Plateau Mining Corporation
Star Point Mine
P.O. Box 30
847 NW HWY 191
Helper, UT 84526
Phone (435) 472-4737

March 7, 2013

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

RE: 2012 Annual Report for Plateau Mining Corporation, Star Point Mine, C/007/0006

Dear Mr. Haddock

Please find attached an electronic copy of the 2012 Annual Report for Plateau Mining Corporations Star Point Mine.

This report includes the Divisions required Annual Report form as well as Plateau Mining Corporations Star Point Mine year-ten vegetation study conducted by MT Nebo Scientific. This vegetation study is a pdf file titled "Revegetation Monitoring for Phase III Bond Release Year 2 (2012)".

If you have any problems opening these files please call me at 435-650-2951 or by email at dware@alphanr.com.

Sincerely,

Dennis N. Ware
Authorized Agent

Print Form | Submit by Email | Reset Form

Annual Report

This Annual Report shows information the Division has for your mine. Submit the completed document and any additional information identified in the Appendices to the Division by the date specified in the cover letter. During a complete inspection an inspector will check and verify the information.

GENERAL INFORMATION

Company Name	Plateau Mining Corporation	Mine Name	Star Point Mine
Permit Number	C/007/0006	Permit expiration Date	January 28, 2017
Operator Name	Plateau Mining Corporation	Phone Number	+1 (435) 472-0475
Mailing Address	P.O. Box 30	Email	dware@alphanr.com
City	Helper		
State	Utah	Zip Code	84526

		DOGM File Location or Annual Report Location
Excess Spoil Piles	☐ Required ☒ Not Required	None
Refuse Piles	☐ Required ☒ Not Required	None
Impoundments	☐ Required ☒ Not Required	None
Other:		

OPERATOR COMMENTS

REVIEWER COMMENTS ☐ Met Requirements ☐ Did Not meet Requirements

REPORTING OF OTHER TECHNICAL DATA

Please list other technical data or information that was not included in the form above, but is required under the approved plan, which must be periodically submitted to the Division.

Please list attachments:

Year-Ten Vegetation Study Conducted by MT Nebo Scientific Titled "Revegetation Monitoring for Phase III Bond Release Year 2 (2012)".

Reviewer Comments

MAPS

Copies of mine maps, current and up-to-date, are to be provided to the Division as an attachment to this report in accordance with the requirements of R645-301-525.240. The map copies shall be made in accordance with 30 CFR 75.1200 as required by MSHA. Mine maps are not considered confidential.

Map Name	Map Number	Included		Confidential	
		Yes	No	Yes	No
Mine in Reclamation Monitoring Phase		☐	☐	☐	☐
		☐	☐	☐	☐
		☐	☐	☐	☐
		☐	☐	☐	☐
		☐	☐	☐	☐

Reviewer Comments ☐ Met Requirements ☐ Did Not Meet Requirements

Revegetation Monitoring
for
Phase III Bond Release

Year 2 (2012)

at the

Star Point Mine

for

Plateau Mining Corporation

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

PLATEAU MINING CORPORATION
P.O. Box 592
Orangeville, Utah 84537

February 2013

TABLE OF CONTENTS

INTRODUCTION 1
Study Rationale 1
Previous Studies 2

METHODS 2
Transect & Quadrat Placement 2
Cover, Frequency & Composition 3
Density 3
Biomass Production 3
Diversity & Similarity Indices 4
Sample Size & Adequacy 5
Photographs 5
Vegetation Sample Maps 5

RESULTS 6
Sample Areas 6
Reclaimed Areas 6
Reference Areas 7
Results of Separated Data 7
Dominant Plant Species 9
Lifeform Composition 10
Total Living Cover 11
Woody Species Density 12
Annual Biomass Production 13
Diversity 14
Separating vs. Lumping Data 16
Results of Lumped Data 16
Total Living Cover in the pre-SMCRA Areas 18
Woody Species Density in the pre-SMCRA Areas 18
Total Living Cover in the post-SMCRA Areas 18
Woody Species Density in the post-SMCRA Areas 18
Annual Biomass Production in the post-SMCRA Areas 18
Reference Areas 19
Total Living Cover 19
Woody Species Density 19
Annual Biomass Production 19
Revegetation Success Standards 20
Statistical Comparisons 20
Reclaimed Sagebrush (pre-SMCRA) vs. Reference Area 20
Reclaimed Sagebrush (post-SMCRA) vs. Reference Area 20
Reclaimed Mountain Grasslands (pre-SMCRA) vs. Reference Area 21

Reclaimed Mountain Grasslands (post-SMCRA) vs. Reference Area 21
Reclaimed Saltbush (post-SMCRA)vs. Reference Area 22

SUMMARY & CONCLUSIONS 23

DATA SUMMARY TABLES 27

COLOR PHOTOGRAPHS OF THE SAMPLE AREAS 65

SAMPLE AREA MAPS 82
Vegetation Sample Area Map A 83
Vegetation Sample Area Map B 84
Vegetation Sample Area Map C 85

NRCS INFORMATION . . . . . APPENDIX

INTRODUCTION

Study Rationale

This report contains data and information from quantitative sampling in 2012, or **Year 2** of a two-year study period on the vegetation at the reclaimed Star Point Mine site in eastern Utah. **Year** 1 (2011) results were provided in an earlier report. The purpose of this document is to compare reclaimed areas of the mine site with specific standards for revegetation success. The content of this report along with the earlier report provides some of the information and data necessary to be included in an application for bond release by the mine owner through the State of Utah, Division of Oil, Gas & Mining (DOGM).

Reclaimed mine sites are required to allow enough time for acceptable plant establishment before applications can be made for bond release. This time period, called the "*Responsibility Period*", prescribes at least 10 years following reclamation before the mine operator can submit a request for *Final* or *Phase III Bond Release* through state and federal regulatory authorities. This period of time is considered to be long enough to determine whether or not adequate re-establishment of a given reclaimed plant community has occurred on sites at this precipitation zone in the western United States. The vegetation of the reclaimed lands must meet specific state and federal requirements.

Study Area

The Star Point Mine is a reclaimed mine site located on the east side of the Wasatch Plateau on Gentry Mountain approximately 23 miles southwest of Price, Utah. Historically, coal mining at the Star Point Mine began in 1916. Coal was shipped to the town of Wattis by 1917 when a railroad was completed there. In 1967, a company called Plateau Limited opened a new mine in the area. By 1971, another company, United Nuclear, purchased the mine. Finally, in 1980, Plateau Mining Company bought and mined the properties. The current permittee, Plateau Mining Corporation, began final reclamation of the mine site in 2001, with final seeding for revegetation finalized in 2003.

Previous Studies

Following reclamation and revegetation, the plant communities have been closely monitored to document the progress on those areas disturbed by the previous mining activities. Earlier documents submitted to the regulatory agencies reported updates on the revegetation process from sampling the area in 2006 (Year 4), 2008 (Year 6) 2010 (Year 8) and as mentioned 2011 (Year 9).

METHODS

Methodologies used for sampling have been consistent between sample years and were performed in accordance with the guidelines provided by DOGM. The reclaimed areas were sampled and separated *between* vegetation types; when the types were comprised of relatively large acreage, additional areas were further separated *within* the types. This method allows for closer scrutiny of the reclaimed mine site on a smaller, area-by-area basis. For the analyses required for bond release comparisons, the datasets were then *lumped* according to the plant community types (more on that later).

To facilitate comparisons between the two consecutive sample years, 2011 and 2012, colors used on the summary tables and graphs remain consistent.

Transect & Quadrat Placement

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

over the entire study area to adequately address and represent each study site as a whole.

Cover, Frequency & Composition

Cover estimates were made employing ocular methods with meter square quadrats. Species composition and relative frequencies were also assessed from the quadrats. Additional information, when applicable, was also recorded on the raw data sheets such as: slope, exposure, grazing use, animal disturbance and other appropriate notes. Plant nomenclature follows *A Utah Flora* (Welsh et al. 2008).

Density

In nearly all areas, density estimates for woody plant species on the reclaimed and reference areas were made using a distance method called the *point-quarter technique*. This technique determines the mean area an individual plant occupies, which then yields the number of these individuals per acre. In this method, random points were placed on the sample sites and divided into four quarters. The distances to the nearest woody plant species were then recorded in each quarter. The average point-to-individual distance was equal to the square root of the mean area per individual.

The one area where this method was not suitable due to its size and community structure was the Mudwater Canyon site. At this site 5x25 ft belt transects were employed. In this method individuals were counted in each transect, summarized for mean and standard deviation, then converted to the number of individuals per acre.

Biomass 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 were clipped, weighed and recorded separately.

Diversity and Similarity Indices

There are several well-documented methods to assess diversity and similarity in plant communities. The *Motyka Index* is a modified form of the *Sorenson Index*, both similarity indices. This index was used on the data; the equation is shown below:

$$IS_{MO} = \left(\frac{2MW}{MA + MB}\right) x100$$

where,

MW = $\sum$ of the smaller quantitative values of species of two communities,
MA = $\sum$ of the quantitative values of all species in one community,
MB = $\sum$ of the quantitative values of all species in another community.

Two diversity indices have been employed to measure the reclaimed and reference areas. *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.

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

Confidence levels were calculated at 80% and 90% (t) with the desired change from the mean (d) placed at 0.10. Sample sizes were, however, also based on the size of each subdivision within each vegetation type, resulting in more samples taken in larger areas.

Photographs

Color photographs of each sample area were taken at the time of sampling; a subset of them have been submitted with this report.

Vegetation Sample Maps

The locations of the reclaimed sample areas were mapped during the field work. These locations were then placed on "as-built" reclamation maps prepared previously by *Earthfax Engineering*, resulting in three Vegetation Sample Area maps; they have been submitted in this report.

RESULTS

Sample Areas

The Star Point Mining & Reclamation Plan (MRP) divided the disturbed areas into three main types based on the native plant communities that existed in the area prior to their disturbance by coal mining and related activities. The three types represented in the "reclaimed areas" and were called: 1) **Sagebrush Areas**, 2) **Mountain Grassland Areas**, and 3) **Saltbush Areas**. During reclamation these sites were seeded with mixtures developed specifically for each area. Additionally, **reference areas**, or areas chosen in undisturbed plant communities to represent final revegetation success standards, were chosen for each disturbed (reclaimed) type. Reference areas were sampled in 2011 and 2012 for comparisons to the reclaimed areas.

Reclaimed Areas

As mentioned above, there were three disturbance types delineated at the mine site. Additionally, these types were further subdivided into smaller areas to allow closer, independent evaluations for the specific sites (see *VEGETATION SAMPLE AREA MAPS* and *COLOR PHOTOGRAPHS OF THE SAMPLE AREAS*). The following table shows the three vegetation types and subdivisions within them.

Table 1: Sample area subdivisions of each reclaimed type.

Reclaimed Sagebrush	Reclaimed Mtn Grassland	Reclaimed Saltbush
Area A	Area E	Area I
Area B	Area F	
Area C	Area G (pre- & post-SMCRA)	
~~Area D~~ (*area was sold and removed from the permit area*)	Mudwater Canyon	
Area H	Corner Canyon	

Reference Areas

The three reference areas along with their corresponding reclaimed areas, are shown in Table 2. The reference areas data can be compared to the reclaimed areas and provide accompaniment for future bond release application through the State of Utah.

Table 2: Reference areas and their respective reclaimed areas.

Reference Areas	**Reclaimed Areas**
Sagebrush	Area A Area B Area C Area H
Mountain Grassland	Area E Area F Area G Mudwater Canyon Corner Canyon
Saltbush	Area I

Results of Separated Data

General comparisons *between* reclaimed types and *within* each community type for the 2012 datasets can be done by reviewing the summary tables of the sample results that have been provided for each reclaimed area as well as the reference areas (Tables 4 through 54). Table 3 shows the number of the appropriate table for each parameter in all sample areas of the study.

Table 3: Separated data locator at the Star Point Mine site (2012).

SAMPLE AREA	Sub-Division	Cover by Species	Total Cover	Composition	Woody Species Density	Production
Reclaimed Sagebrush	A	Table 4	Table 5 (A)	Table 5 (B)	Table 6	n/a
Reclaimed Sagebrush	B	Table 7	Table 8 (A)	Table 8 (B)	Table 9	n/a
Reclaimed Sagebrush	C	Table 10	Table 11 (A)	Table 11 (B)	Table 12	Table 13
Reclaimed Sagebrush	H	Table 28	Table 29 (A)	Table 29 (B)	Table 30	Table 31
Reclaimed Mountain Grassland	E	Table 14	Table 15 (A)	Table 15 (B)	Table 16	n/a
Reclaimed Mountain Grassland	F	Table 17	Table 18 (A)	Table 18 (B)	Table 19	Table 20
Reclaimed Mountain Grassland	G (pre-SMCRA) G (post-SMCRA)	Table 21 Table 24	Table 22 (A) Table 25 (A)	Table 22 (B) Table 25 (B)	Table 23 Table 26	n/a Table 27
Reclaimed Mountain Grassland	Mudwater Canyon	Table 36	Table 37 (A)	Table 37 (B)	Table 38	n/a
Reclaimed Mountain Grassland	Corner Canyon	Table 39	Table 40 (A)	Table 40 (B)	Table 41	Table 42
Reclaimed Saltbush	I	Table 32	Table 33 (A)	Table 33 (B)	Table 34	Table 35
Sagebrush Reference Area	n/a	Table 43	Table 44 (A)	Table 44 (B)	Table 45	Table 46
Mountain Grassland Reference Area	n/a	Table 47	Table 48 (A)	Table 48 (B)	Table 49	Table 50
Saltbush Reference Area	n/a	Table 51	Table 52 (A)	Table 52 (B)	Table 53	Table 54

Dominant Plant Species

In 2012, the most important or dominant plant species in the reclaimed areas at the Star Point Mine site by cover and frequency for the **Reclaimed Sagebrush Areas** were primarily shrubs, or rubber rabbitbrush (*Chrysothamnus nauseosus*), fourwing saltbush (*Atriplex canescens*), shadscale (*A. confertifolia*), winterfat (*Ceratoides lanata*) and big sagebrush (*Artemisia tridentata*). Dominant forbs here consisted of: Pacific aster (*Aster chilensis*), northern vetch (*Hedysarum boreale*), Lewis flax (*Linum lewisii*) and Palmer penstemon (*Penstemon palmeri*). The most important grasses in these reclaimed areas were thickspike wheatgrass (*Elymus lanceolatus*), bluebunch wheatgrass (*E. spicatus*), crested wheatgrass (*Agropyron cristatum*) and Indian ricegrass (*Stipa hymenoides*). All species present in the sample quadrats in the Reclaimed Sagebrush Areas have been provided on Tables 4, 7, 10 and 28.

The dominant shrub species for the **Reclaimed Mountain Grassland Areas** were comprised of big sagebrush, corymb buckwheat (*Eriogonum corymbosum*), Antelope bitterbrush (*Purshia tridentata*), rubber rabbitbrush and curl-leaf mountain mahogany (*Cercocarpus ledifolius*). The dominant forbs in this community were Lewis flax, Pacific aster and Palmer penstemon. The most important grasses here were: Great Basin wildrye (*Elymus cinereus*), mountain brome (*Bromus carinatus*), thickspike wheatgrass and bluebunch wheatgrass. For a list of all species encountered in the Reclaimed Mountain Grassland Areas, refer to Tables 14, 17, 21, 24, 36 and 39.

Lastly, the dominant shrubs by cover and frequency in the **Reclaimed Saltbush Areas** consisted of: shadscale, rubber rabbitbrush and black sagebrush (*Artemisia nova*). The dominant forb here was cicer milkvetch (*Astragalus cicer*), and the most important grasses consisted of bluebunch wheatgrass, western wheatgrass (*Elymus smithii*), Salina wildrye (*Elymus salinus*) and thickspike wheatgrass. For cover and frequency values in the Reclaimed Saltbush Areas, refer to Tables 32.

