OXBOW MINING, LLC
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June 17, 2025

Mr. Leigh Simmons
Environmental Protection Specialist
Colorado Division of Reclamation, Mining and Safety
1313 Sherman Street, Room 215
Denver, CO 80203

Re: Oxbow Mining LLC, Permit No. C-1981-022 - Request for MR-117: Addition of Line Point Intercept Method for Vegetation Sampling

Dear Mr. Simmons,

Oxbow Mining, LLC submits this minor revision request (MR-117) to update permit application package (PAP) information regarding vegetation sampling. Oxbow wishes to include line point intercept method to estimate vegetation cover as an additional option while maintaining the point intercept method in the permit should the need arise in the future.

This optional method addition has been made to the appropriate pages of 2.05-E6, previously approved in TR-77.

The use of the point-intercept or line point-intercept methodologies will be used to estimate vegetation cover. If the point-intercept method is employed, an ocular frame (e.g. ESCO Associates or other manufacturer) will be used to minimize instrument error and maximize precision and observer accuracy.

The number or length of transects, and the statistical methods outlined in TR-77 remain the same and are included in the pages submitted with this MR-117.

WestWater Engineering is planning on sampling the week of June 30, 2025.

Please contact me at (970) 929-6034 should you have questions or require further information.

Sincerely,

Doug A. Smith
Chief Engineer

Attachments
Xc: Mike Ludlow (OMLLC)
Files

1.0 INTRODUCTION

This revegetation plan is designed to restore the physical landscape disturbances associated with the development and operation of the Somerset Mine (now sealed), the Sanborn Creek Mine and the Elk Creek Mine. Operations in the Somerset Mine began in 1901 and continued until 1985. In 1991, Somerset Mining Company opened the Sanborn Creek Mine. Oxbow Mining, LLC (OMLLC) (formerly dba as Somerset Mining Company) is proceeding with reclamation of the mines.

Approximately 72 acres of disturbance (historic figure for Somerset and Sanborn Creek Mine – See Table 2.05-T1 for current disturbance acreages) are associated with the surface plant facilities, mine portals, power line roads, and other minor disturbances. These disturbances, which occur on both private and federal land, will continue for the life of the mine.

Analytical results from seventeen surface soil collections in disturbed and undisturbed areas provide an indication of the suitability of surface materials as a medium for plant growth. These data, as analyzed by Ford Chemical Laboratories on August 8, 1980 indicated that there are no problems with salts. Conductivity and sodium adsorption ration (SAR) values are all below the conservative limits of 4000 umhos/cm and 6, respectively (see WRDC 1981).

The data on heavy metals are total values derived from acid extraction and thus cannot be compared to most standards for reclamation suitability (see Shafer 1979, WDEQ 1981). If samples for undisturbed areas are compared with those from disturbed locations, it is apparent that total heavy metal levels are comparable throughout for boron, cadmium, copper, iron, lead, manganese, mercury, molybdenum, nickel, and selenium. Again however, note that the data examined were acid extractable totals and not plant-available levels. Data for heavy metals are not in a form to evaluate the hazard for plant growth. However, total heavy metals in disturbed materials and undisturbed soils are not significantly different.

In the case of soil texture the 17 samples had a reported texture of either "sandy loam" or "clay". However, this classification was produced without a particle size analysis. The occurrence of numerous samples in two diverse textural classification and the absence of intermediate textural ranges suggest an imprecise determination. Therefore, the soil textural data may not represent sufficiently precise determination to merit serious evaluation as to their suitability for reclamation.

During 1986, soil sample sites for the lower Elk Creek facilities were sampled. These results indicated the soil on the north storage yard is acceptable for revegetation. Other areas of the lower Elk Creek facilities require six inches of suitable root zone material.

In 1987, soil test pits were dug on the west bench, central yard and east bench areas. The results are tabulated in Table 1. These test pits confirm the need for 6 inches of topsoil for the central yard area and east bench. The west bench area appears to have sufficient subsoil for revegetation. The coal material layer is generally less than 6 inches thick. This gob material will either be scarified and mixed with underlying material prior to topsoil placement or scraped up by mobile equipment for use as fill material.

Table 1 Soil Test Pit Results Lower Elk Creek Facilities August 1987				
Location	**Cross Section Reference**	**Soil Description**	**Interval Feet**	**Total Depth Feet**
West Bench	B-B	Coaly Subsoil Coal & Subsoil Subsoil	1+ 1.5 1.5 2.33	6.33
West Bench	D-D'	Subsoil	3.5	3.5
Central Yard	F-F' Lower	Coal Refuse & Ashes	6	6
Central Yard	F-F' Upper	Gob Subsoil/Rock	3 2.5	5.5
East Bench	I-I'	Coal Refuse	6	6
East Bench	K-K	Coal Refuse	7.5	7.5
East Bench	M-M'	Subsoil Coal Refuse	2.08 2.42	6.5

1.1 SEEDBED PREPARATION

As a first step in seedbed preparation, in areas where soil will be replaced, compacted surfaces will be ripped to a depth of at least 12 inches before applying soil. In areas where soil is not available for replacement or where surface materials are suitable, areas will not be ripped to a depth that exposes any undesirable underlying materials. If this depth is less than six inches, then soil will be added to attain a minimum depth of six inches. In areas where broadcast seeding or hydromulching is to be employed, the soil surfaces will be left somewhat roughened condition. Dozers or other tracked equipment may be used to prepare the surface for hydromulching or broadcast seeding. If the seedbed surface is hard and crusty, then tracked equipment will be used to roughen the surface prior to hydroseeding or broadcast seeding.

2.0 REVEGETATION PLAN

2.1 GENERAL REQUIREMENTS (RULE 4.15.1)

The mine has been in existence since 1901, with continual modification since that time until final closure in 2014. With significant areas of the mine disturbed prior to the enactment of reclamation laws, multiple private and public surface landowners, and multiple post-mining land uses, the revegetation plan and revegetation success criteria are necessarily complex. The reclamation plan has been revised (2019) to reflect the complexity of the pre- and post-SMCRA regulatory requirements and the requirements of the post-mining land uses and surface landowners.

2.2 SCHEDULE OF REVEGETATION (RULES 2.05.4.2(E), 4.15.3(1))

Revegetation will be undertaken as soon as practicable during the revegetation window specified below after regrading and replacement of soil growth medium.

