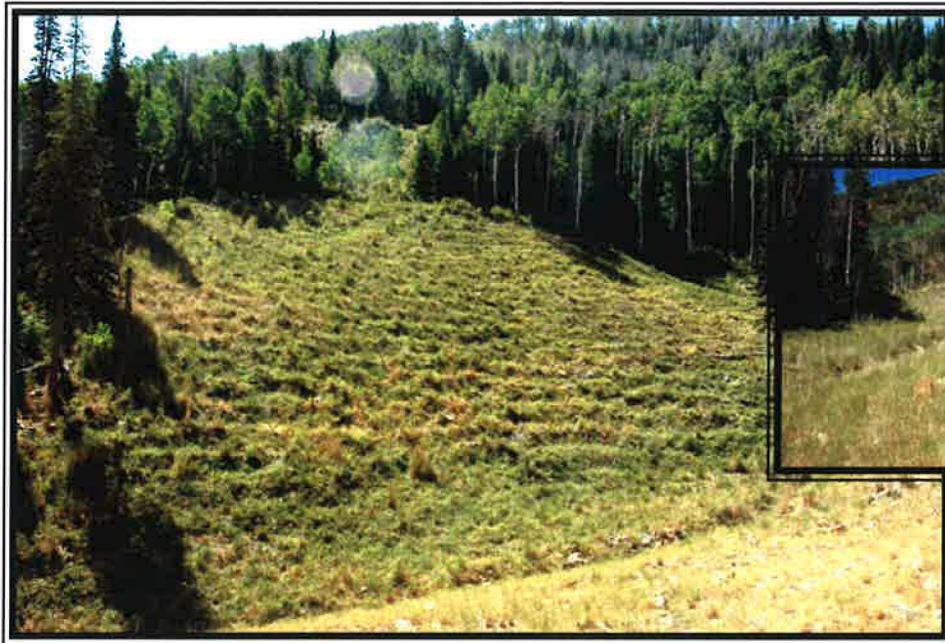
**COLOR PHOTOGRAPHS
OF THE
SAMPLE AREAS**

THE RECLAIMED AREAS

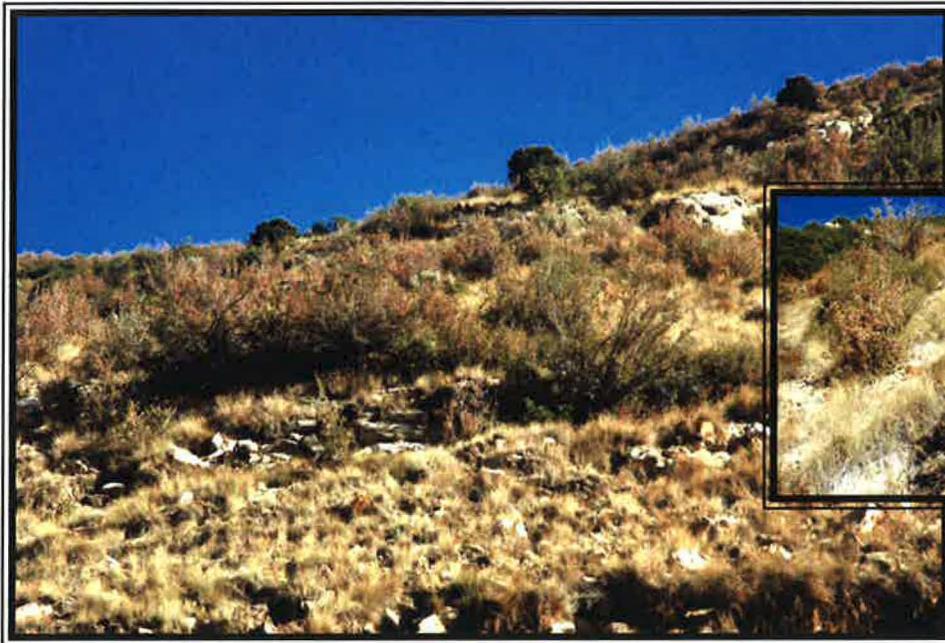








THE REFERENCE AREA



**VEGETATION MONITORING
FOR PHASE III BOND RELEASE
AT THE GORDON CREEK 2/7/8 MINE SITE
YEAR 2: 2010**

**FOR
MOUNTAIN COAL COMPANY, LLC**



Revegetation at the Gordon Creek 2/7/8 Area

Prepared by

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November 2011



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INTRODUCTION

Although the vegetation at the Gordon Creek 2/7/8 Mine site has been sampled and monitored since it was reclaimed, this document reports the second of two consecutive years of more comprehensive quantitative sampling that has been conducted at the site. Consequently, in order for mine owners/operators to achieve “final” or Phase III Bond Release, state and federal regulations require more rigorous sample data to be recorded following the “*responsibility period*” of the site, or the period of time of extended obligation mandated by the regulations following final reclamation and revegetation procedures. This means that theoretically enough time has passed for vegetation to become adequately establishment on the reclaimed land to become “diverse, effective and permanent” and has the potential to meet post-mining land use standards.

Results from the first of the two consecutive sample years was submitted previously in a report titled:

*Vegetation Monitoring for Phase III Bond Release
at the Gordon Creek 2/7/8 Mines
Year 1: 2009*

To facilitate comparisons between years, this report has also been included in Appendix A of this document.

General Site Description & Brief History

The reclaimed Gordon Creek 2/7/8 Mine site is located in the Bryner Canyon and Beaver Creek areas of Carbon County, Utah. Elevation of the area is about 8,000 ft above sea level. The study area is shown on the Jump Creek USGS 7.5 minute series quadrangle map in Section 18, Township 13 South, Range 8 East (Figure 1) . General native plant communities surrounding the reclaimed site include Mountain Brush/Grass, Oak Shrubland, Sagebrush/Grass, Aspen, and Douglas Fir.

Gordon Creek 2/7/8 Mine site is an area where coal mining operations had been conducted for many years. More recently, the area has been reclaimed and the land restored to a condition that is consistent with the pre-mining and post-mining land uses, or primarily livestock grazing. The post-mining land use of the site following final reclamation was determined by the landowner.

Once the mine portals were sealed during reclamation activities, earthwork operations began to return the area back to its approximate original topography. Final seeding was accomplished using seeds of native and approved introduced plant species (Figure 2). Final seedbed preparations and seeding for most of the area occurred in October 1998 with follow-up seeding on the regraded roads in October 1999.

Study Objectives

This report describes the findings of quantitative sampling the vegetation at the Gordon Creek 2/7/8 Mine site in 2010. The site has been reclaimed long enough that the aforementioned *responsibility period* has passed. As mentioned above, after that time period an application for bond release can be initiated.

