Mine File
S. Linner

0036

VALLEY CAMP OF UTAH, INC.

Scofield Route
Helper, Utah 84526

ACT/007/001 #2

26 August 1986

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AUG 27 1986
DIVISION OF
OIL, GAS & MINING

Mr. Lowell P. Braxton
Administrator, MRD&RP
Division of Oil, Gas & Mining
355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, UT 84180-1203

Re: Belina Mine Complex
Permit No. UT-0013
Permit Condition Nos. 5 & 6

Dear Mr. Braxton:

In letter correspondence to you dated June 16, 1986, I submitted to the Division, a "Request for Waiver" of the test plot condition as described in the Division's letter of January 28, 1986. The particular condition was No. 5 of the letter, but since No. 6 of the same letter dealt so closely with the topsoil questions, I requested the waiver for both conditions.

In the request for waiver prepared by Cedar Creek Associates, Valley Camp committed to evaluating the cover and production of the interim revegetation acreage in anticipation that such a study would provide evidence of the suitability of substitute topsoil, stockpiled on site, as acceptable plant growth medium for final reclamation.

As part of the request, we also committed to the preparation and submittal of a report detailing the study procedures, data collected and conclusions extracted from the study.

For your consideration and review, please find enclosed seven copies of that report entitled, "Cover and Productivity Analysis of Temporary Revegetation Sites at Valley Camp of Utah, Inc.'s Utah No. 2 and Belina Operations."

Hopefully, this submittal will satisfy all concerns expressed in Condition Nos. 5 & 6, and, also, result in a reduction of the number of seed mixes required for reclamation.

FILE COPY

If you should have questions or comments pertaining to this submittal, please contact me.

Sincerely,

T. G. Whiteside
Chief Engineer

Enclosures

RECEIVED
AUG 27 1986
DIVISION OF
OIL, GAS & MINING

CEDAR CREEK
ASSOCIATES, INC.
Regulatory Compliance and Resource Specialists

COVER AND PRODUCTIVITY ANALYSIS OF TEMPORARY REVEGETATION SITES AT VALLEY CAMP OF UTAH, INC.'S UTAH #2 AND BELINA OPERATIONS

Prepared For:
VALLEY CAMP OF UTAH, INC.
Scofield, UT

Prepared by:
CEDAR CREEK ASSOCIATES, INC.
Fort Collins, CO

August, 1986

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1.0 INTRODUCTION AND PROJECT HISTORY

The following report details the results of cover and productivity data collection and analysis completed on temporary revegetation sites at Valley Camp of Utah, Inc's (Valley Camp) Utah #2 and Belina permit areas. The temporary revegetation site evaluated at the Utah #2 disturbance was the west-facing slope below the operating truck dump. Field analysis took place on July 11, 1986. The three temporary revegetation sites analyzed at the Belina disturbance included the southeast-facing slope northeast of the operating conveyor (Area A), the north-facing slope above the existing sediment pond (Area B), and the southeast-facing slope to the southwest of the operating conveyor (Area G). Field data were collected from all three Belina sites on July 12, 1986.

The impetus to conduct this study resulted from a stipulation associated with the permit issued for the Utah #2 and Belina operations. The stipulation required Valley Camp to construct revegetation test plots. The purpose of these plots would be to determine whether substitute topsoil material stockpiled at the disturbed sites is suitable plant growth media for final revegetation. This stockpiled substitute topsoil is necessary for use since the current disturbed area was affected prior to the effective date of current mining regulations. No soil had been salvaged on the Utah #2 and Belina disturbances during pre-law years.

Following a June 6, 1986 meeting between Valley Camp, Cedar Creek Associates, Inc. (Cedar Creek), and UDOGM personnel, UDOGM representatives contacted the OSM. The contact was made to determine whether the test plot stipulation could be waived on the basis of the condition of existing vegetation planted on stockpiled substitute topsoil material. The interim revegetation acreage was overlain with varying amounts of substitute topsoil and shows impressive plant cover. Mr. Dwight Kimsey of the OSM proposed that a properly conducted evaluation of interim revegetation acreage could result in a waiver of the test plot stipulation if the interim revegetation met unspecified cover and production levels. Subsequently, Valley Camp contracted with Cedar Creek to conduct the cover and production analyses on the temporarily reclaimed areas.

On July 11, 1986, representatives of Valley Camp, Cedar Creek, and UDOGM met to select temporarily revegetated areas from which cover and production data would be gathered. The objective was to select four sites (one at Utah #2 and three at the Belina complex) which would accurately reflect final revegetation acreage, slope, and aspect considerations. It was also believed necessary to evaluate areas which had been revegetated using techniques (appendices 1 and 2) that paralleled those proposed for final revegetation.

During this field survey, the slope below the truck dump was selected for analysis at the Utah #2 disturbance. It is most representative of the proposed final graded slope and aspect and was planted over five years ago. A sediment pond slope was rejected since it was composed solely of

topsoil material. One other site adjacent to the Utah #2 entrance was rejected since it had been planted in 1985 and had not completed one growing season.

At the Belina complex, three acceptable sites were selected. These sites accurately reflect what is believed to be the dominant aspects to which the presently disturbed area will be graded. The degree of slope for each site is within the range of proposed final graded slopes though they are somewhat steeper than the average of proposed slopes. Techniques used to revegetate these slopes essentially parallel proposed final revegetation techniques. Areas A and B on the Belina disturbance were planted in 1980. The fact that these areas have existed through over five growing seasons added to their suitability as evaluation sites. Area G, planted in 1985, was selected to represent a site where planted species were nearing the end of one growing season. Locations of all sites analyzed are depictd on maps included with this document.

By concensus, it was agreed to limit evaluations on Area B to the upper 25% of the site. The lower 75% of the site apparently had been negatively affected by an overly heavy maintenance fertilizer application which "burned" significant areas of grass. It was felt that the inclusion of this burned area would not result in data representative of the growth potential of the substitute topsoil material.

Few other areas were considered for analysis at the Belina site. One area to the west of Area G was briefly considered. This area showed excellent plant cover, density, and diversity. It was rejected, however, due to the comparatively intense labor effort expended to complete the revegetation process.

