

**OGMCOAL - Skyline Mine - South Fork Husbandry Practices Amendment**

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**From:** "Galecki, Gregg" <GGalecki@archcoal.com>  
**To:** "OGMCOAL@utah.gov" <OGMCOAL@utah.gov>  
**Date:** 5/14/2012 2:11 PM  
**Subject:** Skyline Mine - South Fork Husbandry Practices Amendment  
**CC:** "angelanance@utah.gov" <angelanance@utah.gov>, "daronhaddock@utah.gov" <...>

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All:

An amendment titled, 'South Fork Eccles Creek Breakout Husbandry Practices' has been uploaded to the DOGM WebDav portal under the folder titled "Amendment 05012012a".

The amendment application contains a total of three (3) files. File "SoFork\_CoverC1C2\_5-14-12.pdf" contains a cover letter, a notarized C1 form, and C2 form outlining the project. MRP chapter text modifications are in .doc (2007) format with the text modifications in redline-strikeout format for Chapter 4 Section 4.7 Revegetation Plan. A .pdf formatted report from Mt. Nebo Scientific, Inc. comprises the third file.

Let me know if you have any questions

**Gregg A. Galecki**  
Environmental Engineer  
Canyon Fuel Company, LLC  
Skyline Mine  
(435)448-2636

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**Canyon Fuel  
Company, LLC.  
Skyline Mine**

A Subsidiary of Arch Western Bituminous Group, LLC.

Gregg Galecki, Environ. Engineer  
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**May 14, 2012**

**Mr. Daron R. Haddock  
Coal Program Manager  
Division of Oil, Gas, and Mining  
1594 West North Temple  
Salt Lake City, Utah 84114-5801**

**RE: South Fork Eccles Creek Breakout Husbandry Practices, Canyon Fuel Company, LLC, Skyline Mine, C/007/005.**

**Dear Daron:**

**Attached to this letter are C1 and C2 forms outlining information submitted to acquire permission to conduct husbandry work on the South Fork of Eccles Creek Breakout area. The site has been reclaimed, and the attached report indicates the site qualifies for Phase II bond release. Skyline Mine is not requesting phased bond release at this time. The submitted information is requesting permission to conduct husbandry/maintenance work on the site. The maintenance work consists of planting additional woody species to insure Phase III bond release in the future.**

**The pertinent information is being submitted electronically to the Division WebDav website will be the following files:**

- This cover letter and C1 and C2 forms (.pdf format)**
- Chapter 4; Section 4.7 Revegetation Plan; (1) text file**
- Vegetation Sampling for Phase II Bond Release in South Fork Canyon, 2011, Mt. Nebo Scientific, Inc.**

**A total of three (3) files are being submitted.**

**If you have any questions regarding this information, please give me a call at (435) 448-2636.**

**Sincerely:**

A handwritten signature in blue ink that reads "Gregg A. Galecki".

**Gregg A. Galecki  
Canyon Fuel Company, LLC.  
Environmental Engineer – Skyline Mines**

## APPLICATION FOR COAL PERMIT PROCESSING

Permit Change  New Permit  Renewal  Exploration  Bond Release  Transfer

**Permittee:** Canyon Fuel Company, LLC

**Mine:** Skyline Mine

**Permit Number:** C/007/005

**Title:** South Fork Breakout Husbandry work

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

Modifying re-vegetation section to include husbandry/maintenance work at South Fork Breakout

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

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

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

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

Wesley K Sorensen  
Print Name
Wesley K Sorensen  
Sign Name, Position, Date  
General Manager  
5/14/2012

Subscribed and sworn to before me this 14<sup>th</sup> day of MAY, 2012

Kathleen Atwood  
Notary Public

My commission Expires: \_\_\_\_\_

Attest: State of Utah ) ss:  
County of Carbon



<b>For Office Use Only:</b>	<b>Assigned Tracking Number:</b>	<b>Received by Oil, Gas &amp; Mining</b>



**VEGETATION SAMPLING  
FOR PHASE II BOND RELEASE  
IN SOUTH FORK CANYON**

**2011**

RECLAIMED AREAS  
AND THE  
REVEGETATION REFERENCE AREAS

AT THE  
SKYLINE MINE

CARBON COUNTY, UTAH



*Prepared by*

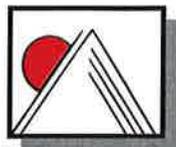
MT. NEBO SCIENTIFIC, INC.  
330 East 400 South, Suite 6  
Springville, Utah 84663  
(801) 489-6937

Patrick D. Collins, Ph.D.

*for*

CANYON FUEL COMPANY  
SKYLINE MINE  
HC 35 Box 380  
Helper, Utah 84526

December 2011



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## INTRODUCTION

### Breakout Site & Land Rehabilitation

Past coal mining activities at the Skyline Mine included development of a Breakout Portal in South Fork Canyon, a tributary of Eccles Canyon, which lies within the Wasatch Plateau of Carbon County, Utah. Once the underground mining in this area was concluded, there was no need to retain the portal, so the opening was sealed and all surface disturbances were reclaimed to their approximate original contours. Revegetation activities were then conducted on the disturbed areas. Visual inspections of the Reclaimed Areas suggested that the vegetation may have become established to a condition and degree that could meet the requirements necessary to achieve **Phase II Bond Release**.

Revegetation standards prescribed by the State of Utah, Division of Oil, Gas & Mining (DOGM) for Phase II Bond Release relate more to plant establishment for soil stabilization and erosion control rather than to the more ecological based standards required for Phase III or *Final* Bond Release. At this point in the revegetation process, it is also an appropriate time to monitor other vegetative attributes and characteristics of the plant communities that are becoming established on reclaimed lands.

### Standards for Revegetation Success

State and federal regulations require those areas that have been reclaimed adhere to specific standards for revegetation success. Often these success standards were established during the permit process through DOGM, or at the time when the land disturbance and subsequent development was proposed. These success standards often include the establishment of “*Reference Areas*”, or native, often adjacent, undisturbed plant communities that were sampled prior to any disturbance, then compared for their similarities with the proposed disturbed areas. Once the Reference Areas have been approved as future revegetation success standards by biologists from DOGM, they are set aside to remain undisturbed for the life of the mine (or the functional life of the given activity). When final reclamation and revegetation has been completed, and the appropriate time has lapsed for adequate plant

establishment (called the “Responsibility Period”), data from parameters of the Reference Areas are then compared statistically to the Reclaimed Areas. If the revegetation standards are met, the bond release process may begin. With that in mind, quantitative sampling was conducted on the re-vegetated areas in South Fork Canyon and also within the Reference Areas during the growing season of 2011 (for this study two Reference Areas were sampled – more detail will be provided about that later). Comparisons of these datasets have been made and results from the field study are shown in this report.

## **METHODS**

### Transect and Quadrat Placement

Transect lines for sampling were placed randomly throughout the Reclaimed and Reference Areas. Random/regular placement of sampling quadrats were designed to record data without preconceived bias. This was accomplished in the study areas by establishing several randomly-placed transect lines, each running the entire length of the area. At frequent and 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 lines a given quadrat was measured for placement. The random numbers selected could be high enough to place quadrats to the lateral limits of the study areas as well as 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 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).

