Closeout Plan Completion Report
South Pit Mine Minimal Impact Operation
Permit No. SA004MN

October 2022

THE ESPANOLA MERCANTILE COMPANY
Established in 1905

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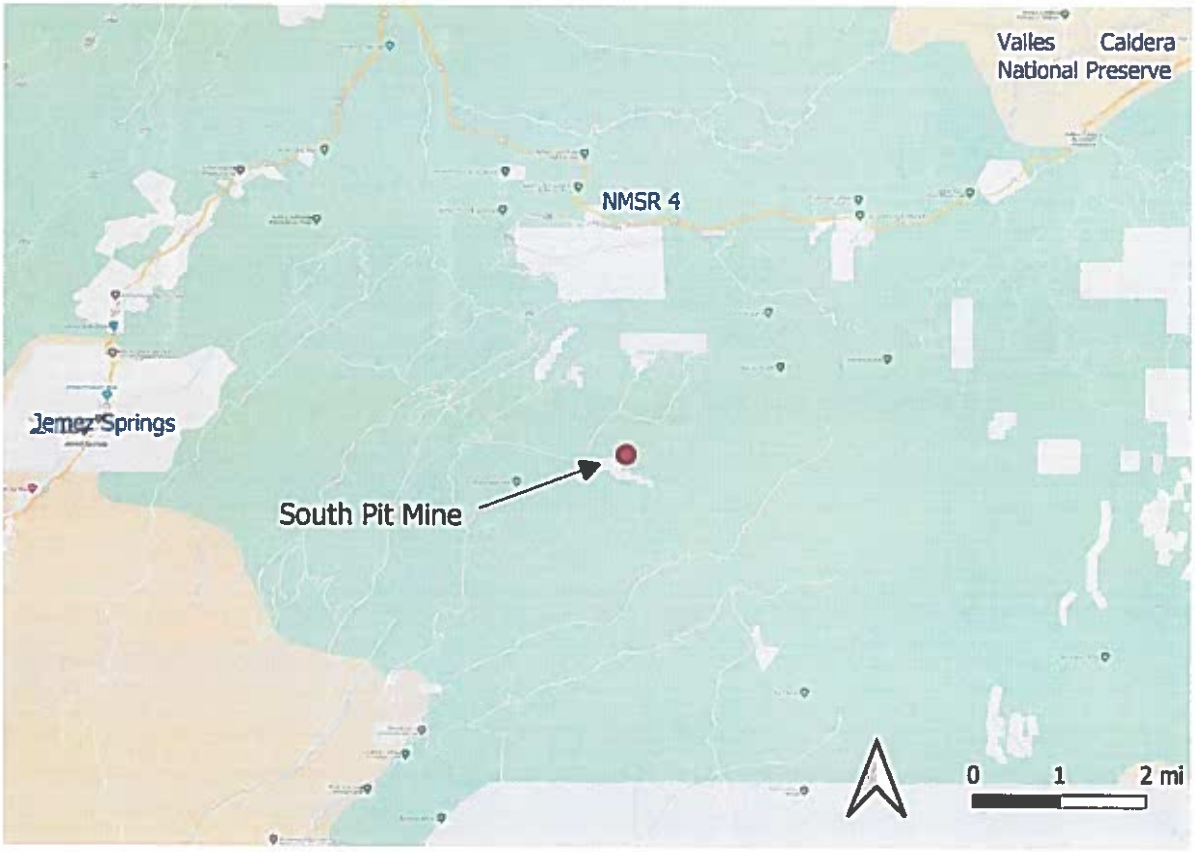
Contents

Introduction

In accordance with 19.10.12.1210 NMAC, The Espanola Mercantile Company requests the release of the financial assurance in the amount of $33,516.00 for the South Pit Mine Minimal Impact Operation Permit No. SA004MN. This document presents the reclamation or closeout measures completed at the 9.3-acre South Pit site and vegetation reports from 2019 and 2021 prepared by Ecosphere Environmental Services, Inc. Enclosed is a check in the amount of $250.00 as a permit modification fee in accordance with 19.10.2.201.I NMAC.

The reclaimed South Pit Mine is in Section 25, T18N, R3E, NW1/4, Redondo Peak Quadrangle, Sandoval County, New Mexico (Figure 1). The South Pit Mine was an open pit pumice mine operated by Copar Pumice Company and began operations in 1997. Over a 10-year period, approximately 250,000 cubic yards of locatable pumice were extracted from the mine. The mine operated early April through November, Monday through Friday, 8 hours per day. The equipment and vehicles utilized in operations included 18-wheeled haul trucks, lubrication-fuel truck, grader, maintenance-welder truck, D8 Caterpillar Dozer, Caterpillar Model 980 loader, and one 24 inch by 50 foot conveyor belt (for truck loading). There was no leaching, milling, or chemical processing at the mine site. Reclamation activities were completed in 2008 with additional tree planting in 2010.