2.3 SEED MIXES, SEEDING & PLANTING AND USE OF SPECIES (RULES 2.05.4.2(E), 4.15.2, 3)

2.3.1 SEED MIXTURES

Several seed mixes have been and will be employed at the mine site, depending upon the post mining land use and surface ownership of the area to be revegetated.

For areas where the surface owner is OMLLC or Hotchkiss Ranches, and the post-mining land use is undeveloped land, a seed mix designed to compliment the post mining land use will be employed (Table 3). Disturbances on lands where the surface owner is the BLM or Forest Service and the post-mining land use is undeveloped land will be revegetated with the seed mix specified by the management agency (Tables 4 and 5).

The seed mix for the private surface holdings was developed by selecting species similar to the major species components (dominant diversity, seasonality and growth form) found in the predominant range sites correlated with the underlying soil communities.

Seeding rates are expressed in pounds of Pure Live Seed (PLS) per acre and are specified at a rate of approximately 35 live seeds per square foot for drill seeding applications.

2.3.2 OTHER PLANT MATERIALS

OMLLC does not propose to employ seedlings or other live plant material in revegetation efforts at the mine site.

Table 3 *OMLLC Seed Mixture: Somerset, Sanborn [illegible] k Creek Mines (non-federal lands)*					
	ORIGIN	**SEEDS PER POUND**	**POUNDS PLS/ACRE**	**PLS PER ACRE**	**PLS PER FT²**
GRASSES					
Thickspike Wheatgrass (Critana) *Agropyron dasystachyum (Elymus lanceolatus lanceolatus)*	N	154,000	0.125	19,250	0.5
Beardless Bluebunch Wheatgrass (Whitmar) *Agropyron spicatum (Pseudoroegneria spicata inermis)*	N	117,000	0.5	58,500	1.3
Western Wheatgrass (Arriba) *Agropyron spicatum (Pascopyron smithii)*	N	110,000	0.25	40,000	0.9
Green Needlegrass *Stipa viridula*	N	181,000	0.25	45,250	1.0
Mountain Brome *Bromus marginatus*	N	90,000	0.75	67,500	1.5
Sheep Fescue *Festuca ovina*	N	560,000	0.5	75,000	1.7
Basin Wildrye *Elymus cinereus (Leymus cinereus)*	N	150,000	0.25	37,500	.9
Sanberg Bluegrass *Poa sandbergii*	N	925,000	0.06	55,500	1.3
		Total Grasses	**2.69**		**9.1**
FORBS					
Western Yarrow *Achillea millefolium*	N	4,125,000	0.03	123,750	2.8
Pacific Aster *Aster chilensis*	N	2,668,000	0.063	168,084	3.9
Cicer milkvetch (Lutana) *Astragalus cicer*	I	145,000	1.0	145,000	3.3
Blue Flax *Linum lewisii*	N	278,000	0.33	91,740	2.1
Sanfoin *Onobrychis viciaefolia*	I	20,000	1.0	20,000	0.5
Rocky Mtn. Penstemon *Penstemon strictus*	N	280,000	0.25	70,000	1.6
Palmer Penstemon *Penstemon palmeri*	N	610,000	0.125	76,250	1.75
		Total Forbs	**2.79**		**15.95**

	ORIGIN	SEEDS PER POUND	POUNDS PLS/ACRE	PLS PER ACRE	PLS PER FT^2
SHRUBS/HALF SHRUBS					
Silver Sagebrush *Artemisia cana*	N	850,000	0.06	51,000	1.2
Fringed Sagebrush *Artemisia frigida*	N	4,500,000	0.03	135,000	3.1
Mtn. Big Sagebrush *Artemisia tridentata vaseyana*	N	2,500,000	0.06	150,000	3.4
Rubber Rabbitbrush *Chrysothamnus nauseous*	N	335,000	0.25	83,750	1.9
Antelope Bitterbrush *Purshia tridentata*	N	15,000	0.75	11,250	0.26
		Total Shrubs/Half Shrubs	**1.15**		**9.86**

TABLE 4
SEED MIXTURE FOR USE ON BLM LANDS
Source: BLM Uncompahgre Field Office PR06 Permit Renewal Correspondence dated June 5, 2013

Species Common Name and Variety	Pounds per acre
Western Wheatgrass v. Arriba	0.96
Slender Wheatgrass v. San Luis	0.66
Mountain Brome v. Bromar	1.50
Big Bluegrass v. Sherman	0.18
Bottlebrush Squirreltail	0.96
Canada Wildrye	0.94
American Vetch	0.60
Rocky Mountain Penstemon	0.09
Western Yarrow	0.06
Total	**5.95 (double rate for broadcasting)**

TABLE 5
SEED MIXTURE FOR USE ON USFS LANDS
Source: USFS Paonia Ranger District PR06 Permit Renewal Correspondence dated June 14, 2013

Habitat Type	Species	Lbs/acres (PLS)
Mountain Shrub	Mountain Brome	4.0
	Prairie Junegrass	3.0
	Western Wheatgrass	4.0
	Indian Ricegrass	3.0
	Sandberg Bluegrass	3.0
	Bluebunch Wheatgrass	3.0
	Total	**20.0**

Habitat Type	Species	Lbs/acres (PLS)
Aspen/Spruce-Fir	Mountain Brome	5.0
	Slender Wheatgrass	3.0
	Thickspike Wheatgrass	3.0
	Indian Ricegrass	3.0
	Canby Bluegrass	3.0
	Blue Wildrye	5.0
	Total	**19.0**

The above seed mixes will also include a mix of native forbs from the following list: *Coreopsis lanceolata, Lupinus argenteus, Phlox drummondii, Thermopsis montanus, Penstemon strictus, Vicia americanus, Achillea millefolium var. occidentailis* (at a very low rate), *Aster chilensis, Erigeron speciosus, Eriogonum umbellatum, or Geranium viscosissimum.*

2.3.3 SEEDING TECHNIQUES AND RATES (RULES 2.05.4.2(E), 4.15.3)

Depending on the site-specific conditions of a given area to be revegetated, seeding will be accomplished at rates indicated in Table 3, 4, or 5 using drill seeding methods. Should conditions warrant broadcast or hydro-seeding methods, the rate will be two times that specified in the applicable table. Seeding in areas managed by the BLM or Forest Service will be in accordance with the rates and application techniques specified (Tables 4 and 5, or as modified) by the management agency at the time of revegetation.

