Chris D. Hansen
Dir. Regulatory Compliance and
Gov. Relations
9815 South Monroe
Suite 203
Sandy, UT 84070
Telephone 801-695-9161

October 15, 2019

Mr. Steve Christensen
Utah Division of Oil, Gas and Mining
1594 West north temple, Suite 1210
P.O. Box 145801
Salt Lake City, Utah 84114-5801

RE: Application for Phase III Bond Release on 34.15 Acres, Canyon Fuel Company, LLC, Gordon Creek 2, 7 & 8 Mine, C/007/0016, Carbon County, Utah

Dear Steve:

Canyon Fuel Company, LLC (CFC) has completed reclamation of the remaining 34.15 acres of the Gordon Creek 2, 7 & 8 Mines located in Carbon County, Utah. CFC is applying for Phase III, or final bond release, for the area. The current amount of the reclamation bond is $171,000.

I am attaching to this letter the appropriate C1 and C2 forms as well as the new documents to be included in the permit as Appendix 2-10 and an updated page for the Chapter 2 Table of Contents. Included in Appendix 2-10 is Mt. Nebo Scientific's analysis of the vegetation monitoring performed on the mine site in September 2019. Also included in his report are copies of the 2009 and 2010 vegetation monitoring. Also included in the appendix are copies of the public notice that will appear in ETV's local paper on October 16th, 2019, the text of the letters sent return receipt requested to the adjacent landowners, federal agencies, and state agencies, certification of reclamation, and the bond release calculation. I will forward the complete package to the Division electronically was well as submitting this paper copy.

I look forward to meeting you in the field for the Phase III Bond Release inspection. If you have any questions, please do not hesitate to give me a call. I sincerely appreciate your and the Division's efforts to complete this final bond release.

Sincerely,

Chris D. Hansen
Director of Regulatory Compliance and Government Relations
Wolverine Fuel, LLC
Office (801) 695-9161
Cell (970) 261-1425

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: Phase III Reclamation Bond Release Application

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

To obtain final reclamation bond release for the Gordon Creek 2/7/8 Mines

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 one (1) review copy of the application.

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
Print Name

Chris D. Hansen Dir. Regulatory Compliance 10/15/19
Sign Name, Position, Date

Subscribed and sworn to before me this 15th day of October, 2019

Amber Cook
Notary Public

My commission Expires: Sept. 28th, 2023

Attest: State of Utah } ss:
County of Salt Lake

AMBER COOK
Notary Public - State of Utah
My Commission Expires
September 28, 2023
Commission #708007

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

Form DOGM- C1 (Revised 9/17/2013)

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

Permittee: Canyon Fuel Company, LLC
Mine: Gordon Creek 2/7/8 Mines **Permit Number:** C/007/0016
Title: Phase III Reclamation Bond Release Application

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

			DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED
■ Add	☐ Replace	☐ Remove	Appendix 2-10
☐ Add	■ Replace	☐ Remove	Replace second page in Chapter 2 Table of Contents, includes redline copy
☐ Add	☐ Replace	☐ Remove	
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Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.	**Received by Oil, Gas & Mining**

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APPENDICES

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Appendix 2-2	Compliance History
Appendix 2-3	Certificate of Insurance
Appendix 2-4	Reclamation Performance Bond
Appendix 2-5	Other Licenses and Permits
Appendix 2-6	Public Notice for Permit Revision
Appendix 2-7	Public Notice for Phase I Bond Release
Appendix 2-8	Notarized Statement of Reclamation
Appendix 2-9	Application for Phase II Bond Release
Appendix 2-10	Application for Phase III Bond Release

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Appendix 2-10

Canyon Fuel Company, LLC

Application

For Phase III Bond Release

Gordon Creek 2, 7 & 8 Mines

C/007/0016

October 2019

Public Notice

Public Notice
Application for Phase III Bond Release for
Remaining 34.15 Acres of Reclaimed Surface
Canyon Fuel Company, LLC Gordon Creek 2, 7 & 8 Mines
Permit C/007/0016

Notice is hereby given that Canyon Fuel Company, LLC, 9815 South Monroe St. Suite 203, Sandy, Utah 84070 has filed an application with the Utah Division of Oil, Gas & Mining (Division) for Phase III Bond Release for the remaining 34.15 acres of reclaimed lands at the Gordon Creek 2, 7 & 8 Mines. The Mine's permit number is C/007/0016. The Mining Permit for this mine was renewed for 5 years on August 28th, 2019. Canyon Fuel Company, LLC (CFC) has fulfilled the necessary requirements contained within the mine's Mining and Reclamation Plan to obtain Phase III Bond Release for the remaining disturbed acres associated with the mine. All areas for bond release have met the requirements as described in the Utah Coal Rules R645-301-400 and R645-301-880.330. The legal description of the permit area for which bond release has been applied follows:

> Township 13 South, Range 8 East, SLBM, Utah. Section 18: N2SE4, N2SW4SE4, S2NE4SW4, SE4SW4, SE4SW4SW4

Coal mining ceased at the mines in late 1990, the portals sealed in 1992, and approximate original contour and natural drainages re-established in August 1997. Reclamation Phase I Bond Release was obtained for the entire mine site along with Phase III Bond Release of the Sweet's Pond Area in October 2003. Vegetation success standards were achieved and no contribution of additional suspended solids to receiving stream flows or runoff outside the permit was occurring by late 2005. Phase II Bond Release was approved for the remaining reclaimed mine acreage in March 2007.

The current amount of the surety bond for the 34.15 acres of reclaimed land is $171,000. The Division will evaluate the proposal for bond release to determine if it meets all the criteria set forth for Phase III Bond Release in the Utah Coal Mining Rules. Written comments, objections and requests for public hearing or informal conference on this proposal may be addressed to:

> Utah Coal Program
> Utah Division of Oil, Gas and Mining
> 1594 West North Temple, Suite 1210
> P.O Box 145801
> Salt Lake City, Ut 84114-5801

Said comments must be submitted thirty (30) days from the date of the last publication of this notice. This notice is being published to comply with the Surface Mining Control and Reclamation Act of 1997, and State and Federal regulations promulgated pursuant to said Act.

Published in the ETV News Progress for four consecutive weeks beginning October 16, 2019.

Landowner/Agency Notifications

Chris D. Hansen
Dir. Regulatory Compliance and
Gov. Relations
9815 South Monroe
Suite 203
Sandy, UT 84070
Telephone 801-695-9161

October 15, 2019

RE: Notification of Application for Phase III Bond Release on 34.15 Acres, Canyon Fuel Company, LLC, Gordon Creek 2, 7 & 8 Mine, C/007/0016, Carbon County, Utah

Canyon Fuel Company, LLC (CFC) has completed reclamation of the remaining 34.15 acres of the Gordon Creek 2, 7 & 8 Mines located in Carbon County, Utah. CFC is applying for Phase III, or final bond release, for the area. Final bond release is predicated on meeting the vegetation and water quality requirements as set forth in sections R645-301-880 and R645-301-400 of the State Utah Coal Mining Rules. As required by these regulations, CFC is hereby giving notice of their application for the total release of the surety bond posted for the 34.15 acres in the bond amount of $171,000.

The permit area is identified in the attached map. The reclaimed area is within Bryner Canyon as depicted on the Jump Creek U.S G.S. 7.5 minute quadrangle map. The legal description of the permit area that contains the reclaimed disturbed area for which final bond release is being requested is:

Township 13 South, Range 8 East, SLBM, Utah. Section 17: SE4SW4SW4. Section 18: N2SE4, N2SW4SE4, S2NE4SW4, SE4SW4, SE4SW4SW4.