Figure 1. South Pit Location



Schedule of Reclamation

Under the approved Forest Service Plan of Operations, mining and reclamation activities were planned for 3-acre tracts. Mining began on the southwest end of the South Pit Mine and progressed in a

northeastern direction. Reclamation activities of the 8 acres disturbed by mining activities ran concurrently with excavation operations and were completed in 2008 with additional tree planting in 2010.

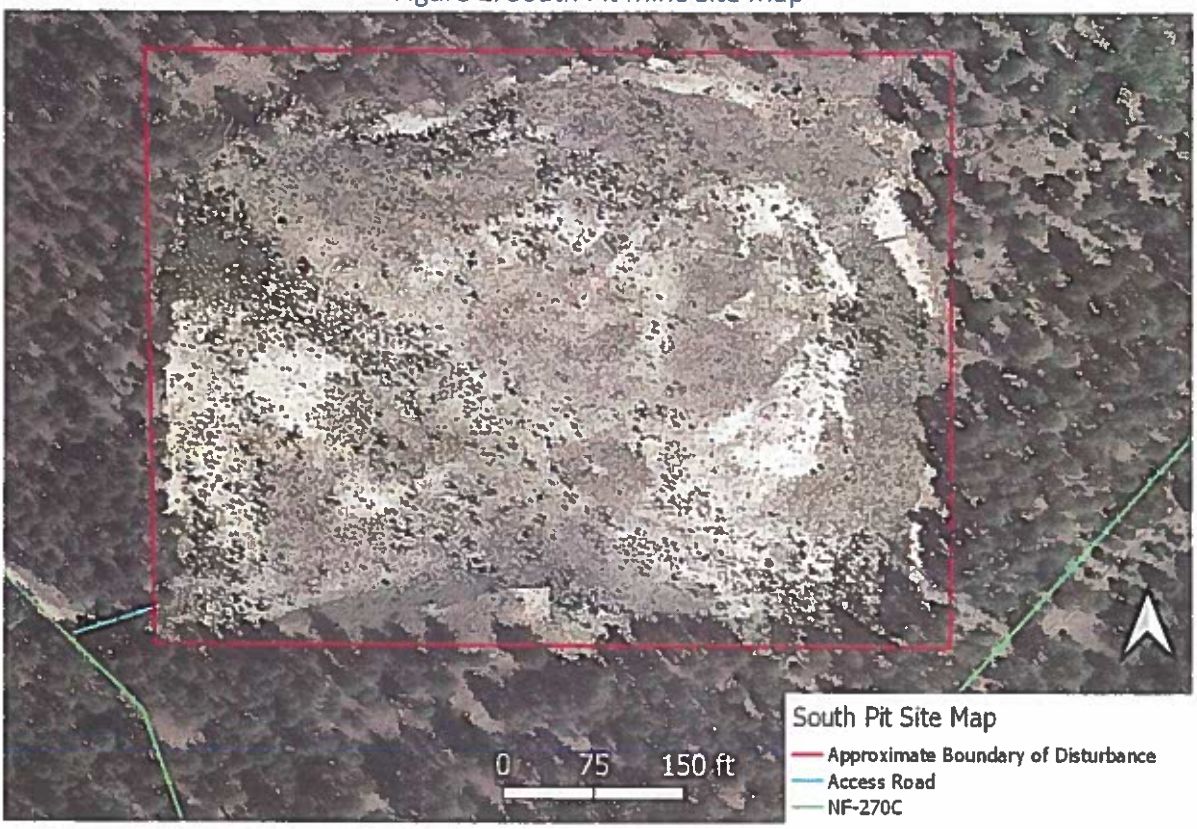
Surface Preparation

The topsoil from the initial mining area was removed and stockpiled on the southwest end of the site. The topsoil stripped from successive mining blocks was used to provide topdressing for the disturbed areas where previous mining and backfilling operations had been completed. Disturbed areas were backfilled with overburden and pumice and regraded. The slopes within the majority of the reclaimed areas are under 30%, and no slopes are greater than 40%. Topsoil was spread to a minimum depth of six inches, fertilized with phosphorus pentoxide at a rate of 100 pounds per acre, and disked to a depth of six inches. On slopes near 30% or greater, 18-inch non-draining contour furrows with straw bales check dams were installed at intervals of 45 feet or less. The furrows had bales staked in at intervals of 100 feet or less. Final grading was completed so that the reclaimed surface has small depressions which concentrate water, promote infiltration, and facilitate the establishment and growth of tree seedlings. Stockpiled logs were scattered over the reclaimed area at a rate of 4 logs per acre or greater.