As the seed mix is comprised primarily of cool season species, autumn planting will be employed to allow these species to benefit from cold winter temperatures and moisture for spring germination requirements. Planting will be undertaken from September 1 to December 1 of any given year, after final regrading and soil/plant growth medium replacement at a given area to be revegetated.

Spring seeding between April 1 and June 15 may be employed if determined to be necessary to minimize potential soil erosion or in conjunction with specific mulching products.

2.4 MULCHING & SOIL STABILIZATION (RULES 2.05.4.2(E), 4.15.4)

In general mulch will not be applied to areas to be revegetated at the mine site. Whenever practicable and available, native adjacent organic material (litter, brush, branches, logs or other plant material) will be replaced on areas to be reclaimed, as long as placement does not hinder reseeding.

In areas with slopes greater than 2.5H:1V, mulch will be applied to minimize downslope erosion after seeding. Mulch may consist of one or more common erosion control materials, including but not limited to; clean straw or hay, coir, hydro-mulch, or erosion control logs, mats, blankets, or other native adjacent or commercially available product. A tackifier may be applied at the rates recommended by the manufacturer to aid in retention of mulch materials on steep slopes.

2.5 IRRIGATION AND FERTILIZATION (RULES 2.05.4.2(E))

OMLLC does not propose to irrigate reclaimed areas.

Fertilization has generally been found to promote annual and noxious weed growth in natural reclamation scenarios, therefore OMLLC does not propose to employ fertilizer in revegetated areas.

2.6 GRAZING (RULE 4.15.5)

OMLLC does not propose to employ grazing as a management technique on revegetated areas owned or managed by OMLLC. On areas owned and managed by Hotchkiss Ranches, the BLM, and Forest Service, grazing is allowed and not controlled by OMLLC.

2.7 WEED AND PEST CONTROL

Noxious weeds will be controlled on the revegetated areas of the mine site. Upon identification of an infestation, OMLLC will implement control measures. Control measures will be implemented based on recommendations of the local NRCS or agricultural extension

office and may employ mechanical, chemical, or biological controls. OMLLC will modify the CDRMS permit as necessary to address any previously unspecified measures to be implemented.

As part of its Annual Reclamation Report (ARR) required under Rule 2.04.13, OMLLC will summarize its weed control activities for the year.

2.8 DETERMINING REVEGETATION SUCCESS (RULES 2.05.4.2(E), 4.15.7)

Any revegetation success determination at the mine site is complicated by the following factors; time of disturbance (pre- or post-SMCRA), surface ownership, multiple vegetation communities, and post-mining land use. Within the mine site there are areas dating from the initial disturbance date of 1901, there are four separate surface land owners (two private and two public), three major vegetation communities (pinon-juniper, mountain shrubland, and aspen/conifer woodland), and two approved post-mining land uses (undeveloped land and industrial/commercial).

Table TR-A illustrates the mine site locations, age (pertinent to revegetation success), post-mining land use, and applicable CDRMS rule (which determines revegetation success criteria).

The following discussion will address each revegetation success variant.

2.8.1 REVEGETATION SUCCESS CRITERIA: PRE-SMCRA, UNDEVELOPED LAND RECLAIMED AREAS (CATEGORY A)

CDRMS Rules 4.15.10(1) specifies the revegetation success criteria for areas previously disturbed (pre-SMCRA) and not reclaimed to the current requirements (post-SMCRA). For the undeveloped land post-mining land use at OMLLC, the applicable revegetation success criterion is that the "minimum ground cover of living plants shall not be less than can be supported by the best available topsoil or other suitable material in the reaffected areas, shall not be less than the ground cover existing before redisturbance, and shall be adequate to control erosion."

As these areas had no topsoil salvaged for use in reclamation, the material used will be best available non-toxic, non-combustible material. These areas were not "re-affected" in the definition of the Act and Rules, therefore the ground cover existing was largely non-existent or annual weedy species, unsuitable in a reclamation scenario. The revegetation success criteria for these areas would then be 'ground cover adequate to control erosion'.

Absent site specific quantitative data, development of the criterion must rely on technical standards and modelling to establish a ground cover value adequate to control erosion. In the past, CDRMS has employed the Universal Soil Loss Equation (and subsequent modifications) to evaluate the success of revegetation for Phase II bond release.

This equation employs five site specific environmental and management factors to calculate the amount of potential soil loss per acre per year. By selecting an acceptable soil loss value, the equation can be rearranged to calculate a cover factor for vegetation. This value can be converted into a ground cover of living plants, which, by virtue of the acceptable level of soil loss selected for the calculations, should yield a ground cover value adequate to control erosion. This value should then be acceptable and defendable as a ground cover success criterion.

The Universal Soil Loss Equation (USLE) is expressed as:

A=R*K*LS*C*P

Where:

A= soil loss in tons/acre/year (for our calculation, selected from quantitative data from the West Elk Mine in 2011)

R= rainfall factor (in this case the 2-year, 6-hour Type II storm event for Somerset, Colorado)

K= soil erodibility factor based on the soil types at the mine (in this case torriorthents, Absarokee-Work loam, and Beenom-Absarokee association; with K factors from 0.05-0.37)

LS= length of slope factor (in this case derived from quantitative measurements of comparable locations at the West Elk Mine)

P=control practice factor based on soil conservation practices (assumed to be 1.0 as the areas of interest are native and not managed)

For our purposes, the equation was rearranged to solve for C, yielding:

C=A/(R*K*LS*P)

For the calculation, the following values were selected from published U.S. Department of Agriculture, U.S. Department of Commerce, and Barfield, Warner and Hahn, 1983 and quantitative field data collected from the area.

A= 13.68
R= 33.30
K= 0.2
LS= 10.57
P= 1.0

Yielding: C=13.68/(33.30*0.2*10.57*1) = 0.194

When the calculated C value is interpolated from the EPA (1977) table "C" Factors for Permanent Pasture and Rangeland, a ground cover of 20% is realized for a predominantly graminoid vegetation community with no appreciable overstory canopy. The definition of the percent ground cover (cover that contacts the surface) includes a random distribution of mulch or vegetation and any mulch (litter) where it exists.

