

**2011  
Report of Findings &  
Three Year Executive Summary  
Revegetation Assessments  
Rocky Flats Site  
Jefferson County, CO**

Prepared for:

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Region 8  
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# Three-Year Executive Summary

## *Vegetation Monitoring of the Rocky Flats Site 2009 through 2011.*

Subsequent to the completion of revegetation activities associated with the closure of the Rocky Flats Site in 2005, the EPA conducted qualitative monitoring (see ESCO 2006, 2007, and 2008). Quantitative monitoring was also conducted between 2009 and 2011 (see ESCO 2009, 2010, and 2011).

This report presents the 2011 quantitative monitoring results, a summary of findings from previous assessments, and an overall conclusion regarding the functioning and success of revegetation at the site.

The quantitative monitoring results have been used to assess the progress of the site toward the goals set in 2004 by the EPA in a document titled "Revegetation Success Criteria – Rocky Flats Environmental Technology Site" (RFETS) (attached). Using the data collected by the EPA in 2009 through 2011 the status of the plant cover in the revegetation parcels was assessed in light of separately established DOE criteria for success (USDOE 2004).

Over the three years of quantitative monitoring, fourteen different revegetation parcels with varying soil type, slope, and vegetation cover have been addressed, including the Present Landfill and Original Landfill (as delineated in the RFETS Revegetation Plan).

Given the importance of surface soil stability at this site, the primary EPA criterion for revegetation success addresses total live vegetation cover by desirable species. The criterion is met either by exceeding the level of 25% absolute cover by desirable plants (planted species or other volunteering native perennials) or by exceeding the level present in a Comparison Area identified on nearby City of Boulder Open Space and Mountain Parks land. In general, all fourteen revegetation parcels sampled over the years, have met this criterion with two exceptions: 1) The east face of the Present Landfill is an engineered riprap surface on which long-term stability is not dependent upon vegetation. Nonetheless, when sampled in 2009 its existing 20% absolute vegetation cover came to within 5% of the standard. 2) At the former site of Building 111, the imported topsoil contained numerous introduced grasses whose vigorous growth prevented native species from establishing. Given that the native seed mix species did not develop, cover by those desirable species is very low. However, given the purposeful import of topsoil which brought with it seeds of species that are inherently vastly more competitive (and that are not listed noxious weeds), those species could henceforth be regarded as "desired."

DOE Legacy Management has vigorously pursued weed control on the site throughout the post-closure history. As a result the occurrence of weeds is generally low. Certain species are expected to appear yearly from freshly blown-in seed, such as diffuse knapweed (*Centaurea diffusa*) and dalmation toadflax (*Linaria genistifolia* ssp. *dalmatica*). Weed control is likely to remain necessary into the near and mid-term future. It can be expected that as the desirable vegetation develops and matures its competitive strength will help keep out the invading species.

Revegetated areas of the Rocky Flats Site have achieved above average results with regard to the established success criteria. These areas are expected to continue providing effective soil stability.

## **2011 Report of Findings**

### **INTRODUCTION**

In late August and early September 2011, ESCO Associates conducted on-site measurements of the vegetation resulting from reseeding efforts at the Rocky Flats Site (RFS, formerly known as Rocky Flats Environmental Technology Site) made during closure activities in 2004 and 2005. These measurements constitute a quantitative evaluation of the viability of vegetation along representative sample transects located in revegetation parcels that have had five or more entire growing seasons since the initial seeding. The results are the basis of the discussion below.

The observations reported here constitute the third year of quantitative assessments begun in 2009. These were preceded by qualitative observations in the years immediately following seeding of the closure sites during 2006 through 2008.

Presented below are the 2011 quantitative results, along with a summary of observations from 2009 through 2011.

### **METHODS**

All revegetation parcels sampled in 2011 were greater than five years old (years since seeding). In 2011, sampled revegetation parcels (Map 1) included the Original Landfill (revegetation parcel 39), various portions of the 903 pad area (revegetation parcels 2 and 17), the vicinity of the former site of Building 371 (revegetation parcels 23 and 56) and an area north of the former Building 771 (revegetation parcel 55). In addition to the Original Landfill site, the other revegetation parcels sampled in 2011 were selected because they had failed to meet criteria in the previous samplings performed by DOE, (USDOE 2010). At each of the RFS revegetation parcels, sample transects (see below) were identified to reflect conditions deemed representative of the dominant surroundings.

In addition, as in 2009 and 2010, a Comparison Area near the Rocky Flats Site was sampled to provide evidence of vegetational performance under revegetation conditions with similar substrate and climate but with longer elapsed time since seeding (Map 2). The Comparison Area was mined for gravel. Therefore the revegetation efforts took place on coarse cobble alluvium similar in overall texture to most of the materials used as growth media on the Rocky Flats Site. This area known as the Jenkins Pit is now included on the City of Boulder Open Space and Mountain Parks (OSMP) Varra property. OSMP cooperation in allowing access to the site was appreciated. Three sampling transects were placed for monitoring purposes at the Jenkins Pit area in 2003 (when it was about seven years old; it is now about 15 years old).

At each sample site, cover data were collected using a point-intercept method by which data are tabulated as interceptions of a very fine and rigidly projected point with a plant species, bare ground, litter, standing dead, or rock. The cover sampling points were optically projected using a Cover-Point Optical Point Projection Device. Sampling occurred along randomly located and randomly oriented 50 m belt transects. Along each transect, 100 points were systematically spaced at a rate of 2 points per meter. Of the pair of points projected at each meter, one was projected at a distance 50 cm to the right and the other at 50 cm to the left of the measuring tape in areas not disturbed by the extension of the tape. Litter was considered to be any organic material that had fallen to the soil surface. Standing dead was any dead plant material that was produced in previous years but was still standing and had not dislodged or broken off to become litter. In addition to "first hit" data (the first interception of any of the above materials as a point is projected from above), "additional hit" data (any additional live species intercepted between the first hit and the ground) were collected. First hit interceptions were used to calculate absolute top layer (first hit) foliar cover by dividing the number of interceptions for a particular species or material by the total number of data points taken (100). First hit relative vegetation cover was calculated by dividing first hit absolute cover for each species by the total first hit vegetation cover. All-layer absolute cover was calculated by dividing all hits for a particular species by the total number of points taken (100). In addition, all-layer relative cover was calculated using all hits for a particular species divided by the total vegetation hits recorded during sampling of the transect.

Two transects were placed in revegetation parcel 39 (Original Landfill) and one transect was placed in each area 2, 17, 23, 55, and 56. UTM coordinates (NAD 83) are provided for these as well as the Comparison Area samples below:

<b>REVEGETATION PARCEL</b>	<b>TRANSECT</b>	<b>UTM DATA (13N)</b>
2	1	0483341 4415488
17	1	0483077 4415379
23	1	0481962 4415930
39	1	0482016 4415146
39	2	0482231 4415170
55	1	482824 4416262
56	1	482246 4415990
Comparison Area	1	482217 4419891
Comparison Area	2	482051 4419996
Comparison Area	3	481929 4419945

## **RESULTS**

Quantitative field data collected in 2011 are presented in Tables A through G in Appendix One. Photographs of the sampled revegetation parcels are present in Appendix Two. Data are summarized in the table below in light of discussion points identified during the process of study plan development. In the table below values shown for the Comparison Area are the averages from the three samples there.

**Summary of Quantitative Revegetation Measurements – Rocky Flats Site, Sept. 2011**

<b>Revegetation Comparison Criteria</b>	<b>Comparison Area</b> [Table G]	<b>RP 2</b> (903 pad & Vicinity) [Table A]	<b>RP 17</b> (903 pad & Vicinity) [Table B]	<b>RP 39</b> (Original Landfill) [Table D]	<b>RP 23</b> (Bldg. 371 Vicinity) [Table C]	<b>RP 56</b> (Bldg. 371 Vicinity) [Table F]	<b>RP 55</b> (North of Bldg. 771) [Table E]
% Absolute Cover: Total Live	42.7%	37.0%	44.0%	36.5%	41.0%	37.0%	43.0%
% Absolute Cover: Desirable Species	33.1%	37.0%	39.0%	36.0%	40.0%	36.0%	43.0%
% Relative Cover: Desirable Species	77.5%	100%	88.6%	98.6%	97.6%	97.3%	100%
% Absolute Cover: Noxious Weeds	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
% Absolute Cover: Weeds**	3.6%	0.0%	5.0%	0.5%	1.0%	1.0%	0.0%
% of Seeded Species Present***	NA <sup>‡</sup>	72.7%	63.6%	72.7%	36.4%	63.6%**	63.6%
% Relative Cover: Most Abundant Single Species	20.3%	27.0%	56.8%	28.8%	61.0%	32.4%	34.9%
% Total Ground Cover	73.0%	54.0%	76.0%	70.5%	62.0%	73.0%	76.0%

RP = Revegetation Parcel

\* Colorado Noxious Weed Lists A and B

\*\* Weeds included here are native and introduced annual/biennial plants and introduced perennial plants

\*\*\* Based on DOE “Flat Areas” seed mix (Appendix Three)

‡ NA = Comparison Area not seeded with Rocky Flats Mixes

xxx = Values out of compliance with DOE criteria

## DISCUSSION

In the discussion below, criteria for revegetation success are either those set forth in an EPA document titled “Revegetation Success Criteria – Rocky Flats Environmental Technology Site” produced in 2004, or those criteria included in the DOE Revegetation Plan for the Rocky Flats Environmental Technology Site dated January 20, 2004.

### ***Revegetation Parcel 2 (Photo 1, Table A)***

This area includes the 903 Pad and its vicinity. The vegetation sample in this area indicated that absolute cover by the current year’s vegetation growth of desirable species was 37%, well in excess of the level of 25% set forth in the proposed EPA criteria for revegetation success on the Rocky Flats Site formulated in 2004. Total ground cover of 54% was less than the 70% level set forth in the Quantitative Grassland Success Criteria included in the DOE Revegetation Plan. Relative cover by desirable species was 100%, far exceeding the 30% DOE criterion.