## Diversity

Two diversity indices have been reported in this document for 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 – or another measure of species diversity.

## Photographs

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

## RESULTS

### Reclaimed Areas

The Reclaimed Areas in the South Fork Canyon were diverse with respect to soil types, exposures and general land physiognomy due to the different disturbance types that were reclaimed. For example, some of the reclamation occurred where topsoil was once stored for future use, whereas, other areas included an access road, pad and a portal breakout (see Photos 1 - 8). Consequently, total living cover and plant species composition in specific areas also varied and was also quite diverse. Because of these differences, the Reclaimed Areas were separated with respect to sample sites. Subsequent scrutiny of the summarized data for each sample site suggested that there were no sites that should be considered dissimilar enough to report their datasets separately, and because the objective of this study was to provide general information about the Reclaimed Area(s) as a whole, these data were “lumped” together into one dataset. In the future, if these sample sites ever needed to be separated for one reason or another, this could easily be done using the raw data spreadsheets.

Grasses dominated the Reclaimed Areas, the most common species were timothy (*Phleum pratense*), Kentucky bluegrass (*Poa pratensis*), bluebunch wheatgrass (*Elymus spicatus*) and western wheatgrass (*E. smithii*). Also quite common was the forb species, filfoil yarrow (*Achillea millefolium*). A few woody species were present in some of the sample quadrats, but their numbers were relatively non-significant. For a list of all species present in the sample quadrats along with their cover and frequency values, refer to Table 1.

It should be noted that, although not a dominate plant in the Reclaimed Areas as a whole, the noxious weed musk thistle (*Carduus nutans*) was common in one section of the portal area. This stand may need to be sprayed or otherwise controlled in the near future to prevent further encroachment into the Reclaimed Areas.

**Table 1: Skyline Mine. Reclaimed Areas in South Fork Canyon. Total cover, standard deviation and frequency by species (2011).**

Reclaimed Areas (n=60)	Mean Percent	Standard Deviation	Percent Frequency
<b>SHRUBS</b>			
<i>Symphoricarpos oreophilus</i>	0.92	4.13	6.67
<i>Lonicera involucrata</i>	0.50	2.36	5.00
<i>Picea engelmannii</i>	1.00	5.46	3.33
<b>FORBS</b>			
<i>Achillea millefolium</i>	10.25	14.13	46.67
<i>Artemisia dracunculus</i>	0.08	0.64	1.67
<i>Carduus nutans</i>	1.08	5.09	5.00
<i>Cirsium sp.</i>	0.17	1.28	1.67
<i>Cynoglossum officinalis</i>	0.08	0.64	1.67
<i>Descurainia pinnata</i>	0.08	0.64	1.67
<i>Fragaria vesca</i>	0.58	2.60	5.00
<i>Geranium richardsonii</i>	0.50	3.84	1.67
<i>Geranium viscosissimum</i>	2.08	4.86	18.33
<i>Lathyrus lanszwertii</i>	0.33	2.56	1.67
<i>Linum lewisii</i>	0.50	2.18	5.00
<i>Lupinus argenteus</i>	1.67	4.15	16.67
<i>Mertensia arizonica</i>	0.33	1.80	3.33
<i>Osmorhiza depauperata</i>	0.50	2.18	5.00
<i>Penstemon whippleanus</i>	0.42	1.38	8.33
<i>Polygonum sp.</i>	0.25	1.42	3.33
<i>Rudbeckia occidentalis</i>	1.83	4.91	15.00
<i>Taraxacum officinalis</i>	1.33	4.07	15.00
<i>Tragopogon dubius</i>	0.17	1.28	1.67
<i>Urtica dioica</i>	0.67	2.49	6.67
<i>Viguiera multiflora</i>	1.00	2.86	8.33
<b>GRASSES</b>			
<i>Bromus carinatus</i>	3.58	9.79	21.67
<i>Bromus inermis</i>	0.42	3.20	1.67
<i>Dactylis glomeratus</i>	2.58	11.20	6.67
<i>Elymus canadensis</i>	1.42	5.01	8.33
<i>Elymus smithii</i>	5.17	9.70	26.67
<i>Elymus spicatus</i>	5.50	10.44	30.00
<i>Juncus ensifolius</i>	0.25	1.92	1.67
<i>Phleum pratensis</i>	18.17	22.30	56.67
<i>Poa pratense</i>	9.42	12.01	46.67
<i>Stipa columbiana</i>	0.50	3.84	1.67

The total living cover for the Reclaimed Areas was estimated at 73.33% (Table 2-A). The composition of the cover was comprised of 62.89% grasses, 33.63% forbs and 3.49% trees/shrubs (Table 2-B).

Reference Areas

As mentioned, two Reference Areas were sampled to be

compared to the Reclaimed Areas. Locations of the Reference Areas were determined by

**Table 2: Skyline Mine. Reclaimed Areas in South Fork Canyon. Total cover and standard deviation (2011).**

Reclaimed Areas (n=60)	Mean Percent	Standard Deviation
<b>A. TOTAL COVER</b>		
Understory Cover	73.33	13.65
Litter	8.93	4.59
Bareground	9.08	7.36
Rock	8.65	6.82
<b>B. % COMPOSITION</b>		
Trees/Shrubs	3.49	9.79
Forbs	33.63	25.62
Grasses	62.89	25.24

**Table 3: Skyline Mine. Reference Area for South Fork Canyon. Total cover, standard deviation and frequency by species (2011).**

Aspen Reference Area (new) (n=20)	Mean Percent	Standard Deviation	Percent Frequency
<b>OVERSTORY</b>			
<i>Populus tremuloides</i>	23.50	27.98	50.00
<b>UNDERSTORY</b>			
<b>SHRUBS</b>			
<i>Chrysothamnus nauseosus</i>	2.00	6.20	10.00
<i>Populus tremuloides</i>	1.75	5.76	10.00
<i>Symphoricarpos oreophilus</i>	16.25	15.64	65.00
<b>FORBS</b>			
<i>Achillea millefolium</i>	2.00	4.00	20.00
<i>Delphinium barbeyi</i>	0.50	2.18	5.00
<i>Erigeron engelmannii</i>	1.00	3.00	10.00
<i>Lathyrus lanszwertii</i>	5.25	7.82	35.00
<i>Rudbeckia occidentalis</i>	0.75	2.38	10.00
<i>Stellaria jamesiana</i>	1.50	3.57	15.00
<i>Viguiera multiflora</i>	2.00	5.10	15.00
<b>GRASSES</b>			
<i>Bromus carinatus</i>	18.50	11.63	90.00
<i>Elymus lanceolatus</i>	1.00	3.00	10.00
<i>Poa pratensis</i>	17.00	13.45	80.00

older Skyline Mine contour maps that revealed little detail. Therefore, GPS coordinates were placed on the maps to be used in the field to locate the Reference Areas. Once a GPS location was found in the field, slight coordinate adjustments were made to place them in the area that was considered the mostly likely

location chosen when the Reference Areas were originally designated. The GPS coordinates for the Aspen Reference Area for this study was: 12 S 482323 E. 4392709 N. (NAD 27).