The technical standard for "minimum ground cover of living plants … adequate to control erosion" shall be 20% total vegetation cover. The revegetation success standard for these reclamation areas shall be; vegetation cover of the reclaimed area will be successful when total live vegetation cover of the reclaimed areas is equal to or greater than 90 percent of the total vegetation cover standard, that being 20%, with 90 percent statistical confidence.

TABLE TR-A. OXBOW MINING, LLC ELK CREEK MINE
REVEGETATION PLAN REQUIREMENTS BY LOCATION, AND PROPOSED SUCCESS CRITERIA

CATEGORY	LOCATION	PRE/POST SMCRA	PMLU	SEDIMENTATION	VEGETATION	NOTES
A	Elk Creek Facilities	*pre SMCRA*	undeveloped lands	see vegetation	live plant **cover** adequate to control erosion	Rule 4.15.10
B	Entrance Road to Cemetery	pre SMCRA	industrial and commercial	see vegetation	may be waived by owner, and vegetation not necessary for erosion control	Rule 4.15.10
B	Somerset Mine Hubbard Fan Shaft # 1 ("parking lot")	*pre SMCRA*	industrial and commercial*	see vegetation	may be waived by owner, and vegetation not necessary for erosion control	Rule 4.15.10
B	Raw Water Intake Gallery	*pre SMCRA*	industrial and commercial	see vegetation	may be waived by owner, and vegetation not necessary for erosion control	Rule 4.15.10
B	Railroad Right of Way/Associated Areas	*pre SMCRA*	industrial and commercial	see vegetation	may be waived by owner, and vegetation not necessary for erosion control	Rule 4.15.10
C	Hubbard Ck Ventilaton Fan # 1 facility	*pre SMCRA w/ redisturbance*	undeveloped lands	see vegetation	live plant cover adequate to control erosion	Rule 4.15.10
C	Sediment Ponds	*pre SMCRA w/ redisturbance*	depends on location	depends on location	depends on location	depends on location
D	Access Roads & Powerlines	depends on location	industrial and commercial	adequate erosion control	may be waived by owner, and vegetation not necessary for erosion control	Rule 4.15.10
D	Bear Ck. Powerline	depends on location	industrial and commercial	adequate erosion control	may be waived by owner, and vegetation not necessary for erosion control	Rule 4.15.10
E	Bear Creek B Seam Portal	pre and post SMCRA	undeveloped lands	see vegetation	live plant cover adequate to control erosion	Rule 4.15.10
F	NFELLC Facilties	pre and post SMCRA	industrial and commercial	adequate erosion control	may be waived by owner, and vegetation not necessary for erosion control	Rule 4.15.10

TABLE TR-A. OXBOW MINING, LLC ELK CREEK MINE
REVEGETATION PLAN REQUIREMENTS BY LOCATION, AND PROPOSED SUCCESS CRITERIA PAGE 2

CATEGORY	LOCATION	PRE/POST SMCRA	PMLU	SEDIMENTATION	VEGETATION	NOTES
G	Elk Ck. Facilities	*post SMCRA*	undeveloped lands	adequate vegetation	total vegetation cover, total herbaceous production, species composition	Rule 4.15.7 & 4.15.8
G	Hubbard Ck Ventilaton Fan #2 facility	*post SMCRA*	undeveloped lands	adequate vegetation	total vegetation cover, total herbaceous production, species composition	Rule 4.15.7 & 4.15.8
G	Methane Degas Wells	*post SMCRA*	undeveloped lands	adequate vegetation	total vegetation cover, total herbaceous production, species composition	Rule 4.15.7 & 4.15.8
G	Sanborn Ck. Tract	*post SMCRA*	undeveloped lands	adequate vegetation	total vegetation cover, total herbaceous production, species composition	Rule 4.15.7 &4.15.8
G	W. Valley & W. Valley II Coal Refuse Facilites	*post SMCRA*	undeveloped lands	adequate vegetation	total vegetation cover, total herbaceous production, species composition	Rule 4.15.7 &4.15.8
H	Bear Ck. Fansite Facility (New)	*post SMCRA*	industrial and commercial	adequate erosion control	may be waived by owner, and vegetation not necessary for erosion control	Rule 4.15.10
H	Bear Ck. Shaft/Vessels	*post SMCRA*	industrial and commercial	adequate erosion control	may be waived by owner, and vegetation not necessary for erosion control	Rule 4.15.10
H	Upper Elk Ck. Facilities Fan/Utility Bench	*post SMCRA*	industrial and commercial	adequate erosion control	may be waived by owner, and vegetation not necessary for erosion control	Rule 4.15.10
H	E. Elk Ck./Sanborn Ck. Road	*post SMCRA*	industrial and commercial	adequate erosion control	may be waived by owner, and vegetation not necessary for erosion control	Rule 4.15.10
H	Lower Elk Ck. Mine Facilities	*post SMCRA*	industrial and commercial	adequate erosion control	may be waived by owner, and vegetation not necessary for erosion control	Rule 4.15.10
H	Bathhouses	*post SMCRA*	industrial and commercial	adequate erosion control	may be waived by owner, and vegetation not necessary for erosion control	Rule 4.15.10
H	Office	*post SMCRA*	industrial and commercial	adequate erosion control	may be waived by owner, and vegetation not necessary for erosion control	Rule 4.15.10
H	Warehouse/Welding Shop Complex	*post SMCRA*	industrial and commercial	adequate erosion control	may be waived by owner, and vegetation not necessary for erosion control	Rule 4.15.10
H	Small Vehicle Maintenance Building	*post SMCRA*	industrial and commercial	adequate erosion control	may be waived by owner, and vegetation not necessary for erosion control	Rule 4.15.10
H	Sanborn Ck. Portal Area Pipeline	*post SMCRA*	industrial and commercial	adequate erosion control	may be waived by owner, and vegetation not necessary for erosion control	Rule 4.15.10
H	Sanborn Ck. Fansite Methane Project & Utility Area	*post SMCRA*	industrial and commercial	adequate erosion control	may be waived by owner, and vegetation not necessary for erosion control	Rule 4.15.10
H	Substation # 3	*post SMCRA*	industrial and commercial*	adequate erosion control	may be waived by owner, and vegetation not necessary for erosion control	Rule 4.15.10
H	Sediment Pond B	*post SMCRA*	remains in place	N/A	N/A	N/A

2.8.2 REVEGETATION SUCCESS CRITERIA: PRE-SMCRA, INDUSTRIAL OR COMMERCIAL RECLAIMED AREAS (CATEGORY B)

A number of areas at the mine are pre-SMCRA and have an approved post-mining land use of industrial/commercial. These areas fall into two categories; A) areas that are regularly traversed and not commonly revegetated for their use (i.e., roads, parking areas, and similar uses), and B) other areas not subject to active use. The first areas (A) will not have a revegetation standard for final revegetation success, as they have been requested to be left as is, post-mine by the surface landowners, and any erosion from these areas is minimized and controlled by in-place best management practices.