Comments concerning Phase III bond release from the legal or equitable owner of record of the surface areas and from the Federal, Utah and local government agencies which would have to initiate, implement approve or authorize the proposed use of the land following reclamation should be mailed to:

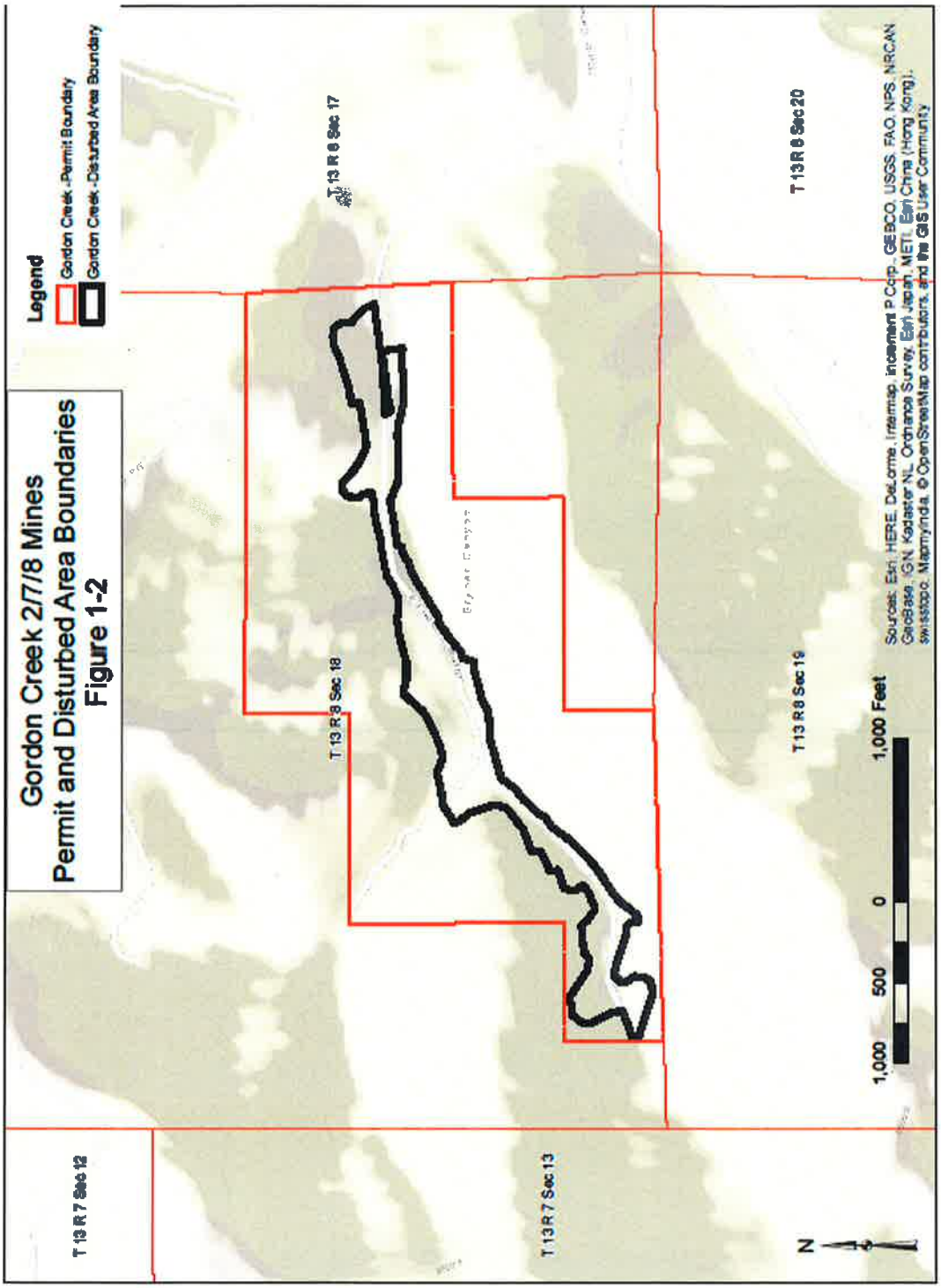
Canyon Fuel Company, LLC
Attention: Chris D. Hansen
9815 South Monroe Street, Suite 203
Sandy, Utah 84070

Sincerely,

Chris D. Hansen
Director of Regulatory Compliance and Government Relations
Wolverine Fuel, LLC

Attachments: Location Map
Notice List

Chris D. Hansen
Dir. Regulatory Compliance and
Gov. Relations
9815 South Monroe
Suite 203
Sandy, UT 84070
Telephone 801-695-9161



List of Landowners and Agencies Receiving Notice of Application for Phase III Bond Release:

Mark Jacob
Jacob Family Ranch, LLC
914 East 300 North
Orem, UT 84097

Pete Jr. and Sharon Stamatakis
1111 South 450 West
Price, UT 84501

Hidden Splendor Resources
1700 Coronet Drive
Reno, NV 86509

Nielsen, LLC
P.O. Box 620
Huntington, UT 84528

Planning and Zoning
Carbon County
751 East 100 North
Suite 2600
Price, UT 84501

Howard Strand, Manager
Denver Field Branch
Office of Surface Mining
1999 Broadway, Suite 3320
Denver, CO 80202-3050

Mark Stilson, Regional Engineer
State of Utah
Division of Water Rights
319 Carbonville Rd, Suite B
Price, UT 84501

Price River Water Improvement District
P. O. Box 903
265 South Fairgrounds Road
Price, UT 84501

State of Utah
Division of Wildlife Resources
319 North Carbonville Rd. Suite A
Price, UT 84501

United States of America
Bureau of Land Management
Attn: Mr. Steven Falk
125 South 600 West
Price, UT 84501

Carbon County Commissioners
751 East 100 North
Suite 2700
Price, UT 84501

Vegetation Monitoring

For

Phase III Bond Release

at the

Gordon Creek 2, 7 & 8 Mines

2019 Mt Nebo Scientific Report

Includes 2009 and 2010 Vegetation Monitoring Reports

VEGETATION MONITORING
FOR PHASE III BOND RELEASE
AT THE GORDON CREEK 2/7/8 MINE SITE
CARBON COUNTY, UTAH
2019

FOR
WOLVERINE FUELS

Gordon Creek 2/7/8 Mine Site: Reclaimed Area (foreground), Aspens and Conifers

Prepared by

MT. NEBO SCIENTIFIC, INC.
330 East 400 South, Suite 6
P.O. Box 337
Springville, Utah 84663
(801) 489-6937

by

Patrick Collins, Ph.D.

for

WOLVERINE FUELS
9815 South Monroe St., Ste. 203
Salt Lake City, Utah 84070

October 2019

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INTRODUCTION

Study Area & History

The 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). Native plant communities surrounding the reclaimed site include Mountain Brush/Grass, Oak Shrubland, Sagebrush/Grass, Aspen and Douglas Fir.

The Gordon Creek 2/7/8 Mine site is an area where coal mining operations had been conducted for many years beginning as early as 1907. More recently in 1998, when the mining operations had been terminated earlier, the mine portals were sealed and final reclamation activities began to restore the land to a condition that is consistent with the post-mining land use. The post-mining land use of the site was determined by the landowner and has been designated primarily for livestock grazing.

Following the earthwork done for reclamation that included regrading and re-contouring the site to the approximate original contours and post-mining topography, final seedbed preparations were made and re-seeding began. Most of the area was seeded in October 1998 with follow-up seeding on the regraded roads in October 1999. Seeding in all areas was accomplished using seeds of native and approved introduced plant species (Figure 2).

Following reclamation and when the *"Responsibility Period"* has been ended, or the period of time of extended obligation mandated by state and federal regulations following final reclamation and revegetation procedures, vegetation sampling was conducted at the reclaimed Gordon Creek 2/7/8 Mine site for *Final* or *Phase III Bond Release*. The Responsibility Period is considered to be enough time for vegetation to become adequately established for it to become "diverse, effective and permanent" and has the potential to meet post-mining land use standards. Quantitative sampling of the vegetation for final bond release was first conducted for two consecutive years – 2009 and 2010. Results from the two consecutive sample years was submitted previously in following reports.