In the reference areas, the most important shrub species in the **Sagebrush Reference Area** by a wide margin was big sagebrush. In 2012, the only forb present in the sample quadrats

was hoary aster (*Machaeranthera canescens*). Dominant grasses in this community were: Indian ricegrass, created wheatgrass and Salina wildrye. For a list of the plants found in the Sagebrush Reference Area, refer to Table 43.

The dominant shrubs in the **Mountain Grassland Reference Area** were: corymb buckwheat and low rabbitbrush (*Chrysothamnus viscidiflorus*). Although forbs were relatively unimportant here, the dominants were: yarrow (*Achillea millefolium*), buckwheat (*Eriogonum* sp.) and hoary aster. The dominant grass by a very wide margin was Salina wildrye. For a list of all species in this reference area, refer to Table 47.

Lastly, for the reference areas, the most important shrub in the **Saltbush Reference Area** was Gardner saltbush (*Atriplex gardneri*), followed distantly by shadscale. Forbs were again relatively unimportant here and were not present in the sample quadrats in 2012. The only grasses present in the sample quadrats was Salina wildrye. For a list of all species present in this community, refer to Table 51.

Lifeform Composition

As a short summary on composition in the **Reclaimed Sagebrush Areas**, grasses were the dominate lifeform followed closely by shrubs and less closely by forbs in all sample sites. For lifeform composition percentages in these reclaimed areas, refer to Tables 5, 8, 11 and 29.

In the **Reclaimed Mountain Grassland Areas**, with only one exception, grasses were the dominant lifeform, shrubs and forbs demonstrated mixed proportions depending on the reclaimed area. For lifeform composition percentages in these areas, refer to Tables 15, 18, 22, 25, 37 and 40.

The composition order of the **Reclaimed Saltbush Areas** showed that grasses comprised more that 3 times that of shrubs; forbs were inconsequential. For composition results in this reclaimed site, refer to Table 33.

In the **Sagebrush Reference Area**, grasses and shrubs were relatively close in proportion,

but followed distantly by forbs (Table 44).

The **Mountain Grassland Reference Area** was very much dominated by grasses (greater than 80%) as shown in the composition, but shrubs and forbs were also represented (Table 48).

Finally, the composition of the **Saltbush Reference Area** was nearly equally represented by shrubs and grasses, with few forbs (Table 52).

The dominant species information as well as the lifeform composition results described above have been provided as additional information to further demonstrate the current condition of the vegetation at the Star Point Mine site. However, the primary parameters for comparing the reclaimed areas with the reference areas were: total living cover, woody species density, annual biomass productivity and diversity. Therefore, these parameters are first shown graphical for the *separated data*, then compared statistically later in the report for the *lumped* (or *combined data*).

Total Living Cover

Total living cover, one of the primary parameters in assessing revegetation success at the mine site, has been shown for individual areas in summary tables provided later in the report; these values have also been shown graphically in figures here. Figure 1 illustrates the total living cover in each Reclaimed Sagebrush Area as well as the Sagebrush Reference Area (RF).

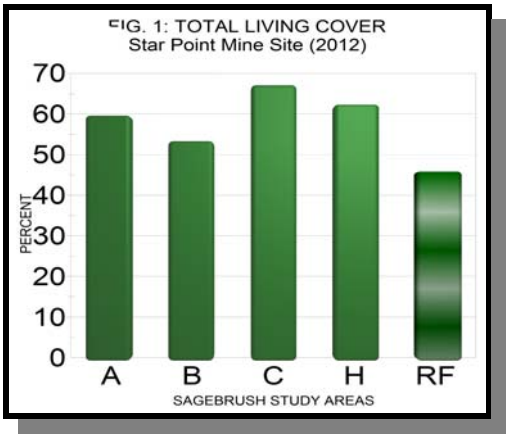


Figure 2 shows the same parameter, total living cover, for all the Reclaimed Mountain Grassland Areas as well as the Mountain Grassland Reference Area.

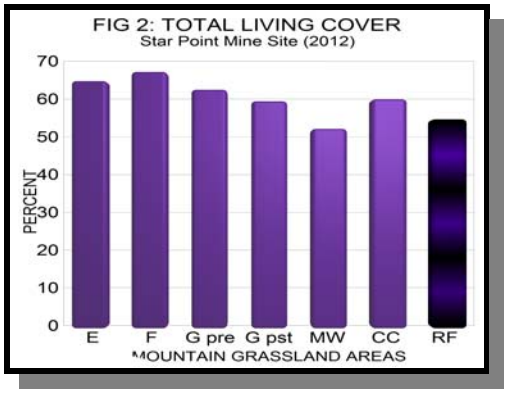
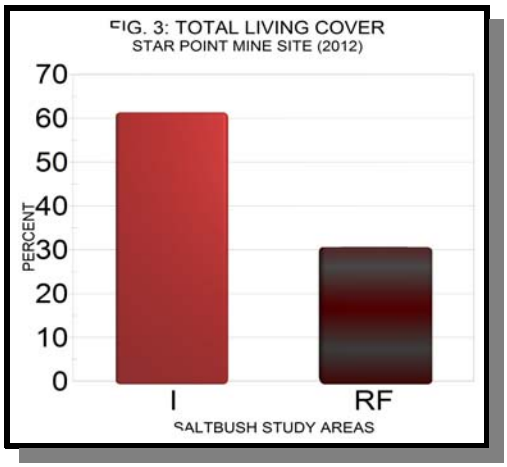
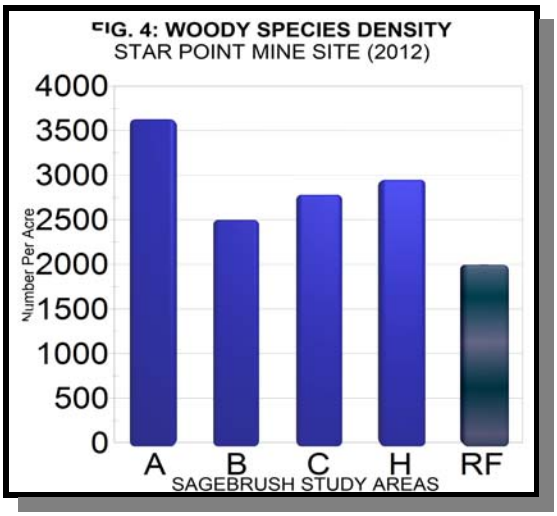


Figure 3 illustrates total living cover for the Reclaimed Saltbush Area along with the Saltbush Reference Area.

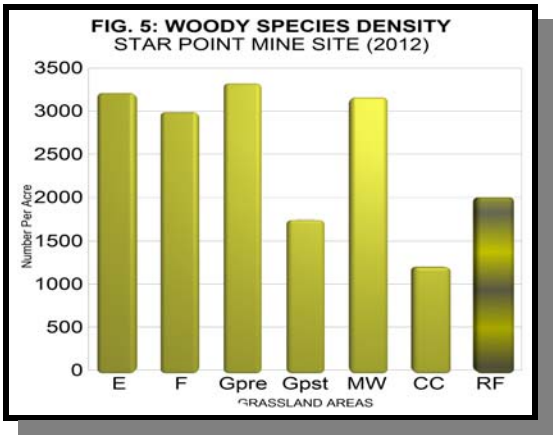


Woody Species Density

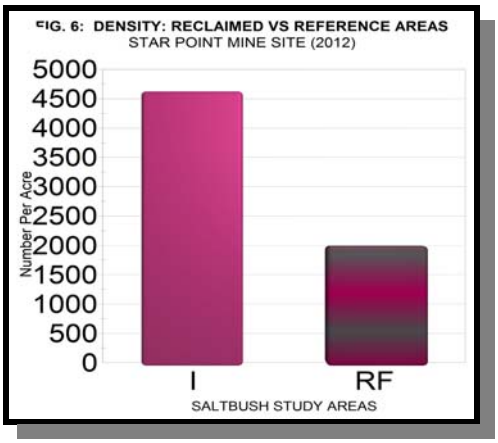
Woody species density values, or the total number of individuals per acre, for each Reclaimed Sagebrush Area as well as the Sagebrush 'standard' [a pre-determined number, *not* the reference area value (further explained later)] are shown in Figure 4.



This same parameter for each Reclaimed Grassland Area and its density standard are shown in Figure 5 (the figure shows both pre=pre-SMCRA and pst=post SMCRA results).



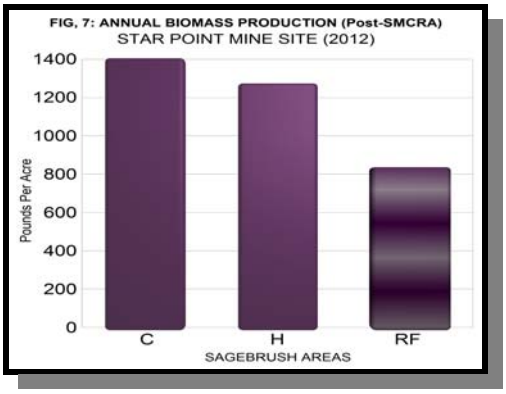
Finally, the woody species density for the Reclaimed Saltbush Areas along with the Saltbush density standard are shown in Figure 6.

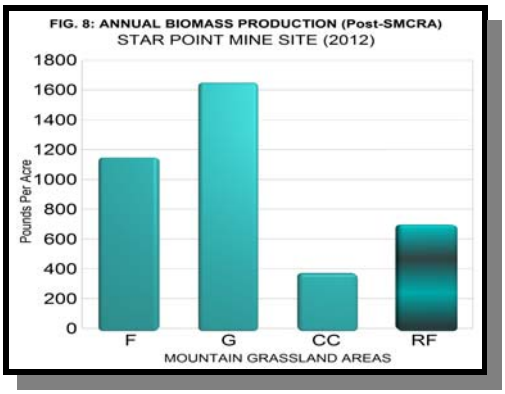


Annual Biomass Production

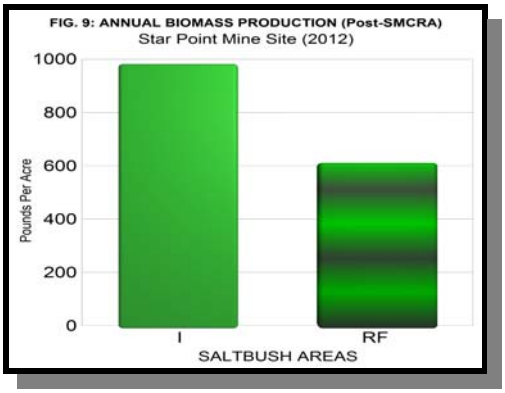
As dictated by the final revegetation success standards in the Star Point Mine's MRP, total annual biomass production was only measured and compared with reference areas in the post-SMCRA sites. The production shown in pounds per acre for the Reclaimed Sagebrush Areas and Sagebrush Reference Area are shown in Figure 7.

Next, the production of the Reclaimed Mountain Grasslands and its associated reference area are shown graphically in Figure 8.





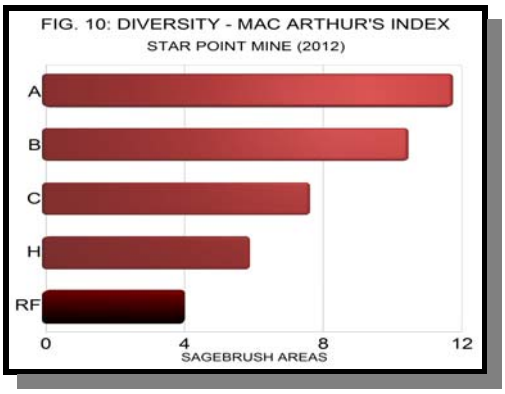
Lastly, the production of the Reclaimed Saltbush Areas can be compared to the Saltbush Reference Area in Figure 9.

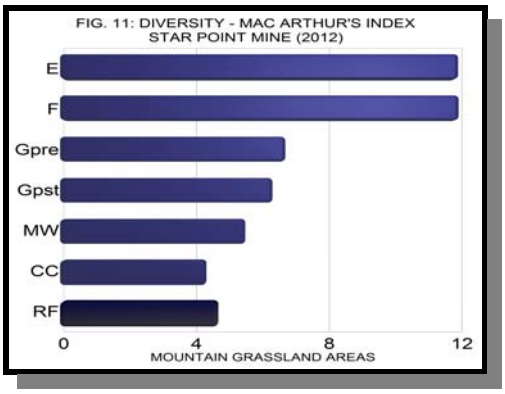


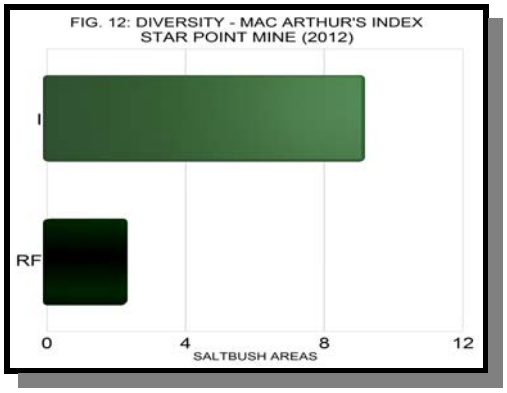
Diversity

Two different diversity measurements have been applied to the reclaimed and reference areas – MacArthur's Index and the Average Number of Species per Quadrat. Graphical representations of these diversity indices are shown below.

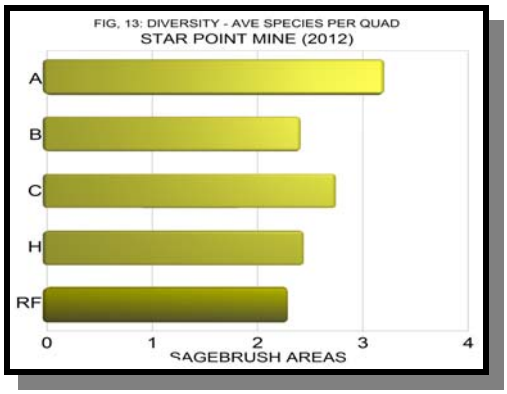
MacArthur's Index

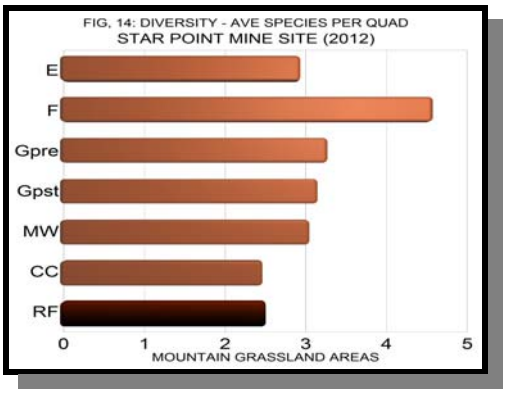


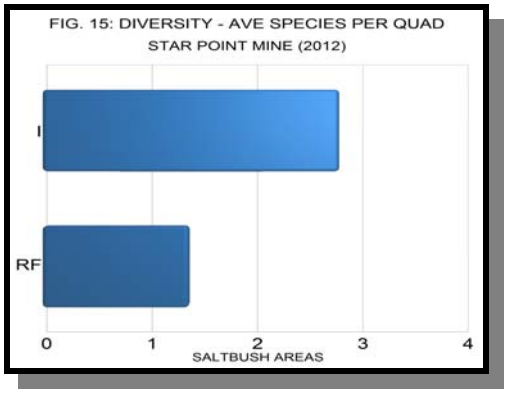




Average Species Per Quadrat







Separating vs Lumping Data

The section above provides the summary data for each sample area including the Reclaimed Areas and Reference Areas along with the subdivisions within the larger reclaimed vegetation types. As explained, this design enables the reviewer to observe the successes (or failures) of individual areas even *within each reclaimed vegetation type*. For example, Areas A, B, C and H are all within the Sagebrush type, yet the sample data were summarized separately for these areas to enable closer scrutiny of the revegetated landscapes.