At the conclusion of this field review, Cedar Creek began data collection on the selected site at the Utah #2 disturbed site.

2.0 METHODOLOGY

2.1 Cover Data Collection

The procedure for measuring cover on Belina areas A, B, and G consisted of extending ten meter transects from randomly selected points (areas of recent dozer work were avoided). Along each transect a one-meter long ten-point optical frame (0.1 meter between points) was placed at one-meter intervals. Each point on the frame consisted of an optical scope with fine cross-hairs. The observer viewed the revegetated surface through each scope and recorded first hits, by cross-hairs on vegetation by species, rock, litter, and bare ground below the instrument. In this manner, 100 readings per transect were recorded. The hits were then tallied by category resulting in percentages recorded for total cover, total vegetative cover, percent cover by species, percent litter and percent bare ground exposure for each transect.

Each transect served as one sample for sample adequacy calculations. Sample adequacy was reached and exceeded for each temporarily reclaimed area analyzed by completing ten transects per area. Ten transects are the equivalent of 1,000 point-intercepts on the sampled area.

The method used for measuring cover at the Utah #2 site was identical to that used for the Belina sites with one exception. Transects at the Utah #2 site were systematically not randomly located. The temporarily revegetated area was of insufficient size to permit randomization. Therefore, transects were aligned from the near top to the near bottom of the slope at approximately two meter intervals. This spacing allowed for complete linear coverage along the north-south axis of the site.

2.2 Productivity Data Collection

Productivity was measured by clipping all current year's plant growth from randomly located 0.5 meter quadrats. Each quadrat served as one sample for sample adequacy calculations. Clipped plant material was bagged by life form (grasses vs. forbes vs. shrubs), transported to Fort Collins, Colorado, oven-dried at 100°C for 24 hours, and then weighed to the nearest 0.1 gram. To determine sample adequacy in the field, "wet" weights were used to complete sample adequacy calculations. Sample adequacy was also calculated on oven-dry samples to ensure that adequate samples were taken. Field data sheets used to record data are on file at Valley Camp's mine office.

Prior to clipping each temporarily reclaimed area, photos (Appendix 3) were taken of the area as a whole and of four randomly selected quadrats to depict site conditions.

2.3 Sample Adequacy Determination

Sample adequacy was determined for both cover and production on all temporarily revegetated areas using the following equation:

$$nm = (ts^2)/(d\bar{x})^2$$

where:

- nm = minimum number of samples needed,
- $\bar{x}$ = estimated sample mean,
- s = estimated sample standard deviation,
- t = value from t-table for a given probability level (1.645 for 90% confidence), and
- d = percent change in the sample mean desired to be detected (0.1 for 10%)

3.0 COVER MEASUREMENTS

Percentages given in the following discussion are averages for the ten transects completed at each sampled site unless otherwise noted. Cover percentages for individual species are given as a percent of total floral cover.

3.1 Utah #2 Disturbance

Seven species were encountered along the ten transects completed for this temporary revegetation site. The dominant specie was Poa pratensis at 47.7% cover followed by Dactylis glomerata at 12.0%, Elymus junceus at 3.7%, and Agropyron smithii at 3.4% cover. A. trachycaulum, Circium vulgare and an unknown forb each had less than 1.0% cover. The average total floral cover for the ten transects equaled 67.5%. Litter and rock accounted for 11.9% and 4.7% cover, respectively. The total ground cover, including the floral, litter, and rock catagories, was 84.1%.

The plants encountered appeared vigorous with no signs of chlorosis evident. Mature seedheads were common for all species found along the transect. Individual plants of Elymus junceus found near the bottom of the slope were exceptionally vigorous specimens. Numerous seedlings were noted during the analysis indicating that reproduction was occuring throughout the site.

Ten transects were evaluated for this site. Using the statistical adequacy calculation, the minimum number of transects necessary for this site would have been approximately 1.5 ($n = 10$; $\bar{x} = 67.5$; $s = 5.017$).

3.2 Belina Disturbances

The average total floral cover for site A was 67.2%. Litter and rock accounted for 14.3% and 10.5% cover, respectively, resulting in a total average ground cover of 92.0%. Eleven species were encountered along the ten transect lines. D. glomerata was the dominant specie on this site providing 35.6% cover. P. pratensis had 15.4% cover followed by A. smithii, A. trachycaulum, Medicago sativa, and Salsola kali with 9.3%, 1.0%, 1.9% and 1.1% cover, respectively. Species having less than 1.0% cover included Bromus inermis, E. junceus, Astragalus sp., and C. vulgare. Artemisia tridentata, the only shrub species encountered on the transects, provided 1.4% cover. A variety of other species, not hit on any transect, were observed on the site. These species included Symphoricarpos oreophilus, Hordeum jubatum, populus tremuloides, Prunus virginiana, Carex sp. and several invading forbs.

Overall, this site appears to be the most vigorous with fully mature grasses, forbs, and shrubs covering the site. A. tridentata is very common on site despite the relatively low cover percentage shown by the data. Fully developed seedheads were common for all grass species encountered. No stressed or chlorotic plants were observed during the field analysis.

Ten transects were extended on this site and the sample adequacy calculation completed for the data. The number of transects required was 3.4 ($n = 10$; $\bar{x} = 67.2$; $s = 7.554$).

D. glomerata was, by far, the dominant specie on site B with an average of 50.2% cover. Of the eight other species encountered along the transects, only P. pratensis at 3.9% and Phlem sp. (believed to be Phlem alpinum) at 3.1% produced notable cover. Of the remaining five species encountered, moss accounted for 2.1% cover while B. inermis, E. junceus, M. sativa, A. tridentata and Picea engelmannii each accounted for less than 1.0% cover. Total floral cover equaled 61.2 percent. .Together with floral cover, litter at 26.2% and rock at 8.3% resulted in a total ground cover of 95.7%, the highest of all areas sampled. Other species observed on site included A. tridentata, Carex sp., Festuca sp., Picea pungens, and several invading forbs.