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

Vegetation Monitoring for Phase III Bond Release
at the Gordon Creek 2/7/8 Mines
Year 2: 2010

For a number of reasons the application for bond release was not filed directly after the above-mentioned vegetation sampling was completed. Moreover, a significant precipitation event occurred in September 2014 at and adjacent to the reclaimed mine site. It was soon determined that this event created flooding that exceeded the approved permit design flows which consequently resulted in the displacement of rip-rap in certain sections of the reclaimed drainage channels. Repair work was completed on the damaged sections of the channels in 2015. This repair work was done in accordance with the existing approved permit through the State of Utah, Division of Oil, Gas & Mining (DOGM). Following channel repairs including filter material and rip-rap replacement, the areas were re-seeded with the approved seed mixture mentioned above. Additional details about the precipitation event and followup repair work at the site can be found in the Gordon Creek 2/7/8 Mining and Reclamation Plan (MRP), Section 3.6, pp. 3-78 through 3-80.

Objectives of the Study

Because a certain amount of time had lapsed since the two consecutive sample years were conducted (2009 and 2010) and the channel repairs described above were accomplished (2015), DOGM staff members recommended the reclaimed mine site and its reference area be sampled for an additional year prior to submitting the final bond release application. Consequently, quantitative sampling was conducted once again in 2019. *The objective of the 2019 study was to confirm (or counter) the findings made from the earlier sample years.*

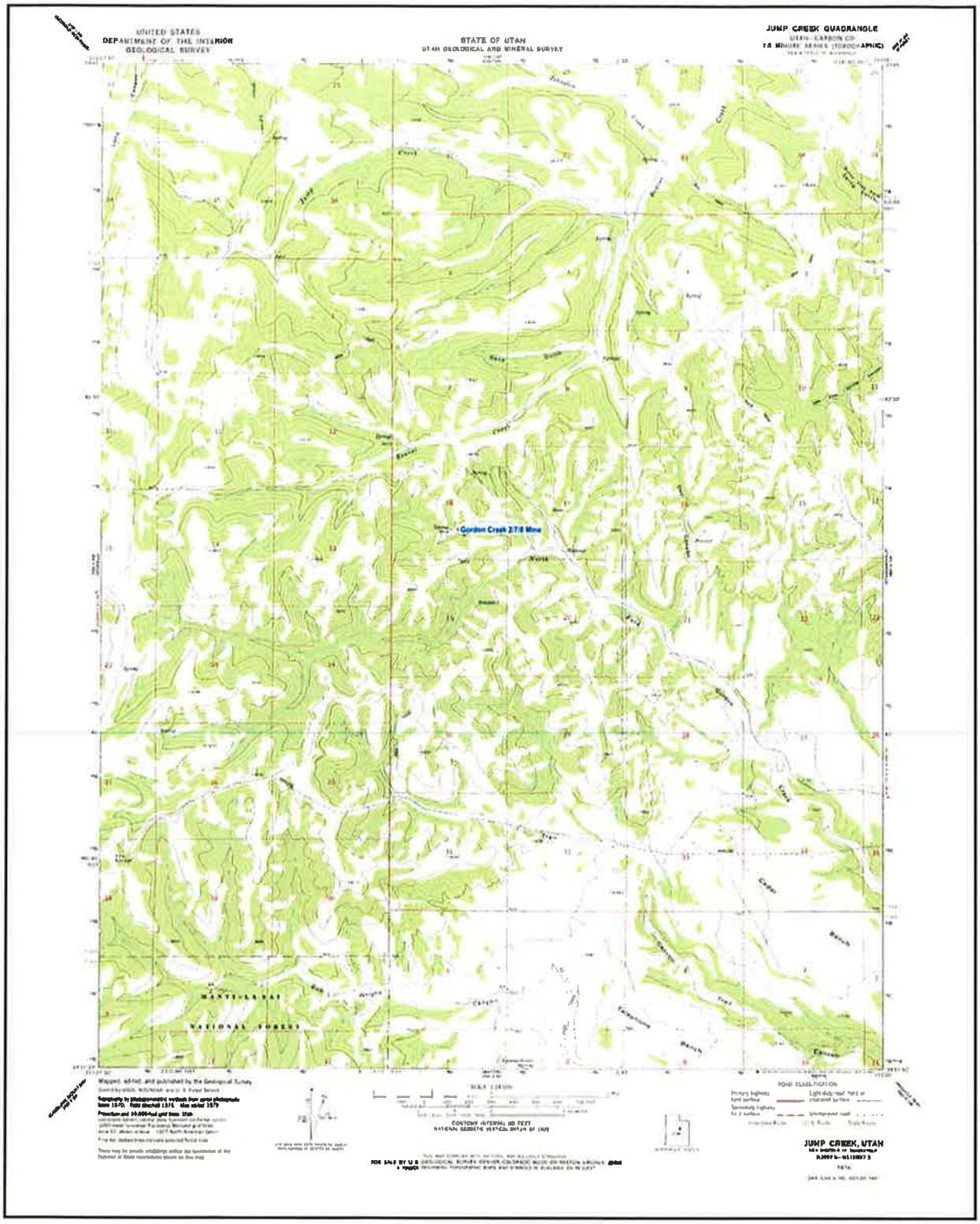


Figure 1: Gordon Creek 2/7/8 Mine Study Area

METHODS

For this study, 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 2-5, 2019. Methodologies used for sampling were performed in accordance with the *Vegetation Information Guidelines* supplied by DOGM and were consistent with the aforementioned 2009 and 2010 study years.

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

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

Transect and Quadrat Placement

In all sample years, random/regular placement of sample quadrats was designed with an attempt to provide unbiased accuracy of the data compiled. This was accomplished by establishing transect lines on 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 were 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 study site as a whole.

Cover, Frequency and Composition

Cover estimates were made using 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 followed *A Utah Flora* (Welsh et al. 2008)[1].

Annual Production

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

Sample Size and 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.

[1] Welsh, S.L., N.D. Atwood, S. Goodrich and L.C. Higgins. 2008. A Utah flora. Print Services, Brigham Young University, Provo, UT. 1019 pp.

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"was reported and is simply the total number or species encountered in the quadrats.

Photographs

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

RESULTS

Reclaimed Area

In 2019, the reclaimed area at the Gordon Creek 2/7/8 Mine was dominated by the grasses: Gt. Basin wildrye (*Elymus cinereus*), thickspike wheatgrass (*E. lanceolatus*), Western wheatgrass (*E. smithii*), bluebunch wheatgrass (*E. spicatus*) and Kentucky bluegrass (*Poa pratensis*). The most important forbs in the area were: gumweed aster (*Machaeranthera grindelioides*) and cicer milkvetch (*Astragalus cicer*). The most common shrub by a wide margin was mountain snowberry (*Symphoricarpos oreophilus*). For a complete list of all the plant species present in the sample quadrats showing their cover and frequency values, refer to Table 1.

Table 1: Gordon Creek 2/7/8 Mine. Total cover, standard deviation and frequency by species (2019).

Reclaimed Areas (n=100)	Mean Percent	Standard Deviation	Percent Frequency
UNDERSTORY			
SHRUBS			
Artemisia tridentata	0.45	3.61	2.00
Chrysothamnus nauseosus	1.75	8.26	5.00
Gutierrezia sarothrae	0.40	2.71	3.00
Purshia tridentata	0.74	4.37	4.00
Rosa woodsii	0.25	2.49	1.00
Salix exigua	0.25	2.49	1.00
Symphoricarpos oreophilus	6.95	14.56	23.00
FORBS			
Artemisia ludoviciana	0.25	1.79	2.00
Astragalus cicer	4.30	11.73	18.00
Bassia scoparia	0.05	0.50	1.00
Cynoglossum officinalis	0.15	1.11	2.00
Machaeranthera grindelioides	4.35	8.74	29.00
Malcolmia africana	0.45	4.01	2.00
Medicago sativa	1.45	5.21	8.00
Melilotus officinalis	0.25	1.48	3.00
Penstemon palmeri	0.11	1.00	2.00
Penstemon strictus	1.05	4.08	8.00
Rumex crispus	0.25	1.79	2.00
Sisymbrium altissimum	0.05	0.50	1.00
GRASSES			
Agropyron cristatum	2.75	9.96	9.00
Bromus carinatus	1.85	6.31	10.00
Elymus cinereus	19.15	23.82	51.00
Elymus lanceolatus	7.80	15.66	29.00
Elymus salinus	1.15	8.12	2.00
Elymus smithii	5.55	11.72	23.00
Elymus spicatus	3.15	10.46	12.00
Poa pratensis	4.30	10.72	18.00

The total living cover in the reclaimed area was estimated at 68.84% (Table 2-A). This cover was comprised of 65.38% grasses, 18.98% forbs and 15.64% shrubs (Table 2-B).