As important as it is to be able to review individual reclaimed areas by separating the datasets, combining the data of each vegetation type, then comparing them statistically with their respective reference areas is the most logical rational in the process of considering the mine site for final bond release. Combined dataset summaries have been provided in Tables 55 through 67.

Results of Lumped Data

There has been a significant amount of vegetation data collected at the Star Point Mine site in 2012 (and 2011) to assess the revegetation success when compared to the success standards.

Even though much data has been recorded in the area, the author has tried to find a logical and straightforward method to compare the *applicable parameters* to assess revegetation success (those required by state and federal regulations), yet also provide other meaningful data (that cannot readily be compared using statistics).

In this attempt, the following section discusses the methods used to compare key parameters for the reclaimed areas and their respective reference areas for bond release.

To begin, it may seem logical to simply lump all the Reclaimed Sagebrush sites together into one dataset, then all the Reclaimed Mountain Grassland sites to another dataset and so forth – then compare these datasets with the appropriate Reference Area. However, different revegetation success standards have been assigned to reclaimed areas – even though they may be in the same vegetation type. Reasons for the dissimilar standards was based on whether or not a given reclaimed area was disturbed prior to, or after, the Surface Mining Control and Reclamation Act of 1977 (SMCRA). Those areas disturbed after, or post-SMCRA, have more stringent revegetation success standards than those disturbed pre-SMCRA. (More information and justification for this distinction can be found in the Star Point Mine's MRP).

Reclaimed Areas divided by vegetation type and Surface Mining Control and Reclamation Act.

1. **Pre-SMCRA**
   a. Reclaimed Sagebrush
      i. Area A
      ii. Area B
   b. Reclaimed Mountain Grassland
      i. Area E
      ii. Area G
      iii. Mudwater Canyon

2. **Post-SMCRA**
   a. Reclaimed Sagebrush
      i. Area C
      ii. Area H
   b. Reclaimed Mountain Grasslands
      i. Area F
      ii. Area G (Area G has both pre- and post-SMCRA areas)
      iii. Corner Canyon
   c. Reclaimed Saltbush
      i. Area I

With that in mind, the datasets have been lumped (combined) by vegetation type and the SMCRA time-frame. The outline above summarizes this treatment of datasets. The following describes the sample results for combined datasets.

Total Living Cover in the pre-SMCRA Areas

The total living cover (combined) for the pre-SMCRA Reclaimed Sagebrush Areas (Areas A & B) was estimated at 57.63% (Table 55). The total living cover for the Reclaimed Mountain Grassland Areas (Areas E, G & Mudwater Canyon) was estimated at 61.47% (Table 60). There were no pre-SMCRA Reclaimed Saltbush Areas at the site.

Woody Species Density in the pre-SMCRA Areas

The pre-SMCRA woody species density for the Reclaimed Sagebrush Areas (Areas A & B) combined was estimated at 3,282 individuals per acre (Table 56). The pre-SMCRA density for the Reclaimed Mountain Grasslands Areas (Areas E, G & Mudwater Canyon) was estimated at 2,962 plants per acre (Table 61). Again, there were no pre-SMCRA Reclaimed Saltbush Areas at the site.

Total Living Cover in the post-SMCRA Areas

Next, the total living cover of the post-SMCRA Reclaimed Sagebrush Areas (Areas C & H) was estimated at 64.17% (Table 57). The total living cover for the Reclaimed Mountain Grassland Areas (Areas F, G & Corner Canyon) was estimated at 62.88% (Table 62). And finally, the post-SMCRA Saltbush Area (Area I) had a total living cover of 60.90% (Table 65).

Woody Species Density in the post-SMCRA Areas

The density for the post-SMCRA Reclaimed Sagebrush Areas (Areas C & H) was estimated at 2,899 plants per acre (Table 58). The density for the Reclaimed Mountain Grassland Areas (Areas F, G & Corner Canyon) was estimated at 2,327 plants per acre (Table 63). Lastly, the post-SMCRA Saltbush Area (Area I) had a density 4,587 (Table 66).

Annual Biomass Production in the post-SMCRA Areas

Annual biomass production was only sampled in the post-SMCRA sites. The combined Reclaimed Sagebrush Areas (Areas C & H) was estimated at 1,328.17 pounds per acre (Table 59). The production for the Reclaimed Mountain Grassland Areas (Areas F, G & Corner

Canyon) was estimated at 1,232.53 pounds per acre (Table 64). Lastly, the Saltbush Area (Area I) had a productivity estimate of 973.74 pounds per acre (Table 67).

Reference Areas

Total Living Cover

The total living cover for the Sagebrush Reference Area was estimated at 45.70% (Table 44). The total living cover for the Mountain Grassland Reference Area was estimated at 54.33% (Table 48). And finally, the Saltbush Reference Area had a total living cover of 30.70% (Table 52).

Woody Species Density

The density for the Sagebrush Reference Area was estimated at 6,558 plants per acre (Table 45), but the pre-determined success standard for this parameter was 2,000 plants per acre[1]. The density for the Mountain Grassland Reference Area was estimated at 1,470 plants per acre (Table 49), but the pre-determined success standard for this parameter was also 2,000 plants per acre. Lastly, the Saltbush Reference Area had a density 3,574 (Table 53), and again the pre-determined success standard for this parameter was 2,000 plants per acre.

Annual Biomass Production

The annual biomass production for the Sagebrush Reference Area was estimated at 835.02 pounds per acre (Table 46). The production for the Mountain Grassland Reference Area was estimated at 698.33 pounds per acre (Table 50). Lastly, the Saltbush Reference Area had a productivity estimate of 609.81 pounds per acre (Table 54).

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[1] The pre-determined density standard here (and in the other reclaimed communities) was determined more appropriate than the reference area for wildlife habitat by state biologists. More details about this can be found in the MRP.

Revegetation Success Standards

A summary of the revegetation success standards for the Star Point Mine has been provided in Table 68. Statistical comparisons between the reclaimed and reference areas are shown in Tables 69 through 71. Some success standards required Natural Resources Conservation Service (NRCS) estimates. For the NRCS information required, refer to the APPENDIX of this report.

Statistical Comparisons

Reclaimed Sagebrush (pre-SMCRA) vs. Reference Area

When the **total living cover** of the pre-SMCRA Reclaimed Sagebrush Areas *combined* was compared to Sagebrush Reference Area, the reclaimed area had a higher cover; the difference was significant statistically [Table 69 (A)]. In other words, the reclaimed area's total living cover was significantly higher than its revegetation success standard.

A **woody species density** comparison of the pre-SMCRA Reclaimed Sagebrush Areas *combined* and the pre-set standard of 2,000 individuals per acre indicated that the density of the former was greater than the standard [Table 69 (A)].

An **annual biomass productivity** standard was not assigned to the pre-SMCRA sites.

Reclaimed Sagebrush (post-SMCRA) vs. Reference Area

In a comparison of the **total living cover** of the post-SMCRA Reclaimed Sagebrush Areas *combined* and the reclaimed areas, again the reclaimed areas value was greater and was statistically significant [Table 69 (B)].

A **woody species density** comparison of the post-SMCRA Reclaimed Sagebrush Areas *combined* and the pre-set standard of 2,000 indicated that the density of the reclaimed areas was greater [Table 69 (B)].

When the **annual biomass productivity** of post-SMCRA Reclaimed Sagebrush Areas *combined* was compared statistically with the Sagebrush Reference Area, the difference was statistically significant – the reclaimed areas had more production [Table 69 (B)].

Reclaimed Mountain Grasslands (pre-SMCRA) vs. Reference Area

In 2012, when the **total living cover** of the pre-SMCRA Reclaimed Mountain Grassland Areas *combined* was compared to Mountain Grassland Reference Area, the reclaimed areas had a statistical greater value [Table 70 (A)].

A **woody species density** comparison of the pre-SMCRA Reclaimed Mountain Grassland Areas *combined* and the pre-set standard of 2,000 indicated that the density of the former was greater than the standard [Table 70 (A)].

An **annual biomass productivity** standard was not given to the pre-SMCRA sites.

Reclaimed Mountain Grasslands (post-SMCRA) vs. Reference Area

In a comparison of the **total living cover** of the post-SMCRA Reclaimed Mountain Grassland Areas *combined*, the reclaimed areas had significantly more cover in 2012 [Table 70 (B)].

In a **woody species density** comparison between the post-SMCRA Reclaimed Mountain Grassland Areas *combined* and the pre-set standard of 2,000 individuals per acre, the reclaimed areas had about 16 percent more plants [Table 70 (B)].

When the **annual biomass productivity** of post-SMCRA Reclaimed Mountain Grassland Areas *combined* was compared statistically with the Mountain Grassland Reference Area, the difference was statistically significant – the reclaimed areas had much more annual biomass production [Table 70 (B)].

Reclaimed Saltbush (post-SMCRA)vs. Reference Area

There were no pre-SMCRA sites in the Reclaimed Saltbush Areas, but a comparison of the **total living cover** of the reclaimed post-SMCRA Saltbush Areas revealed this value to be slightly more than double that of the Saltbush Reference Area [Table 71 (A)].

A **woody species density** comparison of the post-SMCRA Reclaimed Saltbush Areas and the pre-set standard of 2,000 indicated that the density of the reclaimed areas was much greater than the standard [Table 71 (A)].

When the **annual biomass productivity** of post-SMCRA Reclaimed Saltbush Areas was compared statistically with the Saltbush Reference Area, the difference was statistically significant – the reclaimed areas had more annual biomass production here too [Table 71].

SUMMARY & CONCLUSIONS

Subsequent to the long history of mining in the area, the surface disturbances at the Star Point Mine site have been reclaimed and revegetated according to the specifications provided in the Mining & Reclamation Plan. Quantitative vegetation sampling has been conducted at the site to monitor revegetation success. Additionally, specific standards for revegetation success were determined prior to the reclamation activities. This report provides the findings of the more intensive vegetation sampling required for two consecutive years at the end of the *Responsibility Period.* The 2012 data presented herein, along with that previously reported for 2011, can be used to determine whether or not the mine site has met revegetation success standards and may warrant *Phase III* or *Final Bond Release*.

At the Star Point Mine, there are three vegetation types that were restored including Sagebrush, Mountain Grasslands and Saltbush Areas. Accordingly, there were also three reference areas of similar vegetation types that were chosen earlier to be used for revegetation success standards.

As a means to compare data for specific sites within each reclaimed area, datasets were first *separated* and summarized into smaller reclaimed sites. Later, the data were *lumped* (combined) into larger datasets making them more amenable to be used for comparisons with the reference areas for bond release considerations.

Statistical analyses, as well has other comparisons, suggest that reclaimed plant communities at the Star Point Mine site have met or exceeded the revegetation success standards and warrant consideration for Phase III Bond Release.

To conclude, although the complete datasets for 2011 were previously reported and have not been included in this report, the following information summarizes these results and compares them with the 2012 results. The complete datasets reported for both sample years illustrate the condition of the revegetated land at the Star Point Mine site, <u>but the concise graphical summaries of the most relevant parameters for final bond release,</u> are shown below.

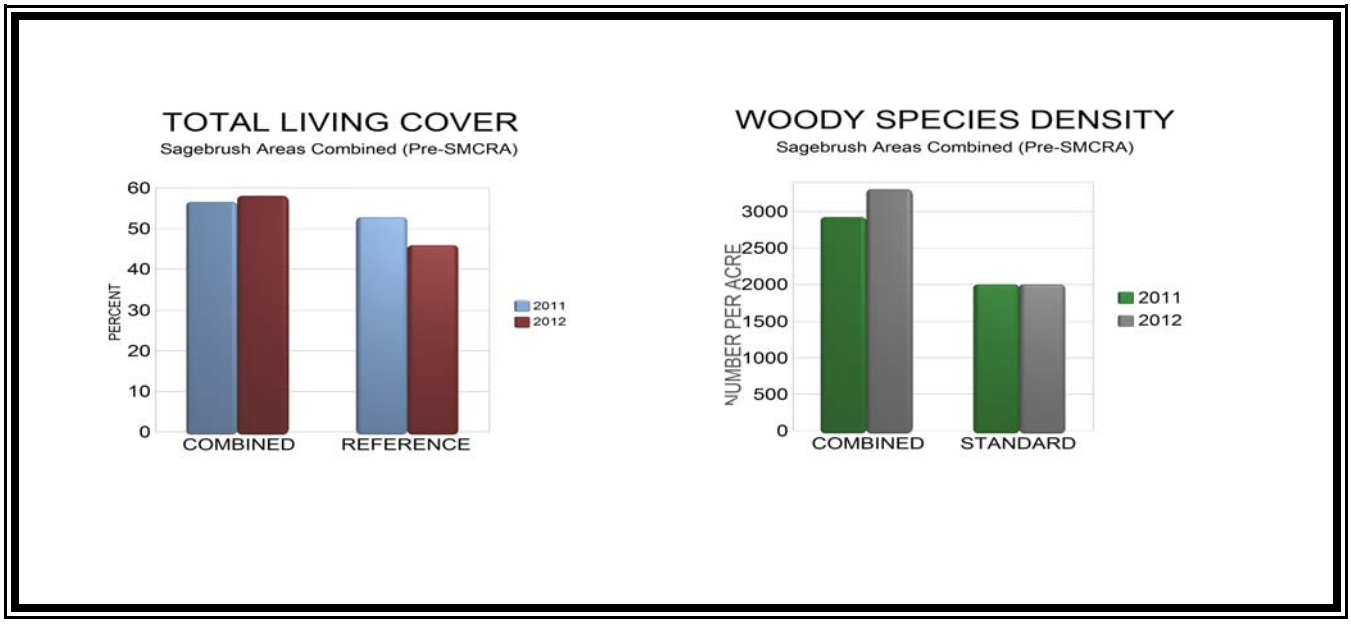

Fig. 16: Summary Information for the Pre-SMCRA Reclaimed Sagebrush and Reference Areas (2011 & 2012)

Fig. 17: Summary Information for the Post-SMCRA Reclaimed Sagebrush and Reference Areas (2011 & 2012)

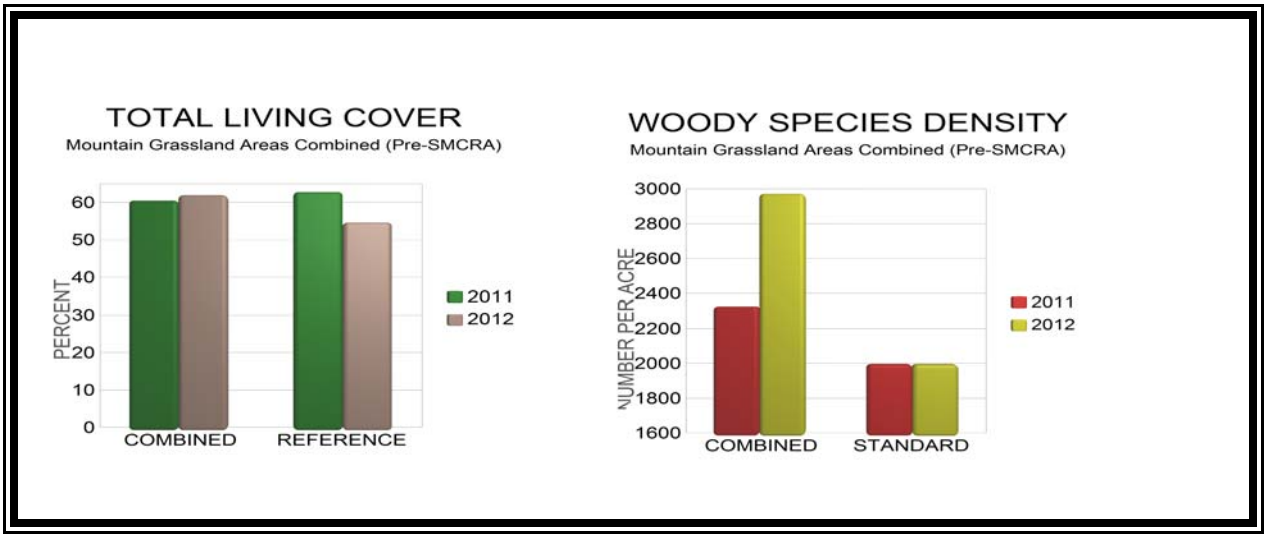

Fig. 18: Summary Information for the Pre-SMCRA Reclaimed Mtn. Grasslands and Reference Areas (2011 & 2012)