<u>COMMON NAME</u>	<u>SCIENTIFIC NAME</u>
SHRUBS	
Bitterbrush	(<i>Purshia tridentata</i>)
Mtn. Mahogany	(<i>Cercocarpus ledifolius</i>)
Rubber rabbitbrush	(<i>Chrysothamnus nauseosus</i>)
Blue elderberry	(<i>Sambucus caerulea</i>)
Snowberry	(<i>Symphoricarpos albus</i>)
Sagebrush	(<i>Artemisia tridentata</i> ssp. <i>vaseyana</i>)
FORBS	
Northern sweetvetch	(<i>Hedysarum boreale</i>)
Cicer milkvetch	(<i>Astragalus cicer</i>)
Purple daisy fleabane	(<i>Erigeron corymbosus</i>)
Little sunflower	(<i>Helianthella uniflora</i>)
Rocky Mt. penstemon	(<i>Penstemon strictus</i>)
Yellow sweet clover	(<i>Melilotus officinalis</i>)
Alfalfa (Ladak)	(<i>Medicago sativa</i>)
Pacific Aster	(<i>Aster chilensis</i>)
GRASSES	
Thickspike wheatgrass	(<i>Elymus lanceolatus</i>)
Bluebunch wheatgrass	(<i>Elymus spicatus</i>)
Slender wheatgrass	(<i>Elymus trachycaulus</i>)
Indian ricegrass	(<i>Stipa hymenoides</i>)
Gt. Basin wildrye	(<i>Elymus cinereus</i>)

Figure 2: Final Seed Mixture for the Gordon Creek 2/7/8 Mine Site

Thus, Mountain Coal Company may soon submit the application for *final* or *Phase III Bond Release* through the State of Utah, Division of Oil, Gas and Mining (DOG M). Vegetation sampling in both 2009 and 2010 were conducted with that in mind. Because sample adequacy and statistical analyses met the required confidence levels, this dataset can be used as **Year 2** of the two consecutive years of vegetation monitoring required to apply for bond release. **Year 1** data also meet appropriate confidence levels (see report in Appendix A).

Reference Area

A reference area, or a native, undisturbed Mountain Brush/Grass plant community that was previously chosen to represent success standards for final revegetation has also been sampled both years. These datasets have been compared with the reclaimed areas of the Gordon Creek 2/7/8 Mine site data.

METHODS

For this report, quantitative and qualitative data were taken from the vegetation of the reclaimed areas at the Gordon Creek 2/7/8 Mine site as well as the Mountain Brush/Grass Reference Area. Sampling was conducted September 7-10, 2010. Methodologies used for sampling were performed in accordance with the *Vegetation Information Guidelines* supplied by DOGM and were consistent with the 2009 methods.

Transect and Quadrat Placement

Random/regular placement of sample quadrats was designed in an attempt to provide unbiased accuracy of the data compiled. This was accomplished by establishing transect lines the entire length of the reclaimed and reference areas. At regular intervals along the transect lines, random numbers were generated and used to measure distances at right angles to determine sample

locations. Whether these random numbers were odd or even determined which side of the transect a given quadrat was placed. The random number selected would be high enough to place quadrats to the lateral limits of the sample areas and all areas in-between. This insured that the sample quadrats were placed randomly over the entire study area with the intent to adequately represent the site as a whole

Cover, Frequency and Composition

Cover estimates were made using employing methods with meter square quadrats. Species composition 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. 2008).

Production

Total annual biomass production was estimated by clipping, drying and weighing current annual growth in sample quadrats. "Double sampling" methods were employed by placing four additional quadrats around the clipped quadrat, then estimating the production of them relative to the clipped plot. Herbaceous and woody species production weights were recorded separately.

Sample Size & Adequacy

Sampling adequacy was calculated using the formula given below.

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

where,

<i>nMIN</i>	=	minimum adequate sample
<i>t</i>	=	appropriate confidence t-value
<i>s</i>	=	standard deviation
<i>x</i>	=	sample mean
<i>d</i>	=	desired change from mean

The values used for “t” and “d” insured that sample adequacy was met with 90% confidence within a 10% deviation from the true mean.

Diversity Indices

MacArthur's Diversity Index was employed as an effective diversity measurement and is computed using the following equation:

$$1/\sum pi^2$$

where,

pi is the proportion of sum frequency contributed by the *i*th species in the sample area of concern.

The proportional contribution of each species is then squared and the values for all species in the sample areas are summed. This index integrates the number of species and the degree to which frequency of occurrence was equitably distributed among those species.

Another diversity measurement was provided that shows the average number of species encountered at each quadrat. Finally, a third measure of diversity or “richness” is simply the total number of species encountered in the quadrats.

Photographs

Color photographs of the sample areas were taken at the time of sampling and have been included in this report.

RESULTS

Reclaimed Areas

Similar to the 2009 sample results, in 2010 the reclaimed areas were greatly dominated by the forb species known as alfalfa (*Medicago sativa*). However, there were also several grasses that were well-represented including Gt. Basin wildrye (*Elymus cinereus*), thickspike wheatgrass (*E. lanceolatus*), western wheatgrass (*E. smithii*) and bluebunch wheatgrass (*E. spicatus*). Shrubs were also present in the dataset, but were relatively uncommon. For a list of all species present

in the sample quadrats, refer to Table 1.

Table 1: Gordon Creek 2/7/8 Mine. Total cover, standard deviation and frequency by species (2010).

Reclaimed Areas (n=150)	Mean Percent	Standard Deviation	Percent Frequency
SHRUBS			
<i>Artemisia tridentata</i>	1.33	7.54	4.00
<i>Chrysothamnus nauseosus</i>	0.83	6.01	2.00
<i>Gutierrezia sarothrae</i>	0.07	0.81	0.67
<i>Symphoricarpos oreophilus</i>	0.20	1.51	2.00
FORBS			
<i>Artemisia ludoviciana</i>	0.20	1.51	2.00
<i>Astragalus cicer</i>	2.20	6.47	13.33
<i>Cynoglossum officinale</i>	2.27	5.64	20.67
<i>Hedysarum boreale</i>	0.17	1.46	1.33
<i>Lappula occidentalis</i>	0.07	0.81	0.67
<i>Medicago sativa</i>	24.42	21.65	69.33
<i>Penstemon strictus</i>	1.83	7.47	8.00
<i>Sisymbrium altissimum</i>	0.03	0.41	0.67
GRASSES			
<i>Agropyron cristatum</i>	1.03	3.93	6.67
<i>Bromus carinatus</i>	0.97	4.57	5.33
<i>Bromus tectorum</i>	0.10	0.91	1.33
<i>Elymus cinereus</i>	11.08	15.98	46.00
<i>Elymus lanceolatus</i>	6.15	9.44	38.67
<i>Elymus salinus</i>	0.27	3.26	0.67
<i>Elymus smithii</i>	5.02	9.80	30.00
<i>Elymus spicatus</i>	3.70	9.15	20.67
<i>Poa pratensis</i>	0.30	2.02	2.67

Total living cover of the reclaimed areas was estimated at 62.23%, all of which came from understory cover (Table 2-A). Forbs and grasses were nearly equally represented in the composition at 49.55% and 46.67%, respectively, whereas shrubs followed at a distant 3.78%

(Table 2-B).

Table 2: Gordon Creek 2/7/8 Mine. Total cover and standard deviation (2010).

Reclaimed Areas (n=150; nMIN=8.89)	Mean Percent	Standard Deviation
A. TOTAL COVER		
Understory	62.23	11.28
Litter	11.57	6.00
Bareground	14.60	9.16
Rock	11.60	6.67
B. % COMPOSITION		
Shrubs	3.78	15.92
Forbs	49.55	31.35
Grasses	46.67	30.63

Total annual biomass production of the reclaimed areas was estimated at 1,085.96 pounds per acre of which 1,041.27 pounds came from herbaceous species (forbs and grasses) and only 44.69 pounds came from woody plants (Table 3).

Table 3: Production at Gordon Creek 2/7/8 (2010).