Table 2: Gordon Creek 2/7/8 Mine. Total cover and standard deviation (2019).

Reclaimed Areas (n=100)	Mean Percent	Standard Deviation
A. TOTAL COVER		
Understory	68.84	11.18
Litter	8.64	4.74
Bareground	10.51	6.61
Rock	12.01	9.40
B. % COMPOSITION		
Shrubs	15.64	24.77
Forbs	18.98	22.30
Grasses	65.38	31.64

The total annual production of the reclaimed site was measured at 2,530.57 pounds per acre, of which 1,982.29 pounds were from herbaceous plants and 548.28 pounds were from woody plants (Table 3).

Table 3: Production at Gordon Creek 2/7/8 (2019).

Reclaimed Areas
(n=50)

Pounds/Acre

LIFEFORM	MEAN	STD. DEV.
Herbaceous	1982.29	1574.04
Woody	548.28	981.78
TOTAL	2530.57	1126.33

Reference Area

The area chosen to be compared with the reclaimed area and represent revegetation success standards was an undisturbed, native plant community adjacent to the mine site called the Mountain Brush/Grass Reference Area.

The plant species encountered in the reference area reported by cover and frequency are shown in Table 4. The most important plants here was the grass, Salina wildrye (*Elymus salinus*) and the shrubs, broom snakeweed (*Gutierrezia sarothrae*) and alder-leaf mountain-mahogany (*Cercocarpus montanus*). The most common forb species were James' buckwheat (*Eriogonum jamesii*) and Prince's plum (*Stanleya pinnata*).

Table 4: Gordon Creek 2/7/8 Mine. Total cover, standard deviation and frequency by species (2019).

Mountain Brush/Grass Reference Area (n=50)	Mean Percent	Standard Deviation	Percent Frequency
UNDERSTORY			
TREES & SHRUBS			
Amelanchier utahensis	1.90	5.91	12.00
Artemisia tridentata vaseyana	0.90	6.30	2.00
Cercocarpus montanus	3.40	7.58	24.00
Eriogonum corymbosum	0.70	3.16	6.00
Gutierrezia sarothrae	7.30	8.50	54.00
Purshia tridentata	1.80	5.55	12.00
Symphoricarpos oreophilus	0.20	1.40	2.00
FORBS			
Descurainia pinnata	0.10	0.70	2.00
Eriogonum jamesii	2.30	5.76	16.00
Penstemon sp.	0.40	1.69	6.00
Stanleya pinnata	1.20	3.94	10.00
GRASSES			
Elymus salinus	23.40	11.51	96.00
Elymus spicatus	0.90	4.44	4.00
Stipa hymenoides	0.30	2.10	2.00

The mean total living cover in the reference area was 44.80% (Table 5-A) of which consisted of 57.43% grasses, 33.29% shrubs and 9.28% forbs (Table 5-B).

Table 5: Gordon Creek 2/7/8 Mine. Total cover and standard deviation (2019).

Mountain Brush/Grass Reference Area (n=50)	Mean Percent	Standard Deviation
A. TOTAL COVER		
Understory	44.80	10.29
Litter	11.30	6.07
Bareground	17.20	10.01
Rock	26.70	12.23
B. % COMPOSITION		
Shrubs	33.29	24.26
Forbs	9.28	15.38
Grasses	57.43	25.85

Total annual production at the site was 1,328.29 pounds per acre and was comprised of 789.79 pounds of herbaceous plants and 538.50 pounds of woody plants (Table 6).

Table 6: Production at Gordon Creek 2/7/8 (2019).

Mountain Brush/Grass Reference Area (n=50)		
Pounds/Acre		
LIFEFORM	**MEAN**	**STD. DEV.**
Herbaceous	789.79	664.97
Woody	538.50	723.00
TOTAL	**1328.29**	**338.11**

Comparisons to the Revegetation Success Standards (2019)

Like the previous sample years, 2019 comparisons were made between the datasets of the reclaimed areas at the Gordon Creek 2/7/8 Mine site and the Mountain Brush/Grass Reference Area. To begin, statistical tests were employed that compared the total living cover of the two areas. A Student's t-test analysis suggested that the reclaimed area's total living cover was significantly greater than 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 (2019).

Reclaimed Area: $\bar{x}$=68.84; s=11.18; n=100

Reference Area: $\bar{x}$=44.80; s=10.29; n=50

t = 12.741; df = 148, SL= p<0.01

When total annual production of the reclaimed area was compared statistically to that of the reference area, results here also suggested there was significantly more in the reclaimed area (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 (2019).

Reclaimed Area: $\bar{x}$=2530.57; s=1126.33; n=50

Reference Area: $\bar{x}$=1328.29; s=338.11; n=50

t = 7.229; df = 98, 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 average number of species present in the sample quadrats. Unlike the previous sample years the reference area value was a little greater when compared to the reclaimed 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 had more plants encountered in the samples compared to the reference area (Figure 7).

FIGURE 5. MacARTHUR'S INDEX - A **diversity** comparison between the reclaimed area at Gordon Creek 2/7/8 and its reference area (2019).

$1/\sum pi^2 =$

Reclaimed Area: 11.242

Reference Area: 5.539

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 (2019).

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

Reclaimed Area: 2.71

Reference Area: 3.52

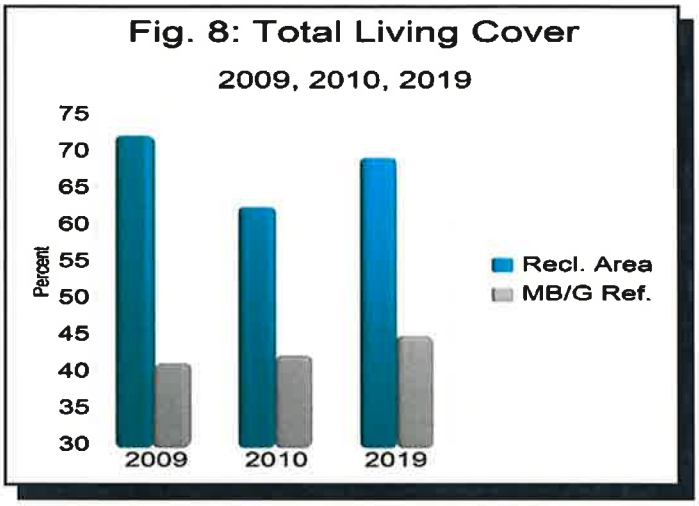
FIGURE 7. TOTAL SPECIES PRESENT - A **diversity** comparison between the reclaimed area at Gordon Creek 2/7/8 and its reference area (2019).