Structure and Equipment Removal

No waste dumps, pits, ponds, plant sites, haul roads, or facilities remain at the South Pit Site.

Figure 2. South Pit Mine Site Map



Soils

According to the Natural Resource Conservation Service (NRCS), soil within the South Pit Mine consisted solely of the La Cueva-Bearsprings Peak families complex. This soil series are very deep, well drained soils that formed in pumice and volcanic ash. These soils occur on mountain slopes and hills. Slopes range from 15 to 40 percent and depth to the base of the soil ranges up to 40 inches.

Due to stripping, stockpiling, and respreading activities, the reclaimed soils have likely been converted from moderately well-developed soil to a younger soil type. Reclamation and soil stabilization procedures were completed in accordance with the approved Plan of Operations.

Vegetation / Revegetation

The South Pit permit area is classified as an upper montane coniferous forest with intermixed grasslands habitat type. The Forest Service's approved seed mixture of grasses, forbs, and shrubs was broadcast seeded after fertilizing and disking while the topsoil was friable. After seeding, straw mulch was spread and crimped into the soil. One-year old container stock of Ponderosa Pine seedlings were planted at a rate of 500 trees per acre in the springtime under prescribed soil moisture and temperature requirements. The mine area was fenced to prevent access to livestock and help the reestablishment of vegetation after reclamation. Livestock were excluded for a period of 3-5 years after revegetation to assure adequate establishment of grasses, forbs, and shrubs.

Table 1. Seed Mix

Common Name	Scientific Name	Pounds per Acre
Grasses		
Arizona Fescue	*Festuca arizonica*	3
Bottlebrush Squirreltail	*Elymus elymoides*	4
Indian Ricegrass	*Oryzopsis hymenoides*	4
Intermediate Wheatgrass	*Thinopyrum intermedium*	1
Junegrass	*Koeleria macrantha*	3
Mountain Brome	*Bromus marginatus*	3
Mountain Muhly	*Muhlenbergia montana*	2
Pine Dropseed	*Blepharoneuron tricholepis*	5
Sand Dropseed	*Sporobolus cryptandrus*	2
Sideoats Grama	*Bouteloua curtipendula*	2
Western Wheatgrass	*Pascopyrum smithii*	4
Forbs		
Alsike Clover	*Trifulium hybridum*	1
American Vetch	*Vicea americana*	1
Golden Banner	*Thermopsis montana*	3
Utah Sweetvetch	*Hedysarum boreale*	2
Western Yarrow	*Achillea millefolium*	1
Shrubs		
Antelope Bitterbrush	*Antelope Bitterbrush*	1
Mountain Mahogany	*Cercocarpus*	4
Mountain Snowberry	*Symphoricarpos*	1
Wax Current	*Ribes cereum*	4
Wood Rose	*Rosa woodsii*	4

Trees		
Ponderosa Pine	*Pinus ponderosa*	500 trees per acre

The 2021 South Pit Permit Modification 21-1 to Permit SA004MN includes technical revegetation success criteria that states:

1) A minimum of 35% live vegetative ground cover;
2) A minimum of 50% combined live vegetation and litter ground cover; and
3) Noxious weed species within the reclaimed area does not exceed 5% of the live vegetative cover. Noxious weed species are listed in the New Mexico Department of Agriculture, New Mexico Noxious Weed List.

In 2019 and 2021, vegetation monitoring was completed by Ecosphere Environmental Services, Inc. to measure reclamation progress at the South Pit Pumice Mine. The cover estimates recorded during the monitoring indicates that the reclamation area at the Mine meets the standard contained in the mine permit. The vegetation monitoring reports have been included in Attachment 1.

Hydrogeology

Surface Water

The South Pit Mine is located within the watershed of San Juan Canyon. From the South Pit mine, San Juan Canyon slopes generally to the southwest for eight miles where it meets Vallecito Creek which then drains into the Jemez River several miles to the southwest. Locally, the site sits on a divide between two short unnamed ephemeral drainages that grade to the southwest. The ephemeral drainages carry surface water during spring run-off from melting snow and after heavy summer thunderstorms.