Reclaimed Areas (n=120; nMIN=49.51)		
	Pounds/Acre	
LIFEFORM	MEAN	STD. DEV.
Herbaceous	1041.27	470.09
Woody	44.69	203.23
TOTAL	1085.96	464.91

Color photographs of the reclaimed areas have been included at the end of this report.

Reference Area

The dominant plant by cover and frequency in the Mountain Brush/Grass Reference Area was the grass species, Salina wildrye (*Elymus salinus*). The most common shrub species in the 2010 dataset were antelope bitterbrush (*Purshia tridentata*), alder-leaf mountain-mahogany (*Cercocarpus montanus*) and corymb buckwheat (*Eriogonum corymbosum*). Forb species were relatively uncommon in the reference area, each of which consisted of less than 1% of the living cover (Table 4).

Color photographs of the reference area have been included at the end of this report.

Table 4: Gordon Creek 2/7/8 Mine. Total cover, standard deviation and frequency by species (2010).

Mountain Brush/Grass Reference Area (n=90)	Mean Percent	Standard Deviation	Percent Frequency
OVERSTORY			
<i>Quercus gambelii</i>	0.22	1.47	2.22
UNDERSTORY			
SHRUBS			
<i>Amelanchier utahensis</i>	1.33	6.49	4.44
<i>Artemisia frigida</i>	0.11	1.05	1.11
<i>Artemisia tridentata</i> var. <i>vaseyana</i>	1.11	6.23	3.33
<i>Cercocarpus montanus</i>	2.83	6.71	20.00
<i>Eriogonum corymbosum</i>	2.44	8.51	8.89
<i>Gutierrezia sarothrae</i>	0.44	1.77	6.67
<i>Mahonia repens</i>	0.28	1.37	4.44
<i>Opuntia fragilis</i>	0.17	0.90	3.33
<i>Purshia tridentata</i>	4.11	11.24	16.67
<i>Quercus gambelii</i>	0.11	1.05	1.11
<i>Symphoricarpos oreophilus</i>	0.06	0.52	1.11
FORBS			
<i>Artemisia ludoviciana</i>	0.06	0.52	1.11
<i>Eriogonum jamesii</i>	0.11	1.05	1.11
<i>Machaeranthera grindelioides</i>	0.17	0.90	2.22
<i>Stanleya pinnata</i>	0.67	2.00	6.67
GRASSES			
<i>Elymus salinus</i>	27.94	12.76	94.44

The total living cover for the reference area was 42.16% (Table 5-A); most of this cover was understory cover (there was only 0.22% cover was overstory). The understory cover was comprised of 69.50% grasses, 28.15% shrubs and 2.36% grasses (Table 5-B).

Table 5: Gordon Creek 2/7/8 Mine. Total cover and standard deviation (2010).

Mountain Brush/Grass Reference Area (n=90; nMIN=8.89)	Mean Percent	Standard Deviation
A. TOTAL COVER		
Overstory (o)	0.22	1.47
Understory (u)	41.94	9.57
Litter	15.61	8.43
Bareground	19.39	9.36
Rock	23.06	10.84
o + u	42.16	9.52
B. % COMPOSITION		
Trees/Shrubs	28.15	30.85
Forbs	2.36	5.99
Grasses	69.50	30.42

Total annual biomass production of the reference area was estimated at 598.51 pounds per acre of which 398.30 pounds came from herbaceous species and 200.21 came from woody plants (Table 6).

Table 6: Production at Gordon Creek 2/7/8 (2010).

Mountain Brush/Grass Reference Area (n=90; nMIN=66.91)		
	Pounds/Acre	
LIFEFORM	MEAN	STD. DEV.
Herbaceous	398.30	185.77
Woody	200.21	284.41
TOTAL	598.51	297.61

Comparisons to the Revegetation Success Standards (2010)

Comparisons were made between the datasets of the reclaimed areas at the Gordon Creek 2/7/8

FIGURE 3. STUDENT'S T TEST - A total living cover comparison between the reclaimed area at Gordon Creek 2/7/8 and its reference area (2010).

Reclaimed Area: \bar{x} =62.23; s=11.28; n=150

Reference Area: \bar{x} =42.16; s=9.52; n=90

t = 14.126; df = 238, SL= p<0.01

Mine site and the Mountain Brush/Grass Reference Area. To begin, statistical tests were implemented that compared the total living vegetative cover of the two areas. A Student's t-test analysis suggested that the reclaimed area's total living cover was significantly greater statistically than the

reference area (Figure 3).

When total annual biomass production of the reclaimed area was compared statistically to that of the reference area, results here also suggested there was significantly more in the former (Figure 4).

FIGURE 4. STUDENT'S T-TEST - A total annual biomass production comparison between the reclaimed area at Gordon Creek 2/7/8 and its reference area (2010).

Reclaimed Area: \bar{x} =1085.96; s=464.91; n=120

Reference Area: \bar{x} =598.51; s=297.61; n=90

t = 8.697; df = 208, SL= p<0.01

MacArthur's Diversity Index was then employed to the datasets of the reclaimed and reference areas. A comparison of the values between these two areas suggested that the total diversity of

the reclaimed area was greater than that of the reference area by quite a wide margin (Figure 5).

Another method of comparing species diversity of the two areas was to simply calculate the mean number of species present in the sample quadrats. Results from this method also suggested that the reclaimed area was more diverse with respect to species when compared to the

FIGURE 5. MacARTHUR'S INDEX - A **diversity** comparison between the reclaimed area at Gordon Creek 2/7/8 and its reference area (2010).

$$1/\sum pi^2 =$$

Reclaimed Area: 7.272

Reference Area: 3.172

FIGURE 6. AVERAGE NUMBER OF SPECIES PER SQUARE METER - A **diversity** comparison between the reclaimed area at Gordon Creek 2/7/8 and its reference area (2010).

$$\bar{x} \text{ NO. SPP/M}^2 =$$

Reclaimed Area: 2.77

Reference Area: 1.77

reference area (Figure 6).

Finally, another diversity-type computation, or the total number of species encountered in the sample quadrats, was compared. Again, the reclaimed area value was greater when compared to the reference area (Figure 7).

FIGURE 7. TOTAL SPECIES PRESENT - A **diversity** comparison between the reclaimed area at Gordon Creek 2/7/8 and its reference area (2010).