Eight of the eleven seeded species were documented as present in the Revegetation Parcel 2 samples. This exceeds and satisfies the 50% DOE criterion. The average relative cover by the single most abundant species (western wheatgrass, *Pascopyrum (Agropyron) smithii*) was 27% of the total vegetation cover. As such it meets (by being less than) the DOE criterion of 45% of cover comprised by a single species.

With regard to noxious weeds, no species were quantitatively encountered in Revegetation Parcel 2. Diffuse knapweed and Dalmatian toadflax were present but not in measurable amounts. DOE has continued to pursue the eradication of noxious weeds on the site. Overall the Original Landfill site (Revegetation Parcel 39) had a low incidence of weeds.

In summary, Revegetation Parcel 2 data indicate a PASS using the EPA criteria, but because total ground cover was less than 70%, this DOE criterion would not be satisfied. The other three DOE criteria were satisfied.

***Revegetation Parcel 17 (Photo 2, Table B)***

Revegetation Parcel 17, like Revegetation Parcel 2, is part of the 903 Pad and its vicinity. Total live vegetation cover by desirable species was 40%, well in excess of the Comparison Area value of 30% and the 25% EPA 2004 criterion. Relative cover by desirable species was 88.6%, far in excess of the DOE criterion of 30%.

Approximately 64% of seeded species were present, exceeding the DOE criterion of 50%. The single most abundant species (western wheatgrass) comprised 57% of the total vegetation cover. Thus, it exceeded the 45% DOE criterion. It should be noted that there was a strong presence of other native species in this stand especially warm season grasses. It is likely that western wheatgrass will continue to comprise a large portion of the cover but with these other native species continuing to be present as well. As such, the 2011 high cover by western wheatgrass is not considered to be a serious problem.

No noxious weeds were encountered in Revegetation Parcel 17. There is 5% cover by smooth brome (*Bromus inermis*) that could expand over the years and crowd out the aforementioned native species. While not a noxious weed, this Eurasian forage grass (present at various locations around the site from agricultural use before the 1950's) can be aggressive.

***Revegetation Parcel 23 (Photo 3, Table C)***

The sample from Revegetation Parcel 23 is in the vicinity of Building 371 but outside of the pre-existing building footprint. This site had 40% live vegetation cover by desirable species, exceeding the 25% EPA success criterion and the Comparison Area value. With over 97% relative cover by desirable species, it far exceeds the DOE criterion of 30%. The total ground cover of 62% was short of the 70% criterion required by the DOE. With approximately 36% of seeded species present, the 50% DOE criterion was

not met. Western wheatgrass comprised more than half of the cover (61%), thus exceeding the 45% DOE criterion. There was no measurable cover by noxious weeds, satisfying the EPA criterion. Thus this area falls short in three of the four DOE criteria, but passes all EPA criteria.

***Revegetation Parcel 39 (Photos 4 and 5, Table D)***

Revegetation Parcel 39 is the Original Landfill site. Two transects documented the vegetation at this site (Table D). Total absolute vegetation cover by desirable species was 36%, exceeding the EPA success criterion of 25%. The Comparison Area, with 33% vegetation cover by desirable species, also exceeded the EPA success criterion. 99% of the cover was comprised of desirable species, easily exceeding the DOE criterion of 30%. The total ground cover (71%) exceeded the 60% DOE criterion.

Over 70% percent of seeded species were present, satisfying the DOE criterion. The single most abundant species (western wheatgrass) comprised only 29% of vegetation cover, thus falling below the upper limit of 45% cited in the DOE Reclamation Plan and satisfying the criterion. Total ground cover was 70.5%, exceeding the DOE standard of 70%.

Diffuse knapweed was the only Colorado A or B list noxious weed species encountered in the sampling but it was not abundant enough to have been encountered quantitatively.

Revegetation Parcel 39 satisfied all revegetation performance criteria of both DOE and EPA.

***Revegetation Parcel 55 (Photo 6, Table E)***

Revegetation Parcel 55 sampling took place north of the former location of Building 771. Total vegetation cover by desirable species was 43%, well in excess of the 25% EPA criterion and the Comparison Area level. Relative cover by desirable species was 100%. 64% of seeded species were present, well exceeding the DOE criterion. Relative cover by the single most abundant species (western wheatgrass) was 39%, thus passing the

DOE criterion. Total ground cover was 76%, exceeding the DOE standard of 70%. No noxious weeds were present, passing the EPA criterion.

All DOE and EPA restoration criteria were satisfied in this area based on data collected during 2011 sampling.

***Revegetation Parcel 56 (Photo 7, Table F)***

*Revegetation Parcel 56* is similar to *Revegetation Parcel 23*, in that it lies in the vicinity of the former Building 371, but north of the footprint of the former building. Total vegetation cover by desirable species was 36%, exceeding the 25% EPA criterion and the Comparison Area level. Relative cover by desirable species was 97% satisfying the DOE criterion of 30%. 64% of seeded species were present, exceeding the DOE criterion. Relative cover by the single most abundant species (western wheatgrass) was 33%, thus passing the DOE criterion of being no greater than 45%. Total ground cover was 73%, exceeding the DOE standard of 70%. No noxious weeds were present, satisfying the EPA criterion on this subject.

All DOE and EPA restoration criteria were passed in 2011 sampling at this site.

***Comparison Area (Photos 8, 9 and 10, Table G)***

The Comparison Area on the nearby Varra Parcel of City of Boulder Open Space and Mountain Parks has progressively improved in cover by desirable species over the three years of monitoring (2009 to 2011). It is believed that the standard it sets is reasonable and useful for the Rocky Flats Site.

## **SUMMARY**

***Total Vegetation Cover***

Despite the very dry late summer, fall and winter of 2010/2011, incident moisture during spring and summer 2011 provided favorable growing conditions resulting in moderately high vegetation cover values, both on the Rocky Flats Site and the Comparison Area. Vegetation cover values from 35% to 40%, that were typical of this year's sampling, are

capable of keeping surface soils stabilized and trapping wind-blown particles in this semiarid type of environment (see Yan 2011).

### ***Total Ground Cover***

With all revegetation parcels near or above 70% total ground cover, erosional protection can be regarded as satisfactory. During dry times vegetational cover will of course decline. In consideration of the extent of rocks at the surface, ground cover values on the Rocky Flats revegetation parcels can be expected to continue to be greater than grasslands on finer-textured soils. Revegetation Parcel 2 with 54% total ground cover had 37% live vegetation cover, which as mentioned above can be expected to protect the soil surface adequately from wind erosion.

### ***Percent of Seeded Species Present***

Of revegetation parcels examined in 2011, with the exception of Revegetation Parcel 23, well over half the seeded species (and mostly greater than  $\frac{3}{4}$ ) were represented. In Revegetation Parcel 23, the establishment of warm season grass species was sparse, but total vegetation cover was quite strong at 41%, soil stabilization was well-accounted for.

### ***Dominance by Single Species***

Relative proportion of cover among species is likely to continue to vary in response to varying moisture conditions as well as competitive interaction at all of the revegetated parcels. With the exception of Revegetation parcels 17 and 23, no single species comprised more than about  $\frac{1}{4}$  to  $\frac{1}{3}$  of total vegetation cover. In Revegetation Parcel 17 with 57% of the vegetation cover as western wheatgrass, there were also quantitatively well-established native warm season grasses. In Revegetation Parcel 23, however, the establishment of the seeded mix was low, and western wheatgrass, along with slender wheatgrass, nearly comprised the entire vegetation cover. The natural occurrence of near mono-cultures of western wheatgrass are common on the plains, and of any of the planted species to be individually dominant, western wheatgrass is the most "natural." Such occurrences are usually associated with rock-free and fine-textured soils. Revegetation Parcel 23 with only 1% rock cover was by far the most rock-free of the sampled revegetation parcels.

### ***Presence of Weeds***

DOE Legacy Management has pursued weed control very vigorously over the six years since seeding. As a result, the presence of noxious weeds is very low. Very minor amounts of diffuse knapweed and Dalmatian toadflax were present, but those easily could have been recently germinated. Seed sources for these plants in the region are unrelenting in their annual production and continuing weed control is often necessary. As vegetation strength develops and during drier years, weed problems can be expected to be less extensive.

### ***Comparison to DOE Performance Criteria***

Among the revegetation parcels assessed in 2011 Revegetation Parcels numbered 2, 17, 23, 55, and 56 were listed by DOE as having failed to meet revegetation success standards (USDOE 2009, 2010). Based on the 2011 EPA data, three of the five parcels sampled (Revegetation Parcels 2, 17, and 23) failed the DOE criteria. All passed the EPA criteria in 2011. The DOE total ground cover criterion of 70% is set very high, predisposing revegetation parcels to fail this criterion in many years. Similarly, the single species limitation at 45% of total vegetation cover is rather high for many young stands that will eventually be more evenly diverse.

Of the eight revegetation parcels examined in the previous two years' observations (2009 and 2010) all but two failed at least one of the DOE criteria (Revegetation Parcels 32 and the Revegetation Parcels 50 and 51 taken together (Present Landfill – Upper Surface)) . In the case of Revegetation Parcel 32 (2010), though it passed DOE criteria, it failed EPA criteria because of the slight, but nonetheless measureable presence of noxious weed cover. In the case of Revegetation Parcels 50 and 51 (2009), the EPA criteria were also passed. Of the six DOE-failed revegetation parcels, all passed the EPA criteria except Revegetation Parcel 52 (Present landfill- East Face) and Building 111. The Present Landfill- East Face is an armored face for which the vegetation success criteria are not applicable. For Building 111 the test hinges on the interpretation of “Desirable Species” on this topsoil import site. Aggressive domestic forage grasses were likely present in the soil cover used, and as such it could be argued that they were purposely planted and thus desirable.