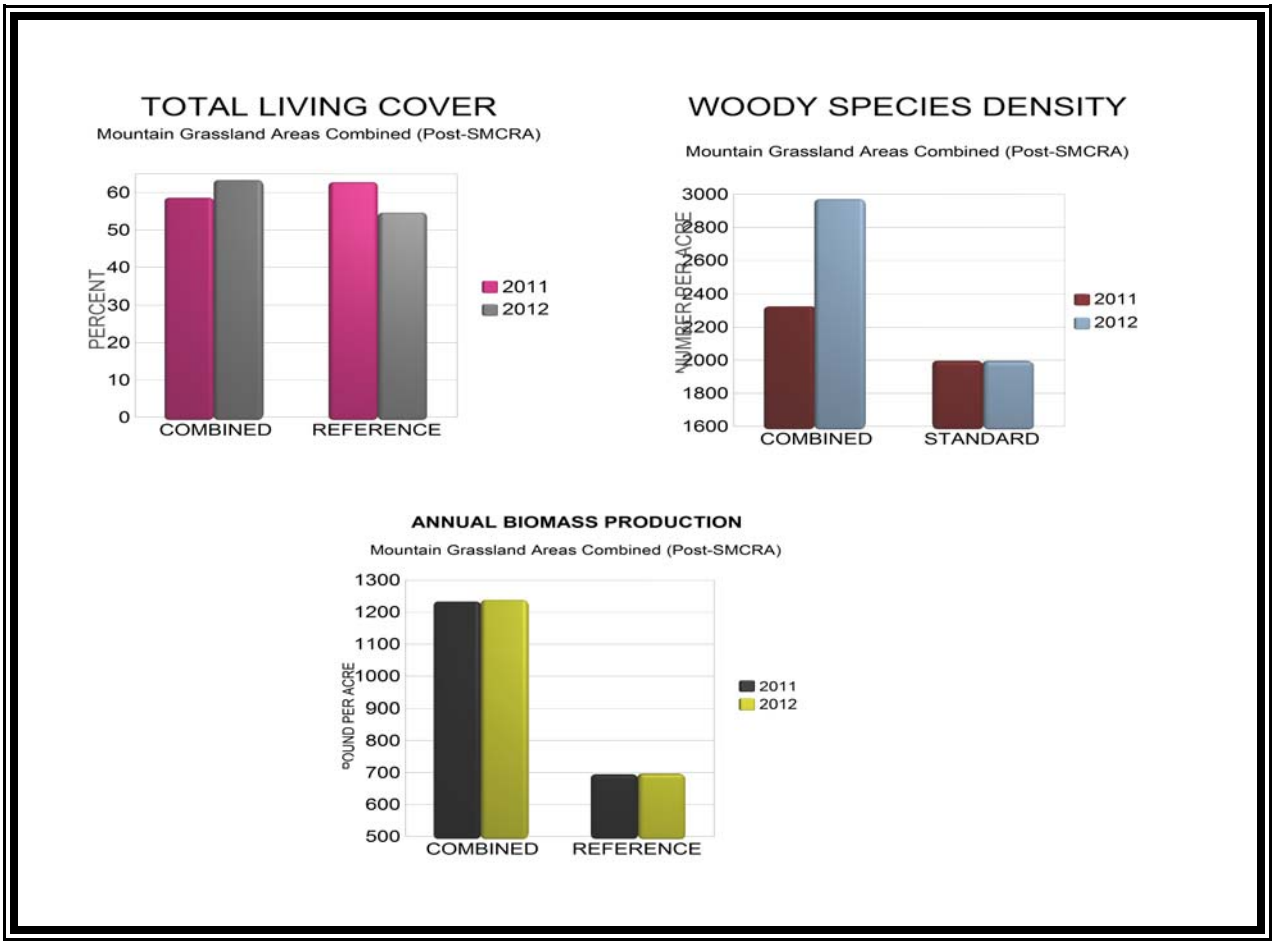

Fig. 19: Summary Information for the Post-SMCRA Reclaimed Mtn. Grasslands and Reference Areas (2011 & 2012)

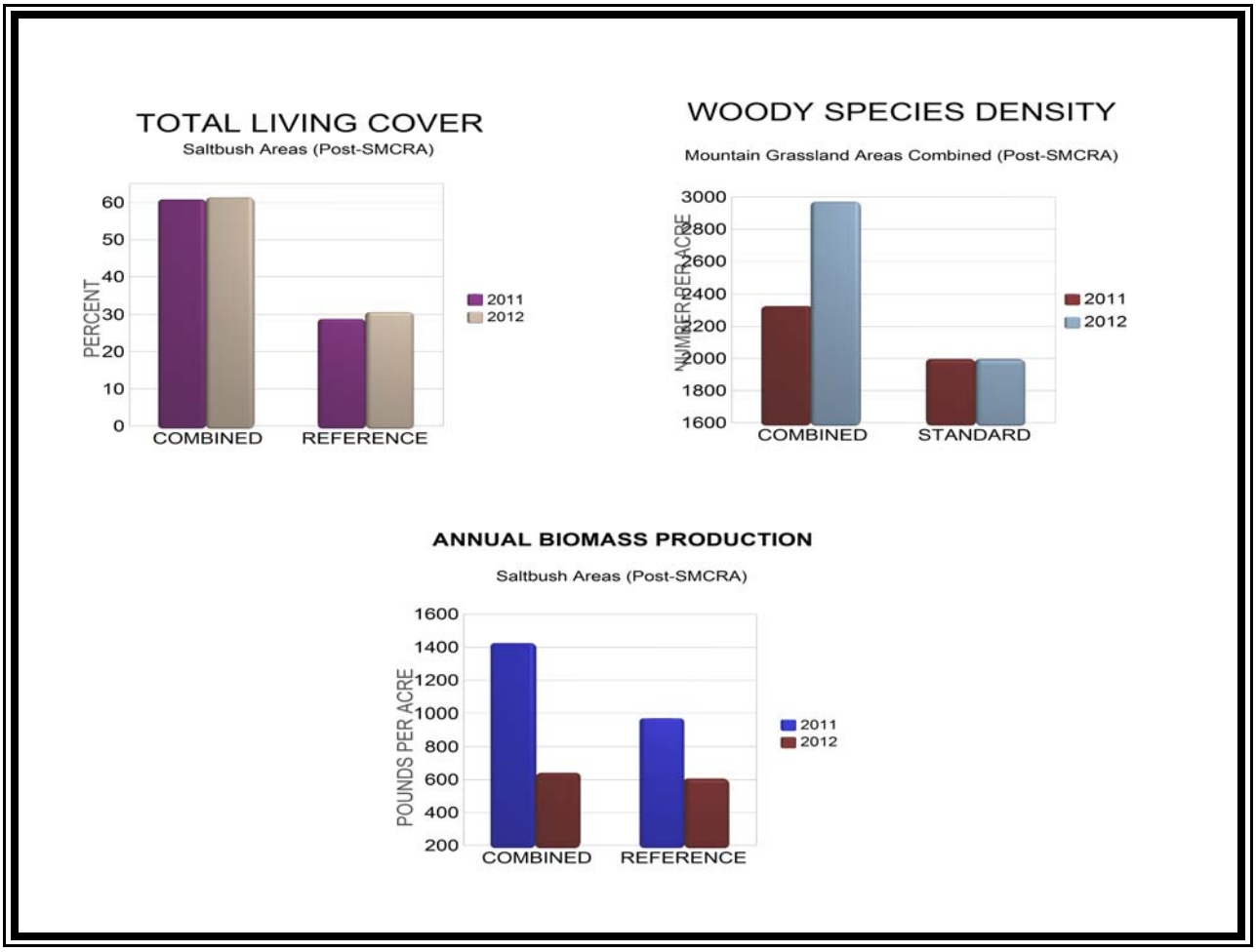

Fig. 20: Summary Information for the Post-SMCRA Reclaimed Saltbush and Reference Areas (2011 & 2012)

DATA SUMMARY TABLES

Table 4: Star Point Mine. **Living Cover and Frequency by Plant Species (2012).**

Reclaimed Sagebrush Area A			n=60
	Mean Percent	**Standard Deviation**	**Percent Frequency**
TREES & SHRUBS			
Acer glabrum	0.17	0.90	3.33
Artemisia tridentata	0.92	3.93	6.67
Atriplex canescens	2.92	11.08	8.33
Atriplex confertifolia	4.17	11.59	15.00
Ceratoides lanata	2.25	7.15	13.33
Cercocarpus ledifolius	0.83	5.26	3.33
Cercocarpus montanus	0.42	3.20	1.67
Chrysothamnus nauseosus	9.55	13.70	46.67
Symphoricarpos oreophilus	1.17	4.60	6.67
FORBS			
Artemisia dracunculus	1.28	4.66	8.33
Aster chilensis	0.83	5.18	5.00
Grindelia squarrosa	0.42	1.89	5.00
Hedysarum boreale	0.75	3.39	5.00
Linum lewisii	1.60	3.93	18.33
Machaeranthera canescens	0.08	0.64	1.67
Melilotus officinalis	1.92	6.53	11.67
Penstemon palmeri	3.52	5.33	45.00
GRASSES			
Agropyron cristatum	2.67	6.36	16.67
Bromus carinatus	0.17	1.28	1.67
Elymus cinereus	1.33	7.68	3.33
Elymus lanceolatus	7.05	12.39	33.33
Elymus salinus	3.50	11.08	11.67
Elymus spicatus	10.92	15.96	41.67
Stipa hymenoides	0.75	3.63	5.00

Table 5: Star Point Mine.
Total Cover and Composition (2012).

Reclaimed Sagebrush Area A		n=60
A. TOTAL COVER	**Mean Percent**	**Standard Deviation**
Understory	59.17	12.08
Litter	8.00	3.44
Bareground	11.00	8.79
Rock	21.83	13.10
B. % COMPOSITION		
Shrubs	36.89	27.46
Forbs	17.99	22.09
Grasses	45.12	28.40

Table 6: Star Point Mine. Woody Species Density (2012).

SPECIES	**Individuals Per Acre**
Reclaimed Sagebrush Area A	n=60
Acer glabrum	30.01
Amelanchier utahensis	45.01
Artemisia tridentata	360.11
Atriplex canescens	330.10
Atriplex confertifolia	480.15
Ceratoides lanata	240.08
Cercocarpus ledifolius	285.09
Cercocarpus montanus	45.01
Chrysothamnus nauseosus	1680.53
Gutierrezia sarothrae	15.00
Symphoricarpos oreophilus	90.03
TOTAL	**3601.13**

Table 7: Star Point Mine. Living Cover and Frequency by Plant Species (2012).

Reclaimed Sagebrush Area B			n=20
	Mean Percent	**Standard Deviation**	**Percent Frequency**
TREES & SHRUBS			
Artemisia tridentata	1.00	4.36	5.00
Atriplex canescens	4.00	12.41	10.00
Atriplex confertifolia	2.50	6.42	15.00
Ceratoides lanata	0.50	2.18	5.00
Chrysothamnus nauseosus	3.50	6.34	30.00
Eriogonum corymbosum	2.00	6.20	10.00
FORBS			
Grindelia squarrosa	0.25	1.09	5.00
Linum lewisii	2.50	5.12	20.00
Penstemon palmeri	2.00	4.30	20.00
GRASSES			
Agropyron cristatum	8.00	12.88	30.00
Elymus lanceolatus	6.25	12.93	20.00
Elymus salinus	7.25	17.64	15.00
Elymus spicatus	10.00	15.57	40.00
Stipa hymenoides	3.25	8.41	15.00

Table 8: Star Point Mine.
Total Cover and Composition (2012).

Reclaimed Sagebrush Area B		n=20
A. TOTAL COVER	**Mean Percent**	**Standard Deviation**
Understory	53.00	13.82
Litter	7.75	2.49
Bareground	30.25	13.27
Rock	9.00	5.15
B. % COMPOSITION		
Shrubs	22.50	20.69
Forbs	11.25	16.89
Grasses	66.25	20.81

Table 9: Star Point Mine . Woody Species Density (2012).

Reclaimed Sagebrush Area B	n=20
SPECIES	**Individuals Per Acre**
Amelanchier utahensis	62.38
Artemisia tridentata	93.57
Atriplex canescens	311.92
Atriplex confertifolia	467.87
Ceratoides lanata	187.15
Cercocarpus ledifolius	31.19
Chrysothamnus nauseosus	998.13
Eriogonum corymbosum	280.72
Pinus edulis	31.19
Symphoricarpos oreophilus	31.19
TOTAL	**2495.33**

Table 10: Star Point Mine. Living Cover and Frequency by Plant Species (2012).

Reclaimed Sagebrush Area C			n=30
	Mean Percent	**Standard Deviation**	**Percent Frequency**
TREES & SHRUBS			
Amelanchier utahensis	1.00	5.39	3.33
Artemisia tridentata	1.00	5.39	3.33
Atriplex canescens	2.83	9.37	10.00
Atriplex confertifolia	1.17	4.78	6.67
Ceratoides lanata	3.50	9.14	16.67
Chrysothamnus nauseosus	11.83	17.25	40.00
FORBS			
Artemisia dracunculus	1.00	3.27	10.00
Aster chilensis	1.67	8.10	6.67
Grindelia squarrosa	0.33	1.80	3.33
Hedysarum boreale	0.33	1.80	3.33
Linum lewisii	1.00	2.71	13.33
Penstemon palmeri	0.17	0.90	3.33
Viguiera multiflora	0.50	1.98	6.67
GRASSES			
Agropyron cristatum	11.83	15.99	50.00
Bromus carinatus	0.50	2.69	3.33
Elymus lanceolatus	4.67	9.83	20.00
Elymus spicatus	21.17	21.63	66.67
Stipa hymenoides	2.00	7.59	6.67

Table 11: Star Point Mine. Total Cover and Composition (2012).

Reclaimed Sagebrush Area C		n=30
A. TOTAL COVER	**Mean Percent**	**Standard Deviation**
Understory	66.50	3.91
Litter	8.17	3.53
Bareground	14.80	6.12
Rock	10.53	4.99
B. % COMPOSITION		
Shrubs	32.38	27.55
Forbs	7.33	16.60
Grasses	60.29	26.21

Table 12: Star Point Mine . Woody Species Density (2012).

Reclaimed Sagebrush Area C	n=30
SPECIES	**Individuals Per Acre**
Amelanchier utahensis	46.20
Artemisia tridentata	184.78
Atriplex canescens	415.77
Atriplex confertifolia	207.88
Ceratoides lanata	947.02
Chrysothamnus nauseosus	923.92
Eriogonum corymbosum	23.10
Gutierrezia sarothrae	23.10
TOTAL	**2771.77**

Table 13: Star Point Mine . Annual Biomass Production (2012).

Reclaimed Sagebrush Area C

(n=30; double sampling n=120)

	Pounds/Acre	
LIFEFORM	**MEAN**	**STD. DEV.**
Herbaceous	606.10	474.12
Woody	786.57	675.15
TOTAL	**1392.67**	439.77

Table 14: Star Point Mine. Living Cover and Frequency by Plant Species (2012).