The reclaimed mine surface was contoured to retain surface water, and therefore has a minimal potential to impact to surface water in the area. To prevent rilling, gullying, and loss of topsoil, slopes were backfilled and regraded at less than 30% and revegetated. Vegetation is well established in this area and there are very little signs of erosion.

Geology

The rocks in the region in and around the South Pit Mine are comprised of a complex series of Late Tertiary and Quaternary volcanic units underlain by mid-Tertiary sedimentary strata. The South pit mine is situated within the El Cajete pyroclastic beds which are locally shallow white to tan pyroclastic fall deposits of vesicular rhyolite (pumice clasts). The El Cajete pyroclastic beds are underlain by Pliocene to Miocene aged volcanoclastic deposits that consist of sandstone and conglomerate that have a maximum observed thickness of 200 feet. The volcanoclastic deposits are underlain by the Abiquiu Formation which is a Miocene to Oligocene aged sandstone/siltstone deposit that attains a thickness of 400 ft.

Groundwater

According to the New Mexico Office of State Engineer's (NMOSE) records, there are three wells within a mile of the reclaimed South Pit Mine. The shallow wells are located in a valley approximately 1,000 ft. south of the reclaimed area and are likely used for livestock, irrigation and/or domestic purposes. Well logs and depth to groundwater information were not available on the NMOSE website for the wells.

Table 2. Vicinity Wells

NMOSE ID	Location	Distance and Direction
RG 44037 POD1	T18N, R3E, Sec. 26,	1,050 feet SW
RG 44037 POD1	T18N, R3E, sec. 26,	1,050 feet SW
LWD 00295 POD1	T18N, R3E, sec. 25	1,300 feet South

The reclaimed mine is situated near the top a ridge and is approximately 100 feet above the elevation of the valley floor where the wells are located. The maximum depth of mining was 30 feet. Since the reclaimed mine is located at the top of the ridge, water available to percolate through the reclaimed area is limited to direct precipitation. Pumice and associated materials are chemically inert and non-acid generating.

There was no leaching, milling, or chemical processing at the mine site. Additionally, no overburden dumps, plant sites, or facilities remain at the site. Due to the relatively shallow depth of excavation, nature of the disturbed material, and lack of on-site processing, impacts to groundwater quality are unlikely. Additionally, due the mine being situated in an upland location and relatively small spatial extent of the mine (9 acres), it is unlikely to have a significant impact on groundwater recharge.

Post Mine Land Use

The South Pit Pumice Mine is located within the Santa Fe National Forest. The successful reclamation has achieved a post-mining land use of recreation, wildlife habitat, and livestock grazing.

Inspection

The Mining and Minerals Division shall conduct an inspection and evaluation of the reclamation or closeout measures completed. The surface owner of the property, other state and federal agencies, and other persons who have requested advance notice of the inspection shall be given notice of the inspection and may be present.

Summary

In accordance with 19.10.12.1210 NMAC, The Espanola Mercantile Company requests the release of the financial assurance in the amount of $33,516.00 for the South Pit Mine Minimal Impact Operation Permit No. SA004MN. The financial assurance has been maintained for a period that exceeds 12 years after the last year of seeding in compliance with 19.10.12.1204. Attachment 1 provides technical justification for meeting the revegetation standards within 2021 South Pit Permit Modification 21-1 to Permit SA004MN. The reclaimed South Pit Mine has been stabilized to minimize future impact to the environment and protect air and water resources and has achieved a self-sustaining ecosystem appropriate for the life zone of the surrounding areas and a post-mining land use of recreation, wildlife habitat, and livestock grazing.

Attachment 1

Vegetation Monitoring Reports

April 2022

2021 Reclamation Monitoring Report

Copar South Pit Mine

Prepared for:

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1. Introduction

In August 2021, Ecosphere Environmental Services, Inc. (Ecosphere) performed vegetation monitoring to measure reclamation progress at Española Mercantile Company's (EMC's) Copar South Pit Mine, located in Sandoval County, New Mexico. In November 2021, the Mining and Minerals Division (MMD) of the New Mexico Energy, Minerals, and Natural Resources Department (EMNRD) approved Permit Modification 21-1 to the Copar South Pit Mine – The Española Mercantile Company Permit No. SA004MN, which added three technical revegetation success criteria:

1. A minimum of 35% live vegetative ground cover;
2. A minimum of 50% combined live vegetation and litter ground cover; and
3. Noxious weed species within the reclaimed area does not exceed 5% of the live vegetative cover. Noxious weed species are listed in the New Mexico Department of Agriculture, New Mexico Noxious Weed List.