Like the Reclaimed Areas, the **Aspen Reference Area** (see Photos 9 - 10) was dominated by grass species, namely mountain brome (*Bromus carinatus*) and Kentucky bluegrass. The most common woody species in the understory cover by far was mountain snowberry (*Symphoricarpos oreophilus*), however, overstory cover was also important with quaking aspen (*Populus tremuloides*) as only species encountered in the sample quadrats. Several forbs were also present in the quadrats, the most common consisting of sweetpea (*Lathyrus lanszwertii*), showy goldeneye (*Viguiera multiflora*) and filfoil yarrow (Table 3).

Total living understory cover was estimated at 69.50%; overstory cover was estimated at 23.50% (Table 4-A). The understory composition consisted of grasses at 52.32%, trees/shrubs at 28.54% and forbs at 19.14% (Table 4-B).

<b>Table 4: Skyline Mine. Reference Area for South Fork Canyon. Total cover and standard deviation (2011).</b>		
<b>Aspen Reference Area (new) (n=20)</b>	<b>Mean Percent</b>	<b>Standard Deviation</b>
<b>A. TOTAL COVER</b>		
Overstory Cover (o)	23.50	27.98
Understory Cover (u)	69.50	8.35
Litter	23.30	7.77
Bareground	5.30	2.00
Rock	1.90	1.58
<b>B. % COMPOSITION</b>		
Trees/Shrubs	28.54	20.31
Forbs	19.14	17.65
Grasses	52.32	18.30

The understory cover of the **Spruce Reference Area** (see Photos 11 - 12) was once again dominated by grass species, the most common of which were nodding brome (*Bromus anamolus*) and tall oatgrass (*Arrhenatherum elatius*). However, woody species were also important in this community with the most common being red elderberry (*Sambucus racemosa*), sticky current (*Ribes viscosissimum*) and wax current (*R. cereum*). Also relatively important in this community were the forbs: saw groundsel (*Senecio serra*), sweetpea, stinging nettle (*Urtica dioica*) and blunt-fruit sweet-cicely (*Osmorhiza depauperata*). Overstory, another important component of the living cover,

**Table 5: Skyline Mine. Reference Area for South Fork Canyon. Total cover, standard deviation and frequency by species (2011).**

Spruce Reference Area (n=20)	Mean Percent	Standard Deviation	Percent Frequency
<b>OVERSTORY</b>			
<i>Abies lasiocarpa</i>	3.75	11.28	10.00
<i>Picea engelmannii</i>	8.75	22.41	20.00
<b>UNDERSTORY</b>			
<b>SHRUBS</b>			
<i>Picea engelmannii</i>	1.50	4.50	10.00
<i>Ribes cereum</i>	4.75	7.15	35.00
<i>Ribes viscosissimum</i>	7.75	9.68	45.00
<i>Sambucus racemosa</i>	7.75	14.01	25.00
<i>Symphoricarpos oreophilus</i>	2.00	6.00	10.00
<b>FORBS</b>			
<i>Achillea millefolium</i>	0.50	2.18	5.00
<i>Fragaria vesca</i>	1.00	4.36	5.00
<i>Helianthella uniflora</i>	1.25	3.11	15.00
<i>Lathyrus lanszwertii</i>	2.50	7.50	10.00
<i>Osmorhiza depauperata</i>	1.50	3.57	15.00
<i>Rudbeckia occidentalis</i>	1.00	3.00	10.00
<i>Senecio serra</i>	2.75	5.80	20.00
<i>Urtica dioica</i>	2.25	4.60	20.00
<b>GRASSES</b>			
<i>Arrhenatherum elatius</i>	13.00	24.97	40.00
<i>Bromus anamolus</i>	15.50	18.02	70.00
<i>Bromus carinatus</i>	1.00	3.00	10.00
<i>Festuca sp.</i>	0.50	2.18	5.00
<i>Poa fendleriana</i>	4.50	19.62	5.00
<i>Poa pratensis</i>	1.00	3.00	10.00

consisted of Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*). For a list of all species encountered in the sample quadrats placed in the Spruce Reference Area, refer to Table 5. [As a side note, this community has recently been impacted by a beetle infestation that has killed many of the conifers in the stand].

The total living understory and overstory cover in the Spruce Reference Area were estimated at 72.00% and 12.50%, respectively (Table 6-A). The composition proportions of the understory cover consisted of 45.40% grasses, 36.62% trees/shrubs and 17.98% forbs (Table 6-A).

The GPS coordinates for the Spruce Reference Area for this study was: 482403 E. 4392270 N. (NAD 27).

**Table 6: Skyline Mine. Reference Area for South Fork Canyon. Total cover and standard deviation (2011).**

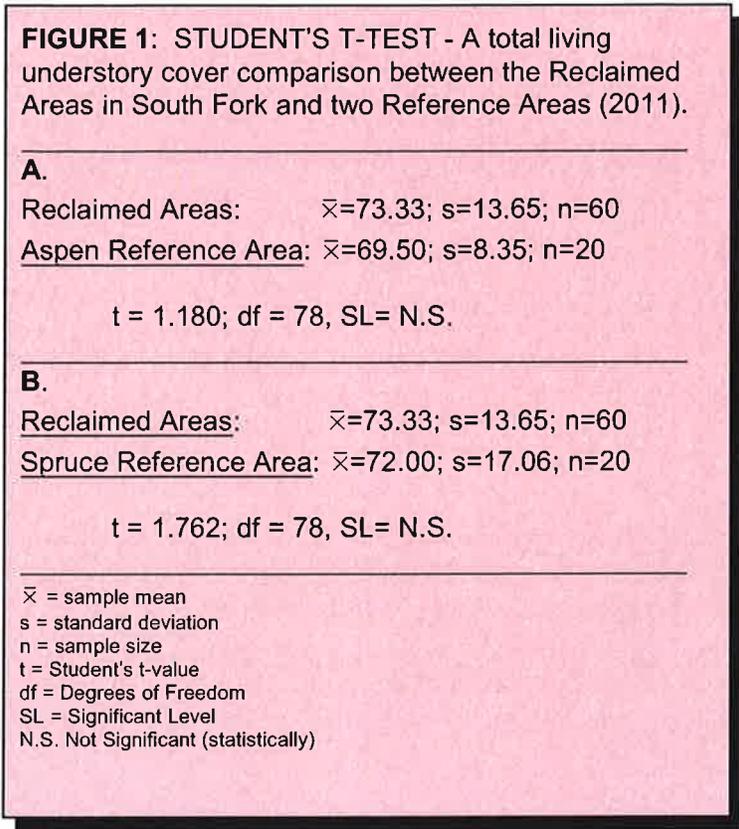
<b>Spruce Reference Area (n=20)</b>	<b>Mean Percent</b>	<b>Standard Deviation</b>
<b>A. TOTAL COVER</b>		
Overstory Cover (o)	12.50	23.74
Understory Cover (u)	72.00	17.06
Litter	19.05	14.36
Bareground	4.60	1.43
Rock	4.35	5.74
<b>B. % COMPOSITION</b>		
Trees/Shrubs	36.62	25.33
Forbs	17.98	13.47

### Dataset Comparisons

Two Reference Areas were sampled for this study as a result of the verbiage reviewed in Skyline Mine's, Mining and Reclamation Plan (MRP). The reclamation section of the MRP states that for revegetation success standards, the areas reclaimed on *south slopes will be compared to the Aspen Reference Area* and the reclaimed *north slopes will be compared to the Spruce Reference Area*. This could be left to interpretation, but rather than make assumptions at this time, both Reference Areas were sampled because there was a variety of slopes at the South Fork Breakout and associated Reclaimed Areas. Consequently, the data for both Reference Areas were compared to the Reclaimed Areas. Figure 1 shows results of statistical comparisons of total living understory cover between each Reference Area and the

Reclaimed Areas. Total living cover of the Reclaimed Areas and the Aspen Reference Area were not statistically dissimilar (Figure 1-A). Moreover, the difference between the total

living cover of the Reclaimed Areas and the Spruce Reference Area was also non-significant (Figure 1-B).



