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Consolidation Coal Company  
Illinois / West Kentucky Operations  
Post Office Box 566  
Sesser, Illinois 62884  
(618) 625-2041

September 4, 1996

Mr. James Carter, Director  
Utah Division of Oil, Gas and Mining  
1594 West North Temple, Suite 1210  
Box 145801  
Salt Lake City, Utah 84114-5801

RE: Hidden Valley Mine  
1996 Revegetation Monitoring Report

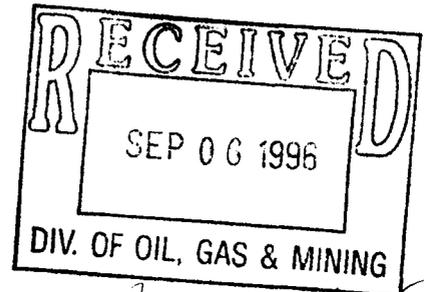
Dear Mr. Carter:

Enclosed are the results of the Revegetation/Reference Monitoring Study conducted at the Hidden Valley Mine in June 1996. If you have any questions concerning the revegetation study, please contact me at (618)625-6847.

Sincerely,

A handwritten signature in cursive script, appearing to read "Timothy D. Kirschbaum".

Timothy D. Kirschbaum  
Environmental Engineer



*P*  
*Reply to [unclear] file #6*  
*ACT/015/007 #6*

**jbr**  
environmental consultants, inc.

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Salt Lake City • Reno • Elko • Cedar City

**HIDDEN VALLEY MINE**  
**Revegetation Monitoring Study**  
**Summer, 1996**

August 13, 1996

submitted to:

Consolidation Coal Company  
P.O. Box 566  
Sesser, Illinois 62884

submitted by:

JBR Environmental Consultants, Inc.  
8160 South Highland Drive  
Sandy, Utah 84093

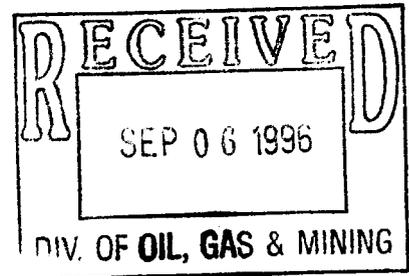


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Appendix

# HIDDEN VALLEY MINE

## Revegetation/Reference Monitoring Study Summer, 1996

### 1.0 Introduction

A vegetation study was conducted by JBR Consultants at the Hidden Valley Reclamation Site in June, 1996. The purpose of the study was to quantitatively monitor the success of revegetation of the disturbed areas with respect to species cover and composition. In addition, the vegetation reference area was sampled to determine revegetation success standards, which was established and surveyed originally in 1986, was re-surveyed in 1992.

Vegetation sampling methods were designed in accordance with the methods stated in the approved Reclamation Plan for the site, and stated in the Division's Vegetation Information Guidelines, revised December, 1991 version. The methods are described below. Results of the study are presented as well.

### 2.0 Precipitation Information

Precipitation information for the site was obtained from monthly records for the closest weather station at Castledale, elevation 5604 feet. The annual precipitation since 1986, when revegetation efforts began, is as follows:

<u>Year</u>	<u>Precipitation (inches)</u>
1992	8.80 inches
1993	11.11
1994	6.49
1995	8.83

Average Annual Precipitation = 7.71", Castledale weather station.

Average Monthly Precipitation 1961-February 1996		1996 Monthly Precipitation Comparison	
January	0.57"	January	0.71"
February	0.53"	February	0.41"
March	0.62"	March	1.61"
April	0.49"	April	0.02"
May	0.73"	May	0.86"
June	0.48"	June	Data not available
July	0.80"	July	Data not available

This National Oceanographic Atmospheric Administration (NOAA) station does not precisely represent weather encountered at Hidden Valley. The station is located approximately 30 miles north of the revegetation site, and is at the base of the Wasatch Plateau, which probably influences the readings. Elevation of the two sites are similar, but the Hidden Valley reclamation site is most likely more xeric, benefitting from infrequent, widely scattered and unquantified rainstorms. (The Emery station which was originally used to monitor site precipitation was discontinued in 1978.)

### **3.0 Sample Site Location**

Transects were located randomly throughout the 6.7-acre reclamation area. The disturbed area at the site was divided into two sections for survey purposes: the roadway and the main area. Data sets were combined to provide a single encompassing survey result summary. Tables providing data and statistical summaries are at the end of this report.