This report presents the results of the 2021 monitoring, as well as estimates of numerical sampling adequacy and statistical tests to demonstrate conformance with the new technical revegetation standards as set forth in the approved permit modification. The 2020 New Mexico Noxious Weed List (EMNRD 2020) was used to evaluate noxious weed status for the 2021 monitoring.

2. Methods

2.1 Cover Estimates

On August 30, 2021, Ecosphere biologist Nicasio Gonzalez conducted vegetation monitoring at the South Pit site. Five points were determined prior to the field investigation using the "Random" tool in ArcGIS (Appendix A, Map 1). Vegetative cover was measured by the Line-Intercept Method (Cook and Bonham 1977). At each point, a 100-foot measuring tape was tossed into the air and the direction indicated by the tape's lower point was used as the transect direction. The 100-foot tape was stretched from the transect point in the direction of the tossed tape and subdivided into 1-foot intervals. All plant species and the distance spanned in each interval were recorded. Measurements of individual plants were read to the nearest 0.1 foot. Only those plants or seedlings touched by the line or lying under or over it were considered. For floral canopies below eye level, the distance each species covered along the line at ground level was measured. For canopies above eye level, the distance covered by the downward projection of the foliage was estimated. Bare ground and litter were also recorded; litter is included in calculations of cover as specified in Española Mercantile Company's MMD permit. Annuals and biennials were excluded from calculations of cover, although they were measured in the field.

All calculations, including cover, sample adequacy, and test statistics were performed in Microsoft Excel.

2.2 Sample Adequacy

All cover estimates were arcsine square root transformed before analysis. Sample adequacy was determined using the Cochran (1977) formula:

$$n_{min} = t^2 s^2 / (0.1\bar{x})^2$$

where

- t is the tabular t value for a preliminary sample with n-1 degrees of freedom and a two-tailed significance level of $\alpha = 0.10$ ($P = 0.90$),
- s is the standard deviation of the preliminary sample, and
- $\bar{x}$ is the sample mean of the preliminary sample.

Sample adequacy is the minimum number of samples required to estimate cover with a 90% confidence that the sample mean for cover represents the true population mean.

2.3 Statistical Testing

All cover estimates were arcsine square root transformed before analysis. The cover estimates were compared to the technical standards using the one-sample, one-tailed t test:

$$t^* = \frac{\bar{x} - 0.9(\text{technical standard})}{s/\sqrt{n}}$$

where

- t^* is the calculated t-statistic,
- $\bar{x}$ is the sample mean,
- s is the standard deviation of the sample, and
- n is the sample size.

The α-level of the test is 0.10 by regulation, and the decision rules for testing the reverse null hypothesis are as follows:

- if $t^* < t(1-\alpha; n-1)$, conclude failure to meet the performance standard
- if $t^* \geq t(1-\alpha; n-1)$, conclude that the performance standard was met

3. Results

3.1 Cover Estimates

31 species were observed during the 2021 monitoring of the South Pit Mine reclamation area (Table 3-1). Nomenclature information was obtained from the Natural Resources Conservation Service (NRCS) PLANTS database (NRCS 2021) and the 2020 New Mexico Noxious Weed List (EMNRD 2020) was used to evaluate noxious weed status.

Table 3-1. Plant Species and Cover Estimates Observed at South Pit, August 2021

Scientific Name	Common Name	New Mexico Noxious Weed Class	Percent cover	s
	Forbs			
Achillea millefolium	yarrow	none	0.68	1.27
Amaranthus sp.	pigweed	none	0.06	0.13
Artemisia carruthii	Carruth's sagewort	none	1.85	2.47
Chenopodium fremontii	Fremont's goosefoot	none	0.38	0.39
Cirsium vulgare	bull thistle	B	0.04	0.09
Dracocephalum parviflorum	American dragonhead	none	0.76	1.70
Dysphania graveolens	fetid goosefoot	none	0.62	1.03
Erysimum capitatum	sanddune wallflower	none	0.02	0.04
Geranium caespitosum	pineywoods geranium	none	0.22	0.39
Heliomeris multiflora	showy goldeneye	none	0.16	0.36
Ipomopsis aggregata	scarlet gilia	none	0.20	0.45
Lupinus neomexicanus	New Mexico lupine	none	2.87	3.79
Machaeranthera asteroides	fall tansyaster	none	0.08	0.18
Medicago lupulina	black medick	none	0.24	0.54
Penstemon sp	penstemon species	none	0.06	0.13
Phacelia sp.	phacelia species	none	0.22	0.22
Senecio wootonii	Wooton's ragwort	none	0.04	0.09
Taraxacum officinale	common dandelion	none	0.20	0.31
Tragopogon dubius	yellow salsify	none	0.28	0.37
Trifolium repens	white clover	none	0.14	0.31