Biologists from the State of Utah also encourages the collection of quantitative data that can indicate which plant species are growing on the Reclaimed Areas and how much (quantity) each of these species are becoming established. Reporting cover by species and frequency enables one to present additional useful information as well as to calculate other insightful parameters.

Not only can reviewers of this document observe the total living cover values, but also shown in the tables are the values of cover and frequency by each plant species encountered in the sample quadrats. That said, one can see whether or not the total living cover consists of *desirable* species or “weedy” exotics. The summary tables above show that most of the plants becoming established were native species that should result in being capable of “*stabilizing the soil surface from erosion*”, as well as “*diverse, effective and permanent*”, and also “*capable of self-generation as well as plant succession*” – all of which are required by regulations for final bond release by state and federal agencies.

Another parameter that one can derived from the quantitative data recorded in this study

was community or species diversity. MacArthur's Diversity Index for the Reclaimed Areas was greater than the Reference Areas (Figure 2), suggesting greater species and community diversity.

Another diversity measurement, the average number of species present in the sample quadrats, was compared. In this comparison the Reclaimed Areas had a greater average number of species than both Reference Areas (Figure 3).

**FIGURE 2.** MacARTHUR'S INDEX - A diversity comparison between the Reclaimed Areas in South Fork and two Reference Areas (2011).

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

<u>Reclaimed Areas:</u>	13.331
<u>Aspen Reference Area:</u>	6.594
<u>Spruce Reference Area:</u>	10.809

**FIGURE 3.** AVERAGE NUMBER OF SPECIES PER SQUARE METER - Another diversity comparison between the Reclaimed Areas in South Fork and two Reference Areas (2011).

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

<u>Reclaimed Areas:</u>	3.87
<u>Aspen Reference Area:</u>	3.75
<u>Spruce Reference Area:</u>	3.65

## DISCUSSION & SUMMARY

Approval by the State of Utah for the Phase II Bond Release is dependent on several factors. One of the most important conditions is probably whether or not the reclaimed site is controlling erosional sediments, or as stated by the State Rules (R645-301-830.310): *"No part of the bond or deposit will be released under this paragraph so long as the lands to which the release would be applicable are contributing suspended solids to streamflow or runoff outside the permit area in excess of the requirements set by UCA 40-10-17(j) of the Act and by R645-301-751"*. When comparisons of an undisturbed plant community (in this case the Reference Areas) were made between those communities that have been disturbed and later revegetated, it has been shown in the RESULTS section that the total cover value, paramount to erosion control, of the Reclaimed Areas was statistically greater than the Reference Areas.

Additionally, one can observe by the data tables presented above that the plant species becoming established on the Reclaimed Areas were dominated by desirable perennial plants and not annuals or weedy exotics. Furthermore, species and community diversity of the Reclaimed Areas was also somewhat greater than both Reference Areas.

With the results of quantitative sampling in the South Fork Reclamation Areas and the Aspen Reference Area as well as the Spruce Reference Areas, along with subsequent comparisons and analyses, Phase II bond release through the State of Utah may be warranted.

## COLOR PHOTOGRAPHS OF THE SAMPLE AREAS



Photo 1: Soil Stockpile Storage and Road Area



Photo 2: General Seeded Area



Photo 3: Lower Revegetated Area



Photo 4: Lower Revegetated Area



Photo 5: Revegetated Access Road

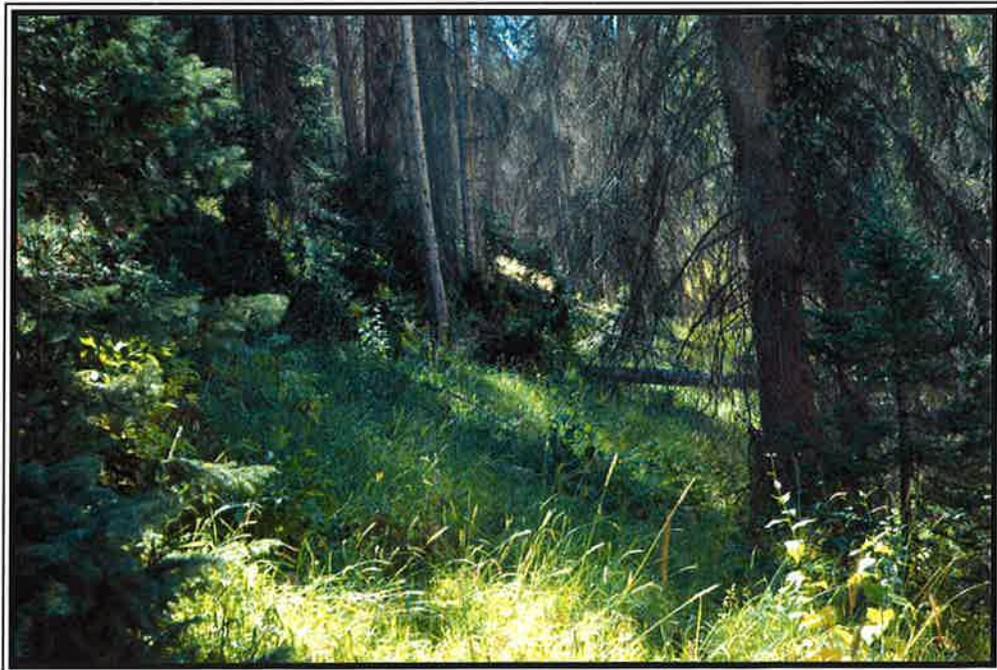


Photo 6: Revegetated Access Road



Photo 7: Breakout Portal Area



Photo 8: Breakout Portal Area



Photo 9: Aspen Reference Area



Photo 10: Aspen Reference Area



Photo 11: Spruce Reference Area



Photo 12: Spruce Reference Area

#### 4.7 REVEGETATION PLAN

Field Code Changed

Planting and revegetation of all disturbed areas will take place following grading and/or topsoil redistribution procedures and will include, as necessary, the addition of remedial soil treatments. Fall seeding is preferred. A suitable, permanent, diverse vegetative cover will be established on all reclaimed areas and be capable of self-regeneration and plant succession. At the Scofield disposal site, reclamation activities will be conducted on areas that are filled to design capacity. All vegetation species will meet the requirements of applicable Utah and Federal seed, poisonous and noxious plant; and introduced species laws or regulations. All revegetation will meet the requirement of R614-301-356.232 and R614-301-356.233. The proposed reclamation schedule is presented in Section 4.2 - RECLAMATION TIMETABLE. The following subsections describe the major aspects of the proposed revegetation plan.