## ***Literature Cited***

Yan, Yuchun, Xingliang Xu, Xiaoping Xin, Guixia Yang, Xu Wang, Ruirui Yan, and Baorui Chen. 2011. Effect of vegetation coverage on aeolian dust accumulation in a semiarid steppe of northern China. *Catena* 87(3) 351-356.

U.S. Department of Energy (USDOE). 2004. Rocky Flats Environmental Technology Site, Revegetation Plan, Revision 2. 47 pp.

U.S. Department of Energy (USDOE). 2010. Annual Report of Site Surveillance and Maintenance Activities at the Rocky Flats, Colorado, Site, Calendar Year 2010. April 2011. USDOE, Legacy Management.

*Map 1. 2011 Quantitative Sample Locations, Rocky Flats Site*

*Map 2. Rocky Flats Comparison Area Sample Locations*

*Appendix One*

*Quantitative Data Tables by Sample Area and Transect*

*(See attached spreadsheet files)*

*Appendix Two*

*Photographs of Sample Locations*

*(See attached document)*

*Appendix Three*

*Seed Mix used*

*(See attached document)*

*Appendix Four*

*Revegetation Parcel Map*

*(See attached map)*

Revegetation Success Criteria - Rocky Flats Environmental Technology Site

Year	.....Assessment Categories.....		
	Marginal Success	Conditional Success	High Probability of Success
2	< 5% absolute cover (desirable species*) <b>AND</b> < one-half of total veg. cover of comparison area**	5 -10% absolute cover (desirable species*) <b>AND</b> one-half to three-fourths of total veg. cover of comparison area**	> 10% absolute cover (desirable species*) <b>AND</b> > three-fourths of total veg. cover of comparison area**
3	< 8% absolute cover (desirable species*) <b>AND</b> < one-half of total veg. cover of comparison area**	8 -15% absolute cover (desirable species*) <b>AND</b> one-half to seven-eighths of total veg. cover of comparison area**	> 15% absolute cover (desirable species*) <b>AND</b> > seven-eighths of total veg. cover of comparison area**
4	< 10% absolute cover (desirable species*) <b>AND</b> < one-half of total veg. cover of comparison area**	10 - 25% absolute cover (desirable species*) <b>AND</b> one-half to nine-tenths of total veg. cover of comparison area**	> 25% absolute cover (desirable species*) <b>AND</b> > nine-tenths of total veg. cover of comparison area**
YEAR 5+	< 10% absolute cover (desirable species*) <b>OR</b> < one-half of total veg. cover of comparison area**	10 - 25% absolute cover (desirable species*) <b>OR</b> one-half to nine-tenths of total veg. cover of comparison area**	<b>PASS</b> with > 25% absolute cover (desirable species*) <b>OR</b> > total veg. cover (desirable species*) of comparison area**
ALL YEARS	> 3% absolute cover by noxious weeds <sup>b</sup>	0.1 to 3% absolute cover by noxious weeds <sup>b</sup> ; effective eradication actions documented	This assessment must also be made (in 5+ year cover test) : Presence of noxious weeds <sup>a</sup> less than 0.1 % absolute cover
Footnotes	<sup>a</sup> Noxious weeds included in the State of Colorado Weed Act (2003) Lists A and B		
	*Desirable species are the species included in the seed mix along with any native species that volunteer on the revegetation site.		** A comparison area agreed upon by USEPA, USFWS, and CDPHE in consultation with RFETS. This area may be a native area or a revegetated area at least five years old as of the date of evaluation.

## DOE Legacy Management Revegetation Success Criteria

Success criteria and monitoring are a necessary component of a revegetation plan to evaluate the success of the revegetation efforts. Revegetation success will be judged according to criteria for species richness, species composition, and total ground cover. These criteria are important indicators of site conditions and stability. The following criteria will be used for establishing revegetation success for the IA:

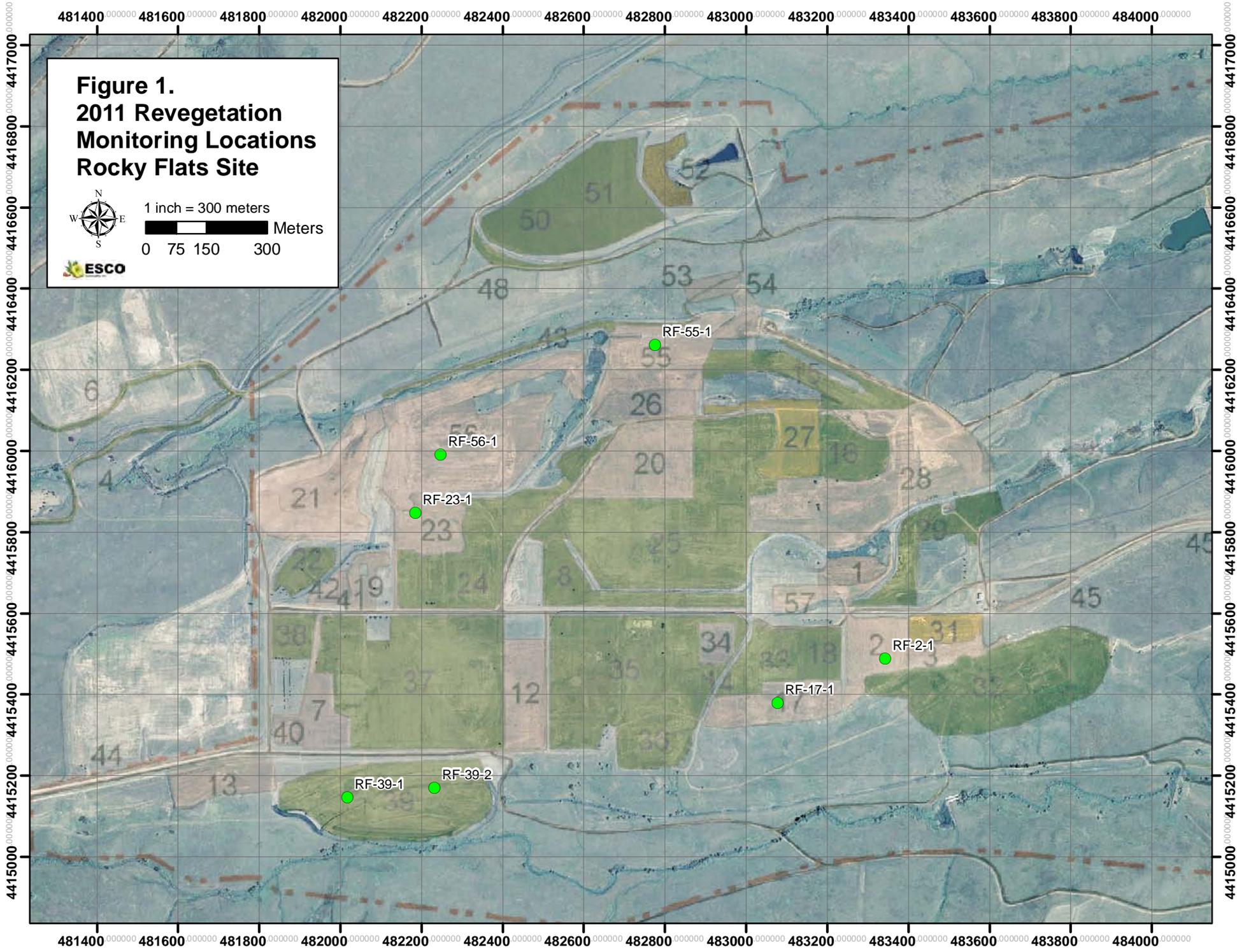
Quantitative grassland success criteria:

1. A minimum of 30% relative foliar cover of live desirable species (seeded native species and/or non-seeded native species).
2. A minimum of 70% total ground cover comprised of litter cover, current year live vegetation basal cover, and rock cover.
3. A minimum of 50% of the seeded native species will be present at the revegetation site.
4. No single species will contribute >45% of the relative foliar cover (except in areas where dominance by a single species is appropriate for long term wildlife and habitat management objectives).

Noxious weeds:

Noxious weeds will be evaluated on a species specific basis and weed control will be employed as necessary using appropriate IWMP strategies to achieve the success criteria listed above.

Monitoring will be conducted annually at selected locations to help determine the need for management and maintenance activities. Success will be based on the results from data collection. Monitoring will be continued until success criteria have been achieved at the selected monitoring locations. For example, if severe weather (i.e., drought) prevent vegetation establishment, then monitoring would be extended.