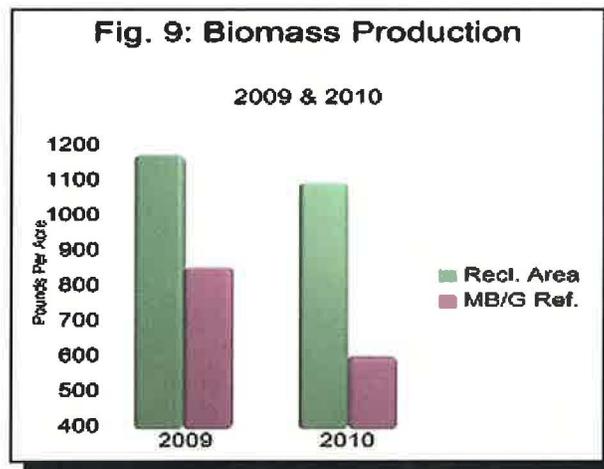
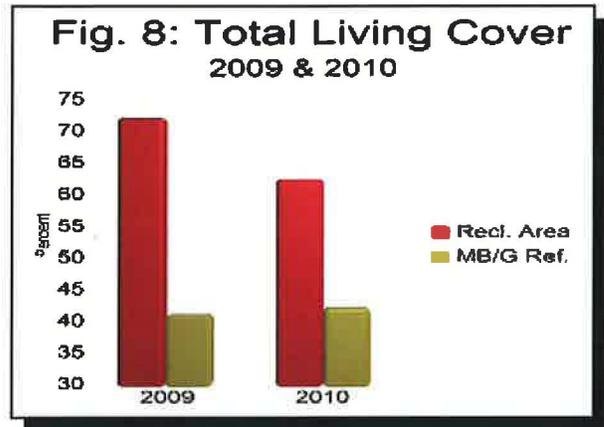
Reclaimed Area: 21

Reference Area: 16

Graphic Comparisons to the Revegetation Success Standards (2009-2010)

As mentioned above, this document is intended to report the findings for the second consecutive year (Year 2, 2010) of two sample years to determine the potential for obtaining final bond release at the reclaimed Gordon Creek 2/7/8 Mine site. Also stated beforehand, detailed results for the first sample year (Year 1, 2009) were reported in a previously-submitted

document (Appendix A). Nonetheless, *to facilitate comparisons between the two consecutive years required for potential bond release without referring to the Year 1 report*, a summary of

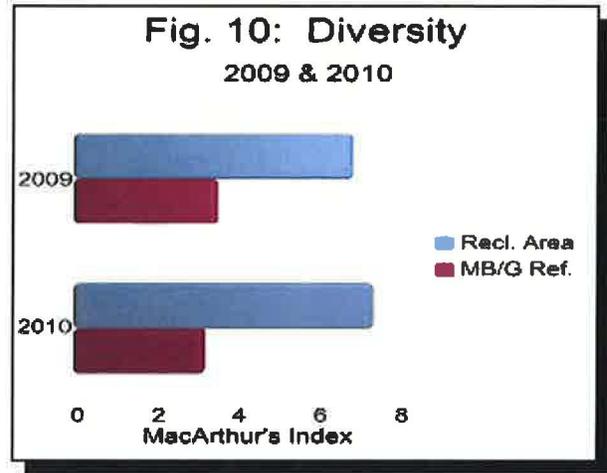


the results for both years, 2009 and 2010, have been prepared and illustrated in this report (Figures 8 - 12).

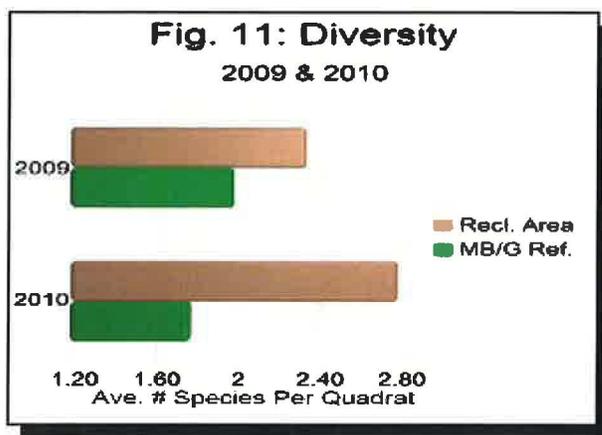
DISCUSSION & SUMMARY

Subsequent to final reclamation, the primary post-mining land use as determined by the land owner will primarily be that of grazing by domestic livestock. Consequently, Gordon Creek's Mining and Reclamation (MRP) identifies "stock grazing" as the post-mining land use, but it also states that "reclamation is

also particularly important as a means of controlling erosion and restoring disturbed areas to productive wildlife habitat".

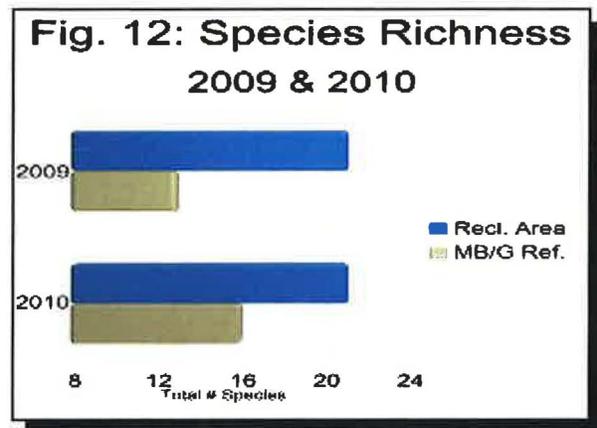


Because the primary post-mining land use was to be focused on livestock grazing, the parameters



to be used for final revegetation success standards dictated in the MRP were **total living cover and annual biomass productivity**. Sample results in 2009 and 2010 show that the total living cover and biomass productivity of the reclaimed area exceeded that of the reference area (Figures 8 and 9, respectively).

Although they were not specifically required in the MRP, other parameters were also compared to evaluate specific wildlife habitat qualities of the reclaimed land when compared to the reference area. These parameters consisted of diversity indices because species and habitat diversity are important components for restoring wildlife habitat. The diversity indices employed to the datasets suggest that the reclaimed area was more diverse than the reference area in both sample years (Figures 10 - 12).



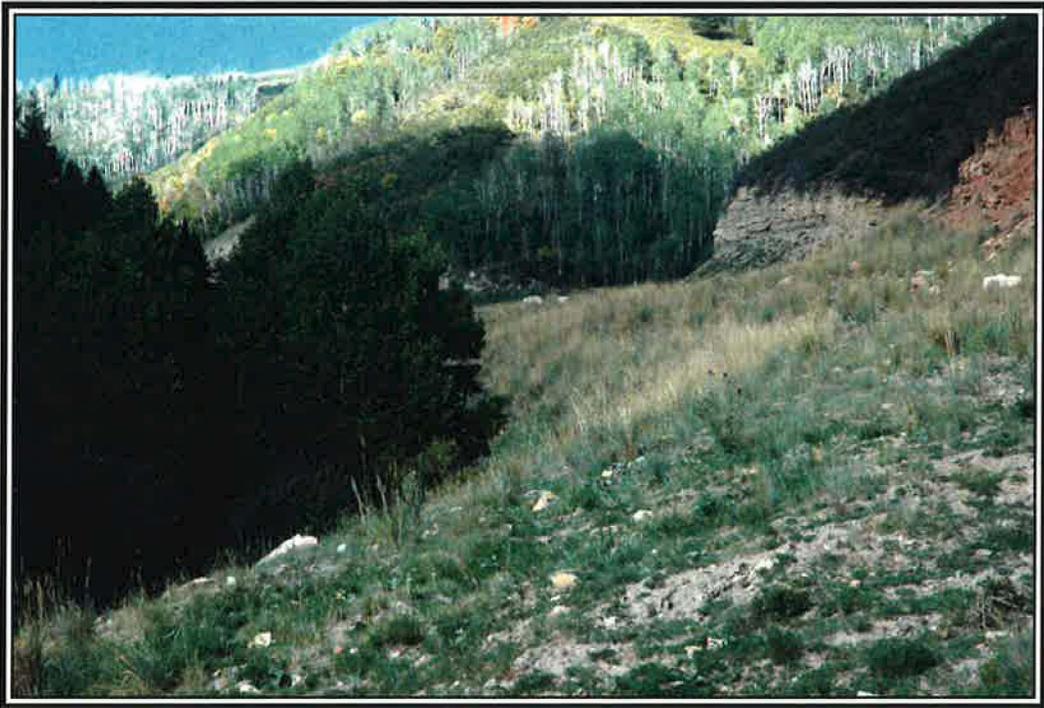
CONCLUSIONS

In conclusion, it appears that revegetation at the Gordon Creek 2/7/8 Mine site has met or exceeded the revegetation success standards for total living cover and annual biomass productivity. Moreover, diversity when compared to the Mountain Brush/Grass Reference Area, was also greater in the reclaimed area. With those parameters in mind, the reclaimed area of the mine site appears to be a likely candidate for Phase III Bond Release through the State of Utah.