Few seedheads were observed on this site though the species present appeared very vigorous. The high level of litter, primarily year-old grass blades, appears to further confirm the overall vigor of this population. The absence of mature seedheads is believed to be a function of the northerly aspect of the site resulting in a later maturing plant population.

Ten transects were extended on this site and the data was used to calculate sample adequacy. Approximately 1.3 transects would have been necessary. The sample mean was 61.1% and the sample standard deviation equaled 4.122.

The total ground cover on Area G, planted in 1985, was 68.7%. Total floral cover, litter, and rock accounted for 28.9%, 21.2%, and 18.6%, respectively. The dominant species on site was Festuca rubra with 19.0% cover. This species is believed to be a volunteer from the mulch application. Eleven other species were encountered along the transects. D. glomerata (4.6%), A. smithii (1.5%), and P. pratensis (1.0%) were the most notable of these species. The remaining eight species (Agropyron dasystachyum, A. trachycaulum, B. inermis, E. junceus, Achillea millifolium, M. sativa, M. officinalis and an unknown forb) each had less than 1.0% cover.

Planted in the fall of 1985, the individual plants on this site appeared healthy. No evidence of chlorosis and little evidence of stress was noted. Developing seedheads were observed for all grasses found along the transects with the exception of E. junceus. Flowers for both planted legumes were observed on site.

Statistical adequacy calculations conducted on the data from ten transects ($\bar{x}$ = 28.9, s = 4.840) showed that sample adequacy could have been attained with 7.6 transects.

4.0 PRODUCTIVITY MEASUREMENTS

All weights reported in this section are oven-dry weights unless otherwise noted.

4.1 Utah #2 Disturbance

The average productivity for a 0.5 meter quadrat was 66.44 grams or the equivalent of approximately 1,182 pounds per acre. Forb production was relatively low at 0.59 grams per 0.5 meter quadrat.

Fifteen quadrats were sampled to meet initial sample adequacy calculations. Calculations completed on the dry weights of the 15 samples showed seven quadrats required sampling for adequacy ($\bar{x}$ = 66.5; s = 10.757).

4.2 Belina Disturbances

At site A, the average production per 0.5 meter quadrat was 123.17 grams. This equates to 2192 pounds of oven-dry forage per acre. Forbs and shrubs averaged 17.69 and 12.93 grams per 0.5 meter quadrat, respectively.

Adequacy calculations completed on dry weights of the ten collected samples showed that four quadrats would have been sufficient for sampling ($\bar{x}$ = 123.2; s = 15.040).

The average production at site B was 49.24 grams per 0.5 meter quadrat or 877 pounds per acre. No forbs or shrubs were collected from any quadrat.

Calculations completed for the ten samples collected ($\bar{x}$ = 49.2; s = 7.611) showed that sampling approximately six and one-half quadrats would have achieved sample adequacy.

The average quadrat at site G yielded 47.18 grams of plant material which equals a per acre production of 840 pounds. Forbs averaged 2.17 grams per quadrat and were present on seven of the twelve quadrats clipped.

Calculations completed on the data from the twelve quadrats indicated that approximately eight quadrats sampled would have fullfilled sample adequacy ($\bar{x}$ = 47.2; s = 8.105) requirements.

5.0 CONCLUSIONS

Average total floral cover percentages for the sites sampled ranged from 67.5% to 28.9%. The Utah #2 and Belina sites A and B, all planted in 1980, had roughly identical percentages at 67.5%, 67.2% and 61.2%, respectively. Belina site G, planted in the fall of 1985, had significantly less cover at 28.9%. It is believed that the latter percent cover should increase through subsequent growing seasons.

Species dominance varied from site to site. Dactylis glomerata was the dominant specie on Belina sites A and B and a major component on the other site sampled. Poa pratensis was the dominant specie on the Utah #2 site and showed excellent performance on Belina sites A and B. Agropyron smithii, though never a truely dominant species, performed comparatively well on all areas with the exception of Belina Area B. A. dasystachyum is believed to be a stronger performer than the sample data would indicate. Some difficulty was encountered in separating this species from A. smithii in the field due to physiognomy. Elymus junceus was a notable component on the Utah #2 site but was a minor species on all sites sampled at the Belina complex. Artemisia tridentata, present on all areas sampled, was a stong performer only on Belina site A.

Species diversity ranged from seven to twelve species over the four areas sampled. Belina Area G, which had the lowest total floral cover, showed the highest diversity. Belina Area B, with nine species counted within transects, appeared to be supporting a significant number of invading species. Most notable of these are Phlem sp. (3.1 % cover) and Picea englemannii (1.0% cover). Numerous other species not counted on transects were present on this area which is the closest in proximity to a non-disturbed area of any temporary revegetation site sampled. Invasion of non-planted species appears to be a viable mechanism on this and other sites sampled. Though present on all sites, Medicago sativa and Melilotus officinalis were not overly impressive performers. This may, in large part, be due to the fact that fall seedings were completed for all temporary revegetation sites. Fall seeding is generally thought to suppress the establishment of these legume species.

Vegetation at all sites sampled appeared healthy. No signs of chlorosis or other nutrient deficiencies were observed. Mature seedheads were found on all sites sampled with the exception of Belina site B. The absence of seedheads at site B was believed to be due to site physical conditions. This cold, north-facing site retains snow much later into the spring than does other sampled sites delaying the maturity of indigenous vegetation. It is believed that seedheads will develop and mature as the season progresses.

Productivity ranged from 840 to 2,192 pounds per acre oven-dry weight. Site A, containing notable forb and shrub components as compared to other sites sampled, had the highest recorded production. Belina site B and Belina site G had production rates of 877 and 840 pounds per acre,

respectively. It is believed that site B production is depressed due to the physical site conditions described above but will continue to increase through this growing season as seedheads develop. The comparatively low production rate of site G is due to the fact that this site has experienced less than one full growing season. As the age of this stand increases, productivity should increase as well.