The number of transects for the entire reclamation area was dependant upon the sample adequacy calculations as described in the Division Guidelines. Testing of total vegetation cover was done to meet a 90 percent confidence level with a 10 percent change in the mean using a 1-tailed t-test. At the onset of the study, it was anticipated that a large number of transects would be needed due to the apparent variability in vegetated cover at the site, therefore statistical adequacy was based on bare ground which was the parameter with the least amount of deviation.

### **3.1 Roadway**

The roadway was marked off in 10-foot intervals, giving the researchers 280 points along its length. A random number table was used to select the sample site starting location.

The side of the road that was selected as the starting point, left vs. right, was alternated every other transect. The tape was laid out to accommodate the 100 ft. length of the tape extending from side to opposite side of the road, therefore the angle of the tape varied depending on the width of road.

Sample sites were located a measured pace of the researcher from the bottom of the road, ending with (280) at the top of the road.

### **3.2 Main Area**

A closely spaced grid was placed on the 1-inch = 100-foot Final Reclamation Map from the Reclamation Plan. Points at grid intersections were numbered sequentially from 1 to 259. A second random number was used to identified the (0-360) directional aspect of the transect.

## **4.0 Sample Types**

### **4.1 Reclamation Area (Roadway and Main Area Combined)**

For each sample, a 100-foot survey tape was laid out for each randomly determined transect. Cover determinations were done along the line by the line-intercept method. Researchers read the continuous transect length, where percent cover of each species, litter, bare ground and rock were obtained by adding the distances along the transect that each occurred. Due to the lack of precipitation, very few annual plant species occurred in the data set, standing skeletons of previous year annual vegetation was counted as litter.

### **4.2 Reference Area**

An ocular method was used to mimic the original 1986 survey of the vegetation reference area. Along the 300-foot transect line, 40 randomly spaced, 1-yard square quadrants were placed. (Random samples were identified at one-foot intervals between 1 and 300, as potential points.) The percent ground cover by species, litter, rock and bare ground were ocularly estimated.

In 1992, both sampling methods, line-intercept and ocular quadrant methods were used in order to establish that comparable results would occur from either method of sampling. It is the intention of the researchers to compare the reference ocular quadrant cover data with the revegetation line-intercept cover data based on this hypothesis. Discussion of this hypothesis is in the 1992 Hidden Valley Mine, Revegetation Monitoring Study.

## **5.0 Data Analysis and Results**

All data obtained from cover and density sampling were checked for completeness and accuracy, and statistical information was generated. For each transect sampled, percent cover was recorded separately for each vegetative species, and the ground cover components of litter, rock and bare ground. Each line transect within the reclamation area represented one sample for the line intercept method. Data sets of the road and main area were combined to provide a single encompassing survey. Each 1-yard square quadrant within the reference area was considered one sample for the ocular quadrant sampling technique.

### **5.1 Reclamation Area**

A total of 30 line-intercept transects were sampled, 15 along the roadway and 15 within the main reclamation area. Data tables follow at the end of this report.

### **5.1.1 Line-Intercept Data**

The 1996 average vegetated cover is 6.6%. Nearly 100% is perennial/desirable vegetation, as annuals are almost nonexistent due to the lack of precipitation. The percent of vegetated cover in the road area was 7.06% while in the main area vegetated cover was 6.06%. The vegetated cover data did not meet the statistical adequacy of a 1-tailed t-test, at the 90% confidence level with a 10% change in the mean, with the 30 samples taken, approximately 61 samples would have been required. However, statistical adequacy at this level was met based on the bare ground parameter. Statistical adequacy would have been met with a minimum number of 18 samples. In this case, 30 samples were taken.

In 1992 data the average perennial desirable plant species cover was 6.0%. There again, however, due to the great variability in the data, statistical adequacy was not met for 1992 perennial cover data. To meet statistical adequacy in 1992 with the 1-tailed t-test at the 90% confidence level with a 10% change in the mean would have required 97 samples.

## **5.2 Reference Area**

A total of forty (40) 1-yard square quadrants were sampled with the reference area. Data tables follow at the end of this report.

### **5.2.1 Ocular Quadrant Data**

The average vegetated cover is 16.5 %, which did not meet the statistical adequacy with the 40 samples, 269 samples would have been required to meet statistical adequacy based on the perennial vegetation parameter.