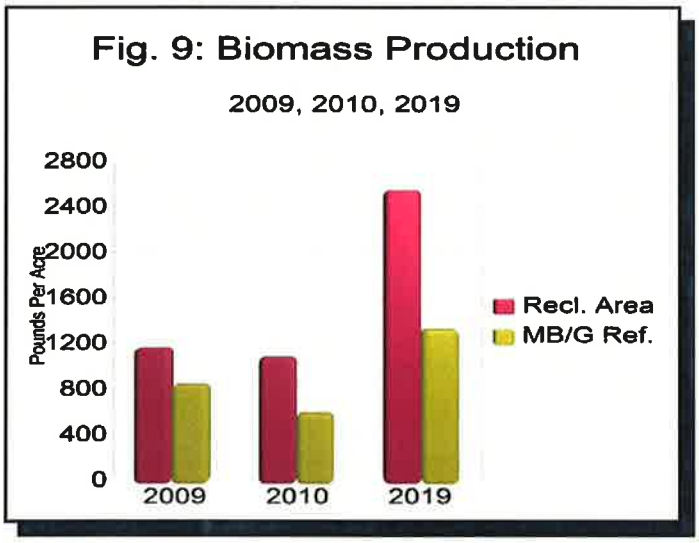
Reclaimed Area: 27

Reference Area: 18

Graphic Comparisons to the Revegetation Success Standards (2009, 2010, 2019)

This document was created to report the findings of an additional sample year beyond the previously reported two consecutive sample years to provide additional data for potential final bond release at the reclaimed Gordon Creek 2/7/8 Mine site. As mentioned above, detailed results for the first sample year (2009) and the second sample year (2010) were reported in a previously-submitted documents. These final reports have also been included in their entirety in this document in Appendix A and Appendix B, respectively. However, to facilitate comparisons between all sample years, graphs have been prepared and included in this report that show comparisons for **total living cover, production** and **diversity** for all three years (Figures 8 - 12).





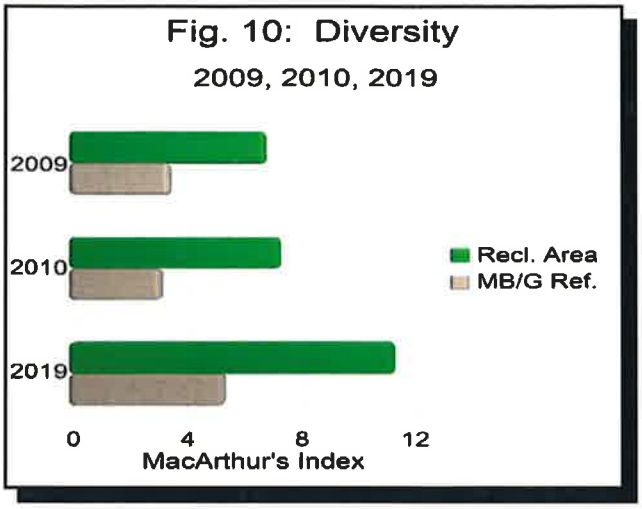


Fig. 10: Diversity
2009, 2010, 2019
2009
2010
2019
Recl. Area
MB/G Ref.
0
4
8
12
MacArthur's Index

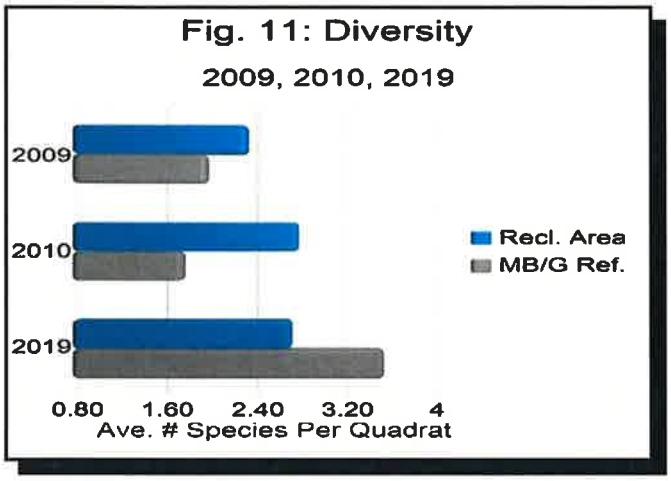


Fig. 11: Diversity
2009, 2010, 2019
2009
2010
2019
Recl. Area
MB/G Ref.
0.80
1.60
2.40
3.20
4
Ave. # Species Per Quadrat

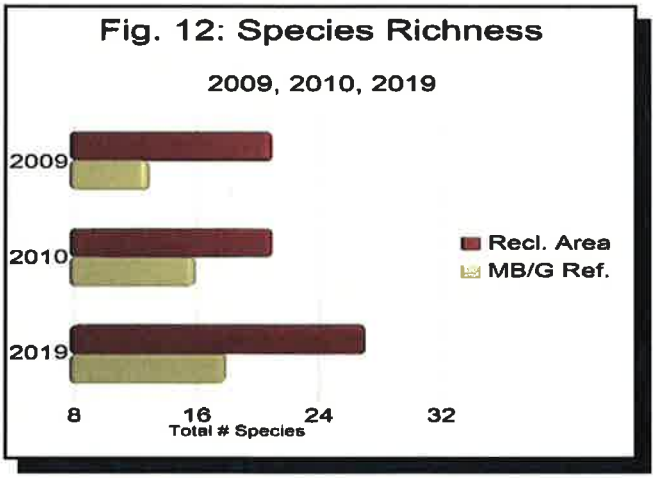


Fig. 12: Species Richness
2009, 2010, 2019
2009
2010
2019
Recl. Area
MB/G Ref.
8
16
24
32
Total # Species

DISCUSSION

Prior to final reclamation, the primary post-mining land use as determined by the land owner, is 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 described in the MRP were **total living cover** and **production**. Sample results in 2009, 2010 and 2019 show that the total living cover and annual production 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 in addition 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. Almost without exception, the diversity indices employed to the datasets suggest that the reclaimed area is more diverse than the reference area in all sample years (Figures 10 - 12).

Because additional sampling was conducted, thus creating a longer time period to make observations of the reclaimed plant communities compared to *other* final bond release vegetation monitoring, some interesting patterns can provide the reviewer with greater insights to the revegetation progress and succession of the restored plant communities. First, **total living cover** values of all sample years were relatively similar. However, the **composition** of the plant cover has changed. For example, woody plants were relatively unimportant in the in 2009 and 2010 at 3.93% and 3.78%, respectively, but in 2019 this value was elevated to 15.64% – close to a 400% increase. Also, forb composition decreased over time, probably due to the reduction of alfalfa, an introduced species, that dominated the reclaimed area in 2009 and 2010. This decrease favored grass species composition which increased by nearly 70%. Annual production increased substantially in the reclaimed and reference areas in 2019 when compared to 2009 and 2010, probably due to an increase in precipitation that year.

SUMMARY & CONCLUSIONS

To summarize and draw some conclusions, results from the first two consecutive sample years, 2009 and 2010, suggested the reclaimed Gordon Creek 2/7/8 Mine site could be a candidate for *Phase III* or *Final Bond Release* through the State of Utah, Division of Oil, Gas & Mining (DOGM). As described above, there had been some time-lapse since that sampling was conducted along some necessary repairs due to a flood event that exceeded the approved designed flows in the reconstructed stream channels of the reclaimed area. Consequently, DOGM staff members recommended the reclaimed mine site and its reference area (a native, undisturbed adjacent plant community that was previously chosen to represent success standards for final revegetation) be sampled for an additional year prior to submitting the final bond release application. Therefore, to confirm the reclaimed mine site has maintained values consistent with the revegetation success standards dictated by the reference area, and also to confirm whether or not the findings and conclusions made in the 2009 and 2010 datasets remain valid to-date, additional vegetation sampling was conducted in 2019 and have been reported in this report.

In conclusion, it appears that vegetation sampling at the Gordon Creek 2/7/8 Mine site in 2019 has confirmed the findings found in the earlier sample periods. The reclaimed site has met or exceeded the revegetation success standards for **total living cover** and **annual 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
2019

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.