##### 4.7.1 Species and Amount per Acre, Portal, Train Loadout and Conveyor Bench Areas

A suitable permanent, effective, and diverse vegetation cover of species native to the area, or suitable substitutes, will be established on all affected areas.

After the initial construction disturbance, the species selected for use and the numbers or amounts per acre depended on the steepness and exposure of the slopes to be revegetated. South facing slopes 1h:3v (or lower) and flat areas were treated with seeding efforts at the rate as shown in Table 4.7-1. South facing slopes at angles of 2h:1v to 1h:2v were treated with hand-set plantings of sagebrush (Artemisia tridentata), rabbitbrush (Chrysothamnus nauseosus), and snowberry or red elderberry at not less than 1 meter (3.25 feet) intervals, with interspacings being seeded by the species shown in Table 4.7-1. The woody species stocking density for south facing slopes were established at approximately 1 meter intervals with minor adjustments for terrain.

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North facing slopes, which are shaded, were planted with hand-set seedlings of Englemann spruce and/or subalpine fir at intervals of 2.5 meters in all directions. Table 4.7-2 lists the seed mixtures spread on the inter-spacing on the north-facing slopes.

Riparian zones were revegetated with handset seedlings of yellow willow, blue spruce, Woods rose and American red raspberry at intervals at 1/2-1 meter. Table 4.7-3 lists the seed mixture spread on the inter-spaces. Steep slopes which have been rip-rapped were not revegetated.

4.7.2 Final Reclamation Seeding Tillage and Mulching, Portal and Train Loadout Areas and Other Small Areas

Seed mixture for final reclamation are shown on Tables 4.7-4, 4.7-5, 4.7-6 and 4.7-6A.

Seeding of the south-facing slopes (1h:3v) or lower flat areas will be conducted using a cyclone spreader. For slopes less than 2h:1v, seeding will be accomplished using a hydro-seeder. Plantings of shrubs and trees will be hand-set to ensure a plant cover of a permanent nature.

Tillage practices on level ground and on slopes flatter than 10h:1v will include leveling, tilling and mulching.

Panting on slopes less than 10h:1v will be accomplished by drilling sed with a mechanical drill. Slopes between 10h:1v and

1.5h:1v will be seeded by hand broadcast and manually buried by raking. Mulch will be applied over the hand broadcast seed. The Permittee elects to revegetate areas with slopes greater than 1.5h:1v without topsoil; such areas will be treated to handset plantings in basins filled with topsoil and with hydromulch seeding in between. Where the substrate consists of outcroppings of stone, no attempt will be made to revegetate.

Revegetation on slopes steeper than 3h:1v will be undertaken as soon as possible following topsoil placement, mainly during spring and early fall, with fall seeding preferred. Where too steep for topsoil placement, planting will be followed immediately after the area becomes available during construction activities. Revegetation on slopes less steep than 3h:1v will follow topsoil placement. All tree and shrub transplants will only be planted in the spring.

The Permittee will create a natural appearance during post mining reclamation by extending tree and shrub planting past the toes of slopes. However, linkages will be left short or extended slightly as necessary to provide an irregular appearance. Grasses and forbs will be reestablished from seed. Trees will be planted as seedlings. The Permittee will additionally place rocks, originally designated as wind barriers, at the bottom of large rock cuts in an informal way so as to provide a more natural appearance. All south-facing slopes will be seeded with the south-slope mixture, and all north-facing slopes will be seeded with the north-slope mixture.

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All riparian areas will be revegetated with handset seedlings as shown on Table 4.7-6. Tables 4.7-4 and 4.7-5 list the seed mixtures to be used on the inter-spaces. Rip-rapped banks will be included in the revegetation process where physically possible.

Noxious plants invading the disturbed areas will be controlled by hand grubbing and/or approved herbicides. Surveillance will be

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maintained annually during the period of liability. Acreage by type for each disturbed area is shown in Table 4.7-7.

4.7.3           Revegetation, Stabilization and Reclamation of the Conveyor Bench

Revegetation, stabilization and reclamation of the conveyor belt slopes have been evaluated during the middle of each growing season, during the first five years after construction when cover and composition studies were most feasible. Erosion pins were placed on slopes at the time of reseeding operations; a table of random numbers was used to determine location. Statistically acceptable techniques have been used in determining percent cover and composition of disturbed area. Revegetation analyses were conducted annually during the first five years and reported to the regulatory authority. The steep slopes (60%+) have continued to slough, which has precluded total revegetation on these slopes. The Permittee has developed a special revegetation plan for the conveyor bench slopes that have not been successfully revegetated. This revegetation plan is included in Volume A-2 and is directed at final reclamation. This special revegetation plan covers four treatment areas, three areas along the conveyor bench and one area at the RRLO. The plan outlines six practices for the four treatment areas:

- (1) apply 40-60 lbs/AC of N<sub>2</sub> in late fall or early spring;
- (2) provide drip irrigation to existing shrubs;
- (3) plant new shrubs each year (area 4 to also be planted with douglas fir, in addition to the shrubs);
- (4) provide irrigation for new plants on area 1-3;
- (5) use in-line fertilization; and

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- (6) broadcast a light application of grass/forb seed each year.

In addition to the six practices, three experimental trials are outlined:

- (1) different rates of fertilizer application;
- (2) cut aspen to see if resprouting can be encouraged; and
- (3) establish a plant materials trial to determine plant adaption.

Along with mine personnel, this plan is visually evaluated each year by SCS. To date (through 1991), practices 1, 2, 3, and 6 have been utilized. Practice 4 is inherent into practice 2, as the mine uses miniature sprays instead of a drip system. Practice 5 has not been used, since slow release fertilizer pellets were used when planting the shrubs. All experimental trials have been conducted, with the following evaluations:

- Exp. 1 (conducted in 1989) - drought conditions precluded any significant results. Further trials deferred until a better climatical pattern occurs;
- Exp. 2 (conducted in fall of 1988) - no results have been observed. Re-evaluate in next three to five years; and
- Exp. 3 defer using in-line fertilization until slow release pellets are used up (1994). Results of the annual evaluation will be included in the annual report to the division.

The final reclamation is to leave the conveyor bench intact. The current condition of the conveyor bench is an area that is well drained with drainage being treated with silt fences and/or strawbales. The bench itself is becoming well vegetated and is functioning as a safety bench to prevent rolling material from

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rolling onto SR 264. The revegetation plan is planned to establish the necessary vegetation for final reclamation. During final reclamation, the conveyor will be removed along with the supporting structures. The only areas requiring treatment will be the disturbed areas where the supporting structures were located. These small areas will be revegetated as outlined in Section 4.7.1 and 4.7.2.