## **6.0 Observations and Discussion**

Hidden Valley has experienced a severe drought in 1996. This is evident in the lack of annual vegetation. Also due to the lack of precipitation is the poor vigor of the shrubs, which have also experienced some mortality among individuals. Many of the perennial grasses are dormant or have greatly reduced their annual production. However, it should be noted that the field results indicate that perennial vegetation cover is stable. A simple comparison of the 1992 figure of 6.0% perennial cover to the 1996 results of 6.6% perennial cover, shows a stability. There is substantial reason to believe that under normal precipitation in subsequent years that the perennial species will respond and once again produce at a more substantial level.

As has been pointed out in previous reports, the revegetation site differs greatly from the reference area on the amount and size of rock cover. The revegetation site lacks large rock cover that influences the native vegetation, as rocks act to retain winter moisture on site as drifting snow typically accumulates around them. Pitting and shading caused by large rocks all influence the spatial occurrence and productivity of the individual plants and the overall site.

**Hidden Valley Mine  
Revegetation Area - Road  
Percent Cover Data - Line Transects  
Summer, 1996**

PLANT SPECIES	STAND							
	1	2	3	4	5	6	7	8
<b>Shrubs and Subshrubs</b>								
<i>Artemisia tridentata</i>								
<i>Atriplex confertifolia</i>	<1			1	2			
<i>Atriplex corrugata</i>	7	4	4		2		1	
<i>Atriplex canescens</i>			1	1	5			2
<i>Chrysothamnus nauseosus</i>								
<i>Eriogonum</i> spp.								
<i>Gutierrezia sarothrae</i>								
<b>Total Shrubs/Subshrubs Cover</b>	<b>7</b>	<b>4</b>	<b>5</b>	<b>2</b>	<b>9</b>	<b>0</b>	<b>1</b>	<b>5</b>
<b>Forbs</b>								
<i>Halogeton glomeratus</i>								
<i>Kochia</i> spp.								
<i>Salsola kali</i>								
<b>Total Forb Cover</b>	<b>0</b>							
<b>Graminoids</b>								
<i>Agropyron cristatum</i>								
<i>Elymus junceus</i>								
<i>Oryzopsis hymenoides</i>								
<i>Sitanion hystrix</i>								
<b>Total Graminoid Cover</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>6</b>
<b>Total Vegetation Cover</b>	<b>7</b>	<b>4</b>	<b>6</b>	<b>5</b>	<b>10</b>	<b>2</b>	<b>4</b>	<b>11</b>
<b>Litter</b>	<b>6</b>	<b>11</b>	<b>14</b>	<b>25</b>	<b>18</b>	<b>8</b>	<b>14</b>	<b>28</b>
<b>Rock</b>	<b>37</b>	<b>34</b>	<b>45</b>	<b>27</b>	<b>34</b>	<b>37</b>	<b>31</b>	<b>25</b>
<b>Bare Ground</b>	<b>50</b>	<b>51</b>	<b>35</b>	<b>43</b>	<b>38</b>	<b>53</b>	<b>51</b>	<b>36</b>

**Hidden Valley Mine  
Revegetation Area- Road  
Percent Cover Data - Line Transects  
Summer, 1996**

PLANT SPECIES	STAND						
	9	10	11	12	13	14	15
<b>Shrubs and Subshrubs</b>							
<i>Artemisia tridentata</i>						<1	
<i>Atriplex confertifolia</i>					2	2	8
<i>Atriplex corrugata</i>							2
<i>Atriplex canescens</i>				6			
<i>Chrysothamnus nauseosus</i>						1	
<i>Eriogonum</i> spp.		1	5				
<i>Gutierrezia sarothrae</i>	1				1	2	1
<b>Total Shrubs/Subshrubs Cover</b>	<b>1</b>	<b>1</b>	<b>5</b>	<b>6</b>	<b>3</b>	<b>6</b>	<b>11</b>
<b>Forbs</b>							
<i>Halogeton glomeratus</i>				<1			
<i>Kochia</i> spp.							
<i>Salsola kali</i>				<1			
<b>Total Forb Cover</b>	<b>0</b>						
<b>Graminoids</b>							
<i>Agropyron cristatum</i>							
<i>Elymus junceus</i>	6	2	3	3			<1
<i>Oryzopsis hymenoides</i>	1			<1			<1
<i>Sitanion hystrix</i>	<1	<1		1	4	3	1
<b>Total Graminoid Cover</b>	<b>7</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>4</b>	<b>3</b>	<b>1</b>
<b>Total Vegetation Cover</b>	<b>8</b>	<b>3</b>	<b>8</b>	<b>10</b>	<b>7</b>	<b>9</b>	<b>12</b>
<b>Litter</b>	<b>34</b>	<b>31</b>	<b>20</b>	<b>35</b>	<b>12</b>	<b>16</b>	<b>19</b>
<b>Rock</b>	<b>26</b>	<b>32</b>	<b>46</b>	<b>19</b>	<b>3</b>	<b>3</b>	<b>21</b>
<b>Bare Ground</b>	<b>32</b>	<b>34</b>	<b>26</b>	<b>36</b>	<b>78</b>	<b>72</b>	<b>48</b>