Reclaimed Mountain Grassland Area E			n=100
	Mean Percent	**Standard Deviation**	**Percent Frequency**
TREES & SHRUBS			
Amelanchier utahensis	0.10	0.99	1.00
Artemisia tridentata	5.50	11.54	24.00
Cercocarpus ledifolius	0.65	3.98	3.00
Chrysothamnus nauseosus	5.70	14.83	16.00
Eriogonum corymbosum	3.80	10.61	16.00
Pseudotsuga menziesii	0.30	2.22	2.00
Purshia tridentata	2.50	6.26	15.00
Symphoricarpos oreophilus	0.10	0.99	1.00
FORBS			
Achillea millefolium	1.50	5.07	10.00
Artemisia dracunculus	0.10	0.99	1.00
Aster chilensis	5.40	12.92	19.00
Grindelia squarrosa	0.55	2.22	6.00
Linum lewisii	2.55	5.63	23.00
Machaeranthera grindelioides	0.35	1.46	5.00
GRASSES			
Agropyron cristatum	0.65	3.37	4.00
Bromus carinatus	3.20	8.47	19.00
Elymus cinereus	13.90	20.09	50.00
Elymus junceus	0.40	2.89	2.00
Elymus lanceolatus	7.20	13.39	32.00
Elymus salinus	1.55	6.88	6.00
Elymus spicatus	6.80	13.59	30.00
Poa pratensis	1.05	5.93	4.00
Stipa hymenoides	0.40	2.71	3.00

Table 15: Star Point Mine.
Total Cover and Composition (2012).

Reclaimed Mountain Grassland Area E		n=100
A. TOTAL COVER	**Mean Percent**	**Standard Deviation**
Understory	64.25	10.11
Litter	7.35	3.04
Bareground	10.45	6.86
Rock	17.95	10.20
B. % COMPOSITION		
Trees/Shrubs	29.68	27.49
Forbs	16.10	21.64
Grasses	54.22	29.46

Table 16: Star Point Mine . Woody Species Density (2012).

Reclaimed Mountain Grassland Area E	n=100
SPECIES	**Individuals Per Acre**
Acer glabrum	7.97
Amelanchier utahensis	63.74
Artemisia tridentata	1051.69
Cercocarpus ledifolius	63.74
Chrysothamnus nauseosus	733.00
Chrysothamnus viscidiflorus	7.97
Ephedra viridis	23.90
Eriogonum corymbosum	509.91
Gutierrezia sarothrae	31.87
Populus tremuloides	15.93
Purshia tridentata	565.68
Pseudotsuga menziesii	79.67
Symphoricarpos oreophilus	31.87
TOTAL	**3186.94**

Table 17: Star Point Mine. Living Cover and Frequency by Plant Species (2012).

Reclaimed Mountain Grassland Area F			n=40
	Mean Percent	**Standard Deviation**	**Percent Frequency**
TREES & SHRUBS			
Artemisia tridentata	2.38	7.33	12.50
Cercocarpus ledifolius	1.25	5.89	5.00
Chrysothamnus nauseosus	11.13	20.99	25.00
Purshia tridentata	2.63	5.12	22.50
Symphoricarpos oreophilus	0.25	1.56	2.50
FORBS			
Achillea millefolium	1.00	4.21	7.50
Aster chilensis	4.00	7.60	27.50
Grindelia squarrosa	0.50	2.18	5.00
Hedysarum boreale	4.50	10.17	20.00
Linum lewisii	1.38	3.53	15.00
Medicago sativa	1.13	5.64	5.00
Melilotus officinalis	17.38	14.01	77.50
Penstemon palmeri	0.75	2.63	7.50
GRASSES			
Bromus carinatus	2.25	9.87	7.50
Dactylis glomeratus	1.25	5.89	5.00
Elymus cinereus	10.75	13.58	50.00
Elymus lanceolatus	1.38	5.81	7.50
Elymus spicatus	2.75	8.29	12.50

Table 18: Star Point Mine. Total Cover and Composition (2012).

Reclaimed Mountain Grassland Area F		n=40
A. TOTAL COVER	**Mean Percent**	**Standard Deviation**
Understory	66.63	6.16
Litter	7.13	2.71
Bareground	14.00	5.15
Rock	12.25	5.24
B. % COMPOSITION		
Shrubs	26.67	31.87
Forbs	45.81	25.31
Grasses	27.53	24.07

Table 19: Star Point Mine . Woody Species Density (2012).

Reclaimed Mountain Grassland Area F	n=40
SPECIES	**Individuals Per Acre**
Acer glabrum	27.83
Artemisia tridentata	834.78
Cercocarpus ledifolius	92.75
Cercocarpus montanus	9.28
Chrysothamnus nauseosus	1205.80
Eriogonum corymbosum	9.28
Pseudotsuga menziesii	55.65
Purshia tridentata	677.10
Symphoricarpos oreophilus	55.65
TOTAL	**2968.12**

Table 20: Star Point Mine . Annual Biomass Production (2012).

Reclaimed Mountain Grassland
Area F

(n=40)

	Pounds/Acre	
LIFEFORM	**MEAN**	**STD. DEV.**
Herbaceous	758.56	534.08
Woody	385.37	566.04
TOTAL	**1143.93**	372.75

Table 21: Star Point Mine. Living Cover and Frequency by Plant Species (2012).

Reclaimed Mountain Grassland Area G (Pre-SMCRA)			n=20
	Mean Percent	**Standard Deviation**	**Percent Frequency**
TREES & SHRUBS			
Artemisia tridentata	13.75	15.80	60.00
Cercocarpus ledifolius	5.50	13.31	15.00
Machaeranthera canescens	0.25	1.09	5.00
Pseudotsuga menziesii	1.25	5.45	5.00
Purshia tridentata	1.25	3.11	15.00
Symphoricarpos oreophilus	0.75	2.38	10.00
FORBS			
Aster chilensis	6.50	9.50	45.00
Astragalus cicer	0.25	1.09	5.00
Linum lewisii	2.75	6.80	25.00
Penstemon palmeri	0.50	1.50	10.00
GRASSES			
Elymus cinereus	22.25	16.77	80.00
Elymus spicatus	7.00	7.97	50.00

Table 22: Star Point Mine.
Total Cover and Composition (2012).

Reclaimed Mountain Grassland Area G (Pre-SMCRA)		n=20
A. TOTAL COVER	**Mean Percent**	**Standard Deviation**
Understory	62.00	10.54
Litter	10.00	3.16
Bareground	12.00	6.40
Rock	16.00	7.84
B. % COMPOSITION		
Trees/Shrubs	36.76	23.76
Forbs	17.14	20.70
Grasses	46.09	26.89

Table 23: Star Point Mine . Woody Species Density (2012).

Reclaimed Mountain Grassland Area G (Pre-SMCRA)	n=20
SPECIES	**Individuals Per Acre**
Artemisia tridentata	1647.49
Cercocarpus ledifolius	247.12
Chrysothamnus nauseosus	164.75
Eriogonum corymbosum	41.19
Pseudotsuga menziesii	205.94
Purshia tridentata	453.06
Symphoricarpos oreophilus	494.25
TOTAL	**3294.99**

Table 24: Star Point Mine. Living Cover and Frequency by Plant Species (2012).

Reclaimed Mountain Grassland Area G (Post SMCRA)			n=30
	Mean Percent	Standard Deviation	Percent Frequency
TREES & SHRUBS			
Amelanchier utahensis	0.50	2.69	3.33
Artemisia tridentata	3.07	12.77	10.00
Cercocarpus ledifolius	1.17	4.78	6.67
Cercocarpus montanus	0.27	1.44	3.33
Chrysothamnus nauseosus	3.17	10.12	13.33
Purshia tridentata	0.67	2.49	6.67
Symphoricarpos oreophilus	0.33	1.25	6.67
FORBS			
Aster chilensis	5.00	11.25	20.00
Astragalus cicer	2.50	6.68	13.33
Linum lewisii	6.17	6.01	60.00
Penstemon palmeri	4.17	5.18	46.67
GRASSES			
Elymus cinereus	26.33	17.60	86.67
Elymus spicatus	5.67	8.73	36.67

Table 25: Star Point Mine.
Total Cover and Composition (2012).

Reclaimed Mountain Grassland Area G (Post SMCRA)		n=30
A. TOTAL COVER	Mean Percent	Standard Deviation
Understory	59.00	11.79
Litter	8.33	2.36
Bareground	12.33	5.73
Rock	20.33	7.63
B. % COMPOSITION		
Shrubs	15.26	26.83
Forbs	30.51	21.12
Grasses	54.23	28.31

Table 26: Star Point Mine . Woody Species Density (2012).

Reclaimed Mountain Grassland Area G (Post SMCRA)	n=30
SPECIES	**Individuals Per Acre**
Amelanchier utahensis	29.08
Artemisia tridentata	261.76
Cercocarpus ledifolius	276.30
Cercocarpus montanus	43.63
Chrysothamnus nauseosus	465.34
Eriogonum corymbosum	14.54
Purshia tridentata	508.97
TOTAL	**1745.04**

Table 27: Star Point Mine . Annual Biomass Production (2012).

Reclaimed Mountain Grassland
Area G (Post SMCRA)

(n=30)

	Pounds/Acre	
LIFEFORM	**MEAN**	**STD. DEV.**
Herbaceous	1349.74	684.67
Woody	286.58	715.12
TOTAL	**1636.32**	914.49

Table 28: Star Point Mine. Living Cover and Frequency by Plant Species (2012).

Reclaimed Sagebrush Area H			n=30
	Mean Percent	**Standard Deviation**	**Percent Frequency**
TREES & SHRUBS			
Atriplex canescens	6.33	13.10	23.33
Ceratoides lanata	3.17	8.90	16.67
Chrysothamnus nauseosus	17.50	19.57	53.33
FORBS			
Bassia scoparia	1.83	5.24	13.33
Medicago sativa	0.33	1.80	3.33
Penstemon palmeri	0.17	0.90	3.33
GRASSES			
Agropyron cristatum	19.17	18.53	63.33
Bromus tectorum	0.50	2.69	3.33
Elymus lanceolatus	3.50	8.58	16.67
Elymus spicatus	8.83	12.89	43.33
Stipa comata	0.50	2.69	3.33

Table 29: Star Point Mine. Total Cover and Composition (2012).

Reclaimed Sagebrush Area H		n=30
A. TOTAL COVER	**Mean Percent**	**Standard Deviation**
Understory	61.83	7.69
Litter	12.33	5.73
Bareground	17.33	7.93
Rock	8.50	5.94
B. % COMPOSITION		
Shrubs	42.96	26.86
Forbs	4.38	10.32
Grasses	52.66	30.04

Table 30: Star Point Mine . Woody Species Density (2012).

Reclaimed Sagebrush Area H	n=30
SPECIES	**Individuals Per Acre**
Artemisia tridentata	24.47
Atriplex canescens	440.51
Atriplex confertifolia	195.28
Ceratoides lanata	1443.89
Chrysothamnus nauseosus	1443.89
TOTAL	**2936.74**

Table 31: Star Point Mine . Annual Biomass Production (2012).

Reclaimed Sagebrush Area H

(n=30)

	Pounds/Acre	
LIFEFORM	**MEAN**	**STD. DEV.**
Herbaceous	433.50	370.61
Woody	830.17	590.31
TOTAL	**1263.66**	486.94

Table 32: Star Point Mine. Living Cover and Frequency by Plant Species (2012).

Reclaimed Saltbush Area I			n=50
	Mean Percent	Standard Deviation	Percent Frequency
TREES & SHRUBS			
Reclaimed Saltbush			
Amelanchier utahensis	0.90	6.30	2.00
Artemisia nova	1.20	4.96	8.00
Artemisia tridentata	0.10	0.70	2.00
Atriplex canescens	1.70	7.46	8.00
Atriplex confertifolia	7.40	11.06	38.00
Atriplex corrugata	0.80	2.89	8.00
Atriplex gardneri	0.30	2.10	2.00
Ceratoides lanata	0.50	2.50	4.00
Chrysothamnus nauseosus	3.70	6.77	34.00
Eriogonum corymbosum	0.70	3.16	6.00
FORBS			
Aster chilensis	0.40	2.80	2.00
Grindelia squarrosa	0.20	1.40	2.00
Linum lewisii	0.30	1.55	4.00
GRASSES			
Agropyron cristatum	2.00	5.74	12.00
Elymus junceus	0.70	4.90	2.00
Elymus lanceolatus	6.60	13.69	24.00
Elymus salinus	5.70	14.97	16.00
Elymus smithii	11.80	16.58	44.00
Elymus spicatus	14.30	17.46	50.00
Stipa hymenoides	1.60	5.87	8.00

Table 33: Star Point Mine. Living Cover and Frequency by Plant Species (2012).

Reclaimed Saltbush Area I		n=50
A. TOTAL COVER	Mean Percent	Standard Deviation
Understory	60.90	10.43
Litter	9.16	2.08
Bareground	20.40	8.77
Rock	9.54	4.53
B. % COMPOSITION		
Shrubs	28.00	19.32
Forbs	1.36	5.08
Grasses	70.64	19.62

Table 34: Star Point Mine. Woody Species Density (2012).

Reclaimed Saltbush Area I	n=50
SPECIES	**Individuals Per Acre**
Amelanchier utahensis	22.93
Artemisia nova	366.94
Artemisia tridentata	22.93
Atriplex canescens	229.34
Atriplex confertifolia	1903.50
Atriplex corrugata	321.07
Atriplex gardneri	114.67
Ceratoides lanata	114.67
Chrysothamnus nauseosus	986.15
Eriogonum corymbosum	504.54
TOTAL	4586.74

Table 35: Star Point Mine . Annual Biomass Production (2012).

Reclaimed Saltbush Area I

(n=50)

	Pounds/Acre	
LIFEFORM	**MEAN**	**STD. DEV.**
Herbaceous	688.77	256.45
Woody	284.96	355.25
TOTAL	**973.74**	330.71

Table 36: Star Point Mine. Living Cover and Frequency by Plant Species (2012).

Reclaimed Mountain Grassland Mudwater Canyon Area			n=30
	Mean Percent	**Standard Deviation**	**Percent Frequency**
TREES & SHRUBS			
Pseudotsuga menziesii	0.17	0.90	3.33
Rosa woodsii	0.67	3.59	3.33
Rubus idaeus	0.23	1.26	3.33
FORBS			
Achillea millefolium	0.17	0.90	3.33
Aster glaucodes	2.10	6.39	13.33
Cynoglossum officinale	0.47	1.31	13.33
Fragaria vesca	0.07	0.36	3.33
Geranium viscosissimum	10.93	8.88	80.00
Viguiera multiflora	0.40	1.52	6.67
GRASSES			
Bromus carinatus	11.37	17.97	46.67
Elymus lanceolatus	7.10	13.45	36.67
Elymus smithii	17.33	13.32	80.00
Festuca ovina	0.17	0.90	3.33
Phleum pratense	0.33	1.80	3.33
Poa pratensis	0.33	1.80	3.33

Table 37: Star Point Mine. Living Cover and Frequency by Plant Species (2012).

Reclaimed Mountain Grassland Mudwater Canyon Area		n=30
A. TOTAL COVER	**Mean Percent**	**Standard Deviation**
Understory	51.83	15.78
Litter	7.17	3.08
Bareground	14.33	7.93
Rock	26.67	13.31
B. % COMPOSITION		
Trees/Shrubs	2.15	6.78
Forbs	28.20	18.93
Grasses	69.65	18.02

Table 38: Star Point Mine . Woody Species Density (2012).