Scientific Name	Common Name	New Mexico Noxious Weed Class	Percent cover	s
Verbascum thapsus	common mullein	none	5.70	4.48
	Grasses			
Agrostis scabra	rough bentgrass	none	0.42	0.94
Bromus tectorum	cheatgrass	C	0.06	0.13
Elymus elymoides	squirreltail	none	0.84	1.77
Muhlenbergia montana	mountain muhly	none	1.53	1.71
Muhlenbergia sp.	muhly species	none	0.06	0.13
Pascopyrum smithii	western wheatgrass	none	21.47	6.48
unknown grass	unknown grass	unknown	0.06	0.13
	Shrubs and Trees			
Fallugia paradoxa	Apache plume	none	1.78	3.10
Pinus ponderosa	ponderosa pine	none	10.03	3.73
	Mosses			
unknown moss species	unknown moss	none	0.06	0.13

Note: s=standard deviation

Western wheatgrass (*Pascopyrum smithii*) contributed the highest cover of any species (21.5%), and ponderosa pine (*Pinus ponderosa*) had the greatest cover of any tree or shrub species (10.0%) (Table 3-1). Live vegetative cover averaged 40.3%. Average litter cover was 16.3% (Table 3-2).

Table 3-2. Total Cover Estimates for the South Pit, October 2021

Parameter	Percent cover	s
Total Vegetative Cover	51.12	5.59
Litter	15.05	5.09
Total Vegetative Cover + Litter	66.17	5.00
Bare Ground	33.83	5.00

Note: s=standard deviation

Two NM noxious weed species were observed during the 2021 monitoring – bull thistle (*Cirsium vulgare*), which is classified as Class B, and cheatgrass (*Bromus tectorum*), which is classified as Class C (EMNRD 2020). Class B species are limited to portions of the state. In areas with severe infestations, management should be designed to contain the infestation and stop any further spread. Class C species are widespread in the state. Management decisions for these species should be determined at the local

level, based on feasibility of control and level of infestation. At the South Pit Mine in 2021, bull thistle accounted for 0.08 percent and cheatgrass accounted for 0.12 percent of live vegetative cover, for a total of 0.20 percent total relative cover of noxious weeds.

3.2 Sampling Adequacy

Table 3-3 presents the sample adequacy calculation for the South Pit 2021 monitoring. The calculated sampling adequacy of Cochran's n_{min} was 2.25 transects.

Table 3-3. Sample Adequacy for 2021 Monitoring at South Pit

Mean Percent Cover, Transformed	s	$t_{(n=5,\ p=0.1,\ \text{two-tailed})}$	Cochran's n_{min}
0.80	0.06	2.132	2.25

Note: s=standard deviation

3.3 Statistical Testing

The Student's *t*-test of the transformed data collected at the South Pit Mine in 2021 indicated that overall mean percent cover was not statistically significantly less than 90 percent of the technical standard under the Copar South Pit Mine permit for both live vegetative cover (technical standard = 35 percent) and vegetative cover plus litter (technical standard = 50 percent) (i.e., $t_{calculated} > t_{critical}$ in both cases; Table 3-4). Additionally, cumulative mean percent cover of bull thistle and cheatgrass, the NM noxious weed species observed at the South Pit Mine in 2021, was significantly less than 90 percent of the technical standard for relative noxious weed cover (technical standard = 5 percent of live vegetative cover) (i.e., $t_{calculated} < t_{critical}$; Table 3-4).

Table 3-4. Student's t-Statistics for a One-Tailed *t*-Test, α=0.1, d.f. = 4, $t_{critical}$ = 1.533.

Parameter	Mean Percent Cover	$t_{calculated}$
Live Vegetative Cover	51.12	8.009
Live Vegetative Cover + Litter	66.17	15.155
Relative Noxious Weed Cover	0.19	-41.290

4. Conclusion

Live vegetative cover and vegetative cover plus litter measured at the Copar South Pit Mine in 2021 met or exceeded the technical standards as set forth in approved Permit Modification 21-1 to the Copar South Pit Mine – The Española Mercantile Company Permit No. SA004MN. Additionally, the noxious weed species observed at the mine – bull thistle, a Class B noxious weed, and cheatgrass, a Class C noxious weed – did not exceed 5 percent of live vegetative cover. The sampling effort for this site was adequate and captured the site variability for vegetation cover, the parameter upon which all others analyzed in this report are based (Cochran's n_{min}= 2.25, n=5).