**Figure 1.**  
**2011 Revegetation**  
**Monitoring Locations**  
**Rocky Flats Site**

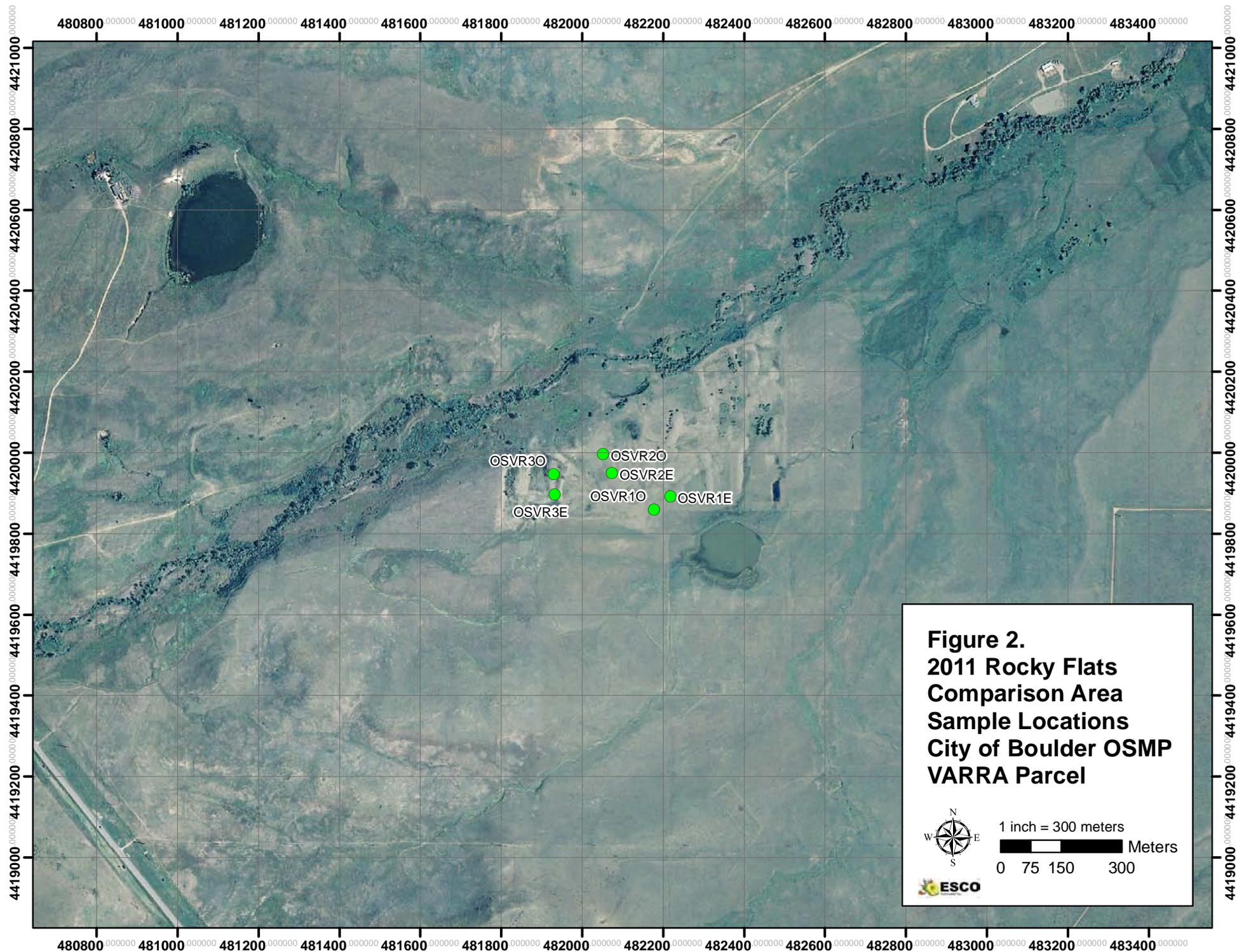
N  
W E  
S

1 inch = 300 meters

Meters

0 75 150 300

ESCO



**Appendix One**  
**Quantitative Data Tables by Sample Area and Transect**

PLANT SPECIES	AVERAGE		RELATIVE VEGETATION		RELATIVE VEGETATION		Percent Foliar Cover Sample Number 2-1
	COVER (%)	FREQUENCY (%)	COVER (%)	COVER-ALL (%)	COVER-ALL (%)		
<b>NATIVE ANNUAL &amp; BIENNIAL FORBS</b>							
<i>Helianthus annuus</i>	0.00	100.00	0.00	0.00	0.00		P
<b>TOTAL NATIVE ANN. &amp; BIEN. FORBS</b>	<b>0.0</b>	<b>100.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>		<b>P</b>
<b>INTRODUCED ANNUAL &amp; BIENNIAL FORBS</b>							
<i>Acosta diffusa</i>	0.00	100.00	0.00	0.00	0.00		P
<i>Bassia sieversiana</i>	0.00	100.00	0.00	0.00	0.00		P
<i>Lactuca serriola</i>	0.00	100.00	0.00	0.00	0.00		P
<i>Salsola australis</i>	0.00	100.00	0.00	0.00	0.00		P
<b>TOTAL INTRO. ANN. &amp; BIEN. FORBS</b>	<b>0.0</b>	<b>100.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>		<b>P</b>
<b>NATIVE ANNUAL GRASSES</b>							
<i>Panicum capillare</i>	0.00	100.00	0.00	0.00	0.00		P
<b>TOTAL NATIVE ANN. GRASSES</b>	<b>0.0</b>	<b>100.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>		<b>P</b>
<b>NATIVE PERENNIAL FORBS</b>							
<i>Agaloma marginata</i>	0.00	100.00	0.00	0.00	0.00		P
<i>Virgulus ericoides</i>	0.00	100.00	0.00	0.00	0.00		P
<b>TOTAL NATIVE PERENNIAL FORBS</b>	<b>0.0</b>	<b>100.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>		<b>P</b>
<b>INTRODUCED PERENNIAL FORBS</b>							
<i>Convolvulus arvensis</i>	0.00	100.00	0.00	0.00	0.00		P
<i>Linaria genistifolia</i> ssp. <i>dalmatica</i>	0.00	100.00	0.00	0.00	0.00		P
<b>TOTAL INTRO. PERENNIAL FORBS</b>	<b>0.0</b>	<b>100.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>		<b>P</b>
<b>NATIVE PERENNIAL GRASSES (cool)</b>							
<i>Elymus canadensis</i>	2.00	100.00	5.41	2.00	5.26		2
<i>Elymus lanceolatus</i> fm. <i>dasystachya</i>	8.00	100.00	21.62	8.00	21.05		8
<i>Elymus trachycaulus</i>	9.00	100.00	24.32	9.00	23.68		9
<i>Nassella viridula</i>	1.00	100.00	2.70	1.00	2.63		1
<i>Pascopyrum smithii</i>	10.00	100.00	27.03	10.00	26.32		10
<b>TOTAL NATIVE PERENNIAL GRASSES (c)</b>	<b>30.0</b>	<b>100.0</b>	<b>81.1</b>	<b>30.0</b>	<b>78.9</b>		<b>30</b>
<b>INTRODUCED PERENNIAL GRASSES (cool)</b>							
<i>Bromopsis inermis</i>	0.00	100.00	0.00	0.00	0.00		P
<i>Setaria viridis</i>	0.00	100.00	0.00	0.00	0.00		P
<b>TOTAL INTRO. PERENNIAL GRASSES (c)</b>	<b>0.0</b>	<b>100.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>		<b>P</b>
<b>NATIVE PERENNIAL GRASSES (warm)</b>							
<i>Andropogon gerardii</i>	0.00	100.00	0.00	1.00	2.63		(1)
<i>Bouteloua curtipendula</i>	2.00	100.00	5.41	2.00	5.26		2
<i>Buchloe dactyloides</i>	1.00	100.00	2.70	1.00	2.63		1
<i>Chondrosium gracile</i>	1.00	100.00	2.70	1.00	2.63		1
<i>Panicum virgatum</i>	2.00	100.00	5.41	2.00	5.26		2
<i>Schizachyrium scoparium</i>	1.00	100.00	2.70	1.00	2.63		1
<b>TOTAL NATIVE PERENNIAL GRASSES (w)</b>	<b>7.0</b>	<b>100.0</b>	<b>18.9</b>	<b>8.0</b>	<b>21.1</b>		<b>7(1)</b>

\* P=Present within 1 m. on either side of the cover transect but not quantitatively encountered.

PLANT SPECIES	AVERAGE COVER (%)	FREQUENCY (%)	RELATIVE VEGETATION COVER (%)	AVERAGE COVER-ALL (%)	RELATIVE VEGETATION COVER-ALL (%)	Percent Foliar Cover Sample Number
Standing dead	1.00	100.00		1.00		1
Litter	11.00	100.00		11.00		11
Bare soil	46.00	100.00		46.00		46
Rock	5.00	100.00		5.00		5
TOTALS	100.0			101.0		100
TOTAL VEGETATION COVER	37.0 (s=0.0)		100.0	38.0 (s=0.0)	100.0	37(1)
GROUND COVER (Litter+Rock+Veg+St.Dead)	54.0			55.0		54(1)
SPECIES DENSITY (# of species/100 sq.m.) (AVERAGE= 23.0 Std.Dev.= 0.0)						23

\* P=Present within 1 m. on either side of the cover transect but not quantitatively encountered.