**COLOR PHOTOGRAPHS
OF THE
SAMPLE AREAS
2010**

THE RECLAIMED AREAS

















THE MOUNTAIN BRUSH/GRASS REFERENCE AREA



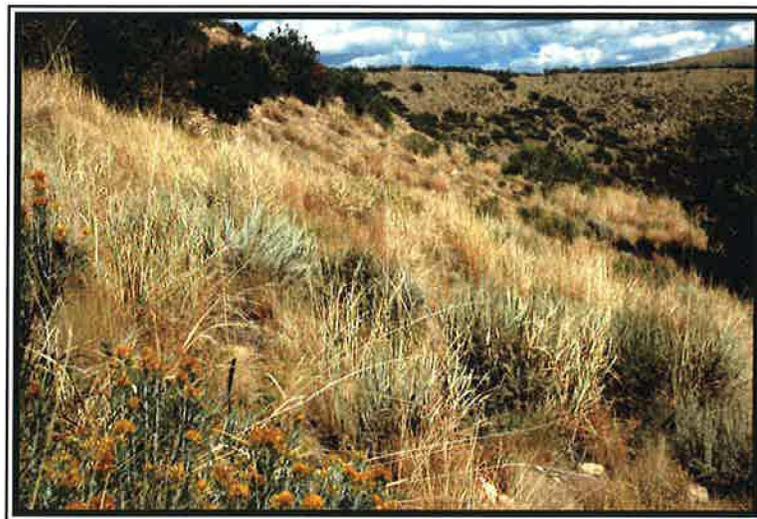


APPENDIX A

Report for
Year 1 (2009)

**VEGETATION MONITORING
FOR PHASE III BOND RELEASE
AT THE GORDON CREEK 2/7/8 MINES
YEAR 1: 2009**

**FOR
MOUNTAIN COAL COMPANY, LLC**



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May 2010



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INTRODUCTION

General Site Description

The Gordon Creek 2/7/8 Mine site is located in the Bryner Canyon and Beaver Creek area of Carbon County, Utah. Elevation of the area is about 8,000 ft above sea level. The study area is shown on the Jump Creek USGS 7.5 minute series quadrangle map in Section 18, Township 13 South, Range 8 East (Figure 1). General plant communities surrounding the area include Mountain Brush/Grass, Oak Shrubland, Sagebrush/Grass, Aspen, and Douglas Fir.

Gordon Creek 2/7/8 is an area where coal mining had been conducted for many years. More recently, the area has been reclaimed and the land restored to a condition that is consistent with the pre-mining and post-mining land uses, or primarily livestock grazing. The post-mining land use of the site following final reclamation was determined by the landowner.

Once the mine portals were sealed during reclamation activities, earthwork operations began to return the area back to its approximate original topography. Final seeding was accomplished using seeds of native and approved introduced plant species (see Figure 2). Final seedbed preparations and seeding for most of the area occurred in October 1998 with follow-up seeding on the regraded roads in October 1999.

Study Objectives

This report describes the findings of quantitative sampling the vegetation at Gordon Creek 2/7/8 Mine site in 2009. The site has been reclaimed long enough that the “*Responsibility Period*” of the mine operator has passed. This means that theoretically enough time has passed for vegetation to become adequately establishment on reclaimed land.

After that time period, an application for bond release can be initiated. Thus, Mountain Coal Company may soon submit the application for *Final* or *Phase III Bond Release* through the State of Utah, Division of Oil, Gas and Mining (DOGM). Vegetation sampling in 2009 was conducted with that in mind. Because sample adequacy and statistical analyses meet the required levels, this dataset can be used as “**Year 1**” of the two consecutive years of vegetation monitoring required to apply for final bond release.

<u>COMMON NAME</u>	<u>SCIENTIFIC NAME</u>
SHRUBS	
Bitterbrush	(<i>Purshia tridentata</i>)
Mtn. Mahogany	(<i>Cercocarpus ledifolius</i>)
Rubber rabbitbrush	(<i>Chrysothamnus nauseosus</i>)
Blue elderberry	(<i>Sambucus caerulea</i>)
Snowberry	(<i>Symphoricarpos albus</i>)
Sagebrush	(<i>Artemisia tridentata</i> ssp. <i>vaseyana</i>)
FORBS	
Northern sweetvetch	(<i>Hedysarum boreale</i>)
Cicer milkvetch	(<i>Astragalus cicer</i>)
Purple daisy fleabane	(<i>Erigeron corymbosus</i>)
Little sunflower	(<i>Helianthella uniflora</i>)
Rocky Mt. penstemon	(<i>Penstemon strictus</i>)
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Gt. Basin wildrye	(<i>Elymus cinereus</i>)

Figure 2: Final Seed Mixture for the Gordon Creek 2/7/8 Mine Site

Reference Area

A reference area, or a native undisturbed Mountain Brush/Grass plant community that was previously chosen to be represent success standards for final revegetation has also been sampled. These data have been compared with the reclaimed areas of the Gordon Creek 2/7/8 Mine site.

METHODS

Quantitative and qualitative data were taken from the vegetation of the reclaimed areas at the Gordon Creek 2/7/8 Mine site as well as the Mountain Brush/Grass Reference Area. Sampling was conducted September 6-9, 2009. Methodologies used for sampling were performed in accordance with the *Vegetation Information Guidelines* supplied by DOGM.

Transect and Quadrat Placement

Random/regular placement of sample quadrats were designed in an attempt to provide unbiased accuracy of the data compiled. This was accomplished by establishing transect lines the entire length of the reclaimed and reference areas. At regular intervals along the transect lines, random numbers were generated and used to measure distances at right angles to determine sample locations. Whether these random numbers were odd or even determined which side of the transect a given quadrat was placed. The random number selected would be high enough to place quadrats to the lateral limits of the sample areas and all areas in-between. This insured that

the sample quadrats were placed randomly over the entire study area in an attempt to adequately represent the site as a whole

Cover, Frequency and Composition

Cover estimates were made using ocular methods with meter square quadrats. Species composition 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. 2008).

Production

Total annual biomass production was estimated by clipping, drying and weighing current annual growth in each sample quadrat. "Double sampling" methods were employed by placing four additional quadrats around the clipped quadrat, then estimating the production of them relative to the clipped plot. Herbaceous and woody species production weights were recorded separately.

Sample Size & Adequacy

Sampling adequacy was calculated using the formula given below.

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

where,

nMIN = minimum adequate sample
t = appropriate confidence t-value
s = standard deviation
x = sample mean
d = desired change from mean

The values used for “t” and “d” insured that sample adequacy was met with 90% confidence within a 10% deviation from the true mean.