5. Certification

Conclusions are based on actual field examinations and are correct to the best of my knowledge.

Signature of Field Biologist:

Nicasio Gonzalez, Biologist II
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Date: August 30, 2021

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Date: April 22, 2022

References

Cochran, W. G. 1977. Sampling Techniques. Third edition. John Wiley & Sons, New York.

Cook, C. W., and C. D. Bonham. 1977. Techniques for Vegetation Measurements and Analysis for a Pre- and Post-Mining Inventory. Range Science Series 28. Range Science Department, Colorado State University, Fort Collins, Colorado.

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Natural Resources Conservation Service (NRCS). 2022. The PLANTS Database. Available online at: http://plants.usda.gov. National Plant Data Team, Greensboro, North Carolina 27401-4901. Accessed April 13, 2022.

Appendix A – Maps

Map 1. South Pit Transect Locations Sampled in 2021

April 2022

Revised 2019 Reclamation Monitoring Report

Copar South Pit Mine

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1. A minimum of 35% live vegetative ground cover;
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This report presents the results of the 2019 monitoring, as well as estimates of numerical sampling adequacy and statistical tests to demonstrate conformance with the new technical revegetation standards as set forth in the approved permit modification. The 2020 New Mexico Noxious Weed List (EMNRD 2020) was used to evaluate noxious weed status for the 2019 monitoring.

2. Methods

2.1 Cover Estimates

On October 10, 2019, Ecosphere biologist C.J. Vialpando conducted vegetation monitoring at the South Pit site. Four points were determined prior to the field investigation using the "Random" tool in ArcGIS (Appendix A, Map 1). Vegetative cover was measured by the Line-Intercept Method (Cook and Bonham 1977). At each point, a 100-foot measuring tape was tossed into the air and the direction indicated by the tape's lower point was used as the transect direction. The 100-foot tape was stretched from the transect point in the direction of the tossed tape and subdivided into 1-foot intervals. All plant species and the distance spanned in each interval were recorded. Measurements of individual plants were read to the nearest 0.1 foot. Only those plants or seedlings touched by the line or lying under or over it were considered. For floral canopies below eye level, the distance each species covered along the line at ground level was measured. For canopies above eye level, the distance covered by the downward projection of the foliage was estimated. Bare ground and litter were also recorded; litter is included in calculations of cover as specified in Española Mercantile Company's MMD permit. Annuals and biennials were excluded from calculations of cover, although they were measured in the field.

All calculations, including cover, sample adequacy, and test statistics were performed in Microsoft Excel.

2.2 Sample Adequacy

All cover estimates were arcsine square root transformed before analysis. Sample adequacy was determined using the Cochran (1977) formula:

$$n_{min} = t^2 s^2 / (0.1\bar{x})^2$$

where

- t is the tabular t value for a preliminary sample with n-1 degrees of freedom and a two-tailed significance level of $\alpha = 0.10$ ($P = 0.90$),
- s is the standard deviation of the preliminary sample, and
- $\bar{x}$ is the sample mean of the preliminary sample.

Sample adequacy is the minimum number of samples required to estimate cover with a 90% confidence that the sample mean for cover represents the true population mean.

2.3 Statistical Testing

All cover estimates were arcsine square root transformed before analysis. The cover estimates were compared to the technical standards using the one-sample, one-tailed t test:

$$t^* = \frac{\bar{x} - 0.9(\text{technical standard})}{s/\sqrt{n}}$$

where

- t^* is the calculated t-statistic,
- $\bar{x}$ is the sample mean,
- s is the standard deviation of the sample, and
- n is the sample size.

The α-level of the test is 0.10 by regulation, and the decision rules for testing the reverse null hypothesis are as follows:

- if $t^* < t\,(1-\alpha; n-1)$, conclude failure to meet the performance standard
- if $t^* \geq t\,(1-\alpha; n-1)$, conclude that the performance standard was met

3. Results

3.1 Cover Estimates

Eighteen species were observed during the 2019 monitoring of the South Pit Mine reclamation area (Table 3-1). Nomenclature information was obtained from the Natural Resources Conservation Service (NRCS) PLANTS database (NRCS 2019) and the 2020 New Mexico Noxious Weed List (EMNRD 2020) was used to evaluate noxious weed status.

Table 3-1. Plant Species and Cover Estimates Observed at South Pit, October 2019

Scientific Name	Common Name	New Mexico Noxious Weed Class	Percent cover	*s*
	Forbs			
Achillea millefolium	western yarrow	none	3.65	1.83
Androsace septentrionalis	pygmyflower rockjasmine	none	0.88	1.02
Cirsium vulgare	bull thistle	B	0.35	0.23
Erysimum capitatum	wallflower	none	0.03	0.04
Lupinus neomexicanus	New Mexico lupine	none	2.00	1.20
Penstemon sp.	penstemon species	none	0.03	0.04
Potentilla hippiana	woolly cinquefoil	none	0.58	0.74
Taraxacum officinale	common dandelion	none	0.05	0.05
Tragopogon dubius	yellow salsify	none	0.15	0.26
Trifolium repens	white clover	none	1.75	1.28
Verbascum thapsus	common mullein	none	1.58	1.34
	Grasses			
Muhlenbergia montana	mountain muhly	none	1.03	0.76
Pascopyrum smithii	western wheatgrass	none	9.75	7.82
Poa fendleriana	muttongrass	none	0.23	0.39
Unknown grass	unknown grass	unknown	0.08	0.13
	Shrubs and Trees			
Artemisia frigida	prairie sagewort	none	0.40	0.69
Pinus ponderosa	ponderosa pine	none	12.23	8.95
Ribes aureum	golden currant	none	5.58	2.90

Note: s=standard deviation

Ponderosa pine contributed the highest cover of any species (12.2%), and western wheatgrass had the greatest cover of any grass species (9.8%) (Table 3-1). Live vegetative cover averaged 40.3%. Average litter cover was 16.3% (Table 3-2).

Table 3-2. Total Cover Estimates for the South Pit, October 2019

Parameter	Percent cover	*s*
Total Vegetative Cover	40.30	5.70
Litter	16.25	3.92
Total Vegetative Cover + Litter	56.55	7.62
Bare Ground	43.45	7.62

Note: *s*=standard deviation

One NM noxious weed species was observed during the 2019 monitoring – bull thistle (*Cirsium vulgare*), which is classified as Class B (EMNRD 2020). Class B species are limited to portions of the state. In areas with severe infestations, management should be designed to contain the infestation and stop any further spread. At the South Pit Mine in 2019, bull thistle accounted for 0.8 percent of live vegetative cover.

3.2 Sampling Adequacy

Table 3-3 presents the sample adequacy calculation for the South Pit 2019 monitoring. The calculated sampling adequacy of Cochran's n_{min} was 4.08 transects.

Table 3-3. Sample Adequacy for 2019 Monitoring at South Pit

Area	Mean Percent Cover, Transformed	*s*	$t_{(n=4,\ p=0.1,\ \text{two-tailed})}$	Cochran's n_{min}
Overall	0.687	0.059	2.353	4.077

Note: *s*=standard deviation

3.3 Statistical Testing

The Student's *t*-test of the transformed data collected at the South Pit Mine in 2019 indicated that overall mean percent cover was not statistically significantly less than 90 percent of the technical standard under the Copar South Pit Mine permit for both live vegetative cover (technical standard = 35 percent) and vegetative cover plus litter (technical standard = 50 percent) (i.e., $t_{calculated} > t_{critical}$ in both cases; Table 3-4). Additionally, mean percent cover of bull thistle, the only NM noxious weed species observed at the South Pit Mine in 2019, was significantly less than 90 percent of the

technical standard for relative noxious weed cover (technical standard = 5 percent of live vegetative cover) (i.e., $t_{calculated} < t_{critical}$; Table 3-4).

Table 3-4. Student's t-Statistics for a One-Tailed *t*-Test, α=0.1, d.f. = 3, $t_{critical}$ = 1.638.

Parameter	Mean Percent Cover	$t_{calculated}$
Live Vegetative Cover	40.3	2.676
Live Vegetative Cover + Litter	56.55	5.772
Noxious Weed Cover	0.35	-19.053

4. Conclusion

Live vegetative cover and vegetative cover plus litter measured at the Copar South Pit Mine in 2019 met or exceeded the technical standards as set forth in approved Permit Modification 21-1 to the Copar South Pit Mine – The Española Mercantile Company Permit No. SA004MN. Additionally, the noxious weed species observed at the mine – bull thistle, a Class B noxious weed – did not exceed 5 percent of live vegetative cover. The sampling effort for this site was adequate and captured the site variability for vegetation cover, the parameter upon which all others analyzed in this report are based (Cochran's n_{min}= 4.07, n=4).

5. Certification

Conclusions are based on actual field examinations and are correct to the best of my knowledge.

Signature of Field Biologist:

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Appendix A – Maps

Map 1. South Pit Transect Locations Sampled in 2019