#### 4.7.4 Irrigation, Portal & Train Loadout Areas

Since the species used for reclamation were known for their survival characteristics, it was felt that application of

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additional water will not be needed. If irrigation is needed, an irrigation plan will be developed at that time and submitted to the Division of Oil, Gas and Mining for approval. The special revegetation plan (see Section 4.7.3) for the conveyor route does include some drip irrigation for establishment.

4.7.5 Monitoring Procedures, Portal, Train Loadout, Waste Rock Disposal Site, South Fork Breakout Areas and Other Small Areas

All areas of final revegetation will be qualitatively evaluated on an annual basis. In addition, shrub survival will be quantified using permanent transects for the first three years after planting. Woody plant density and total living cover will be estimated during the third year (and fifth year on areas with 10 year liability). **Woody plant success standards will meet the requirement of R645-301-356.232. Shrub density will be a minimum of 1500 woody plants per acre at bond release.**

For bond release, data will be collected and submitted using a monitoring method designed to give empirical values sufficient to detect a 10 percent change in vegetative cover at a 90 percent statistical confidence interval. These data will be from those communities disturbed and for established reference areas which will be used for comparison (aspen & sagebrush, reference area for south slopes; spruce-fir, reference area for north slopes; riparian, reference areas for the riparian zone and the Reference Area for the waste rock disposal site). Vegetative parameters to be measured are: cover, density, productivity and species composition. Sampling of the approved reference area and revegetated area will occur for the last two years of the liability period and will meet sample adequacy tests for 90 percent confidence level with a 10 percent change in the mean.

A minimum of the following data will be provided: 1) canopy cover by species and total canopy cover excluding trees, 2) productivity by life form, and 3) density of woody species by life form (trees and shrubs). The Permittee will provide results

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of statistical analyses showing similarity between disturbance areas and reference areas.

The Permittee has inspected all seeded areas at the end of each growing season to determine the success of the seeding program for a period of at least five years (reclamation years 1-5).

Any area not achieving 90 percent original cover in the first five years are investigated to determine the possible failure cause(s) so steps can be taken to establish the desired permanent vegetation.

The Permittee has monitored the vegetative reference area to determine if the reference areas have been subjected to heavy animal use or have been significantly altered by subsidence or other man-induced degradation. If the reference areas are subsided or subject to subsidence the Permittee will quantitatively monitor the reference areas. If damage is such that the reference area is no longer viable, an additional reference area proposal will be submitted to the regulatory authority for approval. The reference areas will be surveyed by the S.C.S. at five year intervals to determine their condition class.

The Permittee understands that the extended period of liability is ten years, unless site-specific data can be submitted which justifies a five-year period, beginning after the last period of augmented seeding, fertilizing or other mechanical practice and that the revegetated areas will be monitored the last years of liability and comparisons made with reference areas. On-site climatological data will be evaluated at the beginning of final reclamation to determine the liability period. The length of the liability period will be established based on the conditions outlined in R614-301-820.310.

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#### 4.7.6 Soil Testing, Portal & Train Loadout Areas

The Permittee tested the topsoil before it was seeded, after initial construction, to determine the type and amount of fertilizer or neutralizer required for seeding at that time. Soil analyses measured the following components:

- Micro-nutrients
- Potassium, Calcium, Magnesium
- Phosphorus
- Nitrogen
- Soil pH and Salinity
- Soil Texture

Chemical analyses for micro-nutrients was conducted by testing soil extracts with DTPA solution and measured by use of an atomic absorption analyzer. Ammonium acetate was used to extract potassium, calcium and magnesium for atomic absorption analysis. Phosphorus determination was made by using sodium bicarbonate extraction and colorimetric analysis. The Kjeldahl method was used for determination of total nitrogen. Soil texture was determined by using a Bouyoucus hydrometer method (sodium hexametaphosphate dispersing agent). Soil pH was determined on a 1:1 soil/water mixture tested with an electrode pH meter. Salinity was analyzed by using a Wheatstone conductivity cell on an extract of each soil sample. These analyses correlated with the consultant's recommendation that 100 pounds per acre of available nitrogen be applied during this initial seeding.

#### 4.7.7 Scofield Waste Rock Disposal Site

The disturbed area affected by the disposal operation will, at the request of the property owner's representative, be leveled off and reclaimed to native rangeland for subsequent use as a corral. The drainage diversion ditch will be left as constructed as it will be fully revegetated and in a stable condition.

The revegetation of the waste disposal area will be in successive stages with a stage representing the portions of the site that have been filled to design capacity. When a stage is completely full, that area will be graded and topsoil will be placed over the waste rock. At least one foot of topsoil derived from aspen or sagebrush vegetative type areas will be placed on the fill area. The soil will be brought into the disposal site from the unit train loadout stockpile, since previous mining activity has rendered none available at the site.

Revegetation will be accomplished by the orderly placement, scarification of the topsoil, and seeding during the late fall.

The potential for upward migration of salts is unknown. The Permittee will analyze for electrical conductivity, sodium content, and sodium absorption ratio prior to revegetation efforts.

Fertilizer rates and applications are discussed in the soil preparation and fertilizer plan (Section 4.5).

The species to be planted and the rates per acre are shown on Table 4.7-6A.

The seeds will be sown by hand (broadcast) and a mulch will be placed atop the seeded surface as outlined in Section 4.7.2. No

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fiber matting will be used since all slopes are expected to be either flat or less than 1.5h:1v. Revegetation success will be evaluated. All ditches and retaining walls will be maintained until the vegetation success standards of R614-301-356 are met. No reclamation is planned for the access roadway at the request of the property owner's representative.

The livestock permittee through the owner has requested that the sedimentation pond not be reclaimed. If, over a period of time, it shows that the pond holds natural runoff water and will be beneficial for livestock and wildlife use, it will not be removed. However, for planning and bonding purposes the sedimentation pond is to be removed and reclaimed (Map 4.16.1C). In the event the pond is not removed, Map 4.16.1B illustrates the reclamation work.

#### 4.7.8 South Fork Breakout

After the area has had the soils redistributed, as outlined in Section 4.6.5, the site will be revegetated. The aspen site will use the seed mixture shown on Table 4.7-4 while the spruce-fir site will use the mixture shown on Table 4.7-5. Following the distribution of topsoil, the area will be evenly covered with certified weed-free straw mulch. The soil with the straw cover will then be deep gouged. The straw will be incorporated in the soil during the deep gouging activities. The appropriate seed mix will then be hand-broadcast and/or through the use of an appropriate hand-held mechanical device at the prescribed rate of application.

Fertilizer rates and applications are discussed in the soil preparation and fertilizer plan (Section 4.5).

Information submitted in 2012 demonstrated the South Fork of Eccles Creek Breakout area qualified for Phase II bond release (See Vegetation Sampling for Phase II Bond Release in South Fork Canyon, 2011, Mt. Nebo Scientific, Inc. - Appendix A-2 Volume 2). To insure Phase III bond release, Skyline conducted husbandry practices and planted additional woody species as a rate of 1,800 to 2,000 plants per acre in 2012. Table 4.7-8D outlines a list of recommended woody species (tublings) based on Dr. Patrick Collins review of the site.