The data presented in this report suggest that acceptable cover and productivity values and notable diversity can be produced on all substitute topsoil material stockpiled at the Utah #2 and Belina disturbances. Existing cover and productivity data for all sites compare favorably with general revegetation and native "range" levels considering the length of time since these areas were planted and the aspect factor affecting Belina site B. There appears to be no reason, based on these data, why the material stockpiled should not be considered acceptable seedbed material for use during revegetation of the Utah #2 and Belina disturbances.

APPENDICES

APPENDIX 1

Materials And Methods Used To Revegetate Temporary Revegetation Sites Analyzed In 1986

Utah #2

Site preparation and planting date: Fall 1980
Depth of substitute topsoil material: 6-8'
Seedbed preparation: dozer tracking
Fertilization: method - hydraulic
amount - 100 lbs N per acre every 3 years beginning 3rd year following seeding
Seeding method: hydroseeding
Mulching: method - hydromulching, broadcast
material and amount - wood fiber - Conwed 2,000-1500 to 2000 lbs/acre; straw - 4,000 lbs/acre
Mulch anchoring: tackifier included with hydromulch; none

Belina Area A and Area B

Site preparation and planting date: Fall 1980
Depth of substitute topsoil material: 6"
Seedbed preparation: dozer tracking
Fertilization: method - hydraulic
amount - 100 lbs N per acre every 3 years beginning 3rd year following seeding
Seeding method: hydroseeding
Mulching: method - hydromulching
material and amount - wood fiber - Conwed 2,000 - 1500 to 2000 lbs/acre
Mulch anchoring: tackifier included with hydromulch

Belina Area G

Site preparation and planting date: Fall 1985
Depth of substitute topsoil material: 6"
Seedbed preparation: dozer tracking
Fertilization: method - hydraulic
amount - 100 lbs N per acre every 3 years beginning 3rd year following seeding
Seeding method: hydroseeding
Mulching: method - hydromulching
material and amount - wood fiber - Conwed 2,000 - 1500 to 2000 lbs/acre; straw - 4,000 lbs/acre
Mulch anchoring: tackifier included with hydromulch; none

APPENDIX 2

Seed Mixtures Used on Temporary Revegetation Sites

Belina A, Belina B, Utah #2

Species	% of Mixture (PLS)
Agropyron dasystachyum (Thickspike wheatgrass)	8
Agropyron riparium (Streambank wheatgrass)	16
Agropyron smithii (Western wheatgrass)	12
Agropyron trachycaulum (Slender wheatgrass)	16
Bromus marginatus (Mountain brome)	5
Dactylis glomerata (Orchardgrass)	9
Elymus junceus (Russian wildrye)	8
Poa pratensis (Kentucky bluegrass)	13
Medicago sativa (Alfalfa)	6
Melilotus officinalis (Yellow sweetclover)	2
Artemisia tridentata vaseyana (Mountain big sagebrush)	4
Chrysothamnus nauseosus (Rubber rabbitbrush)	1
Chrysothamnus vicidiflorus (Douglas rabbitbrush)	<1
	100%

Belina G

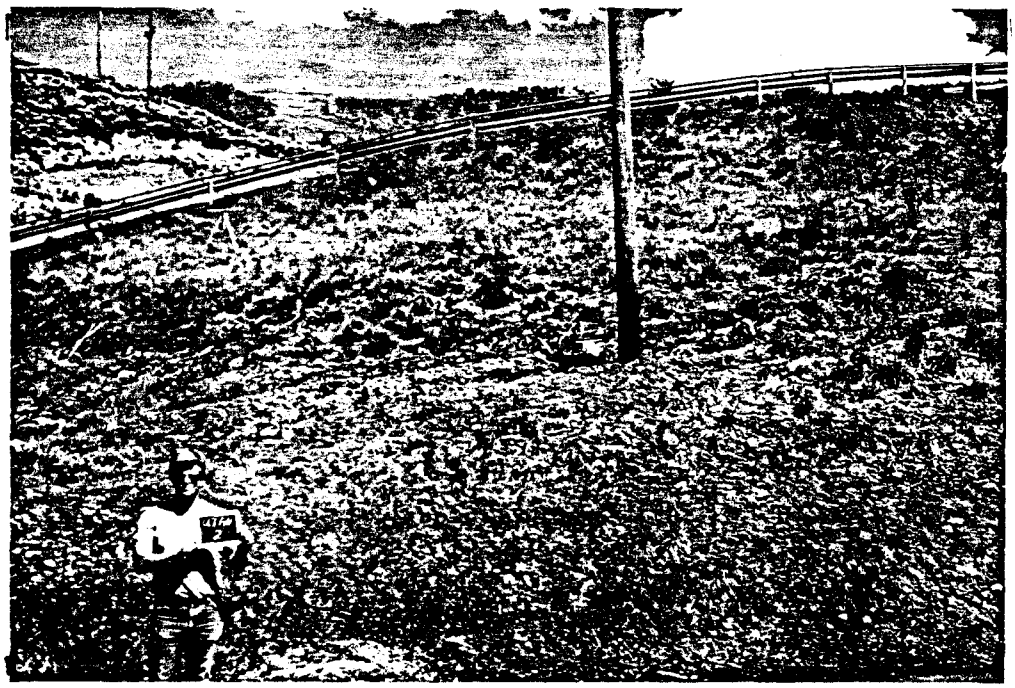
Species	% of Mixture (PLS)
Agropyron dasystachyum (Thickspike wheatgrass)	10
Agropyron smithii (Western wheatgrass)	16
Agropyron spicatum (Bluebunch wheatgrass)	9
Agropyron trachycaulum (Slender wheatgrass)	11
Bromus marginatus (Mountain brome)	9
Dactylis glomerata (Orchardgrass)	4
Elymus junceus (Russian wildrye)	6
Poa pratensis (Kentucky bluegrass)	4
Medicago sativa (Alfalfa)	4
Melilotus officinalis (Yellow sweetclover)	2
Artemisia tridentata vaseyana (Mountain big sagebrush)	16
Chrysothamnus nauseosus (Rubber rabbitbrush)	4
Chrysothamnus vicidiflorus (Douglas rabbitbrush)	5
	100%