Diversity Indices

MacArthur's Diversity Index is an effective diversity measurement and is computed using the following equation:

$$1/\sum pi^2$$

where,

pi is the proportion of sum frequency contributed by the *i*th species in the sample area of concern.

The proportional contribution of each species is then squared and the values for all species in the sample areas are summed. This index integrates the number of species and the degree to which frequency of occurrence was equitably distributed among those species.

Another diversity measurement was provided that shows the average number of species encountered at each quadrat. Finally, a third measure of diversity or “richness” is simply the total number of species encountered in the quadrats.

Photographs

Color photographs of the sample areas were taken at the time of sampling and have been included within this report.

Raw Data

The raw data for total cover, cover by species, frequency and composition are available upon request from DOGM or Mountain Coal Company.

RESULTS

Reclaimed Areas

The reclaimed areas were greatly dominated by the forb species, alfalfa (*Medicago sativa*), however, there were also several grasses that were well-represented including Gt. Basin wildrye (*Elymus cinereus*), thickspike wheatgrass (*E. lanceolatus*), western wheatgrass (*E. smithii*), bluebunch wheatgrass (*E. spicatus*) and Kentucky bluegrass (*Poa pratensis*). For a list of all species present in the sample quadrats, refer to Table 1.

Table 1: Gordon Creek 2/7/8 Mine. Total cover, standard deviation and frequency by species (2009).

Reclaimed Areas (n=150)	Mean Percent	Standard Deviation	Percent Frequency
SHRUBS			
<i>Artemisia tridentata</i>	0.30	2.33	2.00
<i>Chrysothamnus nauseosus</i>	1.70	7.52	5.33
<i>Gutierrezia sarothrae</i>	0.17	1.46	1.33
<i>Purshia tridentata</i>	0.13	1.63	0.67
<i>Symphoricarpos oreophilus</i>	0.27	1.98	2.00
FORBS			
<i>Astragalus cicer</i>	2.63	10.86	12.00
<i>Cynoglossum officinale</i>	0.80	3.52	6.00
<i>Hedysarum boreale</i>	0.13	1.15	1.33
<i>Linum lewisii</i>	0.07	0.81	0.67
<i>Medicago sativa</i>	33.53	29.18	72.00
<i>Penstemon strictus</i>	1.27	4.59	9.33
GRASSES			
<i>Agropyron cristatum</i>	1.17	5.58	5.33
<i>Bromus carinatus</i>	0.13	1.15	1.33
<i>Bromus tectorum</i>	0.03	0.41	0.67
<i>Dactylis glomeratus</i>	0.27	2.37	1.33
<i>Elymus cinereus</i>	7.77	15.52	29.93
<i>Elymus lanceolatus</i>	6.53	12.83	26.67
<i>Elymus salinus</i>	1.43	6.36	6.00
<i>Elymus smithii</i>	5.55	14.13	19.33
<i>Elymus spicatus</i>	4.31	11.17	16.67
<i>Poa pratensis</i>	3.57	10.84	12.67

Total living cover of the reclaimed areas was estimated at 71.77%, all of which came from understory cover (Table 2-A). Although much the composition (51.98%) was comprised of forb species (mostly due to alfalfa), grasses were ranked close behind (44.09%). Shrubs followed at a distant 3.93% of the composition (Table 2-B).

Table 2: Gordon Creek 2/7/8 Mine. Total cover, standard deviation and sample size (2009).

Reclaimed Areas (n=150; nMIN= 6.31)	Mean Percent	Standard Deviation
A. TOTAL COVER		
Understory	71.77	10.96
Litter	9.84	5.78
Bareground	9.25	6.12
Rock	9.14	6.35
B. % COMPOSITION		
Shrubs	3.93	12.77
Forbs	51.98	34.17
Grasses	44.09	31.29
nMIN = Sample Adequacy n= Sample Size		

Total annual biomass production of the reclaimed areas was estimated at 1,164.24 pounds per acre of which 1,138.88 pounds came from herbaceous species (forbs and grasses) and only 25.26 pounds came from woody plants (Table 3).

Table 3: Production at Gordon Creek 2/7/8 (2009).		
Reclaimed Areas (n=150; nMIN=40.12)		
	Pounds/Acre	
LIFEFORM	MEAN	STD. DEV.
Herbaceous	1138.88	471.59
Woody	25.36	114.03
TOTAL	1164.24	448.29

Reference Area

The dominant plant by cover and frequency at the Mountain Brush/Grass Reference Area was the grass species Salina wildrye (*Elymus salinus*). There were four shrub species that were also

relatively common here including alder-leaf mountain-mahogany (*Cercocarpus montanus*), corymb buckwheat (*Eriogonum corymbosum*), broom snakeweed (*Gutierrezia sarothrae*) and antelope bitterbrush (*Purshia tridentata*). Forb species were relatively uncommon in the reference area (Table 4).

Table 4: Gordon Creek 2/7/8 Mine. Total cover, standard deviation and frequency by species (2009).

Mountain Brush/Grass Reference Area (n=90; nMIN= 23.37)	Mean Percent	Standard Deviation	Percent Frequency
OVERSTORY			
<i>Cercocarpus montanus</i>	0.22	2.10	1.11
UNDERSTORY			
SHRUBS			
<i>Amelanchier utahensis</i>	1.11	4.82	7.78
<i>Artemisia frigida</i>	0.11	1.05	1.11
<i>Artemisia tridentata</i> var. <i>vaseyana</i>	0.72	4.69	3.33
<i>Cercocarpus montanus</i>	3.17	7.17	20.00
<i>Eriogonum corymbosum</i>	2.83	8.43	15.56
<i>Gutierrezia sarothrae</i>	1.56	2.95	23.33
<i>Purshia tridentata</i>	1.22	4.55	11.11
<i>Symphoricarpos oreophilus</i>	0.17	1.57	1.11
FORBS			
<i>Eriogonum jamesii</i>	0.56	1.89	8.89
<i>Machaeranthera grindelioides</i>	0.11	0.74	2.22
<i>Stanleya pinnata</i>	0.17	0.90	3.33
GRASSES			
<i>Elymus salinus</i>	28.72	11.04	98.89
<i>Stipa hymenoides</i>	0.44	4.19	1.11

The total living cover for the Reference Area was 41.11% (Table 5-A). Most of this cover was understory cover (there was only 0.22% cover that consisted of overstory). The understory cover was comprised of 73.65% grasses, 24.00% shrubs and 2.35% grasses (Table 5-B).

Table 5: Gordon Creek 2/7/8 Mine. Total cover, standard deviation and sample size (2009).

Mountain Brush/Grass Reference Area (n=90 nMIN= 33.91)	Mean Percent	Standard Deviation
A. TOTAL COVER		
Overstory (o)	0.22	2.10
Understory (u)	40.89	11.73
Litter	14.33	5.44
Bareground	21.44	11.84
Rock	23.33	12.32
o + u	41.11	12.08
B. % COMPOSITION		
Shrubs	24.00	23.56
Forbs	2.35	6.17
Grasses	73.65	23.85

Total annual biomass production of the reference area was estimated at 850.05 pounds per acre of which 603.39 pounds came from herbaceous species and 246.66 came from woody plants (Table 6).

Table 6: Production at Gordon Creek 2/7/8 (2009).