PLANT SPECIES	AVERAGE		RELATIVE		RELATIVE		Percent Foliar Cover Sample Number 17-1
	COVER (%)	FREQUENCY (%)	VEGETATION COVER (%)	AVERAGE COVER-ALL (%)	VEGETATION COVER-ALL (%)		
<b>INTRODUCED ANNUAL &amp; BIENNIAL FORBS</b>							
<i>Bassia sieversiana</i>	0.00	100.00	0.00	0.00	0.00		P
<i>Portulaca oleracea</i>	0.00	100.00	0.00	0.00	0.00		P
<b>TOTAL INTRO. ANN. &amp; BIEN. FORBS</b>	<b>0.0</b>	<b>100.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>		<b>P</b>
<b>INTRODUCED ANNUAL GRASSES</b>							
<i>Anisantha tectorum</i>	0.00	100.00	0.00	0.00	0.00		P
<b>TOTAL INTRO. ANN. GRASSES</b>	<b>0.0</b>	<b>100.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>		<b>P</b>
<b>NATIVE PERENNIAL GRASSES (cool)</b>							
<i>Elymus lanceolatus</i> fm. <i>dasystachya</i>	2.00	100.00	4.55	2.00	4.55		2
<i>Elymus trachycaulus</i>	1.00	100.00	2.27	1.00	2.27		1
<i>Pascopyrum smithii</i>	25.00	100.00	56.82	25.00	56.82		25
<b>TOTAL NATIVE PERENNIAL GRASSES (c)</b>	<b>28.0</b>	<b>100.0</b>	<b>63.6</b>	<b>28.0</b>	<b>63.6</b>		<b>28</b>
<b>INTRODUCED PERENNIAL GRASSES (cool)</b>							
<i>Agropyron desertorum</i>	0.00	100.00	0.00	0.00	0.00		P
<i>Bromopsis inermis</i>	5.00	100.00	11.36	5.00	11.36		5
<b>TOTAL INTRO. PERENNIAL GRASSES (c)</b>	<b>5.0</b>	<b>100.0</b>	<b>11.4</b>	<b>5.0</b>	<b>11.4</b>		<b>5</b>
<b>NATIVE PERENNIAL GRASSES (warm)</b>							
<i>Andropogon gerardii</i>	1.00	100.00	2.27	1.00	2.27		1
<i>Bouteloua curtipendula</i>	6.00	100.00	13.64	6.00	13.64		6
<i>Buchloe dactyloides</i>	1.00	100.00	2.27	1.00	2.27		1
<i>Chondrosium gracile</i>	3.00	100.00	6.82	3.00	6.82		3
<i>Sporobolus cryptandrus</i>	0.00	100.00	0.00	0.00	0.00		P
<b>TOTAL NATIVE PERENNIAL GRASSES (w)</b>	<b>11.0</b>	<b>100.0</b>	<b>25.0</b>	<b>11.0</b>	<b>25.0</b>		<b>11</b>
Standing dead	3.00	100.00		3.00			3
Litter	11.00	100.00		11.00			11
Bare soil	24.00	100.00		24.00			24
Rock	18.00	100.00		18.00			18
<b>TOTALS</b>	<b>100.0</b>			<b>100.0</b>			<b>100</b>
<b>TOTAL VEGETATION COVER</b>	<b>44.0 (s=0.0)</b>		<b>100.0</b>	<b>44.0 (s=0.0)</b>	<b>100.0</b>		<b>44</b>
<b>GROUND COVER (Litter+Rock+Veg+St.Dead)</b>	<b>76.0</b>			<b>76.0</b>			<b>76</b>
<b>SPECIES DENSITY (# of species/100 sq.m.) (AVERAGE= 13.0 Std.Dev.= 0.0)</b>							<b>13</b>

\* P=Present within 1 m. on either side of the cover transect but not quantitatively encountered.

PLANT SPECIES	AVERAGE COVER (%)	FREQUENCY (%)	RELATIVE	AVERAGE	RELATIVE	Percent Foliar Cover Sample Number 23-1
			VEGETATION COVER (%)	COVER-ALL (%)	VEGETATION COVER-ALL (%)	
<b>INTRODUCED ANNUAL &amp; BIENNIAL FORBS</b>						
<i>Bassia sieversiana</i>	0.00	100.00	0.00	0.00	0.00	P
<b>TOTAL INTRO. ANN. &amp; BIEN. FORBS</b>	<b>0.0</b>	<b>100.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>P</b>
<b>NATIVE ANNUAL GRASSES</b>						
<i>Panicum capillare</i>	0.00	100.00	0.00	0.00	0.00	P
<b>TOTAL NATIVE ANN. GRASSES</b>	<b>0.0</b>	<b>100.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>P</b>
<b>INTRODUCED ANNUAL GRASSES</b>						
<i>Anisantha tectorum</i>	1.00	100.00	2.44	1.00	2.44	1
<i>Bromus japonicus</i>	0.00	100.00	0.00	0.00	0.00	P
<b>TOTAL INTRO. ANN. GRASSES</b>	<b>1.0</b>	<b>100.0</b>	<b>2.4</b>	<b>1.0</b>	<b>2.4</b>	<b>1</b>
<b>NATIVE PERENNIAL GRASSES (cool)</b>						
<i>Critesion jubatum</i>	1.00	100.00	2.44	1.00	2.44	1
<i>Elymus canadensis</i>	1.00	100.00	2.44	1.00	2.44	1
<i>Elymus trachycaulus</i>	13.00	100.00	31.71	13.00	31.71	13
<i>Pascopyrum smithii</i>	25.00	100.00	60.98	25.00	60.98	25
<b>TOTAL NATIVE PERENNIAL GRASSES (c)</b>	<b>40.0</b>	<b>100.0</b>	<b>97.6</b>	<b>40.0</b>	<b>97.6</b>	<b>40</b>
<b>INTRODUCED PERENNIAL GRASSES (cool)</b>						
<i>Bromopsis inermis</i>	0.00	100.00	0.00	0.00	0.00	P
<i>Setaria viridis</i>	0.00	100.00	0.00	0.00	0.00	P
<b>TOTAL INTRO. PERENNIAL GRASSES (c)</b>	<b>0.0</b>	<b>100.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>P</b>
<b>NATIVE PERENNIAL GRASSES (warm)</b>						
<i>Aristida purpurea</i>	0.00	100.00	0.00	0.00	0.00	P
<i>Buchloe dactyloides</i>	0.00	100.00	0.00	0.00	0.00	P
<i>Chondrosium gracile</i>	0.00	100.00	0.00	0.00	0.00	P
<b>TOTAL NATIVE PERENNIAL GRASSES (w)</b>	<b>0.0</b>	<b>100.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>P</b>
Standing dead	4.00	100.00		4.00		4
Litter	16.00	100.00		16.00		16
Bare soil	38.00	100.00		38.00		38
Rock	1.00	100.00		1.00		1
<b>TOTALS</b>	<b>100.0</b>			<b>100.0</b>		<b>100</b>
<b>TOTAL VEGETATION COVER</b>	<b>41.0 (s=0.0)</b>		<b>100.0</b>	<b>41.0 (s=0.0)</b>	<b>100.0</b>	<b>41</b>
<b>GROUND COVER (Litter+Rock+Veg+St.Dead)</b>	<b>62.0</b>			<b>62.0</b>		<b>62</b>
<b>SPECIES DENSITY (# of species/100 sq.m.) (AVERAGE= 13.0 Std.Dev.= 0.0)</b>						<b>13</b>

\* P=Present within 1 m. on either side of the cover transect but not quantitatively encountered.

PLANT SPECIES	AVERAGE COVER (%)	FREQUENCY (%)	RELATIVE	AVERAGE	RELATIVE	Percent Foliar	
			VEGETATION COVER (%)	COVER-ALL (%)	VEGETATION COVER-ALL (%)	Cover Sample Numbers 39-1 39-2	
<b>NATIVE ANNUAL &amp; BIENNIAL FORBS</b>							
<i>Dyssodia papposa</i>	0.50	100.00	1.37	0.50	1.37	1	P
<i>Grindelia squarrosa</i>	0.00	100.00	0.00	0.00	0.00	P	P
<b>TOTAL NATIVE ANN. &amp; BIEN. FORBS</b>	<b>0.5</b>	<b>100.0</b>	<b>1.4</b>	<b>0.5</b>	<b>1.4</b>	<b>1</b>	<b>P</b>
<b>INTRODUCED ANNUAL &amp; BIENNIAL FORBS</b>							
<i>Acosta diffusa</i>	0.00	100.00	0.00	0.00	0.00	P	P
<i>Bassia sieversiana</i>	0.00	50.00	0.00	0.00	0.00	P	
<i>Lactuca serriola</i>	0.00	100.00	0.00	0.00	0.00	P	P
<i>Plantago lanceolata</i>	0.00	50.00	0.00	0.00	0.00		P
<b>TOTAL INTRO. ANN. &amp; BIEN. FORBS</b>	<b>0.0</b>	<b>100.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>P</b>	<b>P</b>
<b>INTRODUCED ANNUAL GRASSES</b>							
<i>Anisantha tectorum</i>	0.00	100.00	0.00	0.00	0.00	P	P
<b>TOTAL INTRO. ANN. GRASSES</b>	<b>0.0</b>	<b>100.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>P</b>	<b>P</b>
<b>NATIVE PERENNIAL FORBS</b>							
<i>Gaillardia artistata x pulchella</i>	0.00	50.00	0.00	0.00	0.00		P
<i>Heterotheca villosa</i>	1.50	50.00	4.11	1.50	4.11	3	
<b>TOTAL NATIVE PERENNIAL FORBS</b>	<b>1.5</b>	<b>100.0</b>	<b>4.1</b>	<b>1.5</b>	<b>4.1</b>	<b>3</b>	<b>P</b>
<b>NATIVE PERENNIAL GRASSES (cool)</b>							
<i>Bothriochloa</i> sp.	0.00	50.00	0.00	0.00	0.00	P	
<i>Dichanthelium oligosanthes</i> var. <i>scribnerianum</i>	0.00	50.00	0.00	0.00	0.00	P	
<i>Elymus lanceolatus</i> fm. <i>dasystachya</i>	1.50	100.00	4.11	1.50	4.11	P	3
<i>Elymus trachycaulus</i>	0.00	50.00	0.00	0.00	0.00	P	
<i>Pascopyrum smithii</i>	10.50	100.00	28.77	10.50	28.77	9	12
<b>TOTAL NATIVE PERENNIAL GRASSES (c)</b>	<b>12.0</b>	<b>100.0</b>	<b>32.9</b>	<b>12.0</b>	<b>32.9</b>	<b>9</b>	<b>15</b>
<b>INTRODUCED PERENNIAL GRASSES (cool)</b>							
<i>Setaria viridis</i>	0.00	50.00	0.00	0.00	0.00	P	
<b>TOTAL INTRO. PERENNIAL GRASSES (c)</b>	<b>0.0</b>	<b>50.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>P</b>	<b>---</b>
<b>NATIVE PERENNIAL GRASSES (warm)</b>							
<i>Andropogon gerardii</i>	0.00	100.00	0.00	0.00	0.00	P	P
<i>Aristida purpurea</i>	0.00	50.00	0.00	0.00	0.00	P	
<i>Bouteloua curtipendula</i>	9.00	100.00	24.66	9.00	24.66	15	3
<i>Buchloe dactyloides</i>	10.00	100.00	27.40	10.00	27.40	3	17
<i>Chondrosum gracile</i>	2.50	100.00	6.85	2.50	6.85	P	5
<i>Schizachyrium scoparium</i>	1.00	100.00	2.74	1.00	2.74	1	1
<i>Sorghastrum avenaceum</i>	0.00	100.00	0.00	0.00	0.00	P	P
<i>Sporobolus asper</i>	0.00	50.00	0.00	0.00	0.00		P
<b>TOTAL NATIVE PERENNIAL GRASSES (w)</b>	<b>22.5</b>	<b>100.0</b>	<b>61.6</b>	<b>22.5</b>	<b>61.6</b>	<b>19</b>	<b>26</b>

\* P=Present within 1 m. on either side of the cover transect but not quantitatively encountered.