APPENDIX 3

Photographic Addendum

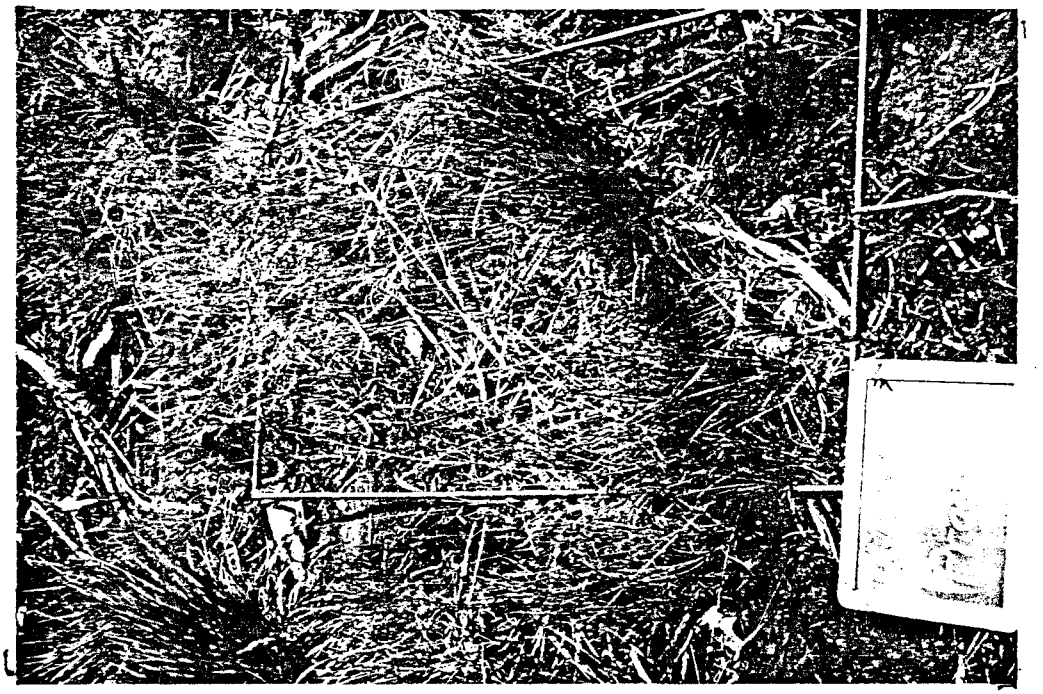
The following photographs were taken on the July 11th and 12th, 1986 field trip to collect temporary revegetation site cover and productivity data. Five photos are presented for each temporary revegetation site evaluated. The first photo in each set of five shows the sites' overall condition and characteristics. The remaining four photos in each set depict randomly selected production quadrats prior to clipping. These photos show site surface conditions more precisely and give an indication of seedbed material surface characteristics, plant density, and general plant vigor.