Mountain Brush/Grass Reference Area (n=90)		
	Pounds/Acre	
LIFEFORM	MEAN	STD. DEV.
Herbaceous	603.39	222.68
Woody	246.66	252.20
TOTAL	850.05	300.91

Dataset Comparisons

Comparisons were made between the datasets of the reclaimed areas at Gordon Creek 2/7/8 and the Mountain Brush/Grass Reference Area . To begin, statistical tests were implemented comparing the total living plant cover of the two areas. A Student's t-test analysis suggested that the reclaimed area's

total living cover was significantly greater statistically when it was compared to the reference area (Figure 3).

When total annual biomass production of the reclaimed area was statistically compared to that of the reference area, results also suggested there was significantly more in the former (Figure 4).

MacArthur's Diversity Index was also employed to the datasets of the reclaimed and reference areas. A comparison of the values between these two areas suggested that the total diversity of the reclaimed area was greater than

FIGURE 3. STUDENT'S T TEST - A total living cover comparison between the reclaimed area at Gordon Creek 2/7/8 and its reference area (2009).

Reclaimed Area: $\bar{x}=71.77$; $s=10.96$; $n=150$

Reference Area: $\bar{x}=41.11$; $s=12.08$; $n=90$

$t = 20.186$; $df = 238$, $SL= p<0.01$

FIGURE 4. STUDENT'S T TEST - A total annual biomass production comparison between the reclaimed area at Gordon Creek 2/7/8 and its reference area (2009).

Reclaimed Area: $\bar{x}=1164.24$; $s=448.29$; $n=150$

Reference Area: $\bar{x}=850.05$; $s=300.91$; $n=90$

$t = 5.897$; $df = 238$, $SL= p<0.01$

that of the reference area by quite a wide margin (Figure 5).

Another method of comparing species diversity of the two areas was to simply calculate the mean number of species present in the sample quadrats. Results from this method also

suggested that the reclaimed area was more diverse with respect to species when compared to the reference area (Figure 6).

FIGURE 5. MacARTHUR'S INDEX - A **diversity** comparison between the reclaimed area at Gordon Creek 2/7/8 and its reference area (2009).

$$1/\sum p_i^2 =$$

Reclaimed Area: 6.780

Reference Area: 3.474

FIGURE 6. AVERAGE NUMBER OF SPECIES PER SQUARE METER - A **diversity** comparison between the reclaimed area at Gordon Creek 2/7/8 and its reference area (2009).

$$\bar{x} \text{ NO. SPP/M}^2 =$$

Reclaimed Area: 2.33

Reference Area: 1.98

Finally, another diversity-type computation, the total number of species encountered in the sample quadrats, were compared. Again, the reclaimed area value was greater when compared to the reference area (Figure 7).

FIGURE 7. TOTAL SPECIES PRESENT -
A diversity comparison between the
reclaimed area at Gordon Creek 2/7/8 and its
reference area (2009).

Reclaimed Area: 21

Reference Area: 13

DISCUSSION & CONCLUSIONS

Subsequent to final reclamation, the primary post-mining land use as determined by the land owner, will primarily be that of grazing by domestic livestock. Consequently, Gordon Creek's Mining and Reclamation (MRP) identifies "*stock grazing*" as the post-mining land use, but it also mentions that "*reclamation is also particularly important as a means of controlling erosion and restoring disturbed areas to productive wildlife habitat*".

Because the primary post-mining land was to be focused on livestock grazing, the parameters to be used for final revegetation success standards dictated in the MRP were **total living cover** and **annual biomass productivity**. Sample results in 2009 show that the total living cover and biomass productivity of the reclaimed area exceeded that of the reference area.

Although they were not specifically called for in the MRP, other parameters were also compared herein to evaluate specific wildlife habitat qualities of the reclaimed land when compared to the reference area. These parameters were diversity indices because species and habitat diversity are important components for restoring wildlife habitat. The diversity indices employed to the datasets suggest that the reclaimed area was more diverse than the reference area in 2009.

SUMMARY

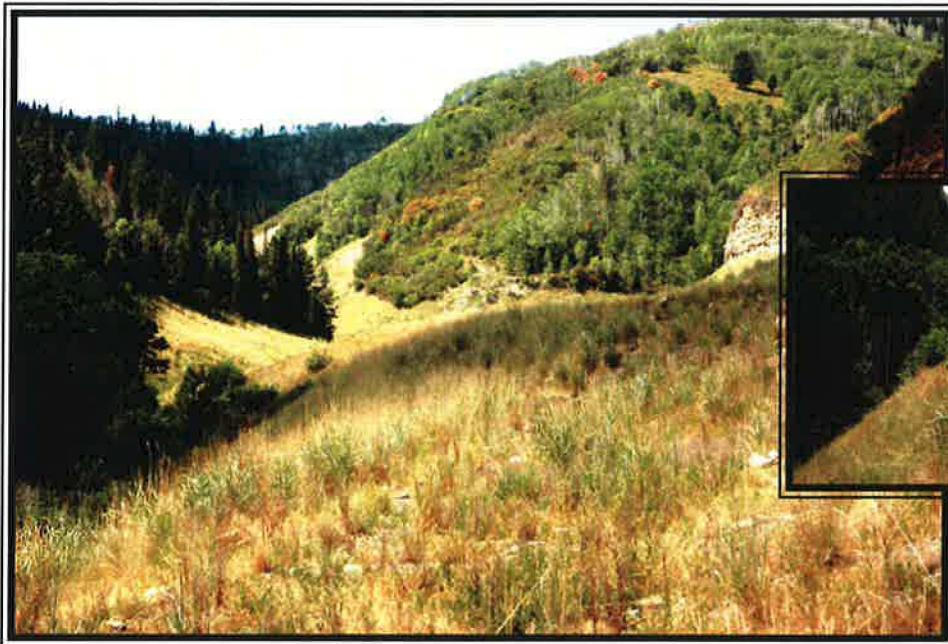
This document reports the results of quantitative sampling the vegetation of the reclaimed area at the Gordon Creek 2/7/8 Mine site. The datasets in this report represent **Year 1** of the two consecutive years required for an application for final bond release to be submitted through the State of Utah, Division of Oil, Gas & Mining (DOG M). A reference area was chosen early in the process to one day provide an area for comparison for future revegetation success standards. This Mountain Brush/Grass Reference Area was also sampled and the results were reported in this document.