For the second set of reclaimed areas (B) that are not actively used, the revegetation success requirement is one of minimum ground cover of living plants adequate to control erosion. The standard has been derived from the USLE equation described in Section 2.8.1.

The technical standard for "minimum ground cover of living plants … adequate to control erosion" shall be 20% total vegetation cover. The revegetation success standard for these reclamation areas shall be; vegetation cover of the reclaimed area will be successful when total live vegetation cover of the reclaimed areas is equal to or greater than 90 percent of the total vegetation cover standard, that being 20%, with 90 percent statistical confidence.

2.8.3 REVEGETATION SUCCESS CRITERIA: PRE-SMCRA (WITH REDISTURBANCE), UNDEVELOPED LAND RECLAIMED AREAS (CATEGORY C)

Two areas were identified at the mine that are pre-SMCRA and were subsequently redisturbed to facilitate mine operations after the passage of the Act; the Hubbard Creek Ventilation Fan #1 facility and the sediment ponds (with the exception of sediment pond B, described separately below). These areas have an approved post-mining land use of undeveloped land. Given that these locations did not have topsoil (or other native plant growth medium) salvaged for reclamation use, and were not designed or constructed with current reclamation standards in mind, it was determined that the requirements of Rule 4.15.10 apply to revegetation standards, that is, the revegetation success requirement is one of minimum ground cover of living plants adequate to control erosion. The standard has been derived from the USLE equation described in Section 2.8.1.

The technical standard for "minimum ground cover of living plants … adequate to control erosion" shall be 20% total vegetation cover. The revegetation success standard for these reclamation areas shall be; vegetation cover of the reclaimed area will be successful when total live vegetation cover of the reclaimed areas is equal to or greater than 90 percent of the total vegetation cover standard, that being 20%, with 90 percent statistical confidence.

2.8.4 REVEGETATION SUCCESS CRITERIA: PRE-SMCRA (WITH REDISTURBANCE), INDUSTRIAL/COMMERCIAL RECLAIMED AREAS (CATEGORY D)

A number of areas at the mine were disturbed pre-SMCRA, and were subsequently redisturbed after the passage of the Act. These areas have an approved post-mining land use of industrial/commercial and have been developed for that post-mining land use. These areas fall into two categories; A) areas that are regularly traversed and not commonly revegetated for their use (i.e., roads, parking areas, and similar uses), and B) other areas not

subject to active use. The first areas (A) will not have a revegetation standard for final revegetation success, as they have been requested to be left as is, post-mine by the surface landowners, and any erosion from these areas is minimized and controlled by in-place best management practices.

For the second set of reclaimed areas (B) that are not actively used, the revegetation success requirement is one of minimum ground cover of living plants adequate to control erosion. The standard has been derived from the USLE equation described in Section 2.8.1.

The technical standard for "minimum ground cover of living plants ... adequate to control erosion" shall be 20% total vegetation cover. The revegetation success standard for these reclamation areas shall be; vegetation cover of the reclaimed area will be successful when total live vegetation cover of the reclaimed areas is equal to or greater than 90 percent of the total vegetation cover standard, that being 20%, with 90 percent statistical confidence.

2.8.5 REVEGETATION SUCCESS CRITERIA: MIXED PRE- & POST-SMCRA UNDEVELOPED LAND RECLAIMED AREAS (CATEGORY E)

One area at the mine that was disturbed pre-SMCRA and was subsequently disturbed post-SMCRA to facilitate mine operations is the Bear Creek B Seam Portal facility. This area has an approved post-mining land use of undeveloped land. Given that this location did not have topsoil (or other native plant growth medium) salvaged for reclamation use, and was not entirely designed or constructed with current reclamation standards in mind, it was determined that the requirements of Rule 4.15.10 applied to revegetation standards, that is, the revegetation success requirement is one of minimum ground cover of living plants adequate to control erosion. The standard has been derived from the USLE equation described in Section 2.8.1.

The technical standard for "minimum ground cover of living plants ... adequate to control erosion" shall be 20% total vegetation cover. The revegetation success standard for these reclamation areas shall be; vegetation cover of the reclaimed area will be successful when total live vegetation cover of the reclaimed areas is equal to or greater than 90 percent of the total vegetation cover standard, that being 20%, with 90 percent statistical confidence.

2.8.6 REVEGETATION SUCCESS CRITERIA: MIXED PRE- & POST-SMCRA INDUSTRIAL OR COMMERCIAL RECLAIMED AREAS (CATEGORY F)

A number of areas at the mine were disturbed either pre- or post-SMCRA. These areas have an approved post-mining land use of industrial/commercial and have been developed for that post-mining land use. These areas are regularly traversed and not commonly revegetated for their use (i.e., NFELLC facilities, and similar areas). These areas will not have a revegetation standard for final revegetation success, as they have been requested to be left post-mine by the surface landowners, and any erosion from these areas is minimized and controlled by in-place best management practices.

2.8.7 REVEGETATION SUCCESS CRITERIA: POST-SMCRA, UNDEVELOPED LAND RECLAIMED AREAS, USING A REFERENCE AREA (CATEGORY G)

The following will be the revegetation success criteria for the post-SMCRA areas at mine where the post-mining land use is undeveloped land:

Vegetation Cover

Vegetation cover of the reclaimed area will be successful when total live vegetation cover of the reclaimed areas is equal to or greater than 90 percent of the total herbaceous vegetation cover of the applicable approved reference area with 90 percent statistical confidence.

Herbaceous Production

Herbaceous production (defined as current year above-ground biomass of herbaceous vegetation) of reclaimed areas will be successful when total herbaceous production is equal to or greater than 90 percent of the total herbaceous production of the applicable approved reference area with 90 percent statistical confidence.