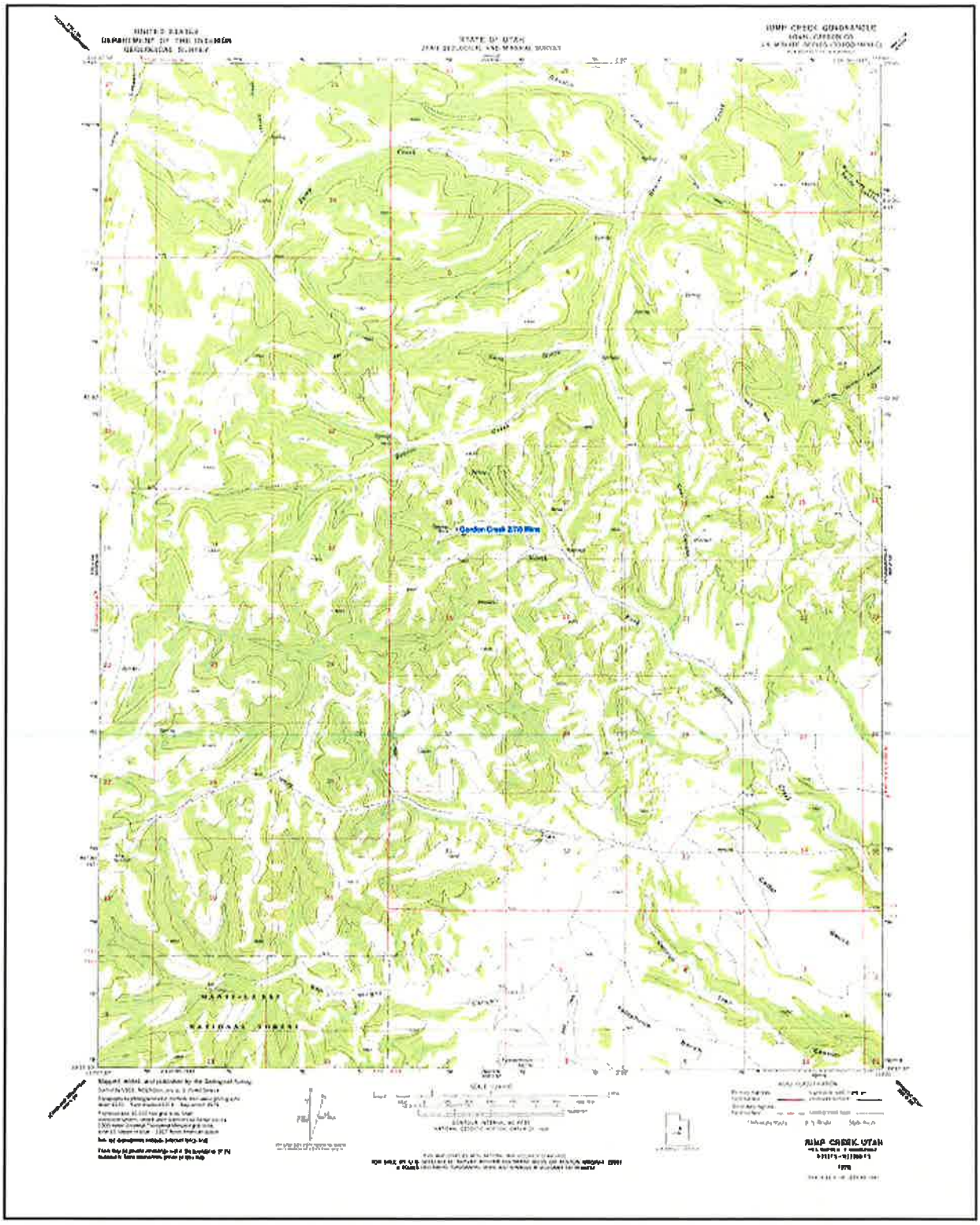


Figure 1: Gordon Creek 2/7/8 Mine Study Area

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.

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

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

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.

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 or 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			
Artemisia tridentata	0.30	2.33	2.00
Chrysothamnus nauseosus	1.70	7.52	5.33
Gutierrezia sarothrae	0.17	1.46	1.33
Purshia tridentata	0.13	1.63	0.67
Symphoricarpos oreophilus	0.27	1.98	2.00
FORBS			
Astragalus cicer	2.63	10.86	12.00
Cynoglossum officinale	0.80	3.52	6.00
Hedysarum boreale	0.13	1.15	1.33
Linum lewisii	0.07	0.81	0.67
Medicago sativa	33.53	29.18	72.00
Penstemon strictus	1.27	4.59	9.33
GRASSES			
Agropyron cristatum	1.17	5.58	5.33
Bromus carinatus	0.13	1.15	1.33
Bromus tectorum	0.03	0.41	0.67
Dactylis glomeratus	0.27	2.37	1.33
Elymus cinereus	7.77	15.52	29.93
Elymus lanceolatus	6.53	12.83	26.67
Elymus salinus	1.43	6.36	6.00
Elymus smithii	5.55	14.13	19.33
Elymus spicatus	4.31	11.17	16.67
Poa pratensis	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			
Cercocarpus montanus	0.22	2.10	1.11
UNDERSTORY			
SHRUBS			
Amelanchier utahensis	1.11	4.82	7.78
Artemisia frigida	0.11	1.05	1.11
Artemisia tridentata var. vaseyana	0.72	4.69	3.33
Cercocarpus montanus	3.17	7.17	20.00
Eriogonum corymbosum	2.83	8.43	15.56
Gutierrezia sarothrae	1.56	2.95	23.33
Purshia tridentata	1.22	4.55	11.11
Symphoricarpos oreophilus	0.17	1.57	1.11
FORBS			
Eriogonum jamesii	0.56	1.89	8.89
Machaeranthera grindelioides	0.11	0.74	2.22
Stanleya pinnata	0.17	0.90	3.33
GRASSES			
Elymus salinus	28.72	11.04	98.89
Stipa hymenoides	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).

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

$1/\sum pi^2 =$

Reclaimed Area: 6.780

Reference Area: 3.474

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 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).

$\bar{x}$ 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

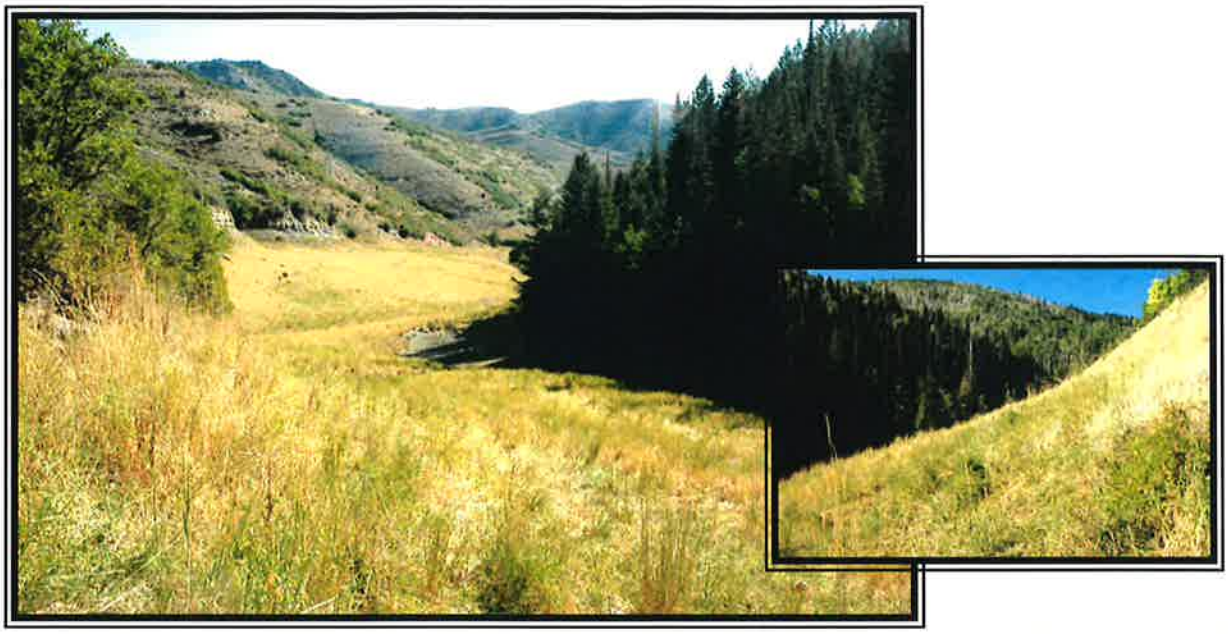
This document reports the results of quantitative sampling the vegetation of the reclaimed area at the Gordon Creek 2/7/8 Mine site. The datasets in this report represent **Year 1** of the two consecutive years required for an application for final bond release to be submitted through the State of Utah, Division of Oil, Gas & Mining (DOGM). 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

APPENDIX B

Report for
Year 2 (2010)

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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for

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November 2011

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REPORT FOR YEAR 1 (2009) ..... Appendix A

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.