PLANT SPECIES	AVERAGE COVER (%)	FREQUENCY (%)	RELATIVE	AVERAGE	RELATIVE	Percent Foliar	
			VEGETATION COVER (%)	COVER-ALL (%)	VEGETATION COVER-ALL (%)	Cover Sample Numbers	
						39-1	39-2
Standing dead	2.50	100.00		2.50		2	3
Litter	12.50	100.00		12.50		12	13
Bare soil	29.50	100.00		29.50		35	24
Rock	19.00	100.00		19.00		19	19
TOTALS	100.0			100.0		100	100
TOTAL VEGETATION COVER	36.5 (s=6.4)		100.0	36.5 (s=6.4)	100.0	32	41
GROUND COVER (Litter+Rock+Veg+St. Dead)	70.5			70.5		65	76
SPECIES DENSITY (# of species/100 sq.m.) (AVERAGE= 18.0 Std.Dev.= 2.8)						20	16

\* P=Present within 1 m. on either side of the cover transect but not quantitatively encountered.

PLANT SPECIES	AVERAGE		RELATIVE	RELATIVE		Percent Foliar Cover Sample Number 55-1
	COVER (%)	FREQUENCY (%)	VEGETATION COVER (%)	AVERAGE COVER-ALL COVER-ALL (%)	VEGETATION COVER-ALL COVER-ALL (%)	
<b>NATIVE ANNUAL &amp; BIENNIAL FORBS</b>						
Grindelia squarrosa	0.00	100.00	0.00	0.00	0.00	P
Helianthus petiolaris	0.00	100.00	0.00	0.00	0.00	P
<b>TOTAL NATIVE ANN. &amp; BIEN. FORBS</b>	<b>0.0</b>	<b>100.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>P</b>
<b>INTRODUCED ANNUAL &amp; BIENNIAL FORBS</b>						
Plantago lanceolata	0.00	100.00	0.00	0.00	0.00	P
Verbascum blattaria	0.00	100.00	0.00	0.00	0.00	P
Verbascum thapsus	0.00	100.00	0.00	0.00	0.00	P
<b>TOTAL INTRO. ANN. &amp; BIEN. FORBS</b>	<b>0.0</b>	<b>100.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>P</b>
<b>NATIVE PERENNIAL FORBS</b>						
Oenothera villosa	0.00	100.00	0.00	0.00	0.00	P
<b>TOTAL NATIVE PERENNIAL FORBS</b>	<b>0.0</b>	<b>100.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>P</b>
<b>NATIVE PERENNIAL GRASSES (cool)</b>						
Elymus lanceolatus fm. dasystachya	6.00	100.00	13.95	6.00	13.95	6
Elymus trachycaulus	1.00	100.00	2.33	1.00	2.33	1
Pascopyrum smithii	15.00	100.00	34.88	15.00	34.88	15
<b>TOTAL NATIVE PERENNIAL GRASSES (c)</b>	<b>22.0</b>	<b>100.0</b>	<b>51.2</b>	<b>22.0</b>	<b>51.2</b>	<b>22</b>
<b>INTRODUCED PERENNIAL GRASSES (cool)</b>						
Bromopsis inermis	0.00	100.00	0.00	0.00	0.00	P
<b>TOTAL INTRO. PERENNIAL GRASSES (c)</b>	<b>0.0</b>	<b>100.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>P</b>
<b>NATIVE PERENNIAL GRASSES (warm)</b>						
Andropogon gerardii	1.00	100.00	2.33	1.00	2.33	1
Bouteloua curtipendula	6.00	100.00	13.95	6.00	13.95	6
Buchloe dactyloides	4.00	100.00	9.30	4.00	9.30	4
Chondrosum gracile	8.00	100.00	18.60	8.00	18.60	8
Schizachyrium scoparium	1.00	100.00	2.33	1.00	2.33	1
Sporobolus asper	1.00	100.00	2.33	1.00	2.33	1
<b>TOTAL NATIVE PERENNIAL GRASSES (w)</b>	<b>21.0</b>	<b>100.0</b>	<b>48.8</b>	<b>21.0</b>	<b>48.8</b>	<b>21</b>
Standing dead	3.00	100.00		3.00		3
Litter	23.00	100.00		23.00		23
Bare soil	24.00	100.00		24.00		24
Rock	7.00	100.00		7.00		7
<b>TOTALS</b>	<b>100.0</b>			<b>100.0</b>		<b>100</b>
<b>TOTAL VEGETATION COVER</b>	<b>43.0 (s=0.0)</b>		<b>100.0</b>	<b>43.0 (s=0.0)</b>	<b>100.0</b>	<b>43</b>
<b>GROUND COVER (Litter+Rock+Veg+St.Dead)</b>	<b>76.0</b>			<b>76.0</b>		<b>76</b>
<b>SPECIES DENSITY (# of species/100 sq.m.) (AVERAGE= 16.0 Std.Dev.= 0.0)</b>						<b>16</b>

\* P=Present within 1 m. on either side of the cover transect but not quantitatively encountered.

PLANT SPECIES	AVERAGE		RELATIVE VEGETATION		RELATIVE VEGETATION		Percent Foliar Cover Sample Number 56-1
	COVER (%)	FREQUENCY (%)	COVER (%)	COVER-ALL (%)	COVER-ALL (%)		
<b>INTRODUCED ANNUAL &amp; BIENNIAL FORBS</b>							
<i>Alyssum parviflorum</i>	0.00	100.00	0.00	0.00	0.00		P
<i>Lactuca serriola</i>	0.00	100.00	0.00	0.00	0.00		P
<b>TOTAL INTRO. ANN. &amp; BIEN. FORBS</b>	<b>0.0</b>	<b>100.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>		<b>P</b>
<b>NATIVE ANNUAL GRASSES</b>							
<i>Panicum capillare</i>	0.00	100.00	0.00	0.00	0.00		P
<b>TOTAL NATIVE ANN. GRASSES</b>	<b>0.0</b>	<b>100.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>		<b>P</b>
<b>INTRODUCED ANNUAL GRASSES</b>							
<i>Anisantha tectorum</i>	1.00	100.00	2.70	1.00	2.70		1
<b>TOTAL INTRO. ANN. GRASSES</b>	<b>1.0</b>	<b>100.0</b>	<b>2.7</b>	<b>1.0</b>	<b>2.7</b>		<b>1</b>
<b>NATIVE PERENNIAL FORBS</b>							
<i>Chamaesyce fendleri</i>	0.00	100.00	0.00	0.00	0.00		P
<b>TOTAL NATIVE PERENNIAL FORBS</b>	<b>0.0</b>	<b>100.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>		<b>P</b>
<b>NATIVE PERENNIAL GRASSES (cool)</b>							
<i>Elymus lanceolatus</i> fm. <i>dasystachya</i>	1.00	100.00	2.70	1.00	2.70		1
<i>Elymus trachycaulus</i>	2.00	100.00	5.41	2.00	5.41		2
<i>Pascopyrum smithii</i>	12.00	100.00	32.43	12.00	32.43		12
<b>TOTAL NATIVE PERENNIAL GRASSES (c)</b>	<b>15.0</b>	<b>100.0</b>	<b>40.5</b>	<b>15.0</b>	<b>40.5</b>		<b>15</b>
<b>INTRODUCED PERENNIAL GRASSES (cool)</b>							
<i>Setaria viridis</i>	0.00	100.00	0.00	0.00	0.00		P
<b>TOTAL INTRO. PERENNIAL GRASSES (c)</b>	<b>0.0</b>	<b>100.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>		<b>P</b>
<b>NATIVE PERENNIAL GRASSES (warm)</b>							
<i>Andropogon gerardii</i>	0.00	100.00	0.00	0.00	0.00		P
<i>Bouteloua curtipendula</i>	10.00	100.00	27.03	10.00	27.03		10
<i>Buchloe dactyloides</i>	4.00	100.00	10.81	4.00	10.81		4
<i>Chondrosium gracile</i>	3.00	100.00	8.11	3.00	8.11		3
<i>Schizachyrium scoparium</i>	2.00	100.00	5.41	2.00	5.41		2
<i>Sporobolus asper</i>	1.00	100.00	2.70	1.00	2.70		1
<i>Sporobolus heterolepis</i>	1.00	100.00	2.70	1.00	2.70		1
<b>TOTAL NATIVE PERENNIAL GRASSES (w)</b>	<b>21.0</b>	<b>100.0</b>	<b>56.8</b>	<b>21.0</b>	<b>56.8</b>		<b>21</b>
Standing dead	2.00	100.00		2.00			2
Litter	20.00	100.00		20.00			20
Bare soil	27.00	100.00		27.00			27
Rock	14.00	100.00		14.00			14
<b>TOTALS</b>	<b>100.0</b>			<b>100.0</b>			<b>100</b>
<b>TOTAL VEGETATION COVER</b>	<b>37.0 (s=0.0)</b>		<b>100.0</b>	<b>37.0 (s=0.0)</b>	<b>100.0</b>		<b>37</b>
<b>GROUND COVER (Litter+Rock+Veg+St.Dea)</b>	<b>73.0</b>			<b>73.0</b>			<b>73</b>
<b>SPECIES DENSITY (# of species/100 sq.m.)</b> (AVERAGE= 16.0 Std.Dev.= 0.0)							<b>16</b>

\* P=Present within 1 m. on either side of the cover transect but not quantitatively encountered.