Woody Plant Density

There shall be no woody plant density revegetation success standard pursuant to the request of the surface landowners that woody plants not be actively re-established on the reclaimed areas of the mine.

Species Composition

The species composition revegetation success standard was derived from quantitative sampling of the approved reference area, and represents the significant species contributing to the composition of the reference area, based on seasonality, lifeform, and origin.

Species composition and a demonstration of the adequacy of the seasonal nature and support of the post-mining land use of the reclaimed area vegetation will be successful when there are three or more perennial or biennial plant species of which two are graminoids and one is a perennial or biennial forb or shrub. No one component of the above three species should comprise greater than 60% relative cover nor less than 2% relative cover, during a given year's quantitative sampling.

Species composition data will be derived from quantitative relative vegetation cover information collected by species or quantitative herbaceous production data collected by species. Plant species listed as noxious by the Colorado Department of Agriculture (species on CDA Noxious Weed List A or B) may not be considered in the evaluation of species composition success.

2.8.8 REVEGETATION SUCCESS CRITERIA: POST-SMCRA, INDUSTRIAL OR COMMERCIAL RECLAIMED AREAS (CATEGORY H)

A number of areas at the mine were disturbed post-SMCRA, have an approved post-mining land use of industrial/commercial, and have been developed for that post-mining land use. The activities on these areas are not conducive to revegetation for their use (i.e., Elk Creek and Sanborn Creek facilities, sediment pond B, and similar areas). These areas will not have a revegetation standard for final revegetation success, as they have been requested to be left post-mine by the surface landowners, and any erosion from these areas is minimized and controlled by in-place best management practices.

2.9 REVEGETATION SAMPLING METHODS AND STATISTICAL DEMONSTRATIONS FOR REVEGETATION SUCCESS (RULES 2.05.4.2(E), 4.15.11)

2.9.1 METHOD FOR SAMPLING PRE-SMCRA, UNDEVELOPED LAND RECLAIMED AREAS (CATEGORY A)

In pre-SMCRA reclaimed areas that have an undeveloped land post-mining land use, revegetation sampling to determine reclamation success will be necessary only where determined by the surface landowner and where necessary for surface erosion control. These areas are identified in Table TR-A.

The applicable revegetation success standard for such areas will be a technical standard for live plant cover adequate to control erosion as specified in Section 2.8.1.

Quantitative sampling will employ the applicable methods for sampling design, timing, sample numbers/sample adequacy, and statistical analysis as described in Methods for Sampling Post-SMCRA, Undeveloped Land Reclaimed Areas Using a Reference Area.

Live Plant Cover

The use of the point-intercept or line point-intercept methodologies will be used to estimate vegetation cover. If the point-intercept method is employed, an ocular frame (e.g. ESCO Associates or other manufacturer) will be used to minimize instrument error and maximize precision and observer accuracy. Cover transects will be 25 meters in length, with two sample data points collected at 1.0 meter intervals along the transect on opposite sides of the transect centerline, 1.5m apart. Transect direction will be established randomly through the use of computer generated random directions (0-360°). In no event will transects be allowed to extend within ten feet of reference area or revegetated area boundaries to minimize impacts from "edge effect."

For statistical purposes, each cover transect (comprising 50 data points) serves as a sample unit. Data points recorded the first vertical "hit" on vegetation (above or below the instrument), and any cryptogamic crust. Subsequent "hits" on vegetation (prior to interception of the ground) will be recorded. Cover data are recorded and reported by individual plant species. The first interception is used to calculate total vegetation cover values. Additional interceptions area used to calculate relative cover of individual plant species and lifeforms.

Revegetation will be deemed successful for the success criterion of live plant cover if the value of the sample mean from the reclaimed area is equal to or greater than 90 percent of the value of the final revegetation success criterion for live plant cover with 90% statistical confidence.

2.9.2 METHOD FOR SAMPLING PRE-SMCRA, INDUSTRIAL/COMMERCIAL RECLAIMED AREAS (CATEGORY B)

In pre-SMCRA reclaimed areas that have an industrial/commercial post-mining land use, revegetation sampling to determine reclamation success will be necessary only where determined by the surface landowner and where necessary for surface erosion control. These areas are identified in Table TR-A.

The applicable revegetation standard for such areas will be a technical standard for live plant cover adequate to control erosion as specified in Section 2.8.2.

Quantitative sampling will employ the applicable methods for sampling design, timing, sample numbers/sample adequacy, and statistical analysis as described in Methods for Sampling Post-SMCRA, Undeveloped Land Reclaimed Areas Using a Reference Area.

Live Plant Cover

The use of the point-intercept or line point-intercept methodologies will be used to estimate vegetation cover. If the point-intercept method is employed, an ocular frame (e.g. ESCO Associates or other manufacturer) will be used to minimize instrument error and maximize precision and observer accuracy. Cover transects will be 25 meters in length, with two sample data points collected at 1.0 meter intervals along the transect on opposite sides of the transect centerline, 1.5m apart. Transect direction will be established randomly through the use of computer generated random directions (0-360°). In no event will transects be allowed to extend within ten feet of reference area or revegetated area boundaries to minimize impacts from "edge effect."

For statistical purposes, each cover transect (comprising 50 data points) serves as a sample unit. Data points recorded the first vertical "hit" on vegetation (above or below the instrument), and any cryptogamic crust. Subsequent "hits" on vegetation (prior to interception of the ground) will be recorded. Cover data are recorded and reported by individual plant species. The first interception is used to calculate total vegetation cover values. Additional interceptions area used to calculate relative cover of individual plant species and lifeforms.

Revegetation will be deemed successful for the success criterion of live plant cover if the value of the sample mean from the reclaimed area is equal to or greater than 90 percent of the value of the final revegetation success criterion for live plant cover with 90% statistical confidence.

2.9.3 METHOD FOR SAMPLING PRE-SMCRA (WITH REDISTURBANCE), UNDEVELOPED LAND RECLAIMED AREAS (CATEGORY C)

In re-disturbed pre-SMCRA reclaimed areas that have an undeveloped land post-mining land use, revegetation sampling to determine reclamation success will be necessary only where determined by the surface landowner and where necessary for surface erosion control. These areas are identified in Table TR-A.

The applicable revegetation standard for such areas will be a technical standard for live plant cover adequate to control erosion as specified in Section 2.8.3.