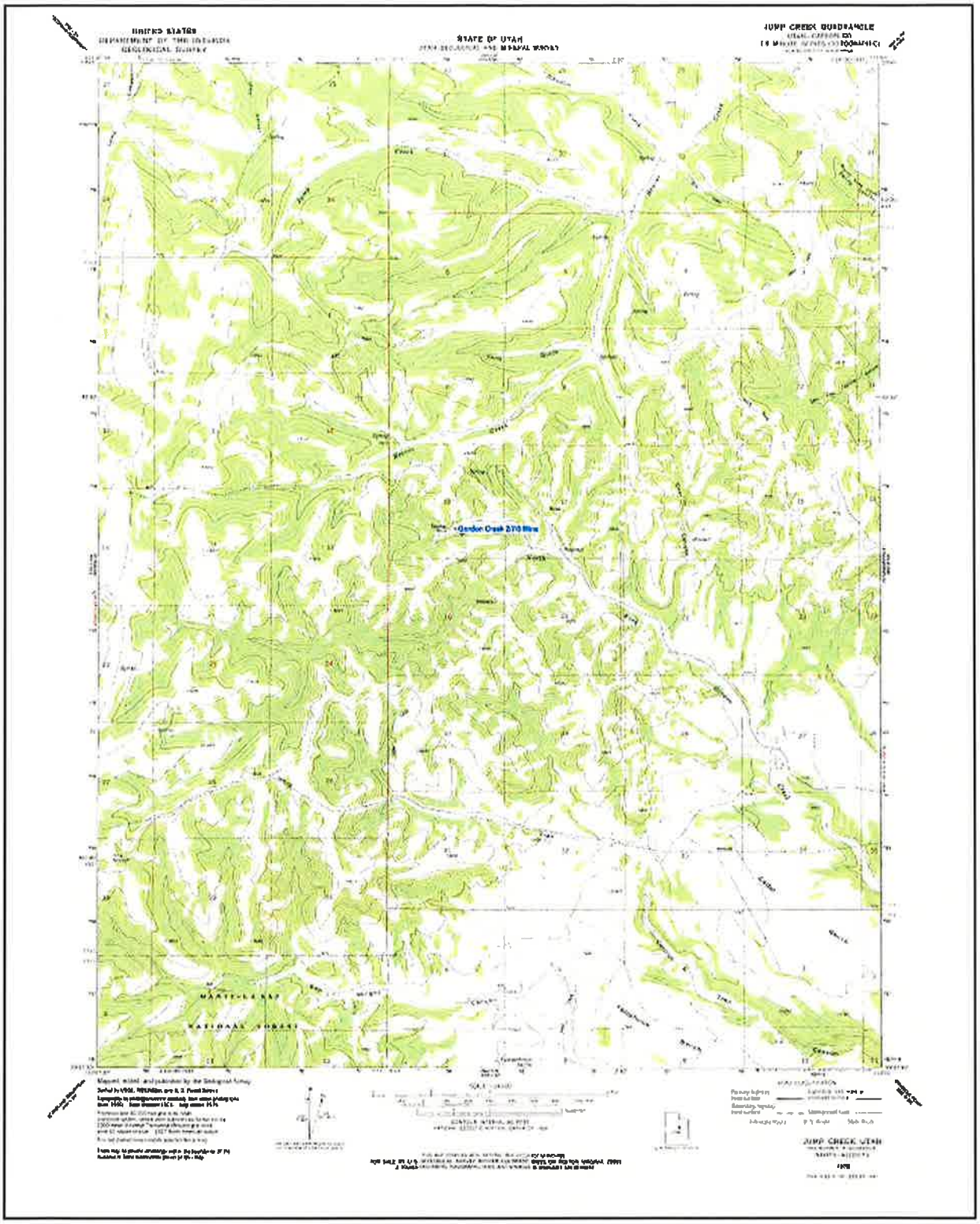


Figure 1: Gordon Creek 2/7/8 Mine Study Area

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.

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

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 (DOGM). 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,

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 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 or 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			
Artemisia tridentata	1.33	7.54	4.00
Chrysothamnus nauseosus	0.83	6.01	2.00
Gutierrezia sarothrae	0.07	0.81	0.67
Symphoricarpos oreophilus	0.20	1.51	2.00
FORBS			
Artemisia ludoviciana	0.20	1.51	2.00
Astragalus cicer	2.20	6.47	13.33
Cynoglossum officinale	2.27	5.64	20.67
Hedysarum boreale	0.17	1.46	1.33
Lappula occidentalis	0.07	0.81	0.67
Medicago sativa	24.42	21.65	69.33
Penstemon strictus	1.83	7.47	8.00
Sisymbrium altissimum	0.03	0.41	0.67
GRASSES			
Agropyron cristatum	1.03	3.93	6.67
Bromus carinatus	0.97	4.57	5.33
Bromus tectorum	0.10	0.91	1.33
Elymus cinereus	11.08	15.98	46.00
Elymus lanceolatus	6.15	9.44	38.67
Elymus salinus	0.27	3.26	0.67
Elymus smithii	5.02	9.80	30.00
Elymus spicatus	3.70	9.15	20.67
Poa pratensis	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*). There 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			
Quercus gambelii	0.22	1.47	2.22
UNDERSTORY			
SHRUBS			
Amelanchier utahensis	1.33	6.49	4.44
Artemisia frigida	0.11	1.05	1.11
Artemisia tridentata var. vaseyana	1.11	6.23	3.33
Cercocarpus montanus	2.83	6.71	20.00
Eriogonum corymbosum	2.44	8.51	8.89
Gutierrezia sarothrae	0.44	1.77	6.67
Mahonia repens	0.28	1.37	4.44
Opuntia fragilis	0.17	0.90	3.33
Purshia tridentata	4.11	11.24	16.67
Quercus gambelii	0.11	1.05	1.11
Symphoricarpos oreophilus	0.06	0.52	1.11
FORBS			
Artemisia ludoviciana	0.06	0.52	1.11
Eriogonum jamesii	0.11	1.05	1.11
Machaeranthera grindelioides	0.17	0.90	2.22
Stanleya pinnata	0.67	2.00	6.67
GRASSES			
Elymus salinus	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 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).

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

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 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 (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).

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

Reclaimed Area: 2.77

Reference Area: 1.77

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).

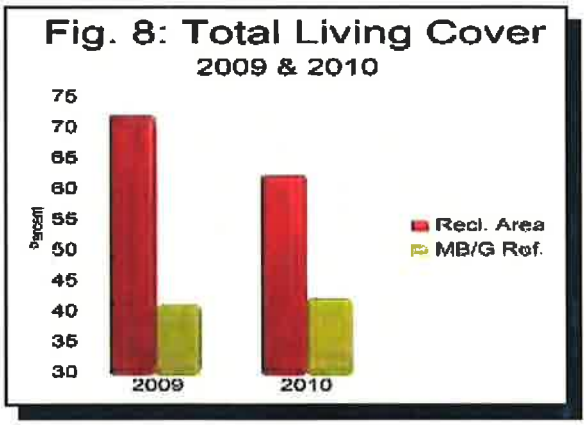
FIGURE 7. TOTAL SPECIES PRESENT - A **diversity** comparison between the reclaimed area at Gordon Creek 2/7/8 and its reference area (2010).