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James Canyon Area

Refer to Section 2.7 for a discussion of the revegetation success standards for the James Canyon Project area. Refers to Sections 2-11 and 4-20 for additional information pertaining to the project.

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Revised 4/4/075-11-12  
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4.7.9 Winter Quarters Ventilation Facility (WQVF)

Refer to both Section 2.7 and the Mt. Nebo Vegetation report located in Appendix A-2, Volume 2 for a discussion of the vegetation for the WQVF. The interim and final revegetation seed mixes for the WQVF area are listed in Tables 4.7-8A through 4.7-8C. Reclamation success standards are based on the reference area(s) identified in the Mt. Nebo report. Noxious plants invading the WQVF permit area will be controlled by hand-grubbing, and/or approved herbicides. Surveillance will be monitored annually during the liability period.

Revised 3-24-10

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Table 4.7-1

INTERIM SEED MIXTURE

South-facing slopes of 1h:3v or lower and flat areas.

Grasses	lbs/acre
Kentucky blue grass (native)	.5
Mountain brome (native)	2
Blue wildrye (native)	2
Bluebunch wheat grass (native)	2
Sheep Fescue (native)	1
<b>Forbs</b>	
Thickleaf peavine (native)	4
Showy Goldeneye (native)	1
Sticky geranium (native)	1
Mountain lupine (native)	2
Blue Lewis Flax (native)	2
Big sagebrush (native)	0.5
Mountain snowberry (native)	1
<b>Total</b>	<b>16</b>

Transplants and/or seedlings per acre\*Shrubs and trees (handset at 1 m intervals)

Aspen (native) - seedlingstublings  
 Mountain snowberry (native) - tublings  
 Big sagebrush (native) - tublings  
 13.5

Revised: 3-13-09

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Table 4.7-2  
 INTERIM SEED MIXTURE  
 NORTH-FACING SLOPES

Grasses	lbs/acre
Mountain brome (native)	2
Kentucky bluegrass (native)	.5
Forbs	
Showy GoldeneyeHeart-leaf arnica (native)	.5
Rocky Mountain Penstemon (native) Sweetroot, spreading	.5
Sticky geranium (native)	1
Mountain lupine (native)	2
Thickleaf sweetpea (native)	4
Arrowleaf Balsamroot (native)1	
Lewis Blue Flax (native)	2
Shrubs and Trees (Handset at 1 – 2.5m intervals)	
Mountain snowberry (native) (1 m intervals) – tublings	
Englemann spruce (native) (2.5 m intervals) – tublings	
Subalpine fir (native) (2.5 m intervals) - tublings	

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Table 4.7-3

INTERIM RIPARIAN HABITAT SEED MIXTURE

Grasses	lbs/acre
Slender wheatgrass (native) (on terrace areas)	3
Mountain brome (native) (on terrace areas)	3
Tufted hairgrass (native) (along bank areas)	2
Kentucky bluegrass (native)	2
Woods' rose	1
Chokecherry (on terrace areas and bank margins)	1
<b>Total</b>	<b>12.25</b>

Shrubs and Trees (handset at 1/2-1 m intervals)

Yellow (Watson) willow (native) - rooted cuttings, 1/2 m interval (on banks and rip-rap areas).

Blue spruce (native) - (1 m intervals) tublings (on terrace areas)

Woods rose (native) - (1/2 m intervals) - tubling (on bank areas)

American red raspberry (native) - (1/2 m intervals) - tubling (on rip rap areas)

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Table 4.7-4

## SEED MIXTURE

South to West Facing Slopes	
Grasses	lbs/acre*
<u>Agropyron riparium</u> Streambank wheatgrass	4.0
<u>Agropyron dasystachyum</u> Thickspike wheatgrass	4.0
<u>Bromus marginatus</u> Mountain brome	5.0
<u>Phleum pratensis</u> Timothy	0.5
<u>Poa pratensis</u> Kentucky bluegrass	0.1
Forbs	lbs/acre*
<u>Achellia millifolium</u> Yarrow	0.1
<u>Artemisia ludoviciana</u> 'Summit' louisiana sagewort	0.1
<u>Linum lewisii</u> Lewis flax	1.0
<u>Melilotus officinalis</u> Yellow sweetclover	2.0
<u>Penstemon strictus</u> 'Bandera' rocky mountain penstemon	0.5
Shrubs and Trees	lbs/acre*
<u>Amelanchier alnifolia</u> Sacatoon serviceberry	1.0
<u>Artemisia tridentata vaseyana</u> Mountain big sagebrush	0.2
<u>Rhus trilobata</u> Squawbush	3.0
<u>Rosa woodsii</u> Wood's rose	1.0
<u>Symphoricarpos oreophylus</u> Mountain snowberry	2.0
Transplants	#/acre
<u>Chrysothamnus nauseosus albicaulis</u> Whitestem rubber rabbitbrush	250
<u>Populus tremuloides</u> Quaking aspen	400
<u>Sambucus cerulea</u> Blue elderberry	400

\* Pure live seed for broadcast seeding methods

Table 4.7-5

SEED MIXTURE

North to East-facing slopes

Grasses	lbs/acre*
<u>Agropyron trachycaulum</u>	
Slender wheatgrass	3.0
<u>Bromus marginatus</u>	
Mountain brome	6.0
<u>Festuca ovina</u>	
Hard sheep fescue	1.0
<u>Poa pratensis</u>	
Kentucky bluegrass	0.2
Forbs	lbs/acre*
<u>Achellia millifolium</u>	
Yarrow	0.1
<u>Aster chilensis</u>	
Pacific aster	0.1
<u>Lupinus sericeus</u>	
Silky lupine	2.0
<u>Mellilotus officinalis</u>	
Yellow sweetclover	1.5
<u>Osmorhiza occidentalis</u>	
Sweet anise	2.0
<u>Penstemon strictus</u>	
'Bandera' rocky mountain penstemon	0.5
Shrubs and Trees	lbs/acre*
<u>Sambucus racemosa</u>	
Red elderberry	1.0
<u>Symphoricarpos oreophylus</u>	
Mountain snowberry	2.0
Transplants	#/acre
<u>Abies concolor</u>	
White fir	200
<u>Picea englemanni</u>	
Englemann spruce	400
<u>Potentilla fruticosa</u>	
Woody cinquefoil	100
<u>Rubus idaeus</u>	
American raspberry	100

\* Pure live seed for broadcast seeding methods

Table 4.7-6

Shrub Supplement for Riparian Zone  
To Be Used in Addition To The South and North Slope Mixtures

	#/acre
<u>Cornus stolonifera</u>	
Red-osier dogwood	200
<u>Mahonia repens</u>	
Creeping oregon grape	400
<u>Salix sp.</u>	
Willow cuttings	2,000
<b>TOTAL</b>	<b>2,800</b>