PLANT SPECIES	AVERAGE COVER (%)	FREQUENCY (%)	RELATIVE	AVERAGE	RELATIVE	Percent Foliar		
			VEGETATION COVER (%)	COVER-ALL (%)	VEGETATION COVER-ALL (%)	Cover Sample Numbers		
						1	2	3
<b>NATIVE ANNUAL &amp; BIENNIAL FORBS</b>								
<i>Chenopodium leptophyllum</i>	0.00	33.33	0.00	0.00	0.00	P		
<i>Dyssodia papposa</i>	0.00	100.00	0.00	0.00	0.00	P	P	P
<i>Grindelia squarrosa</i>	0.00	100.00	0.00	0.00	0.00	P	P	P
<i>Plantago elongata</i>	0.33	33.33	0.78	0.33	0.76		1	
<b>TOTAL NATIVE ANN. &amp; BIEN. FORBS</b>	<b>0.3</b>	<b>100.0</b>	<b>0.8</b>	<b>0.3</b>	<b>0.8</b>	<b>P</b>	<b>1</b>	<b>P</b>
<b>INTRODUCED ANNUAL &amp; BIENNIAL FORBS</b>								
<i>Acosta diffusa</i>	0.33	66.67	0.78	0.33	0.76		1	P
<i>Alyssum parviflorum</i>	1.00	33.33	2.34	1.00	2.27	3		
<i>Ambrosia artemisiifolia</i> var. <i>elatior</i>	0.33	100.00	0.78	0.33	0.76	P	P	1
<i>Plantago lanceolata</i>	0.00	33.33	0.00	0.00	0.00		P	
<i>Tragopogon dubius</i> ssp. <i>major</i>	0.00	66.67	0.00	0.00	0.00	P	P	
<i>Verbascum thapsus</i>	0.00	33.33	0.00	0.00	0.00	P		
<b>TOTAL INTRO. ANN. &amp; BIEN. FORBS</b>	<b>1.7</b>	<b>100.0</b>	<b>3.9</b>	<b>1.7</b>	<b>3.8</b>	<b>3</b>	<b>1</b>	<b>1</b>
<b>NATIVE ANNUAL GRASSES</b>								
<i>Panicum capillare</i>	0.33	33.33	0.78	0.33	0.76			1
<b>TOTAL NATIVE ANN. GRASSES</b>	<b>0.3</b>	<b>33.3</b>	<b>0.8</b>	<b>0.3</b>	<b>0.8</b>	<b>---</b>	<b>---</b>	<b>1</b>
<b>INTRODUCED ANNUAL GRASSES</b>								
<i>Bromus japonicus</i>	0.33	33.33	0.78	0.33	0.76		1	
<b>TOTAL INTRO. ANN. GRASSES</b>	<b>0.3</b>	<b>33.3</b>	<b>0.8</b>	<b>0.3</b>	<b>0.8</b>	<b>---</b>	<b>1</b>	<b>---</b>
<b>NATIVE PERENNIAL FORBS</b>								
<i>Aster porteri</i>	2.33	66.67	5.47	2.33	5.30		4	3
<i>Heterotheca villosa</i>	0.33	66.67	0.78	0.33	0.76	1	P	
<i>Talinum parviflorum</i>	0.00	33.33	0.00	0.00	0.00	P		
<i>Virgulus ericoides</i>	0.00	33.33	0.00	0.00	0.00			P
<b>TOTAL NATIVE PERENNIAL FORBS</b>	<b>2.7</b>	<b>100.0</b>	<b>6.3</b>	<b>2.7</b>	<b>6.1</b>	<b>1</b>	<b>4</b>	<b>3</b>
<b>INTRODUCED PERENNIAL FORBS</b>								
<i>Cichorium intybus</i>	0.67	66.67	1.56	0.67	1.52	P		2
<i>Convolvulus arvensis</i>	0.33	33.33	0.78	0.33	0.76	1		
<i>Rumex crispus</i>	0.00	33.33	0.00	0.00	0.00	P		
<i>Trifolium repens</i>	0.00	33.33	0.00	0.00	0.00	P		
<b>TOTAL INTRO. PERENNIAL FORBS</b>	<b>1.0</b>	<b>66.7</b>	<b>2.3</b>	<b>1.0</b>	<b>2.3</b>	<b>1</b>	<b>---</b>	<b>2</b>
<b>NATIVE PERENNIAL GRASSES (cool)</b>								
<i>Carex stenophylla</i> ssp. <i>eleocharis</i>	0.00	33.33	0.00	0.00	0.00		P	
<i>Eleocharis acicularis</i>	0.33	33.33	0.78	0.33	0.76			1
<i>Eleocharis palustris</i>	0.33	33.33	0.78	0.33	0.76			1
<i>Hesperostipa comata</i>	0.33	33.33	0.78	0.33	0.76	1		
<i>Juncus longistylis</i>	3.33	66.67	7.81	3.33	7.58		P	10
<i>Koeleria macrantha</i>	0.00	33.33	0.00	0.00	0.00		P	
<i>Pascopyrum smithii</i>	6.67	100.00	15.63	6.67	15.15	15	2	3
<i>Poa compressa</i>	0.67	66.67	1.56	1.00	2.27		P	2(1)
<b>TOTAL NATIVE PERENNIAL GRASSES (c)</b>	<b>11.7</b>	<b>100.0</b>	<b>27.3</b>	<b>12.0</b>	<b>27.3</b>	<b>16</b>	<b>2</b>	<b>17(1)</b>

\* P=Present within 1 m. on either side of the cover transect but not quantitatively encountered.

PLANT SPECIES	AVERAGE COVER (%)	FREQUENCY (%)	RELATIVE	RELATIVE	Percent Foliar Cover			
			VEGETATION COVER (%)	AVERAGE COVER-ALL (%)	VEGETATION COVER-ALL (%)	Sample Numbers		
						1	2	3
<b>INTRODUCED PERENNIAL GRASSES (cool)</b>								
Agropyron desertorum	1.00	33.33	2.34	1.00	2.27	3		
Agrostis gigantea	0.00	33.33	0.00	0.00	0.00	P		
Echinochloa crus-galli	0.33	33.33	0.78	0.33	0.76	1		
Festuca arundinacea	0.00	33.33	0.00	0.00	0.00	P		
Festuca ovina	4.67	66.67	10.94	5.33	12.12	9(1)	5(1)	
<b>TOTAL INTRO. PERENNIAL GRASSES (c)</b>	<b>6.0</b>	<b>66.7</b>	<b>14.1</b>	<b>6.7</b>	<b>15.2</b>	<b>12(1)</b>	---	<b>6(1)</b>
<b>NATIVE PERENNIAL GRASSES (warm)</b>								
Andropogon gerardii	0.00	33.33	0.00	0.00	0.00	P		
Bouteloua curtipendula	1.33	100.00	3.13	1.33	3.03	2	1	1
Buchloe dactyloides	3.33	66.67	7.81	3.33	7.58	1	9	
Chondrosium gracile	8.67	100.00	20.31	9.00	20.45	7(1)	15	4
Schizachyrium scoparium	1.00	66.67	2.34	1.00	2.27	3 P		
Sorghastrum avenaceum	0.33	33.33	0.78	0.33	0.76	1		
Sporobolus airoides	2.00	100.00	4.69	2.00	4.55	5	P	1
Sporobolus asper	1.33	33.33	3.13	1.33	3.03	4		
Sporobolus cryptandrus	0.67	66.67	1.56	0.67	1.52	1	1	
<b>TOTAL NATIVE PERENNIAL GRASSES (w)</b>	<b>18.7</b>	<b>100.0</b>	<b>43.8</b>	<b>19.0</b>	<b>43.2</b>	<b>16(1)</b>	<b>29</b>	<b>11</b>
<b>NATIVE SUBSHRUBS</b>								
Gutierrezia sarothrae	0.00	33.33	0.00	0.00	0.00	P		
<b>TOTAL NATIVE SUBSHRUBS</b>	<b>0.0</b>	<b>33.3</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	---	---	<b>P</b>
<b>SUCCULENTS</b>								
Opuntia macrorhiza	0.00	33.33	0.00	0.00	0.00	P		
Opuntia phaeacantha	0.00	33.33	0.00	0.00	0.00	P		
<b>TOTAL SUCCULENTS</b>	<b>0.0</b>	<b>33.3</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>P</b>	---	---
Standing dead	3.67	100.00		3.67		4	3	4
Litter	17.00	100.00		17.00		20	11	20
Bare soil	27.00	100.00		27.00		20	32	29
Rock	9.67	100.00		9.67		7	16	6
<b>TOTALS</b>	<b>100.0</b>			<b>101.3</b>		<b>100</b>	<b>100</b>	<b>100</b>
<b>TOTAL VEGETATION COVER</b>	<b>42.7 (s=5.7)</b>		<b>100.0</b>	<b>44.0 (s=6.6)</b>	<b>100.0</b>	<b>49(2)</b>	<b>38</b>	<b>41(2)</b>
<b>GROUND COVER (Litter+Rock+Veg+St.Dead)</b>	<b>73.0</b>			<b>74.3</b>		<b>80(2)</b>	<b>68</b>	<b>71(2)</b>
<b>SPECIES DENSITY (# of species/100 sq.m.)</b> (AVERAGE= 23.3 Std.Dev.= 2.1)						<b>24</b>	<b>21</b>	<b>25</b>

\* P=Present within 1 m. on either side of the cover transect but not quantitatively encountered.