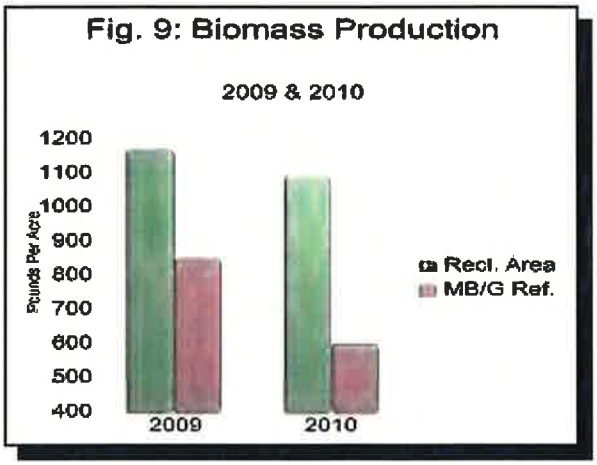
Reclaimed Area: 21

Reference Area: 16

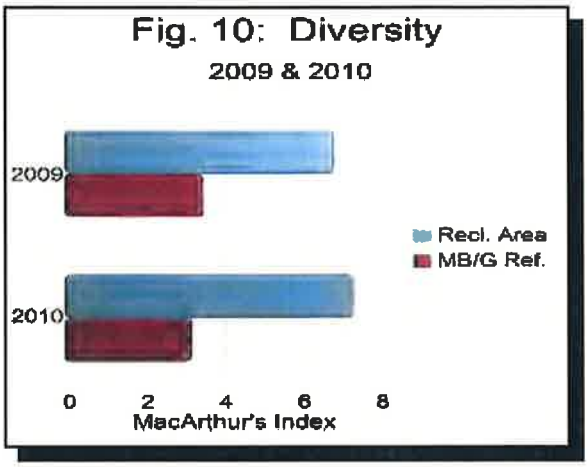
Graphic Comparisons to the Revegetation Success Standards (2009-2010)

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).



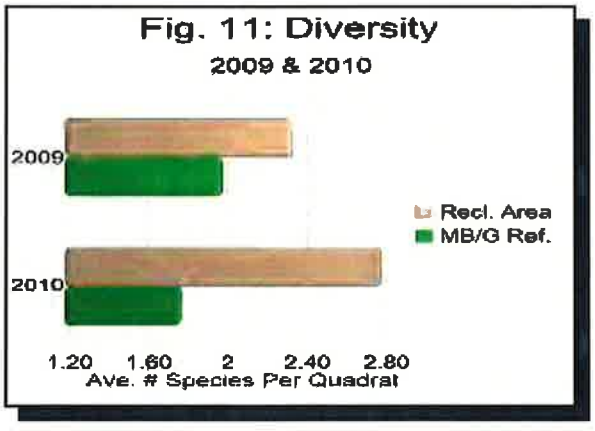


DISCUSSION & SUMMARY

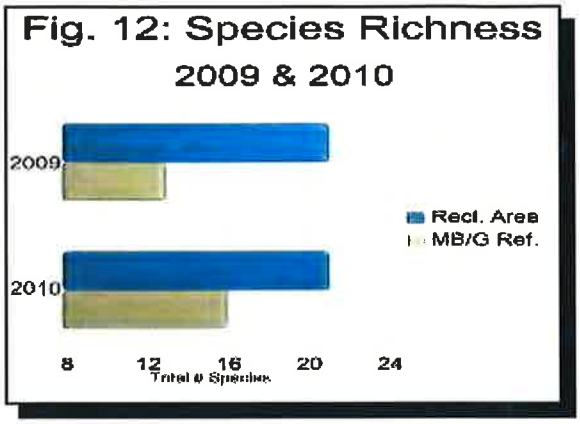


Subsequent to final reclamation, the primary post-mining land use as determined by the land owner will primarily be that of grazing by domestic livestock. Consequently, Gordon Creek's Mining and Reclamation (MRP) identifies "*stock grazing*" as the post-mining land use, but it also states that *"reclamation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



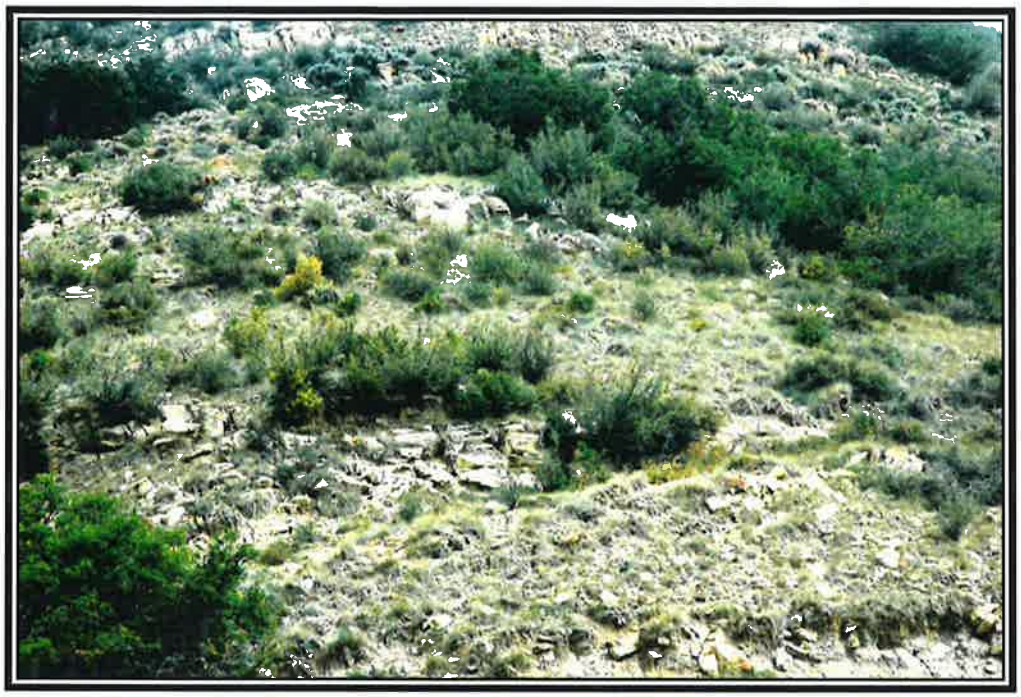
CONCLUSIONS

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



Reclamation Certification

Canyon Fuel Company, LLC
Gordon Creek 2, 7 & 8 Mines
C/007/0016

Phase III Bond Release of 34.15 Acres of Land in the Gordon Creek 2, 7 & 8 Mine Permit

I hereby certify to the best of my information and belief all the information contained in this application for Phase III Bond release is true and correct and that all applicable reclamation activities have been accomplished in accordance with the requirement of the Act, the regulatory program and the approved reclamation plan.

Chris D. Hansen
Print Name

Director of Regulatory Complaince and Government Relations, Wolverine Fuels, LLC
Position

Chris D. Hansen 10/15/19
Signature Date

Subscribed and sworn to before me this 15th day of October, 2019

Amber Cook
Notary Public

AMBER COOK
Notary Public - State of Utah
My Commission Expires
September 28, 2023
Commission #708007

My Commission Expires: September 28th, 2023
Attest: State of Utah
County of Salt Lake

Bond Release Calculation

Bond Release Calculation

Gordon Creek 2, 7 & 8 Mines Phase III Bond Release Reduction on the Remaining 34.15 Acres

The current reclamation bond amount is $171,000. This is an application for final bond release for the Gordon Creek 2, 7 & 8 Mines Permit area. Therefore, the bond will be reduced to zero dollars.