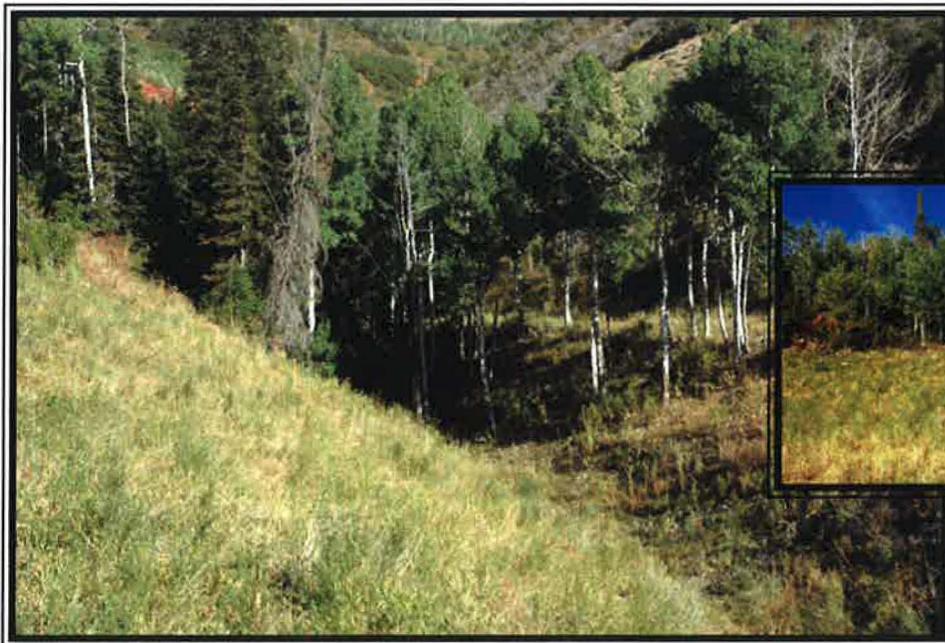
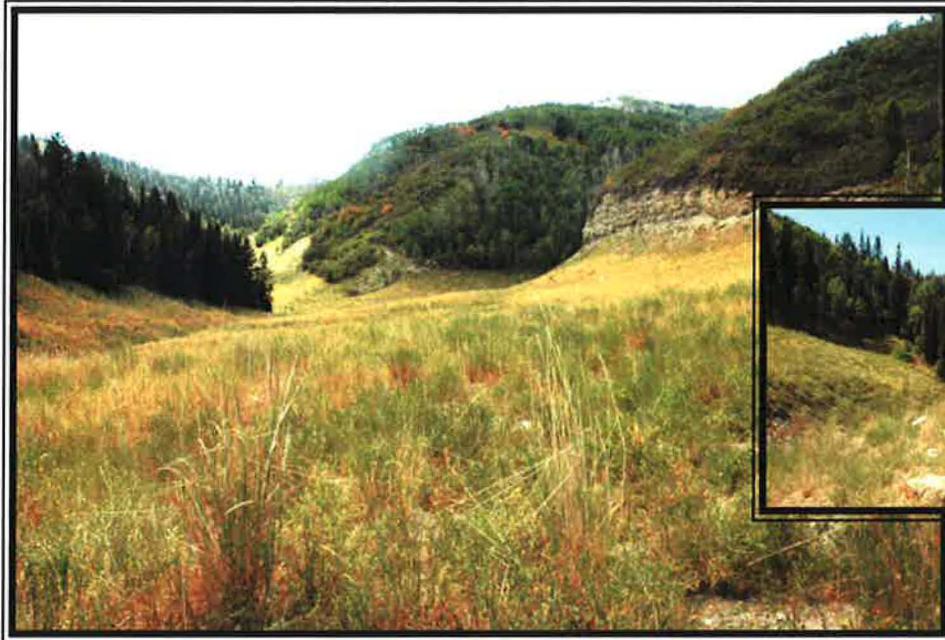
For **Year 1** (2009), when the total living cover, annual biomass production, MacArthur's Divisity Index, average number of species per quadrat and the total number of species of the reclaimed areas were compared with the reference area, all analyses suggested the reclaimed areas met or exceeded those parameters.

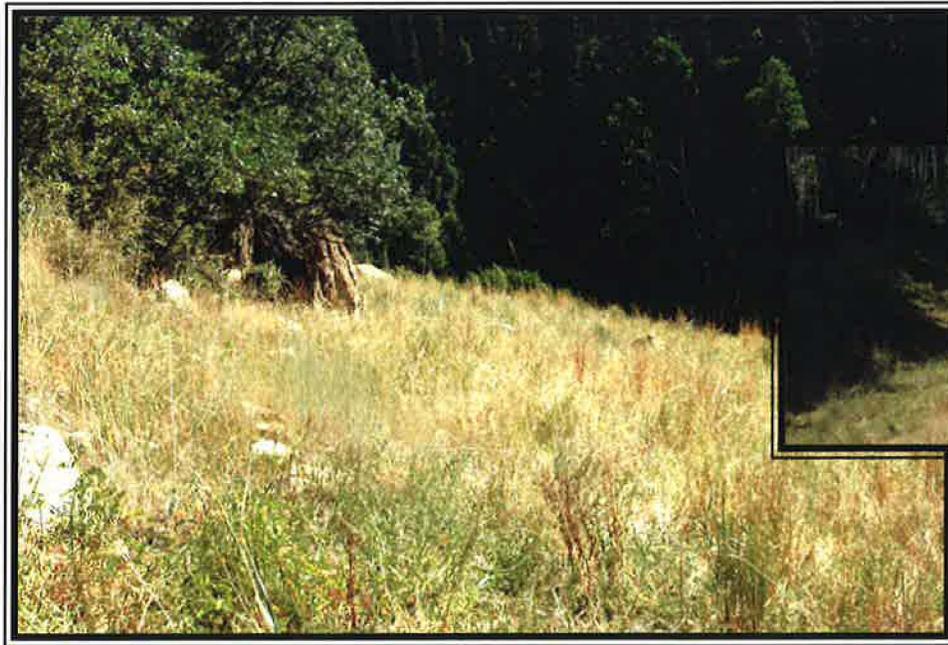
Year 2 (2010) sample period will be conducted to meet the required number of sample years for a Phaze III Bond Release application.

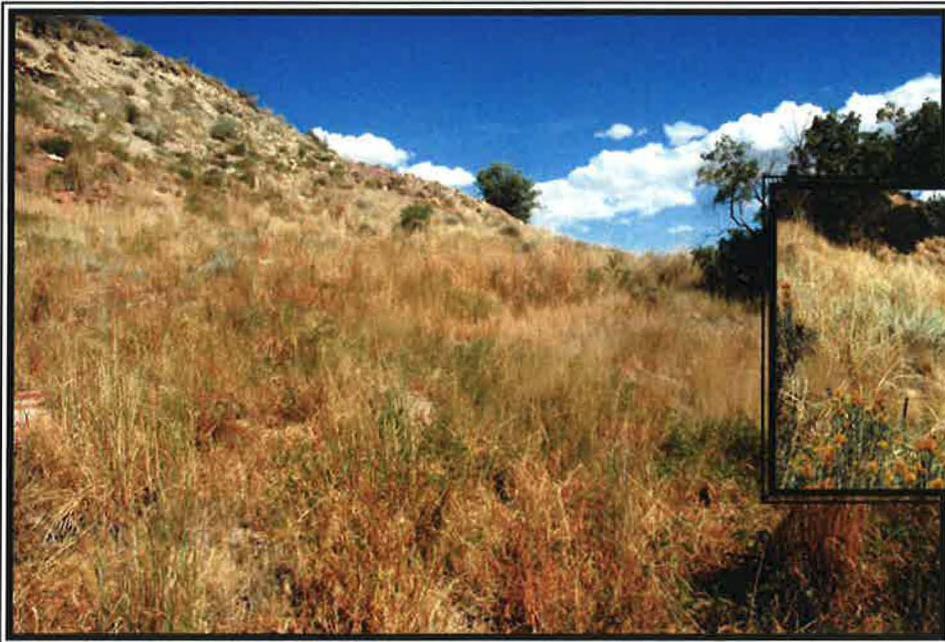
**COLOR PHOTOGRAPHS
OF THE
SAMPLE AREAS**

THE RECLAIMED AREAS









THE REFERENCE AREA