Reclaimed Mountain Grassland Mudwater Canyon Area	n=21
SPECIES	**Individuals Per Acre**
Acer glabrum	215.67
Juniperus communis	16.59
Lonicera involucrata	49.77
Populus tremuloides	82.95
Pseudotsuga menziesii	49.77
Ribes aureum	116.13
Ribes viscosissimum	116.13
Rosa woodsii	580.65
Rubus idaeus	1675.59
Symphoricarpos oreophilus	232.26
TOTAL	**3135.51**
sd	3815.89

Table 39: Star Point Mine. Living Cover and Frequency by Plant Species (2012).

Reclaimed Grassland Corner Canyon Area			n=10
	Mean Percent	**Standard Deviation**	**Percent Frequency**
TREES & SHRUBS			
Symphoricarpos oreophilus	4.00	8.31	20.00
FORBS			
Cirsium sp.	0.90	1.58	30.00
Cynoglossum officinale	0.20	0.60	10.00
Geranium viscosissimum	6.10	7.29	6.00
Viguiera multiflora	0.20	0.60	10.00
GRASSES			
Elymus lanceolatus	4.80	6.58	40.00
Elymus smithii	37.80	10.27	100.00
Phleum pratense	5.50	9.60	30.00

Table 40: Star Point Mine. Living Cover and Frequency by Plant Species (2012).

Reclaimed Grassland Corner Canyon Area		n=10
A. TOTAL COVER	**Mean Percent**	**Standard Deviation**
Understory	59.50	10.59
Litter	9.00	3.00
Bareground	10.00	3.87
Rock	21.50	7.09
B. % COMPOSITION		
Shrubs	5.48	11.27
Forbs	12.12	11.44
Grasses	82.40	15.19

Table 41: Star Point Mine . Woody Species Density (2012).

Reclaimed Grassland Corner Canyon Area Area	n=10
SPECIES	**Individuals Per Acre**
Chrysothamnus nauseosus	90.53
Lonicera involucrata	120.71
Pseudotsuga menziesii	30.18
Rosa woodsii	30.18
Symphoricarpos oreophilus	935.47
TOTAL	**1207.06**

Table 42: Star Point Mine . Annual Biomass Production (2012).

Reclaimed Grassland
Corner Canyon Area

(n=10)

	Pounds/Acre	
LIFEFORM	**MEAN**	**STD. DEV.**
Herbaceous	296.34	151.71
Woody	79.24	204.53
TOTAL	**375.58**	191.06

Table 43: Star Point Mine. Living Cover and Frequency by Plant Species (2012).

Sagebrush Reference Area			n=50
	Mean Percent	**Standard Deviation**	**Percent Frequency**
TREES & SHRUBS			
Artemisia tridentata	18.74	13.05	86.00
Chrysothamnus nauseosus	0.20	1.40	2.00
Gutierrezia sarothrae	0.80	2.32	10.00
Pinus edulis	0.30	2.10	2.00
FORBS			
Machaeranthera canescens	0.20	1.40	2.00
GRASSES			
Agropyron cristatum	8.40	11.72	46.00
Bromus tectorum	0.40	2.20	4.00
Elymus salinus	7.00	14.63	24.00
Stipa hymenoides	9.66	11.45	52.00

Table 44: Star Point Mine. Living Cover and Frequency by Plant Species (2012).

Sagebrush Reference Area		n=50
Understory	45.70	12.65
Litter	14.20	4.54
Bareground	37.70	12.32
Rock	2.40	2.09
B. % COMPOSITION		
Shrubs	43.60	23.76
Forbs	0.50	3.50
Grasses	55.90	23.63

Table 45: Star Point Mine . Woody Species Density (2012).

Sagebrush Reference Area	n=50
SPECIES	**Individuals Per Acre**
Amelanchier utahensis	65.58
Artemisia tridentata	6229.87
Chrysothamnus nauseosus	32.79
Gutierrezia sarothrae	163.94
Pinus edulis	65.58
TOTAL	**6557.76**

Table 46: Star Point Mine . Annual Biomass Production (2012).

Sagebrush Reference Area

(n=50)

	Pounds/Acre	
LIFEFORM	**MEAN**	**STD. DEV.**
Herbaceous	504.55	309.42
Woody	330.47	302.00
TOTAL	**835.02**	335.40

Table 47: Star Point Mine. Living Cover and Frequency by Plant Species (2012).

Mountain Grassland Reference Area			n=30
TREES & SHRUBS	**Mean Percent**	**Standard Deviation**	**Percent Frequency**
Artemisia tridentata	0.33	1.80	3.33
Chrysothamnus viscidiflorus	5.83	8.95	36.67
Eriogonum corymbosum	2.33	7.27	10.00
Gutierrezia sarothrae	0.17	0.90	3.33
FORBS			
Achillea millefolium	0.67	2.13	10.00
Eriogonum sp.	0.50	1.98	6.67
Linum lewisii	0.33	1.80	3.33
Machaeranthera canescens	0.83	2.27	13.33
GRASSES			
Elymus salinus	34.67	14.54	96.67
Koeleria macrantha	3.50	5.65	30.00
Poa secunda	5.17	8.61	36.67

Table 48: Star Point Mine. Living Cover and Frequency by Plant Species (2012).

Mountain Grassland Reference Area		n=30
A. TOTAL COVER	**Mean Percent**	**Standard Deviation**
Understory	54.33	8.44
Litter	17.50	8.92
Bareground	12.17	7.15
Rock	16.00	10.28
B. % COMPOSITION		
Shrubs	15.53	17.49
Forbs	4.45	7.91
Grasses	80.01	18.05

Table 49: Star Point Mine . Woody Species Density (2012).

Mountain Grassland Reference Area	n=30
SPECIES	**Individuals Per Acre**
Artemisia tridentata	134.78
Chrysothamnus viscidiflorus	661.67
Cercocarpus montanus	24.51
Eriogonum corymbosum	563.64
Gutierrezia sarothrae	73.52
Pseudotsuga menziesii	12.25
TOTAL	**1470.37**

Table 50: Star Point Mine . Annual Biomass Production (2012).

Mountain Grassland Reference Area

(n=30)

	Pounds/Acre	
LIFEFORM	**MEAN**	**STD. DEV.**
Herbaceous	549.61	246.72
Woody	148.72	241.66
TOTAL	**698.33**	225.00

Table 51: Star Point Mine . Woody Species Density (2012).

Saltbush Reference Area			n=50
	Mean Percent	**Standard Deviation**	**Percent Frequency**
SHRUBS			
Artemisia nova	0.30	2.10	2.00
Atriplex confertifolia	2.00	7.14	8.00
Atriplex gardneri	17.80	13.57	70.00
Chrysothamnus nauseosus	0.10	0.70	2.00
FORBS			
GRASSES			
Elymus salinus	10.50	11.97	54.00

Table 52: Star Point Mine. Living Cover and Frequency by Plant Species (2012).

Saltbush Reference Area		n=50
A. TOTAL COVER	**Mean Percent**	**Standard Deviation**
Understory	30.70	5.48
Litter	8.68	5.08
Bareground	49.40	11.34
Rock	11.22	9.33
B. % COMPOSITION		
Shrubs	65.75	38.68
Forbs	0.00	0.00
Grasses	34.25	38.68

Table 53: Star Point Mine . Woody Species Density (2012).

Saltbush Reference Area	n=50
SPECIES	**Individuals Per Acre**
Artemisia nova	160.81
Atriplex confertifolia	607.50
Atriplex gardneri	2680.15
Chrysothamnus nauseosus	89.34
Ephedra viridis	17.87
Eriogonum corymbosum	17.87
TOTAL	**3573.54**

Table 54: Star Point Mine . Annual Biomass Production (2012).

Saltbush Reference Area

(n=50)

	Pounds/Acre	
LIFEFORM	**MEAN**	**STD. DEV.**
Herbaceous	155.05	206.21
Woody	454.76	375.10
TOTAL	**609.81**	251.77

COMBINED BY TIME PERIOD (PRE-SMCRA VS. POST-SMCRA)

Table 55: Star Point Mine. *Combined* Data for Total Cover (2012).

Pre-SMCRA **Reclaimed Sagebrush Areas** (Includes: Area A & Area B)		
	Mean Percent	**Standard Deviation**
TOTAL LIVING COVER	57.63	12.82
Sample size (n) = 80 SAMPLE ADEQUACY (nMIN) 80%± 0.10 = 8 samples 90%± 0.10 = 13 samples		

Table 56: Star Point Mine . *Combined* Data for Woody Species Density (2012).

Pre-SMCRA

Reclaimed Sagebrush Areas

(Includes: Area A & Area B)

Number of Individuals Per Acre	**Mean**	**Standard Deviation**
TOTAL	3282.49	1587.49
Sample size (n) = 80 SAMPLE ADEQUACY (nMIN) 80%± 0.10 = 38 samples 90%± 0.10 = 63 samples		

Table 57: Star Point Mine. *Combined* Data for Total Cover (2012).

Post-SMCRA Reclaimed Sagebrush Areas (Includes: Area C & Area H)		
	Mean Percent	**Standard Deviation**
TOTAL LIVING COVER	64.17	6.53
Sample size (n) = 60 SAMPLE ADEQUACY (nMIN) 80%± 0.10 = 2 samples 90%± 0.10 = 3 samples		

Table 58: Star Point Mine . *Combined* Data for Woody Species Density (2012).

Post-SMCRA

Reclaimed Sagebrush Areas

(Includes: Area C & Area H)

Number of Individuals Per Acre	**Mean**	**Standard Deviation**
TOTAL	2899.40	1162.26

Sample size (n) = 60
SAMPLE ADEQUACY (nMIN)
80%± 0.10 = 26 samples
90%± 0.10 = 43 samples

Table 59: Star Point Mine . *Combined* Data for Annual Biomass Production (2012).

Post-SMCRA

Reclaimed Sagebrush Areas

(Includes: Area C & Area H)

	Pounds/Acre	
LIFEFORM	**MEAN**	**STD. DEV.**
Herbaceous	519.80	434.18
Woody	808.37	634.53
TOTAL	**1328.17**	**468.42**

Sample size (n) = 60
SAMPLE ADEQUACY (nMIN)
80%± 0.10 = 20 samples
90%± 0.10 = 34 samples

Table 60: Star Point Mine. *Combined* Data for Total Cover (2012).

Pre-SMCRA **Reclaimed Mountain Grassland Areas** (Includes: **Area E**, **Area G & Mudwater Canyon**)		
	Mean Percent	**Standard Deviation**
TOTAL LIVING COVER	61.47	12.51
Sample size (n) = 150 SAMPLE ADEQUACY (nMIN) 80%± 0.10 = 7 samples 90%± 0.10 = 11 samples		

Table 61: Star Point Mine . *Combined* Data for Woody Species Density (2012).

Pre-SMCRA

Reclaimed Mountain Grassland Areas

(Includes: **Area E**, **Area G & Mudwater Canyon**)

Number of Individuals Per Acre	**Mean**	**Standard Deviation**
TOTAL	2961.71	1365.02
Sample size (n) = 141 SAMPLE ADEQUACY (nMIN) 80%± 0.10 = 35 samples 90%± 0.10 = 57 samples		

Table 62: Star Point Mine. *Combined* Data for Total Cover (2012).

Post-SMCRA Reclaimed Mountain Grassland Areas (Includes: Area F, Area G & Corner Canyon)		
	Mean Percent	**Standard Deviation**
TOTAL LIVING COVER	62.88	6.96
Sample size (n) = 80 SAMPLE ADEQUACY (nMIN) 80%± 0.10 = 4 samples 90%± 0.10 = 7samples		

Table 63: Star Point Mine . *Combined* Data for Woody Species Density (2012).

Post-SMCRA

Reclaimed Mountain Grass Land Areas

(Includes: Area F, Area G & Corner Canyon)

Number of Individuals Per Acre	**Mean**	**Standard Deviation**
TOTAL	2326.94	1296.65

Sample size (n) = 120
SAMPLE ADEQUACY (nMIN)
80%± 0.10 = 51 samples
90%± 0.10 = 84 samples

Table 64: Star Point Mine . *Combined* Data for Annual Biomass Production (2012).

Post-SMCRA

Reclaimed Mountain Grass Land Areas

(Includes: Area F, Area G & Corner Canyon)

	Pounds/Acre	
LIFEFORM	**MEAN**	**STD. DEV.**
Herbaceous	922.48	672.45
Woody	310.06	605.73
TOTAL	**1232.53**	**737.91**

Sample size (n) = 80
SAMPLE ADEQUACY (nMIN)
80%± 0.10 = 59 samples
90%± 0.10 = 97 samples

Table 65: Star Point Mine. *Combined* Data for Total Cover (2012).

Post-SMCRA **Reclaimed Saltbush Areas** (Includes: **Area I**)		
	Mean Percent	**Standard Deviation**
TOTAL LIVING COVER	60.90	10.43
Sample size (n) =50 SAMPLE ADEQUACY (nMIN) 80%± 0.10 = 6 samples 90%± 0.10 = 10 samples		

Table 66: Star Point Mine . *Combined* Data for Woody Species Density (2012).

Post-SMCRA

Reclaimed Saltbush Areas

(Includes: **Area I**)

Number of Individuals Per Acre	**Mean**	**Standard Deviation**
TOTAL	4586.74	1949.48

Sample size (n) = 50
SAMPLE ADEQUACY (nMIN)
80%± 0.10 = 30 samples
90%± 0.10 = 49 samples

Table 67: Star Point Mine . *Combined* Data for Annual Biomass Production (2012).

Post-SMCRA

Reclaimed Saltbush Areas

(Includes: Area I)

	Pounds/Acre	
LIFEFORM	**MEAN**	**STD. DEV.**
Herbaceous	688.77	256.45
Woody	284.96	355.25
TOTAL	**973.74**	**330.71**

Sample size (n) = 50
SAMPLE ADEQUACY (nMIN)
80%± 0.10 = 19 samples
90%± 0.10 = 31 samples

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Table 68: Summary of revegetation success standards for success at the Star Point Mine (source: from the Star Point Mine, Mining & Reclamation Plan).

SEEDED AREA	DISTURBANCE	COVER	DENSITY	DIVERSITY	PRODUCTION
SALTBUSH	Pre-SMCRA	(no pre-SMCRA)	(no pre-SMCRA)	(no pre-SMCRA)	(no pre-SMCRA)
	Post-SMCRA	Saltbush Reference Area	2,000 plants/ac	Saltbush Reference Area	Saltbush Reference Area
SAGEBRUSH	Pre-SMCRA	Sagebrush Reference Area	2,000 plants/ac	(no standard)	NRCS estimates
	Post-SMCRA	Sagebrush Reference Area	2,000 plants/ac	Sagebrush Reference Area	Sagebrush Reference Area
MOUNTAIN GRASSLAND	Pre-SMCRA	Mtn. Grassland Reference Area	2,000 plants/ac	(no standard)	NRCS estimates
	Post-SMCRA	Mtn. Grassland Reference Area	2,000 plants/ac	Mtn. Grassland Reference Area	Mtn. Grassland Reference Area
FOREST SERVICE	Pre-SMCRA	(no pre-SMCRA)	(no pre-SMCRA)	(no pre-SMCRA)	(no pre-SMCRA)
	Post-SMCRA	(F.S. approval)	(F.S. approval)	(F.S. approval)	(F.S. approval)

TABLE 69: Statistical summary sheet comparing the Reclaimed Sagebrush areas and Sagebrush Reference Area at the Star Point Mine site (2012).

A. SAGEBRUSH AREAS (Pre-SMCRA)			
Reclaimed Area A & Area B (Combined)			
Total Living Cover	$\bar{x}$=57.63	s=12.82	n=80
Density	$\bar{x}$=3282.49	s=1587.79	n=80
Sagebrush Reference Area			
Total Living Cover	$\bar{x}$=45.70	s=12.65	n=50
Density	$\bar{x}$=2000.00*	s=n/a	n=n/a
STATISTICAL ANALYSES			
Total Living Cover	t=5.188	df=128	SL=p<0.001
Density	t=n/a	df=n/a	SL=n/a
B. SAGEBRUSH AREAS (Post-SMCRA)			
Reclaimed Area C & Area H (Combined)			
Total Living Cover	$\bar{x}$=64.17	s=6.53	n=60
Density	$\bar{x}$=2899.40	s=1162.26	n=60
Production	$\bar{x}$=1328.17	s=468.42	n=60
Sagebrush Reference Area			
Total Living Cover	$\bar{x}$=45.70	s=12.65	n=50
Density	$\bar{x}$=2000.00*	s=n/a	n=n/a
Production	$\bar{x}$=835.02	s=335.40	n=50
STATISTICAL ANALYSES			
Total Living Cover	t=9.850	df=108	SL=p<0.001
Density	t=n/a	df=n/a	SL=n/a
Production	t=6.630	df=108	SL=p<0.001

$\bar{x}$= sample mean, s = sample standard deviation, n = sample size,
NS = non-significant, t = Student's t-value, df = degrees of freedom,
SL = significance level, p = probability level, *= pre-determined standard

TABLE 70: Statistical summary sheet comparing the Reclaimed Mountain Grass areas and Mountain Grassland Reference Area at the Star Point Mine site (2012).

A. MOUNTAIN GRASSLAND AREAS (Pre-SMCRA)

Reclaimed : Area E, Area G & Mudwater Canyon (Combined)

Total Living Cover	$\bar{x}$=61.47	s=12.51	n=150
Density	$\bar{x}$=2961.71	s=1365.02	n=141

Mountain Grassland Reference Area

Total Living Cover	$\bar{x}$=54.53	s=8.44	n=30
Density	$\bar{x}$=2000.00*	s=n/a	n=n/a

STATISTICAL ANALYSES

Total Living Cover	t=2.906	df=178	SL=p<0.005
Density	t=n/a	df=n/a	SL=n/a

B. MOUNTAIN GRASSLAND AREAS (Post-SMCRA)

Area F, Area G & Corner Canyon (Combined)

Total Living Cover	$\bar{x}$=62.88	s=6.96	n=80
Density	$\bar{x}$=2326.94	s=1296.65	n=120
Production	$\bar{x}$=1232.53	s=737.91	n=80

Mountain Grassland Reference Area

Total Living Cover	$\bar{x}$=54.53	s=8.44	n=30
Density	$\bar{x}$=2000.00*	s=n/a	n=n/a
Production	$\bar{x}$=698.33	s=225.00	n=30

STATISTICAL ANALYSES

Total Living Cover	t=5.280	df=108	SL=p<0.001
Density	t=n/a	df=n/a	SL=n/a
Production	t=3.888	df=108	SL=p<0.001

$\bar{x}$= sample mean, s = sample standard deviation, n = sample size,
NS = non-significant, t = Student's t-value, df = degrees of freedom,
SL = significance level, p = probability level, *= pre-determined standard

TABLE 71: Statistical summary sheet comparing the Reclaimed Saltbush areas and Saltbush Reference Area at the Star Point Mine site (2012).

A. SALTBUSH AREAS (Post-SMCRA)			
Area I			
Total Living Cover	$\bar{x}$=60.90	s=10.43	n=50
Density	$\bar{x}$=4586.74	s=1949.48	n=50
Production	$\bar{x}$=973.74	s=330.71	n=50
Saltbush Reference Area			
Total Living Cover	$\bar{x}$=30.70	s=5.48	n=50
Density	$\bar{x}$=2000.00*	s=n/a	n=n/a
Production	$\bar{x}$=609.81	s=251.77	n=50
STATISTICAL ANALYSES			
Total Living Cover	t=18.125	df=98	SL=p<0.001
Density	t=n/a	df=n/a	SL=n/a
Production	t=6.191	df=98	SL=p<0.001

$\bar{x}$= sample mean, s = sample standard deviation, n = sample size,
NS = non-significant, t = Student's t-value, df = degrees of freedom,
SL = significance level, p = probability level, *= pre-determined standard

COLOR PHOTOGRAPHS
OF THE
SAMPLE AREAS

Reclaimed Area A

Reclaimed Area A (continued)

Reclaimed Area B

Reclaimed Area C

Reclaimed Area E

Reclaimed Area E (continued)

Reclaimed Area F

Reclaimed Area G (Pre-SMCRA)

Reclaimed Area G (Post-SMCRA)

Reclaimed Area H

Reclaimed Area I

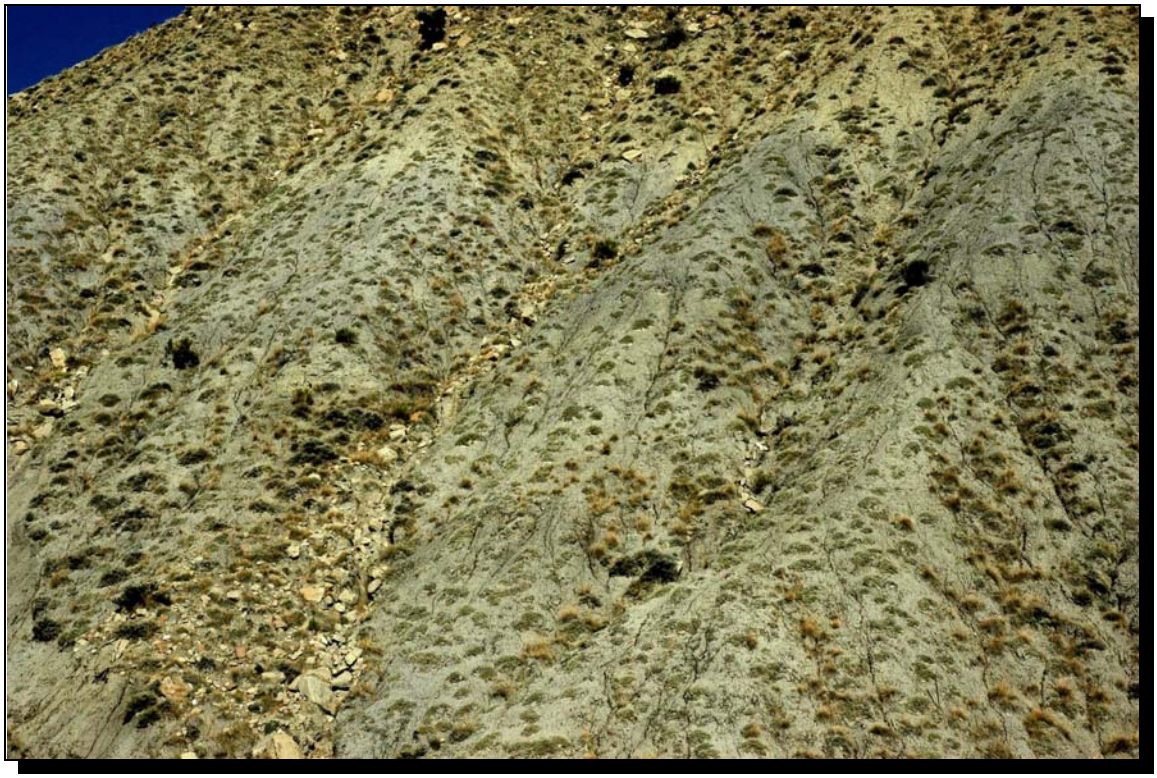
MUDWATER CANYON AREA

CORNER CANYON AREA

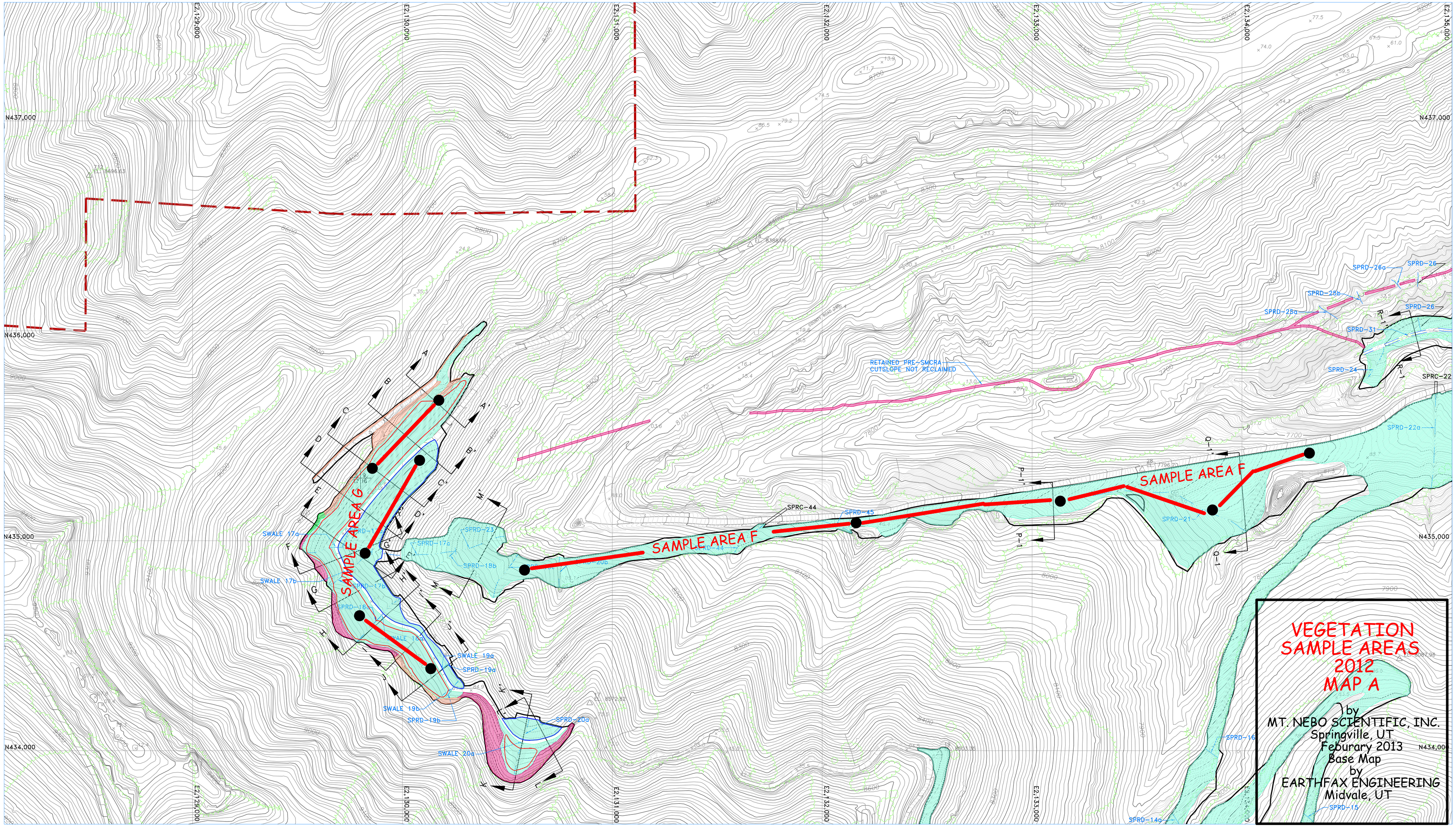
SAGEBRUSH REFERENCE AREA

MOUNTAIN GRASSLAND REFERENCE AREA

SALTBUSH REFERENCE AREA



SAMPLE AREA MAPS



LEGEND

- PRIMARY ROAD
- SECONDARY ROAD
- TRAIL
- BRIDGE, CULVERT
- RAILROAD
- BUILDINGS, STRUCTURES
- LAKE, POND
- RIVER, STREAM
- FENCE
- ASBUILT CONTOURS
- TREE LINES
- RECLAMATION DISTURBED AREA BOUNDARY
- CROSS SECTION
- PERMIT BOUNDARY
- PARTIALLY BACKFILLED PRE-SMCRA HIGHWALL
- PARTIALLY BACKFILLED PRE-SMCRA CUTSLOPE
- PARTIALLY BACKFILLED POST-SMCRA CUTSLOPE
- RECLAMATION CHANNEL
- DEEP GOUGED SURFACE (HAY AND STRAW MULCH) LAST AUGMENTED SEEDING FALL 2002
- SECTION CORNER
- AREA OF COAL REFUSE BURIAL. COAL REFUSE BURIED WITH A MIN. OF 4' OF COVER MATERIAL. (APPROX. 113,532 CY HAULED TO THE LION'S DECK)
- AREA PROVIDING COVER MATERIAL FOR COAL REFUSE PLACED ON THE LION'S DECK (APPROX. 14,700 CY WAS USED TO FILL THE STOPE HOLE AND 54,502 CY WAS USED TO COVER THE COAL REFUSE)
- Sample Transect Lines

NOTES:

1. PHASE 1 BOND RELEASE FOR 93.77 ACRES.
2. BACKFILL, GRADING AND GROWTH MEDIA/TOPSOIL PLACEMENT FOR THE MINE #1 AND MINE #2 AREAS BEGAN IN AUGUST, 2001 AND WERE COMPLETED IN DECEMBER, 2001. GROWTH MEDIA/TOPSOIL PLACEMENT OCCURRED CONCURRENTLY WITH BACKFILLING AND GRADING AS AREAS ACHIEVED FINAL GRADE.
3. BACKFILL, GRADING AND GROWTH MEDIA/TOPSOIL PLACEMENT FOR THE LION'S DECK, PONDS 1 AND 2, AND THE LOWER FACILITIES AREAS BEGAN IN APRIL, 2002 AND WERE COMPLETED IN NOVEMBER, 2002. GROWTH MEDIA/TOPSOIL PLACEMENT OCCURRED CONCURRENTLY WITH BACKFILLING AND GRADING AS AREAS ACHIEVED FINAL GRADE.
4. TOWNSHIP 15 SOUTH, RANGE 8 EAST.

NORTH

200' 100' 0 200'

REGISTERED PROFESSIONAL ENGINEER
No. 189797
LAYNE D. JENSEN
NOT VALID WITHOUT A SIGNATURE
STATE OF UTAH

RAG

FILE: G:\UC779\07\DWG\542200a-AB\ 08-08-03

REVISION/HISTORY

BY	DATE	DESCRIPTION
LDJ	05-05-02	RESPOND TO TA COMMENTS
1		
LDJ	10-10-03	AS-BUILT
2		
LDJ	02-05-04	RESPOND TO TA COMMENTS
3		
PDC	02-27-07	VEGETATION SAMPLE LOCATIONS ADDED
4		
5		
6		

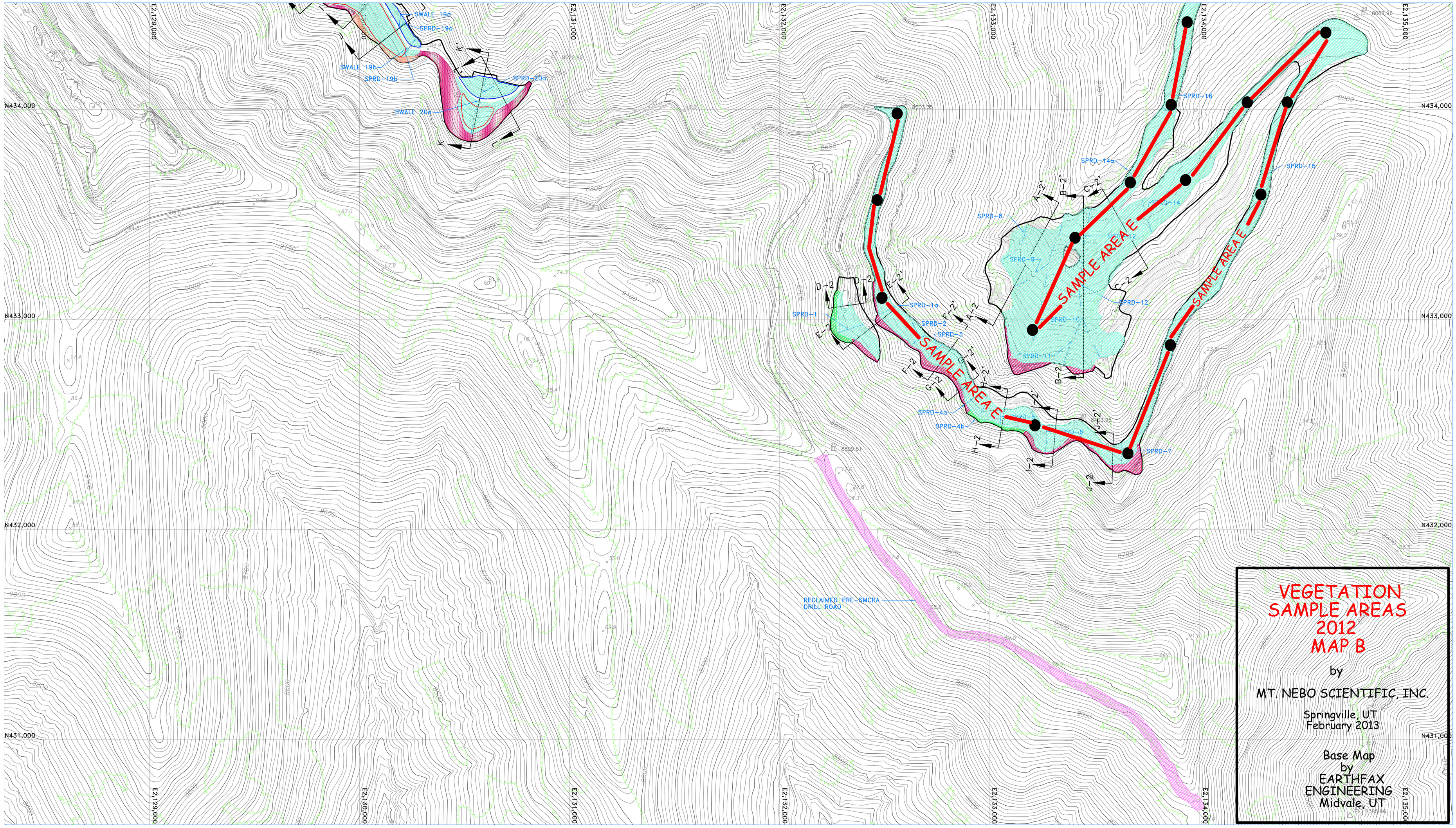
STARPOINT MINE

AS-BUILT RECLAMATION TOPOGRAPHY AND TREATMENT MAP

SHEET 1

PLATEAU MINING CORPORATION
847 NW HIGHWAY 191 HELPER, UTAH 84526
PHONE: (435) 472-0475

MAP 542.200a



VEGETATION SAMPLE AREAS 2012 MAP B

by

MT. NEBO SCIENTIFIC, INC.

Springville, UT
February 2013

Base Map
by
EARTHFAX
ENGINEERING
Midvale, UT

LEGEND

- PRIMARY ROAD
- SECONDARY ROAD
- TRAIL
- BRIDGE, CULVERT
- RAILROAD
- BUILDINGS, STRUCTURES
- LAKE, POND
- RIVER, STREAM
- FENCE
- ASBUILT CONTOURS
- TREE LINES
- RECLAMATION DISTURBED AREA BOUNDARY
- CROSS SECTION
- PERMIT BOUNDARY
- PARTIALLY BACKFILLED PRE-SMCRA HIGHWALL
- PARTIALLY BACKFILLED PRE-SMCRA CUTSLOPE
- PARTIALLY BACKFILLED POST-SMCRA CUTSLOPE
- RECLAMATION CHANNEL
- DEEP GOUGED SURFACE (HAY AND STRAW MULCH) LAST AUGMENTED SEEDING FALL 2002
- DEEP GOUGED SURFACE LAST AUGMENTED SEEDING FALL 2003
- SAMPLE TRANSECT LINES
- SECTION CORNER
- AREA OF COAL REFUSE BURIAL. COAL REFUSE BURIED WITH A MIN. OF 4' OF COVER MATERIAL. (APPROX. 113,532 CY HAULED TO THE LION'S DECK)
- AREA PROVIDING COVER MATERIAL FOR COAL REFUSE PLACED ON THE LION'S DECK (APPROX. 14,700 CY WAS USED TO FILL THE STOPE HOLE AND 54,502 CY WAS USED TO COVER THE COAL REFUSE)

NOTES:

1. PHASE 1 BOND RELEASE FOR 93.77 ACRES.
2. BACKFILL, GRADING AND GROWTH MEDIA/TOPSOIL PLACEMENT FOR THE MINE #1 AND MINE #2 AREAS BEGAN IN AUGUST, 2001 AND WERE COMPLETED IN DECEMBER, 2001. GROWTH MEDIA/TOPSOIL PLACEMENT OCCURRED CONCURRENTLY WITH BACKFILLING AND GRADING AS AREAS ACHIEVED FINAL GRADE.
3. BACKFILL, GRADING AND GROWTH MEDIA/TOPSOIL PLACEMENT FOR THE LION'S DECK, PONDS 1 AND 2, AND THE LOWER FACILITIES AREAS BEGAN IN APRIL, 2002 AND WERE COMPLETED IN NOVEMBER, 2002. GROWTH MEDIA/TOPSOIL PLACEMENT OCCURRED CONCURRENTLY WITH BACKFILLING AND GRADING AS AREAS ACHIEVED FINAL GRADE.
4. TOWNSHIP 15 SOUTH, RANGE 8 EAST.

NORTH

200' 100' 0 200'

REGISTERED PROFESSIONAL ENGINEER
No. 189797
LAYNE D. JENSEN
NOT VALID WITHOUT A SIGNATURE
STATE OF UTAH

RAG

FILE: G:\UC779\07\DWG\542200B-AB\ 08-08-03

REVISION/HISTORY

BY	DATE	DESCRIPTION
RBW	10-99	RESPOND TO TA COMMENTS
1		
LDJ	10-10-03	AS-BUILT
2		
LDJ	02-05-04	RESPOND TO TA COMMENTS
3		
PDC	03-27-07	VEGETATION SAMPLE LOCATIONS ADDED
4		
5		
6		

STARPOINT MINE

AS-BUILT RECLAMATION TOPOGRAPHY AND TREATMENT MAP

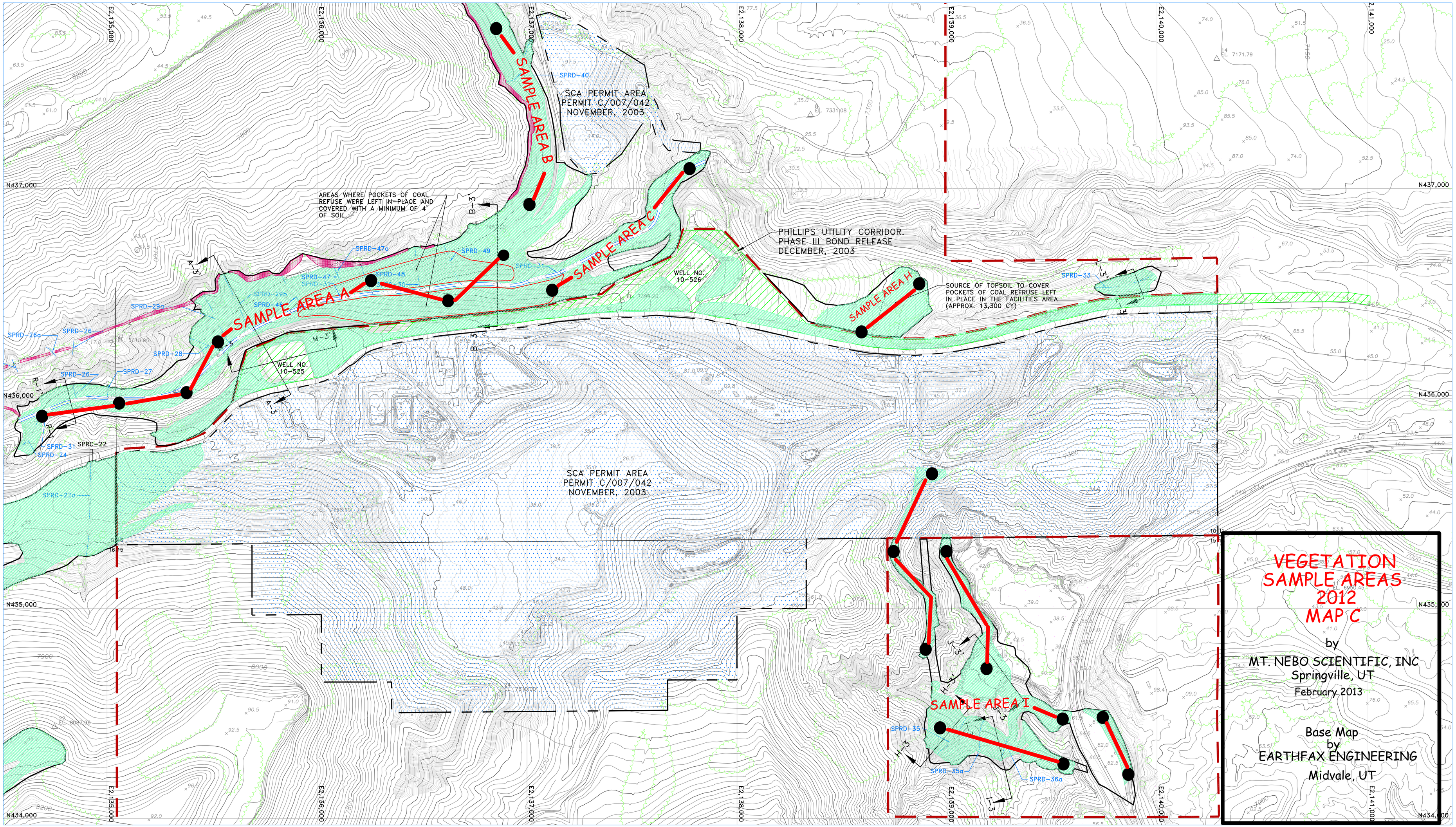
SHEET 2

PLATEAU MINING CORPORATION

847 NW HIGHWAY 191 HELPER, UTAH 84526
PHONE: (435) 472-0475

2 of 3

MAP 542.200b



LEGEND

- PRIMARY ROAD
- SECONDARY ROAD
- TRAIL
- BRIDGE, CULVERT
- RAILROAD
- BUILDINGS, STRUCTURES
- LAKE, POND
- RIVER, STREAM
- FENCE
- ASBUILT CONTOURS
- TREE LINES
- RECLAMATION DISTURBED AREA BOUNDARY
- CROSS SECTION
- PERMIT BOUNDARY
- PHILLIPS GAS WELLS AND UTILLITY CORRIDOR (11.77 ACRES POST MINING LAND USE CHANGE AND PHASE III BOND RELEASED IN DECEMBER 2003)
- SECTION CORNER
- PARTIALLY BACKFILLED PRE-SMCRA CUTSLOPE
- SCA PERMIT BOUNDARY AND PERMIT C/007/042 NOVEMBER, 2003
- RECLAMATION CHANNEL
- DEEP GOUGED SURFACE (HAY AND STRAW MULCH) LAST AUGMENTED SEEDING FALL 2002
- SAMPLE TRANSECT LINES

NOTES:

1. PHASE 1 BOND RELEASE FOR 93.77 ACRES.
2. BACKFILL, GRADING AND GROWTH MEDIA/TOPSOIL PLACEMENT FOR THE MINE #1 AND MINE #2 AREAS BEGAN IN AUGUST, 2001 AND WERE COMPLETED IN DECEMBER, 2001. GROWTH MEDIA/TOPSOIL PLACEMENT OCCURRED CONCURRENTLY WITH BACKFILLING AND GRADING AS AREAS ACHIEVED FINAL GRADE.
3. BACKFILL, GRADING AND GROWTH MEDIA/TOPSOIL PLACEMENT FOR THE LOADOUT AREA BEGAN IN SEPTEMBER, 2001 AND WERE COMPLETED IN DECEMBER, 2001. GROWTH MEDIA/TOPSOIL PLACEMENT OCCURRED CONCURRENTLY WITH BACKFILLING AND GRADING AS AREAS ACHIEVED FINAL GRADE.
4. ALL EXCESS COAL REFUSE FROM THE MAIN CHANNEL AREA, NOT USED AS BACKFILL, WAS PLACED ON THE REFUSE PILE.
5. TOWNSHIP 15 SOUTH, RANGE 8 EAST.

NORTH

200' 100' 0 200'

FILE: G:\UC779\07\DWG\542200C-AB\ 08-08-03

REGISTERED PROFESSIONAL ENGINEER
No. 189797
LAYNE D. JENSEN
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RAG

REVISION/HISTORY

BY	DATE	DESCRIPTION
LDJ	10-10-03	AS-BUILT
LDJ	02-05-04	RESPOND TO TA COMMENTS
PDC	03-27-07	VEGETATION SAMPLE LOCATIONS ADDED

STARPOINT MINE

AS-BUILT RECLAMATION TOPOGRAPHY AND TREATMENT MAP

SHEET 3

PLATEAU MINING CORPORATION
847 NW HIGHWAY 191 HELPER, UTAH 84526
PHONE: (435) 472-0475

MAP 542.200c

APPENDIX

United States Department of Agriculture

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

October 4, 2012

Patrick D. Collins, Ph.D.
Mt. Nebo Scientific, Inc.
Research & Consulting
P.O. Box 337
330 East 400 South, Suite 6
Springville, UT 84663

Dear Mr. Collins:

Following our visit on September 10, 2012 to the reclamation sites at the Star Point Mine and our visit on October 1, 2012 to the reclamation site in Mudwater Canyon, it appears that the vegetative conditions were very similar to the conditions we observed in September of 2011. The overall vegetative community appears to be well-established and vigorous. Plant productivity is good and seed production is evident. In my opinion, the vegetative community has done well, especially considering the amount of rock content in the soils and the amount of rock on the soil surface. The vegetation also appeared to be more vigorous than expected following the severe 2012 drought season. Refer to the report dated September 14, 2011 for more specific vegetative information (plant species, estimated production) at both the Star Point Mine and Mudwater Canyon reclamation sites. I have attached photographs from both the Star Point Mine and Mudwater Canyon reclamation sites which were taken on September, 10 2012 and October 1, 2012, respectively.

If you have any questions or comments, please feel free to contact me at (435) 637-0041, Ext. 120.

Sincerely,

/s/

Jeff Fenton
Rangeland Management Specialist
USDA Natural Resources Conservation Service
Price, Utah

The Natural Resources Conservation Service provides leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment.

An Equal Opportunity Provider and Employer

Star Point Mine (Site E)
Township 15 South, Range 8 East, Section 16

The Natural Resources Conservation Service provides leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment.

An Equal Opportunity Provider and Employer

The Natural Resources Conservation Service provides leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment.

An Equal Opportunity Provider and Employer

Star Point Mine (Site G)
Township 15 South, Range 8 East, Section 16

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Star Point Mine (Site A)
Township 15 South, Range 8 East, Section 10

The Natural Resources Conservation Service provides leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment.

An Equal Opportunity Provider and Employer

Star Point Mine (Site B)
Township 15 South, Range 8 East, Section 10

The Natural Resources Conservation Service provides leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment.

An Equal Opportunity Provider and Employer

Mudwater Canyon
Township 15 South, Range 8 East, Section 8

The Natural Resources Conservation Service provides leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment.

An Equal Opportunity Provider and Employer

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