**Hidden Valley Mine  
Revegetation Area - Main Area  
Percent Cover Data - Line Transects  
Summer, 1996**

PLANT SPECIES	STAND							
	1	2	3	4	5	6	7	8
<b>Shrubs and Subshrubs</b>								
<i>Atriplex confertifolia</i>						5		
<i>Atriplex corrugata</i>							1	1
<i>Atriplex canescens</i>	6	3		<1	7	1	1	1
<i>Atriplex gardneri</i>					<1			
<i>Ceratoides lanata</i>	1				3			
<i>Chysothamnus nauseosus</i>					2			
<i>Sarcobatus vermiculatus</i>		3						
<b>Total Shrubs/Subshrubs Cover</b>	<b>7</b>	<b>6</b>	<b>0</b>	<b>0</b>	<b>12</b>	<b>6</b>	<b>2</b>	<b>2</b>
<b>Forbs</b>								
<i>Descurainia spp.</i>	<1							
<i>Halogeton glomeratus</i>		<1		<1	<1			
<i>Kochia spp.</i>			<1					
<b>Total Forb Cover</b>	<b>0</b>							
<b>Graminoids</b>								
<i>Agropyron cristatum</i>			2	2	5	<1	3	1
<i>Elymus junceus</i>			<1	1	2			
<i>Sitanion hystrix</i>								
<b>Total Graminoid Cover</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>3</b>	<b>7</b>	<b>0</b>	<b>3</b>	<b>1</b>
<b>Total Vegetation Cover</b>	<b>7</b>	<b>6</b>	<b>2</b>	<b>3</b>	<b>19</b>	<b>6</b>	<b>5</b>	<b>3</b>
<b>Litter</b>	<b>9</b>	<b>43</b>	<b>55</b>	<b>25</b>	<b>20</b>	<b>14</b>	<b>34</b>	<b>19</b>
<b>Rock</b>	<b>4</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>9</b>	<b>1</b>	<b>0</b>	<b>1</b>
<b>Bare Ground</b>	<b>80</b>	<b>49</b>	<b>41</b>	<b>69</b>	<b>52</b>	<b>79</b>	<b>61</b>	<b>77</b>

**Hidden Valley Mine  
Revegetation Area - Main Area  
Percent Cover Data - Line Transects  
Summer, 1996**

PLANT SPECIES	STAND						
	9	10	11	12	13	14	15
<b>Shrubs and Subshrubs</b>							
<i>Atriplex confertifolia</i>	<1		<1				
<i>Atriplex corrugata</i>	2			1		1	5
<i>Atriplex canescens</i>	3		10		1		1
<i>Atriplex gardneri</i>							
<i>Ceratoides lanata</i>			2				1
<i>Chysothamnus nauseosus</i>							
<i>Sarcobatus vermiculatus</i>				8			
<b>Total Shrubs/Subshrubs Cover</b>	<b>5</b>	<b>0</b>	<b>12</b>	<b>9</b>	<b>1</b>	<b>1</b>	<b>7</b>
<b>Forbs</b>							
<i>Descurania</i> spp.							
<i>Halogeton glomeratus</i>							
<i>Kochia</i> spp.							
<b>Total Forb Cover</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Graminoids</b>							
<i>Agropyron cristatum</i>	<1				3		<1
<i>Elymus junceus</i>	1				1		
<i>Sitanion hystrix</i>							
<b>Total Graminoid Cover</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>0</b>	<b>0</b>
<b>Total Vegetation Cover</b>	<b>6</b>	<b>0</b>	<b>12</b>	<b>9</b>	<b>5</b>	<b>1</b>	<b>7</b>
<b>Litter</b>	<b>7</b>	<b>7</b>	<b>17</b>	<b>6</b>	<b>20</b>	<b>17</b>	<b>13</b>
<b>Rock</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>25</b>	<b>1</b>	<b>&lt;1</b>	<b>5</b>
<b>Bare Ground</b>	<b>84</b>	<b>91</b>	<b>69</b>	<b>60</b>	<b>74</b>	<b>82</b>	<b>75</b>