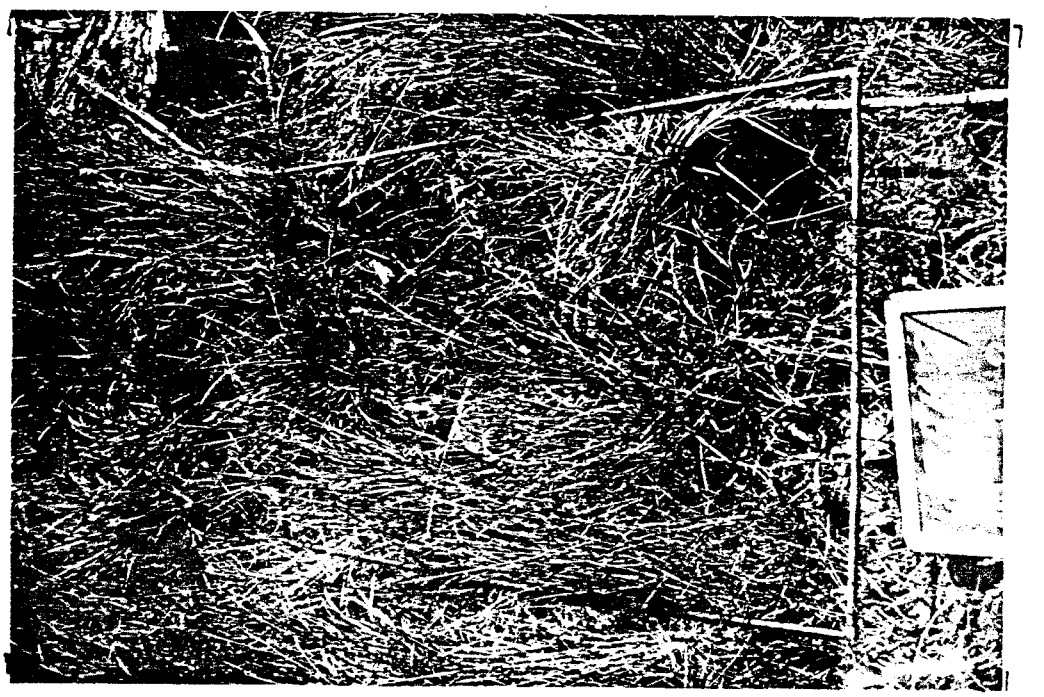
UTAH # 2 SITE



BELINA AREA A SITE

UTAH # 2 QUADRATS





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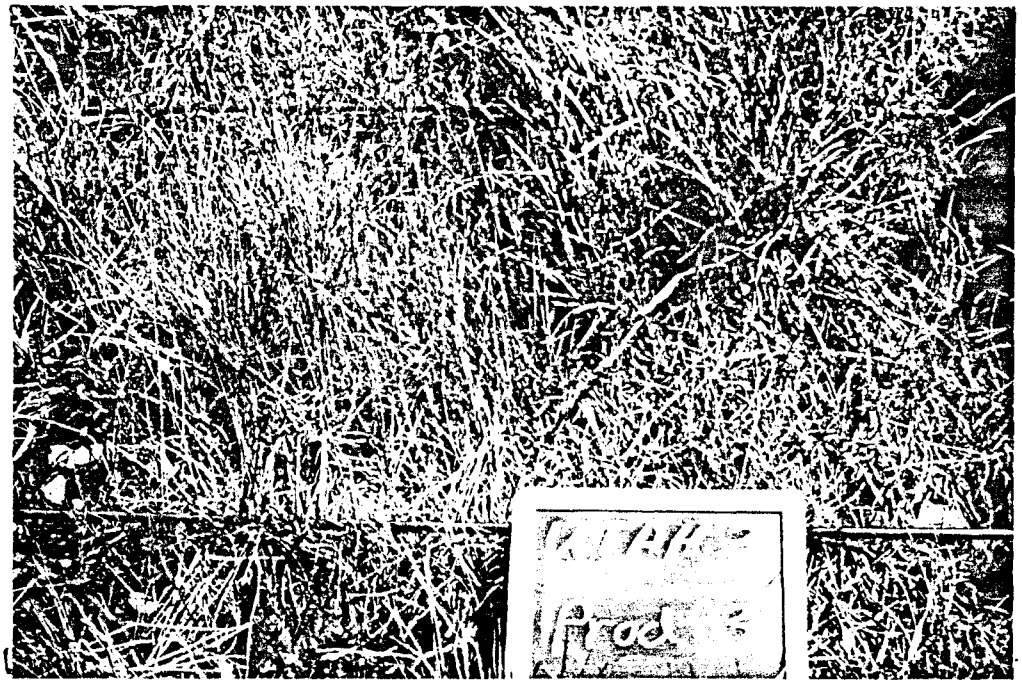
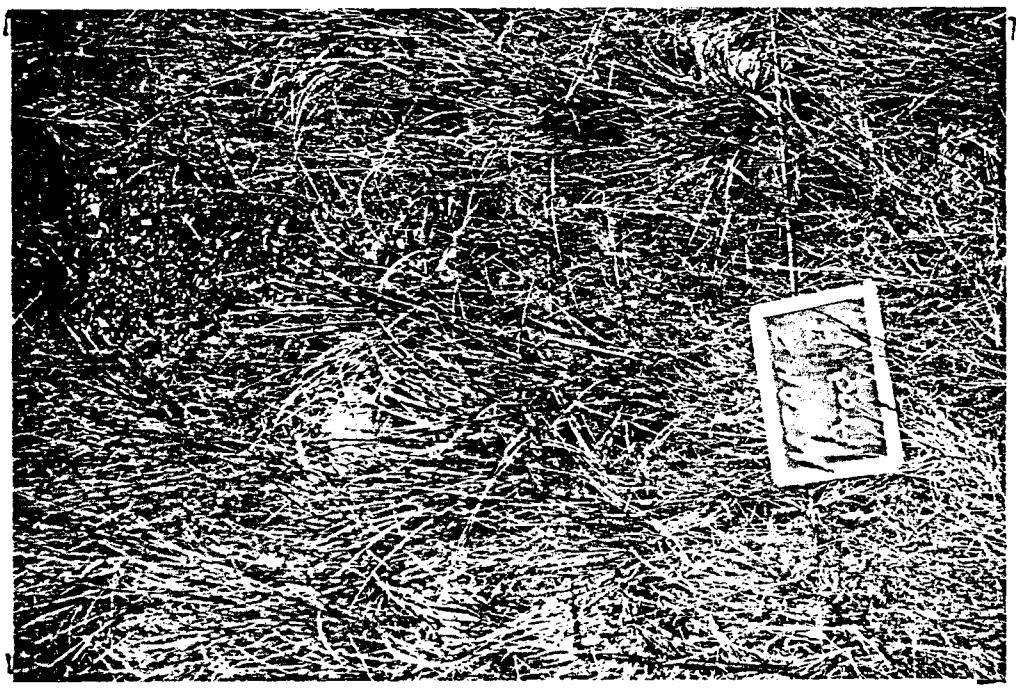
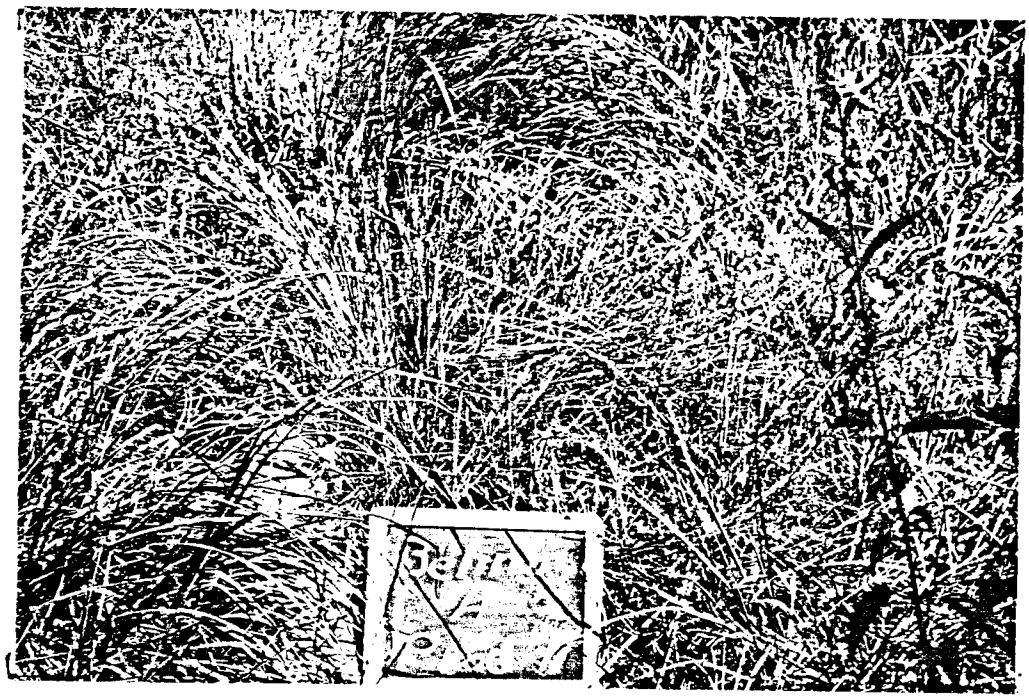