Table 4.7-6A

SEED MIXTURE

Waste Rock Disposal Area

Grasses	lbs/acre*
<u>Agropyron smithii</u>	
Western wheatgrass	4.0
<u>Agropyron dasystachyum</u>	
Thickspike wheatgrass	4.0
<u>Bromus marginatus</u>	
Mountain brome	6.0
<u>Poa pratensis</u>	
Kentucky bluegrass	0.1
Forbs	lbs/acre*
<u>Artemisia ludoviciana</u>	
'Summit' louisiana sagewort	0.1
<u>Linum lewisii</u>	
Lewis flax	1.0
<u>Medicago sativa</u>	
'ladak' alfalfa	1.0
<u>Melilotus officinalis</u>	
Yellow sweetclover	1.0
<u>Penstemon strictus</u>	
'Bandera' rocky mountain penstemon	0.5
<u>Astragalus cicer</u>	
Cicer Milkvetch	0.5
Transplants	#/acre
<u>Chrysothamnus nauseosus albicaulis</u>	
Whitestem rubber rabbitbrush	200
<u>Artemisia tridentata vaseyana</u>	
Mountain big sagebrush	1,000
<u>Rosa woodsii</u>	
Wood's rose	500

\* Pure live seed for broadcast seeding methods

ADDITION TO	TEXT
Table 4.7-6A Page 4-57	Table 4.7-6A Page 4-57 Date 08/11/93



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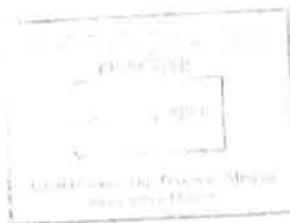
Table 4.7-7

The acreage and seed mixture of each disturbance area is as follows:

	Seed Mixture	Acreage	%
Laddeport (including transplant area)	South Fork	10.62	76
	North Slope	3.30	24
	Paparian	<u>.08</u>	<u>---</u>
		13.99	100
Pavil Yard South Slope (including transplant area)	North Slope	10.92	30
	South Slope	16.37	85
	already disturbed	<u>5.11</u>	<u>25</u>
		36.40	100
Water Tank and Well Pads	South Slope	.26	100
Conveyor Route	South Slope	8.97	100
Waste Rock Disposal	Waste Rock Seed Mix	7.55	100
	Contemporaneous Reclamation	2.64	
	New Expansion	5.09	
South Fork Breakout	South Slope	.3	31
	North Slope	<u>.46</u>	<u>62</u>
		<u>1.36</u>	<u>100</u>
		62.13	

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Table 4.7-7 Page 4-58	Table 4.7-7 Page 4-58 Date 08/11/98

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Table 4.7-8A

**Interim Revegetation Seed Mixture for the Winter Quarters  
Ventilation Facility.**

Species <sup>a)</sup>	Rate <sup>b)</sup> (# PLS/Ac)	Seeds/ft <sup>2</sup>
<i>Elymus lanceolatus</i>	4.00	14.14
<i>Elymus smithii</i>	5.00	14.46
<i>Elymus trachycaulus</i>	4.00	14.69
<i>Hedysarum boreale</i>	10.00	7.71
<i>Poa pratensis</i>	0.30	14.99
<b>TOTAL</b>	<b>23.30</b>	<b>66.00</b>

<sup>a)</sup> Depending on commercial availability, species can be substituted by a qualified botanist.

<sup>b)</sup> Rates based on broadcast seeding methods.

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Table 4.7-8B

**Final Revegetation Seed Mixture for the Riparian Community at the Winter Quarters Ventilation Facility.**

Species <sup>a)</sup>	Rate <sup>b)</sup> (# PL./Ac)	Seeds/lb <sup>2</sup>
<b>FORBS</b>		
<i>Aquilegia caerulea</i>	1.00	8.46
<i>Geranium viscosissimum</i>	7.00	8.36
<b>GRASSES (or Grass-like)</b>		
<i>Agrostis stolonifera</i>	0.05	7.35
<i>Carex microptera</i>	0.40	7.78
<i>Carex nebrascensis</i>	0.50	6.13
<i>Elymus trachycaulus</i>	2.00	7.35
<i>Juncus arcticus</i>	0.03	7.51
<i>Poa pratensis</i>	0.10	5.00
<b>TOTAL</b>	<b>11.08</b>	<b>57.91</b>

<sup>a)</sup> Depending on commercial availability, species can be substituted by a qualified botanist.

<sup>b)</sup> Rates based on broadcast seeding methods.

<sup>c)</sup> Willows from containerized, bare-root or local cuttings will be planted in a "staggered or clumped" fashion at a average rate of one plant per 10 linear feet of streambank.

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Table 4.7-8C

**Final Revegetation Seed Mixture for the Sagebrush/Grass  
Community at the Winter Quarters Ventilation Facility.**

Species <sup>a)</sup>	Rate <sup>b)</sup> (# PLS/Ac)	Seeds/lb <sup>2</sup>
<b>SHRUBS</b>		
<i>Amelanchier utahensis</i>	6.00	3.55
<i>Artemisia tridentata</i> var. <i>vaseyana</i>	0.10	5.74
<i>Ceratoides lanata</i>	4.00	5.05
<i>Purshia tridentata</i>	15.00	5.17
<i>Symphoricarpos oreophilius</i>	3.00	5.17
<b>FORBS</b>		
<i>Achillea millefolium</i>	0.03	1.91
<i>Hedysarum boreale</i>	5.00	3.89
<i>Linum lewisii</i>	0.70	4.47
<i>Lupinus sericeus</i>	8.00	4.51
<i>Penstemon rydbergii</i>	1.50	4.54
<i>Viguiera multiflora</i>	0.20	4.84
<b>GRASSES</b>		
<i>Bromus carinatus</i>	1.50	3.44
<i>Elymus spicatus</i>	1.50	4.82
<i>Elymus trachycaulus</i>	1.00	3.87
<i>Poa pratensis</i>	0.10	5.00
<i>Poa secunda</i>	0.20	4.25
<b>TOTAL</b>	<b>47.83</b>	<b>69.98</b>

<sup>a)</sup> Depending on commercial availability, species can be substituted by a qualified botanist.

<sup>b)</sup> Rates based on broadcast seeding methods.

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Table 4.7-8D

Field Code Changed

<p align="center"><u>Suggestions for Containerized Plants for Revegetation in South Fork Canyon at the Skyline Mine in Carbon County, Utah</u></p>	
<u>Scientific Name*</u>	<u>Common Name</u>
<u><i>Abies lasiocarpa</i></u>	<u>Subalpine Fir</u>
<u><i>Chrysothamnus viscidiflorus</i></u>	<u>Low Rabbitbrush</u>
<u><i>Chrysothamnus nauseosus</i></u>	<u>Rubber Rabbitbrush</u>
<u><i>Lonicera involucrata</i></u>	<u>Black Twinberry</u>
<u><i>Picea engelmannii</i></u>	<u>Engelmann's Spruce</u>
<u><i>Populus tremuloides</i></u>	<u>Aspen</u>
<u><i>Ribes aureum</i></u>	<u>Golden Current</u>
<u><i>Ribes viscosissimum</i></u>	<u>Sticky Current</u>
<u><i>Ribes cereum</i></u>	<u>Wax Current</u>
<u><i>Sambucus racemosa</i></u>	<u>Red Elderberry</u>
<u><i>Symphoricarpos oreophilus</i></u>	<u>Mountain Snowberry</u>
<p>* Species used will be dependent on commercial availability. Substitutions possible if reviewed beforehand by a qualified botanist.</p>	