**Appendix Two**  
**Photographs of Sample Locations**



Photograph 1. Area 2 Sample 1, Sept. 2011.



Photograph 2. Area 17 Sample 1, Sept. 2011.



Photograph 3. Area 23 Sample 1, Sept. 2011.



Photograph 4. Area 39 Sample 1, Sept. 2011.



Photograph 5. Area 39 Sample 2, Sept. 2011.



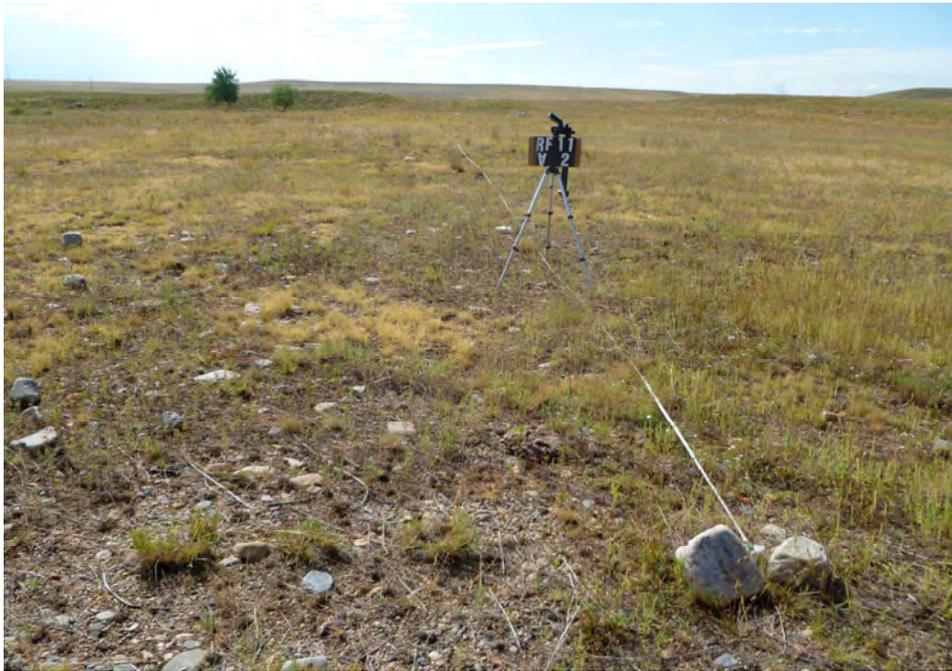
Photograph 6. Area 55 Sample 1, Sept. 2011.



Photograph 7. Area 56 Sample 1, Sept. 2011.



Photograph 8. Comparison Area Sample 1, Sept. 2011.



Photograph 9. Comparison Area Sample 2, Sept. 2011.



Photograph 10. Comparison Area Sample 3, Sept. 2011.

**Appendix Three**  
**Seed Mix used**

**Flat Areas (Areas On Pediment Tops\* With Slopes Less Than 10%) Revegetation Seed Mix  
(Based on 50 seeds/sq.ft.)**

**Blue Map Areas**

**This Revegetation Specification Sheet Supercedes All Previous Revegetation Information For RFETS**

**Date: 2/05**

Scientific Name	Common Name	Variety	% of Seed Mix	# Seeds Needed	# Seeds/Lb.	# Seeds/Sq. Ft.	Lbs./Acre (PLS)
<b>Graminoids</b>							
Agropyron smithii	Western Wheatgrass	Arriba	20	435600	120000	10.0	3.63
Agropyron trachycaulum	Slender Wheatgrass	San Luis	10	217800	120000	5.0	1.82
Andropogon gerardii	Big Bluestem	Bonilla	10	217800	130000	5.0	1.68
Andropogon scoparius	Little Bluestem	Aldous	8	174240	225000	4.0	0.77
Bouteloua curtipendula	Side-Oats Grama	Vaughn	15	326700	190000	7.5	1.72
Bouteloua gracilis	Blue Grama	Hachita	15	326700	710000	7.5	0.46
Buchloe dactyloides	Buffalo Grass	Texoka	5	108900	45000	2.5	2.42
Koleria pyramidata	June Grass		3	65340	2315400	1.5	0.03
Sorghastrum nutans	Indian Grass	Cheyenne	2	43560	120000	1.0	0.36
Sporobolus cryptandra	Sand Dropseed		7	152460	5298000	3.5	0.03
Stipa viridula	Green Needlegrass	Lodorm	5	108900	115000	2.5	0.95
	<b>Total</b>		<b>100</b>	<b>2178000</b>		<b>50.0</b>	<b>13.86</b>

Sq. ft/acre 43560  
 Seeds/sq. ft. 50  
 Seeds needed/acre 2178000

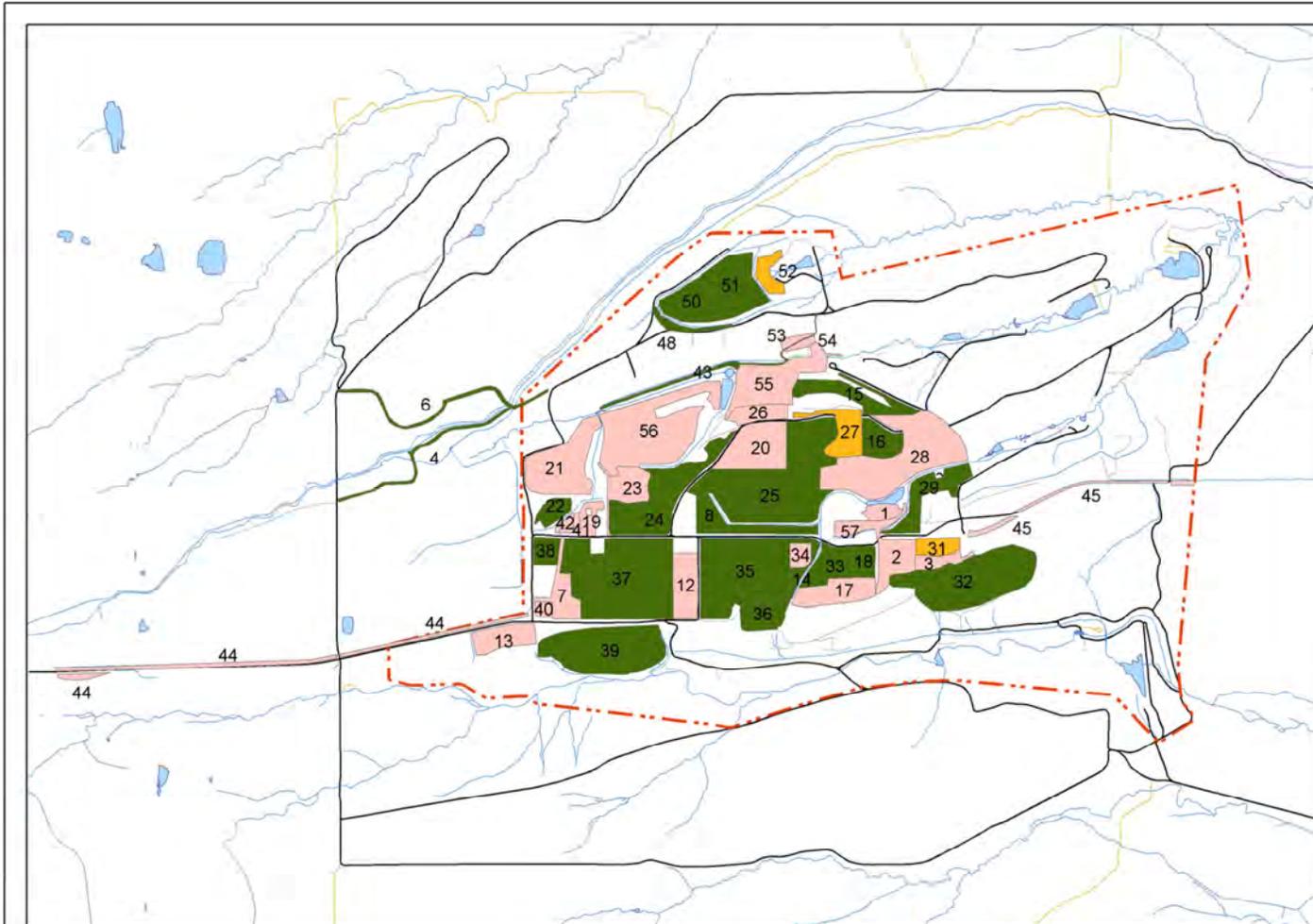
- 1) This pounds per acre assumes drill-seeding is used. If the seed is to be broadcast, the application rates are to be doubled.
- 2) PLS = pure live seed. Be sure to specify this to the seed dealer when ordering.
- 3) The seed is to be certified weed free.

**NOTE:**

\* The pediment tops are the upper flat surface areas throughout the IA.  
 Slender wheatgrass was added to species mix as an early successional species.

For questions regarding this spec sheet contact the K-H Ecology Group at x2231, x3560, or x5938.

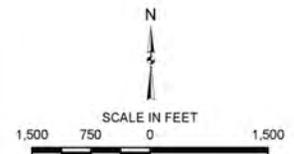
**Appendix Four**  
**Revegetation Parcel Map**



### Revegetation Parcels At Rocky Flats Site

#### Legend

- Revegetation Monitoring Locations 2009**
- Success Criteria Not Met In 2009
  - Success Criteria Met In 2009
  - Success Criteria Met In 2009  
(Excluding >45% by Single Species)
  - Lake or pond
  - RFS COU Boundary
  - Stream, ditch, or other drainage feature
- Roads**
- ATV ONLY
  - OPEN
  - TRUCK BY PERMISSION



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