**HIDDEN VALLEY**  
**REFERENCE AREA - COVER DATA Summer, 1996**  
**36" x 36" Random Ocular Quadrants**

Quadrant	% Vegetation	Plant Species %	Litter %	Rock %	Bare Ground%	Total %
1	6	ARARN 6	10	40	44	100
2	9	ARTR2 4 ARENA 5	10	20	61	100
3	8	ARTRN 6 ARENA 2	5	30	57	100
4	7	ARTR 6 ARENA 1	0	60	33	100
5	13	ORHY 1 HIJA 10 ARENA 2	10	67	10	100
6	31	EPHED 25 HIJA 6	10	29	30	100
7	70	EPHED 70	10	10	10	100
8	0	0	15	40	45	100
9	0	0	5	47	48	100
10	0	0	30	35	35	100
11	0	0	6	30	64	100
12	10	GUSA2 10	0	35	55	100
13	10	GUSA2 10	5	30	55	100
14	3	EPHED 3	6	46	45	100
15	6	EPHED 6	0	60	34	100
16	0	0	25	30	45	100
17	6	EPHED 6	25	25	44	100
18	0	0	20	35	45	100
19	10	EPHED 10	0	40	50	100
20	21	ORHY 3 HIJA 6 EPHED 12	12	40	25	100

**Plant Symbol Key**

ARARN	Artemisia arbuscula nova	ECHIN3	Echinocereus spp
ARTR2	Artemisia tridentata	EPHED	Ephedra spp.
ARENA	Arenaria spp.	GUSA2	Gutierrezia sarothrae
ATCON	Atriplex confertifolia	HIJA	Hilaria jamesii
ATCOR	Atriplex corrugata	ORHY	Oryzopsis hymenoides
		POA++	Poa spp.

Quadrant	% Vegetation	Plant Species %	Litter %	Rock %	Bare Ground %	Total %
21	74	HIJA 6 EPHED 68	20	0	6	100
22	10	EPHED 10	10	35	45	100
23	1	HIJA 1	0	94	5	100
24	17	ARARN 12 HIJA 5	0	41	42	100
25	20	ARARN 20	0	60	20	100
26	0	0	0	75	25	100
27	34	ARARN 20 ORHY 5 HIJA 5 POA++ 2 ARENA 2	10	46	10	100
28	40	ORHY 10 HIJA 25 ATCOR 5	10	40	10	100
29	6	HIJA 6	0	90	4	100
30	0	0	0	100	0	100
31	0	0	15	80	5	100
32	3	GUSA2 3	0	87	10	100
33	10	ARARN 10	2	35	53	100
34	10	ARARN 3 ATCOR 6 HIJA 1	0	55	35	100
35	15	EPHED 3 HIJA 2 ATCOR 10	0	30	55	100
36	70	ARARN 40 ORHY 30	5	13	12	100
37	64	ARARN 50 ORHY 12 HIJA 2	6	20	10	100
38	19	GUSA2 10 ORHY 6 ATCON 3	6	75	0	100
39	20	ECHIN3 6 ARENA 2 ORHY 6 GUSA2 6	0	80	0	100
40	35	ARARN 20 HIJA 6 POA++ 2 ATCON 5 ARENA 2	15	30	10	100

**Plant Symbol Key**

ARARN	Artemisia arbuscula nova	ECHIN3	Echinocereus spp
ARTR2	Artemisia tridentata	EPHED	Ephedra spp.
ARENA	Arenaria spp.	GUSA2	Gutierrezia sarothrae
ATCON	Atriplex confertifolia	HIJA	Hilaria jamesii
ATCOR	Atriplex corrugata	ORHY	Oryzopsis hymenoides
		POA++	Poa spp.

**SAMPLE ADEQUACY INFORMATION  
HIDDEN VALLEY MINE AREA, FALL, 1996**

Sample Set	n	x	std	$n_{min}$
Roadway Reclamation Line Transects - Vegetation	15	7.1	2.9	31
Roadway Reclamation Line Transects - Bare Ground	15	45.9	14.8	19
Main Area Reclamation Line Transects - Vegetation	15	6.1	4.8	111
Main Area Reclamation Line Transects - Bare Ground	15	69.9	14.2	8
Revegetation Area Line Transects - Vegetation	30	6.6	3.9	61
Revegetation Area Line Transects - Bare Ground	30	58.0	18.8	18
Reference Area Ocular Quadrants Vegetation	40	16.5	20.7	269
Reference Area Ocular Quadrants Bare Ground	40	29.9	20.3	78