Quantitative sampling will employ the applicable methods for sampling design, timing, sample numbers/sample adequacy, and statistical analysis as described in Methods for Sampling Post-SMCRA, Undeveloped Land Reclaimed Areas Using a Reference Area.

Live Plant Cover

The use of the point-intercept or line point-intercept methodologies will be used to estimate vegetation cover. If the point-intercept method is employed, an ocular frame (e.g. ESCO Associates or other manufacturer) will be used to minimize instrument error and maximize precision and observer accuracy. Cover transects will be 25 meters in length, with two sample data points collected at 1.0 meter intervals along the transect on opposite sides of the transect centerline, 1.5m apart. Transect direction will be established randomly through the use of computer generated random directions (0-360°). In no event will transects be allowed to extend within ten feet of reference area or revegetated area boundaries to minimize impacts from "edge effect."

For statistical purposes, each cover transect (comprising 50 data points) serves as a sample unit. Data points recorded the first vertical "hit" on vegetation (above or below the instrument), and any cryptogamic crust. Subsequent "hits" on vegetation (prior to interception of the ground) will be recorded. Cover data are recorded and reported by individual plant species. The first interception is used to calculate total vegetation cover values. Additional interceptions area used to calculate relative cover of individual plant species and lifeforms.

Revegetation will be deemed successful for the success criterion of live plant cover if the value of the sample mean from the reclaimed area is equal to or greater than 90 percent of the value of the final revegetation success criterion for live plant cover with 90% statistical confidence.

2.9.4 METHOD FOR SAMPLING PRE-SMCRA (WITH REDISTURBANCE), INDUSTRIAL/COMMERCIAL RECLAIMED AREAS (CATEGORY D)

In re-disturbed pre-SMCRA reclaimed areas that have an undeveloped land post-mining land use, revegetation sampling to determine reclamation success will be necessary only where determined by the surface landowner and where necessary for surface erosion control. These areas are identified in Table TR-A.

The applicable revegetation standard for such areas will be a technical standard for live plant cover adequate to control erosion as specified in Section 2.8.4.

Quantitative sampling will employ the applicable methods for sampling design, timing, sample numbers/sample adequacy, and statistical analysis as described in Methods for Sampling Post-SMCRA, Undeveloped Land Reclaimed Areas Using a Reference Area.

Live Plant Cover

The use of the point-intercept or line point-intercept methodologies will be used to estimate vegetation cover. If the point-intercept method is employed, an ocular frame (e.g. ESCO Associates or other manufacturer) will be used to minimize instrument error and maximize precision and observer accuracy. Cover transects will be 25 meters in length, with two sample data points collected at 1.0 meter intervals along the transect on opposite sides of the transect centerline, 1.5m apart. Transect direction will be established randomly through the

use of computer generated random directions (0-360°). In no event will transects be allowed to extend within ten feet of reference area or revegetated area boundaries to minimize impacts from "edge effect."

For statistical purposes, each cover transect (comprising 50 data points) serves as a sample unit. Data points recorded the first vertical "hit" on vegetation (above or below the instrument), and any cryptogamic crust. Subsequent "hits" on vegetation (prior to interception of the ground) will be recorded. Cover data are recorded and reported by individual plant species. The first interception is used to calculate total vegetation cover values. Additional interceptions area used to calculate relative cover of individual plant species and lifeforms.

Revegetation will be deemed successful for the success criterion of live plant cover if the value of the sample mean from the reclaimed area is equal to or greater than 90 percent of the value of the final revegetation success criterion for live plant cover with 90% statistical confidence.

2.9.5 METHOD FOR SAMPLING MIXED PRE- & POST-SMCRA UNDEVELOPED LAND RECLAIMED AREAS (CATEGORY E)

In mixed pre-and Post-SMCRA reclaimed areas that have an undeveloped land post-mining land use, revegetation sampling to determine reclamation success will be necessary only where determined by the surface landowner and where necessary for surface erosion control. These areas are identified in Table TR-A.

The applicable revegetation standard for such areas will be a technical standard for live plant cover adequate to control erosion as specified in Section 2.8.5.

Quantitative sampling will employ the applicable methods for sampling design, timing, sample numbers/sample adequacy, and statistical analysis as described in Methods for Sampling Post-SMCRA, Undeveloped Land Reclaimed Areas Using a Reference Area.

Live Plant Cover

The use of the point-intercept or line point-intercept methodologies will be used to estimate vegetation cover. If the point-intercept method is employed, an ocular frame (e.g. ESCO Associates or other manufacturer) will be used to minimize instrument error and maximize precision and observer accuracy. Cover transects will be 25 meters in length, with two sample data points collected at 1.0 meter intervals along the transect on opposite sides of the transect centerline, 1.5m apart. Transect direction will be established randomly through the use of computer generated random directions (0-360°). In no event will transects be allowed to extend within ten feet of reference area or revegetated area boundaries to minimize impacts from "edge effect."

For statistical purposes, each cover transect (comprising 50 data points) serves as a sample unit. Data points recorded the first vertical "hit" on vegetation (above or below the instrument), and any cryptogamic crust. Subsequent "hits" on vegetation (prior to interception of the ground) will be recorded. Cover data are recorded and reported by individual plant species. The first interception is used to calculate total vegetation cover

values. Additional interceptions area used to calculate relative cover of individual plant species and lifeforms.

Revegetation will be deemed successful for the success criterion of live plant cover if the value of the sample mean from the reclaimed area is equal to or greater than 90 percent of the value of the final revegetation success criterion for live plant cover with 90% statistical confidence.

2.9.6 METHOD FOR SAMPLING MIXED PRE- & POST-SMCRA INDUSTRIAL COMMERCIAL RECLAIMED AREAS (CATEGORY F)

In re-disturbed pre-SMCRA reclaimed areas that have an industrial/commercial post-mining land use, revegetation sampling to determine reclamation success will not be necessary as these areas will not be revegetated per the surface landowner's request.

2.9.7 METHODS FOR SAMPLING POST-SMCRA, UNDEVELOPED LAND RECLAIMED AREAS, USING A REFERENCE AREA (CATEGORY G)

2.9.7.1 SAMPLING DESIGN

Reference Areas

Based on the location of reclaimed areas to be evaluated for bond release, one or more of the applicable approved reference areas will be quantitatively sampled during the same season as the reclaimed areas.

Sample locations within each eligible reclaimed area will be randomly determined by use of a 100'x100' grid overlaying the reference area. Sample points within the reference area will be selected using a random numbers table. Sample point locations will be located in the field through compass triangulation, GPS, and pacing from known landmarks.

Reclaimed Areas

As the reclaimed areas within the mine site are irregularly dispersed and the sites vary in size, standard methods of gridding the reclaimed areas and generating random sample points are not practical.

The area of each reclaimed site will be calculated as a percentage of the total area of all reclaimed areas to be sampled at a given time, as well as the total area of eligible reclaimed locations. By selecting an initial number of total samples, locations for sampling by representative area and reclamation year were assigned.

Sample locations within each eligible reclaimed area will be randomly determined by use of a 100'x100' grid for sites larger than five acres and a 50'x50' grid for reclaimed areas less than five acres in areal extent. For example, where a reclaimed site was one acre in size, a 50'x50' grid will yield sixteen potential sample points. Where the reclaimed site is predominantly linear in nature (as is the case with reclaimed access roads), the overall length of the reclaimed site will be determined, and sufficient random numbers generated to allow for generation of sample points on a one hundred foot spacing. A sample point within the

reclaimed site will be selected using a random numbers table. Sample point locations will be located in the field through compass triangulation, GPS, and pacing from known landmarks.

2.9.7.2 FIELD SAMPLING

Timing

Field investigation of reference and reclaimed areas will be undertaken during the period of maximum plant growth. This time period generally coincides with anthesis/seed set and maximum presence of the majority of plant species found in reference areas, reclamation areas, and adjacent native areas at the mine site.

Total Vegetation Cover

The use of the point-intercept or line point-intercept methodologies will be used to estimate vegetation cover. If the point-intercept method is employed, an ocular frame (e.g. ESCO Associates or other manufacturer) will be used to minimize instrument error and maximize precision and observer accuracy. Cover transects will be 25 meters in length, with two sample data points collected at 1.0 meter intervals along the transect on opposite sides of the transect centerline, 1.5m apart. Transect direction will be established randomly through the use of computer generated random directions (0-360°). In no event will transects be allowed to extend within ten feet of reference area or revegetated area boundaries to minimize impacts from "edge effect."

For statistical purposes, each cover transect (comprising 50 data points) serves as a sample unit. Data points recorded the first vertical "hit" on vegetation (above or below the instrument), soil (bare ground), rock, litter, or cryptogamic crust. Subsequent "hits" on vegetation (prior to interception of the ground) will be recorded. Cover data are recorded and reported by individual plant species. The first interception is used to calculate total vegetation cover values. Additional interceptions area used to calculate relative cover of individual plant species and lifeforms. The quantitative cover data also provides the basis for calculation of species composition and relative importance.

Total Herbaceous Production

Total herbaceous production will be estimated by the harvest method. One herbaceous production plot will be located and randomly oriented at the origin of each cover transect. Herbaceous production plots will be 0.50 square meters (m^2) in area, or larger or smaller based on the prevailing vegetation cover of the area to be sampled. All current year above ground live herbaceous plant biomass will be clipped within the quadrat. Production material will be air or oven dried until weights vary by no more than 0.1g.

Species Composition

Species composition information is derived from quantitative vegetation cover data. Relative cover information provided a basis for evaluation of the importance of each encountered plant species and lifeform and for comparison to the final revegetation success criterion.

Woody Plant Density

Woody plant density data will not be collected as there is no woody plant density revegetation success criterion for the mine site, as requested by surface landowners.

2.9.7.3 SAMPLE NUMBERS/SAMPLE ADEQUACY

For the purposes of this study, total vegetation cover and total herbaceous production sampling will be undertaken to sample adequacy with a minimum of fifteen (15) samples for each parameter sampled. Parameter sample adequacy testing will occur at the one-sided 90% confidence level. Comparisons between sample mean parameter values and the revegetation success standard assume that the sample mean value accurately represents the population mean in all cases.

The following formula will be used for sample adequacy calculations:

$$n_{min} = \frac{(t)^2 (s)^2}{(d\ X_{bar})^2}$$

where: n_{min} = minimum sample size
s = sample standard deviation
t = the Student's t distribution value at the 90% level (one-sided)
d = percent acceptable deviation from the mean (10%)
X_{bar} = sample mean

2.9.7.4 STATISTICAL ANALYSIS

Statistical analysis for the revegetation success criteria of total vegetation cover and total herbaceous production is required if the value of the sample mean from the reclaimed area is less than 90 percent of the value of the final revegetation success criterion for total vegetation cover or total herbaceous production. A statistical analysis is not required for the evaluation of species composition.

Should a statistical analysis be required to determine revegetation success, a Student's t test will be employed. The Student's t test is a robust statistical test to evaluate the equivalency of two sample means (Zar, 1974). This test will be employed to test the null hypothesis that the sample mean for reclaimed area parameter is equal to or greater than 90 percent of the value of the corresponding reference area mean or success standard. Standard statistical probability ranges will be employed in the determination of whether the reclaimed area mean is significantly less than the criterion. When the reclaimed area mean is not statistically significantly less than the reference area mean or criterion, the revegetation will have been demonstrated successful.

2.9.7.5 SPECIES IDENTIFICATION AND VERIFICATION

Species identification will be accomplished in the field through the use of plant identification keys (e.g. Harrington, 1954, Weber, 1990; Whitson, 1987; Zimdahl, 1990, Stubbendieck, *et al*, 1995). In cases where plant identification was inconclusive in the field, voucher specimens will be pressed for later lab identification.

2.9.8 METHOD FOR SAMPLING POST-SMCRA, INDUSTRIAL/COMMERCIAL RECLAIMED AREAS (CATEGORY H)

In post-SMCRA reclaimed areas that have and industrial/commercial post-mining land use, no revegetation sampling to determine reclamation success will be necessary as these areas will not be revegetated per the surface landowner's request.

The use of the point-intercept or line point-intercept methodologies will be used to estimate vegetation cover. If the point-intercept method is employed, an ocular frame (e.g. ESCO Associates or other manufacturer) will be used to minimize instrument error and maximize precision and observer accuracy.

Replaces
Live plant cover will be estimated by the use of the point-intercept method. An ocular point frame (e.g. ESCO Associates or other manufacturer) will be used to minimize instrument error and maximize precision and observer accuracy.