AREA A QUADRATS



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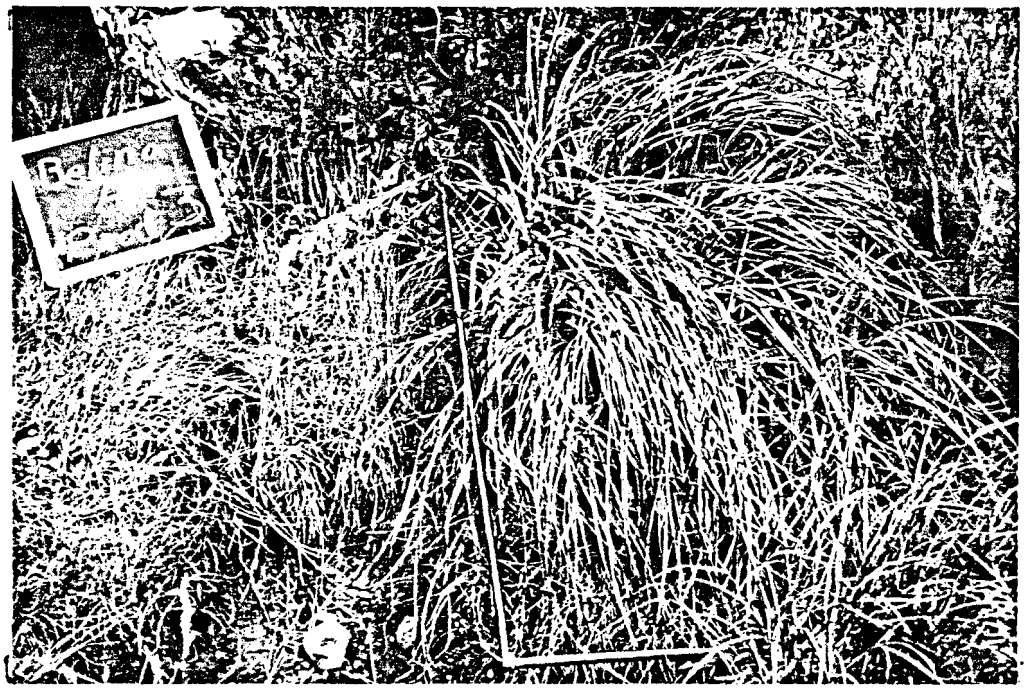
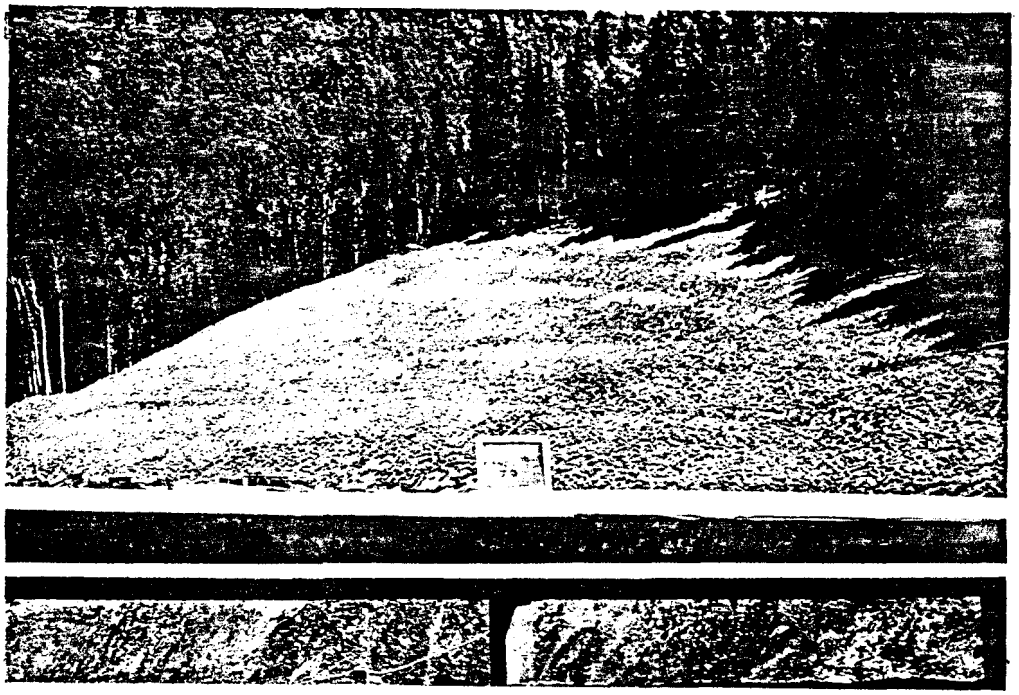
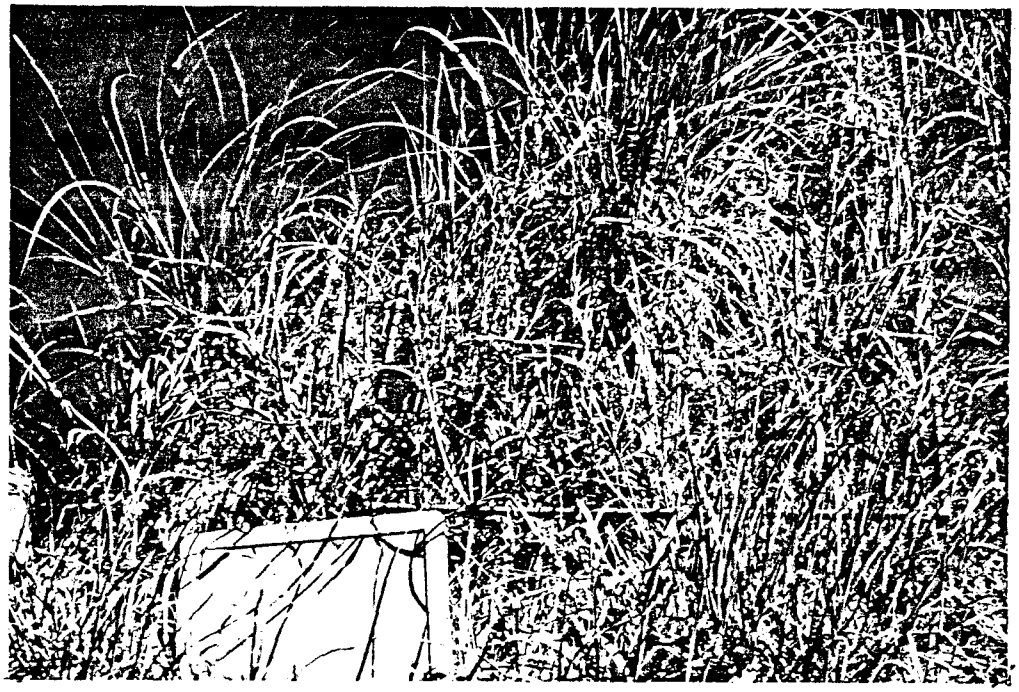


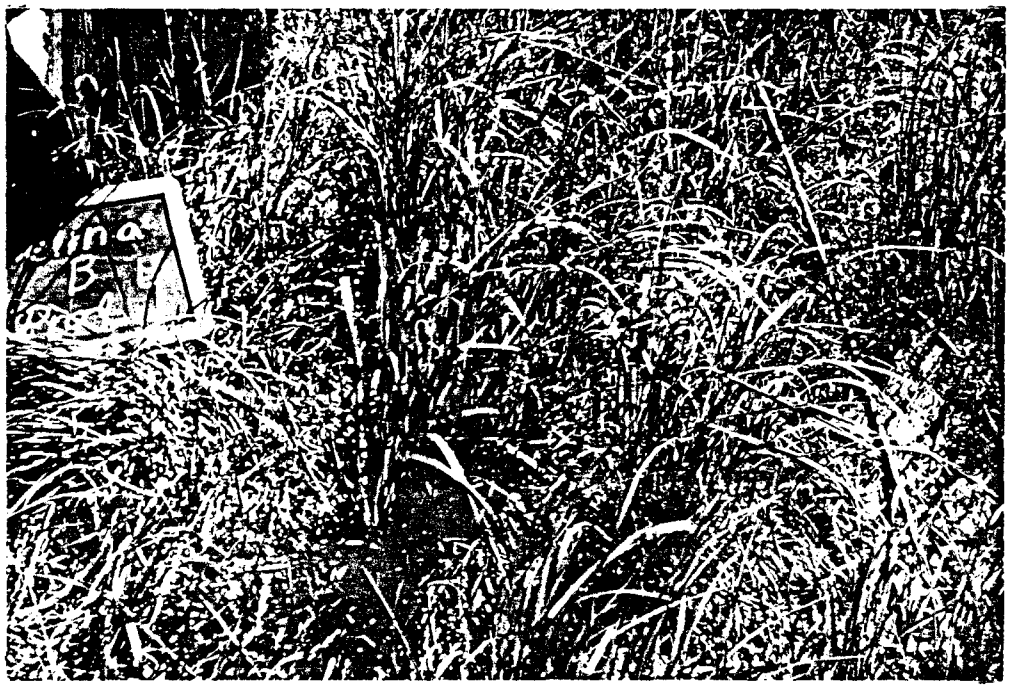
BELINA AREA B SITE



AREA B QUADRATS

AREA B QUADRATS

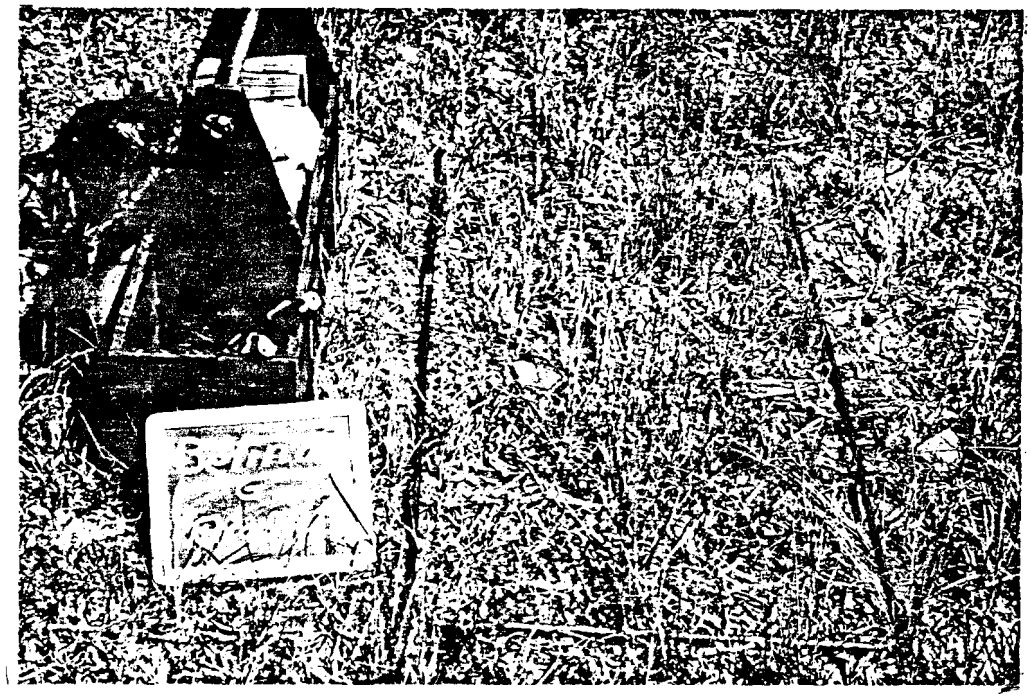




BELINA AREA G SITE

AREA G QUADRATS

AREA G QUADRATS



MAPS

Document Information Form

Mine Number: C/007/0001

File Name: Incoming
White Oak

To: Lowell Braxton

From:

Person T.G. Whiteside

Company Valley Camp.

Date Received: 8/27/86

Explanation: Map- Vegetation Map Temporary Reclamation - Loadout Area- Drawing D3-0074

cc: