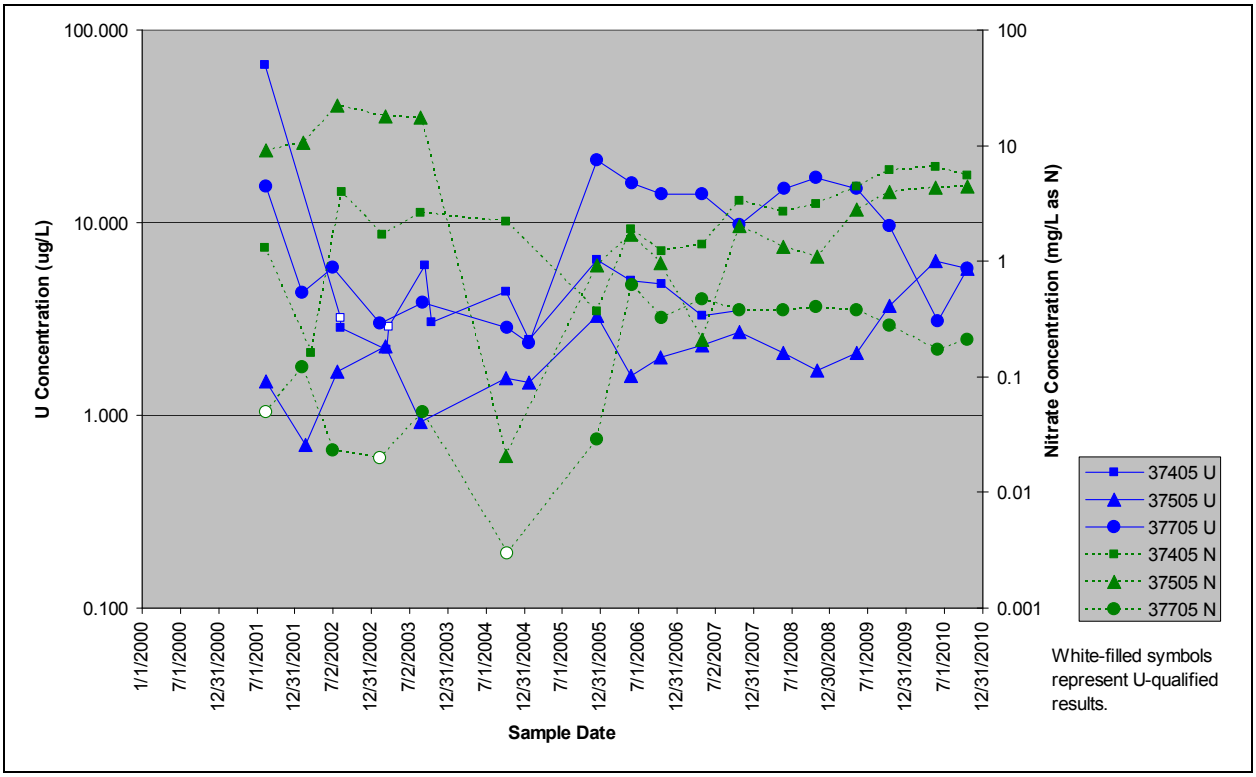

Notes: U data include results for U-mass and converted isotopic activities. Several results were qualified but are not shown differently for simplicity. Note logarithmic concentration scales.

Figure 258. Concentrations of U and Nitrate in Samples From B371 Sentinel Wells

East Government property boundary (former Rocky Flats Environmental Technology Site [RFETS] boundary): Boundary wells 10394 (Woman Creek and Indiana Street) and 41691 (Walnut Creek and Indiana Street) are located far outside the DOE-controlled area of the COU, on refuge lands managed by the U.S. Fish and Wildlife Service. Monitoring these wells is not required to support the remedy, and the associated groundwater data do not support technical objectives of the RFS monitoring network. Nonetheless, they are monitored to meet operational requirements stipulated in RFLMA.

These wells were each sampled once in 2010 (June). As in 2006 and 2009, results included detections of 1,3-DCB, an insecticide that is also used to make herbicides, at both wells. The applicable RFLMA standard for this constituent is 94 µg/L, and the reported concentrations in the 2010 samples were 0.52 µg/L (estimated) at well 10394 and 1.5 µg/L at well 41691. Nitrate was detected at an estimated concentration of 0.021 mg/L at well 41691. Concentrations of U were within their previously reported ranges at these locations (8.3 µg/L at well 41691 and 3.7 µg/L at well 10394).

3.2 Ecological Monitoring

3.2.1 Introduction

The Ecology group conducts ecological monitoring of the Site's ecological resources to ensure regulatory compliance and to preserve, protect, and manage those resources. Ecological

monitoring is an integral aspect of determining whether the management objectives and goals for the natural resources at the Site are being achieved. This report summarizes the results of the ecological monitoring that was conducted at the Site during 2010. It includes a brief summary of the monitoring conducted for Preble's meadow jumping mouse (*Zapus hudsonius preblei*; Preble's mouse) mitigation and wetland mitigation activities; however, the details of those monitoring efforts are summarized in separate regulatory reports provided to the appropriate agencies.

At an elevation of approximately 6,000 feet, the Site contains a unique ecotonal mixture of mountain and prairie plant species resulting from the topography of the area and its proximity to the mountain front. The POU, the area surrounding the COU (the general area where the former IA was once located), is one of the largest remaining undeveloped tracts of its kind along the Colorado Piedmont. A number of plant communities present in the COU and POU have been identified as increasingly rare and unique by the Colorado Natural Heritage Program (CNHP 1994, 1995). These communities include the xeric tallgrass prairie, tall upland shrubland, wetlands, and Great Plains riparian woodland communities. Small inclusions of a number of other increasingly rare plant communities are also found on the Site. Many of these communities support populations of increasingly rare animals as well, including the federally protected Preble's mouse, and other uncommon species such as the grasshopper sparrow (*Ammodramus savannarum*), loggerhead shrike (*Lanius ludovicianus*), Merriam's shrew (*Sorex merriami*), black-crowned night heron (*Nycticorax nycticorax*), hops blue butterfly (*Celastrina sp.*), and Arogos skipper (*Atrytone arogos*).

During 2007, transfer of portions of the POU was made to USFWS to create the Rocky Flats National Wildlife Refuge. As a result, the total acreage managed by LM is now approximately 1,308 acres in the COU and 484 acres in the POU. A summary of the highlights from the 2010 field season is provided in the following sections. Full, detailed summaries, methodology, and analyses for each field monitoring effort are presented as stand-alone reports on the Ecology DVD included with this report.

3.2.2 Vegetation Monitoring

Vegetation monitoring reported here is conducted at the Site to provide information necessary for management of the natural resources. Objectives of the vegetation monitoring in 2010 were to:

- Identify any new plant species not found at the Site previously.
- Identify and document infestations of selected noxious weeds at the Site to assist with the planning of noxious weed control applications.
- Document and track herbicide applications in 2010.
- Document where revegetation activities were conducted in 2010.
- Evaluate the success of revegetation activities at the Site.
- Conduct photomonitoring for visual documentation of changes in vegetation establishment at the Site.

3.2.2.1 Site Flora

The complete list of plant species known to be at the Site at the end of 2010 is available on the Ecology DVD included with this report. The Site species list includes the complete flora of both the COU and the POU. The vascular flora of the Site consists of 632 species of plants. Two new records of vascular plant species for the Site flora are reported. Common teasel (*Dipsacus fullonum*), a noxious weed, was found growing in a wetland area in Rock Creek near the Lindsay Ranch on the Refuge. The patch of plants was small enough that eradication is possible before the species spreads throughout the drainage. The USFWS was contacted and informed of the population. This species is common on surrounding lands, and future monitoring will continue to look for it elsewhere at the Site. Yellow cress (*Rorippa teres*), a small mustard plant, was found growing along the pond margin in the mud flats at Pond A-2. The species is a native wetland plant. The following taxonomic names will be used at the Site for the new plant species records[22]:

Family	Scientific Name	Speccode	Common Name
Dipsacaceae	*Dipsacus fullonum* L.	DIFU1	Common Teasel
Brassicaceae	*Rorippa teres* (Michaux) Stuckey	ROTE1	Yellow Cress

Voucher specimens of the species will be deposited at the University of Colorado Herbarium in Boulder, Colorado.

3.2.2.2 Weed Mapping and Weed Control

Resource management is an important concern at the Site with a goal to protect and sustain the native ecological resources that make the Site so unique along the Front Range. One of the challenges at the Site is to manage the ecological resources with a limited set of management tools. Currently, most efforts focus on the control or eradication of the weed species themselves, with little emphasis on trying to improve conditions for the desired native species. Two of the key tools for grassland management, fire and grazing, are not currently allowed at the Site. As a result, management of the ecological resources in the COU is largely limited to controlling the noxious weeds themselves. The Comprehensive Conservation Plan (USFWS 2005), developed by USFWS for management of the Rocky Flats National Wildlife Refuge, has identified the full range of Integrated Pest Management tools for use at the Refuge for controlling weeds. This includes administrative, cultural, biological (including grazing), mechanical (including prescribed fire), and chemical as viable tools for controlling noxious weeds and ecosystem management. Thus, there may be a greater opportunity for some of these other resource management tools to be used in the future.

The methods used for weed mapping are provided in the full report on the Ecology DVD included with this report.

Figure 259 and Figure 260 show the 2010 weed distribution maps for diffuse knapweed (*Centaurea diffusa*) and Dalmatian toadflax (*Linaria dalmatica*), respectively. Table 91 shows

[22] Nomenclature follows GPFA (1986), Weber (1976), Weber (1990), Weber and Wittmann (1992), and Weber and Wittmann (2001), in that order of determination. Species were verified at the University of Colorado Herbarium in, Boulder, Colorado.

the estimated total acreage and acreage-by-density categories for each species, based on the mapping data from 2007 through 2010. The total area of the COU is approximately 1,308 acres. In 2010, diffuse knapweed was observed on approximately 230 acres at various levels of infestation. Dalmatian toadflax was mapped on approximately 168 acres in 2010. Both species showed a decrease in acreage compared to the 2009 mapping data. Annual fluctuations in the abundance of many grassland species are not uncommon as they respond to changes in temperature, precipitation amounts, timing of precipitation, and other environmental factors.

Additional species that were mapped based on fortuitous observations in 2010 included Scotch thistle (*Onopordum acanthium*), Dame's rocket (*Hesperis matronalis*), leafy spurge (*Euphorbia uralensis*), tall mustard (*Cardaria chalepensis*), whitetop (*Cardaria draba*), and wild carrot (*Daucus carota*). No acreages are provided for these species since the polygons simply show the general location of the infestations. Figure 261 shows the locations of these species as mapped in 2010.

During 2010, approximately 264 acres were treated with herbicides at the Site via ground application (Figure 262). Table 92 lists the target species, herbicides used, application rates, and the approximate timing of the application during the year. (**Note:** Multiple herbicides are listed at some locations. This does not mean that each herbicide was used across that entire location. Rather, depending on site-specific characteristics such as target weed species, the locations of water bodies, soil types, and the professional judgment of the licensed herbicide applicator, different herbicides were used within that location to provide the control needed.)

In 2007, a small patch of leafy spurge, a state-listed noxious weed, was documented for the first time at the Site. This patch was sprayed in 2007 to control its spread. In 2008, two additional small patches of leafy spurge were found in the northern COU. Because these new patches of leafy spurge had already started going to seed when they were discovered, the seedheads were cut off, bagged, and sent to the landfill for burial. These three locations and an additional location were sprayed with Plateau herbicide in 2009 to control the infestations. Observations in 2010 showed no leafy spurge plants flowered at any of the known locations. No plants were observed at one location, and a few small rosettes were starting to come up in October 2010 at the other locations. Additional control is planned for 2011 to eradicate the leafy spurge. Hand control and weed-whacking were also used to control some small patches of Scotch thistle, tall mustard, tamarisk (*Tamarix ramosissima*), and whitetop in 2010.

Biocontrol insects continue to be used at the Site. Stem-mining beetles (*Mecinus janthinus*) were released several years ago at a few locations to help control Dalmatian toadflax. Additional beetles were obtained from the Colorado Department of Agriculture in 2010 and released at two locations. Examination of several populations of Dalmatian toadflax at the site (both in the COU and POU) in 2010 showed that the beetles have essentially spread across the site. At nearly every location beetles were observed on the plants. Therefore, no future releases are planned, and the hope is that the beetles will continue to increase and expand, ultimately controlling the Dalmatian toadflax to a level at which herbicide applications are not required.

Table 91. COU Noxious Weed Acreage Summary (2007–2010)

Species	Density (acres)				Total	% of Total COU
	High	Medium	Low	Scattered		
Diffuse knapweed						
2007	2.2	41.2	248.8	167.7	459.9	35
2008	1.8	20.6	110.0	147.5	279.9	21
2009	1.6	44.6	231.2	147.5	424.9	32
2010	0.1	10.6	155.0	64.3	230.1	18
Dalmatian toadflax						
2007	77.1	51.0	0.0	109.0	237.1	18
2008	0	0	54.3	151.8	206.1	16
2009	2.1	16.8	56.5	386.7	462.1	35
2010	0.0	2.1	64.2	101.4	167.7	13
The total acreage of the COU is 1,308 acres.						

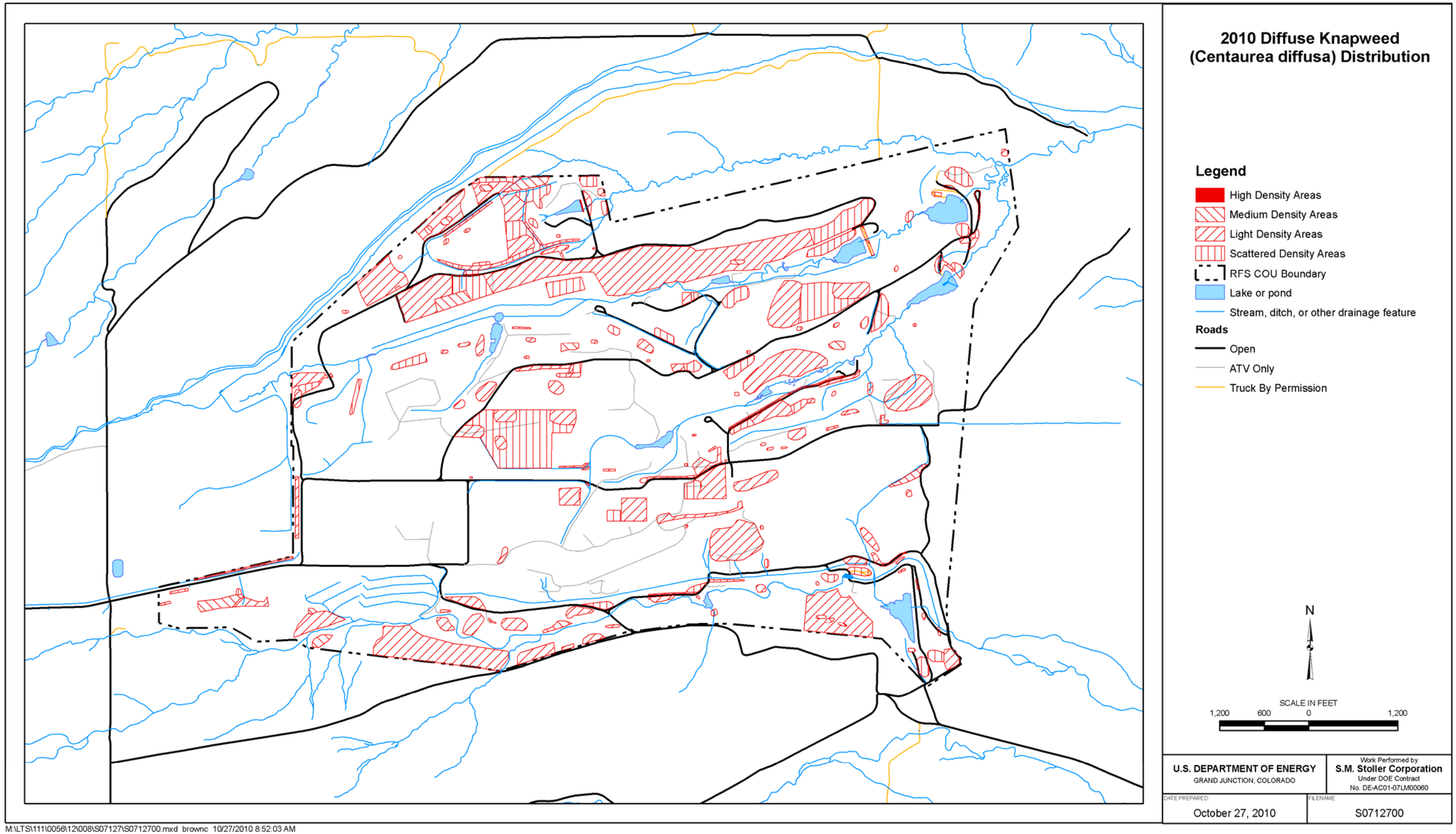

*Figure 259. 2010 Diffuse Knapweed (*Centaurea diffusa*) Distribution at Rocky Flats*

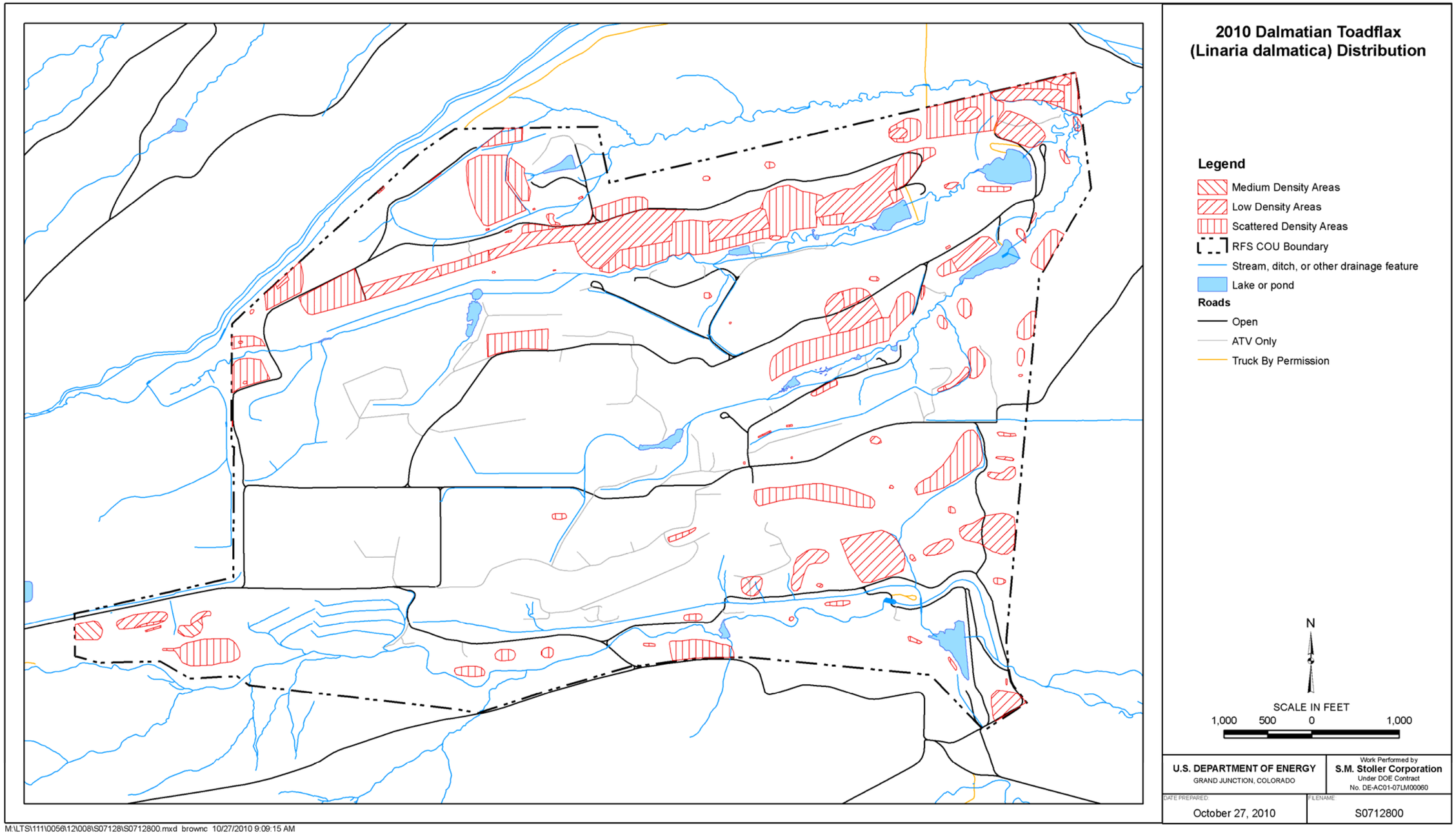

*Figure 260. 2010 Dalmation Toadflax (*Linaria dalmatica*) Distribution at Rocky Flats*

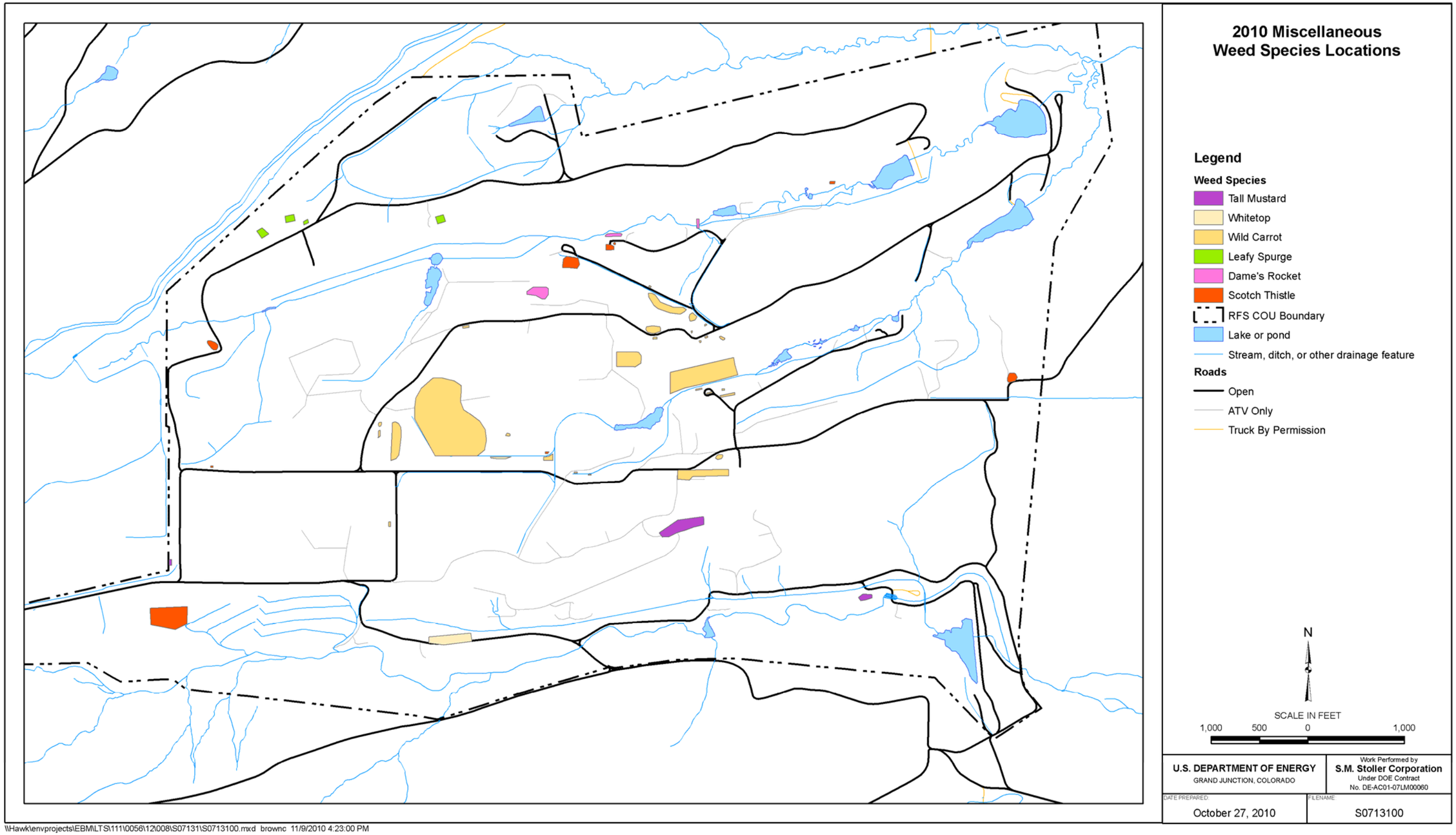

Figure 261. 2010 Miscellaneous Noxious Weed Locations at Rocky Flats

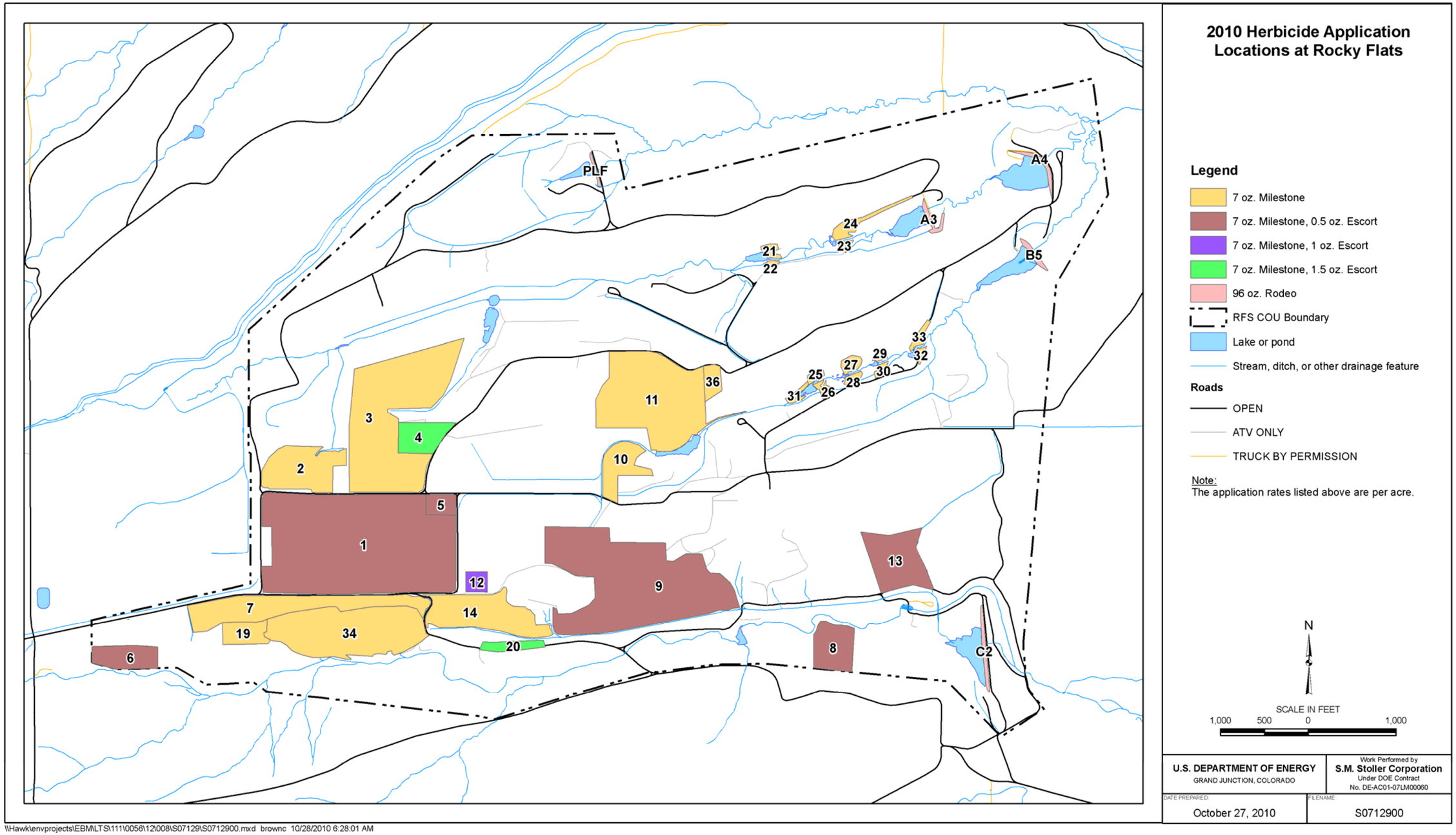

Figure 262. 2010 Herbicide Application Locations at the Rocky Flats Site

Table 92. FY 2010 Herbicide Application Summary

Location	Target Species[a]	Treatment	Actual Acreage Treated[b]	Time of Year Treated
1	CEDI1	7 oz. Milestone, 0.5 oz. Escort	57.00	Spring 2010
2	CEDI1	7 oz. Milestone	9.50	Spring 2010
3	CEDI1	7 oz. Milestone	34.00	Spring 2010
4	CADR1	7 oz. Milestone, 1.5 oz. Escort	4.25	Spring 2010
5	CADR1	7 oz. Milestone, 0.5 oz. Escort	2.00	Spring 2010
6	CEDI1, VETH1	7 oz. Milestone, 0.5 oz. Escort	5.00	Spring 2010
7	CEDI1	7 oz. Milestone	13.00	Spring 2010
8	CEDI1, VETH1	7 oz. Milestone, 0.5 oz. Escort	6.00	Spring 2010
9	CEDI1	7 oz. Milestone, 0.5 oz. Escort	42.00	Spring 2010
10	CEDI1	7 oz. Milestone	4.80	Spring 2010
11	CEDI1, DACA1	7 oz. Milestone	26.00	Spring 2010
12	CADR1	7 oz. Milestone, 1 oz. Escort	1.50	Spring 2010
13	CEDI1, VETH1	7 oz. Milestone, 0.5 oz. Escort	9.50	Spring 2010
14	CIAR1	7 oz. Milestone	11.00	Spring 2010
19	CEDI1, VETH1, ONAC1	7 oz. Milestone	3.50	Spring 2010
20	CADR1	7 oz. Milestone, 1.5 oz. Escort	2.00	Spring 2010
21	CEDI1, CIAR1, MEOF1	7 oz. Milestone	0.50	Spring 2010
22	CEDI1, CIAR1, MEOF1	7 oz. Milestone	0.30	Spring 2010
23	CEDI1, CIAR1, MEOF1	7 oz. Milestone	0.30	Spring 2010
24	CEDI1, CIAR1, MEOF1	7 oz. Milestone	1.75	Spring 2010
25	CEDI1, CIAR1, MEOF1	7 oz. Milestone	0.50	Spring 2010
26	CEDI1, CIAR1, MEOF1	7 oz. Milestone	0.60	Spring 2010
27	CEDI1, CIAR1, MEOF1	7 oz. Milestone	0.75	Spring 2010
28	CEDI1, CIAR1, MEOF1	7 oz. Milestone	0.50	Spring 2010
29	CEDI1, CIAR1, MEOF1	7 oz. Milestone	0.40	Spring 2010
30	CEDI1, CIAR1, MEOF1	7 oz. Milestone	0.50	Spring 2010
31	CEDI1, CIAR1, MEOF1	7 oz. Milestone	0.25	Spring 2010
32	CEDI1, CIAR1, MEOF1	7 oz. Milestone	0.25	Spring 2010
33	CEDI1, CIAR1, MEOF1	7 oz. Milestone	0.75	Spring 2010
34	CEDI1	7 oz. Milestone	21.50	Spring 2010
36	CEDI1, DACA1	7 oz. Milestone	1.60	Spring 2010
Riprap Dam Faces	Total Kill	96 oz/acre Rodeo	2.9	Spring 2010
		Total Area Treated in 2009	264.4	

Note: oz. = ounces
[a] Species Codes: CADR1 = whitetop, CEDI1 = diffuse knapweed, CIAR1 = Canada thistle, DACA1 = wild carrot, MEOF1 = yellow sweetclover, ONAC1 = scotch thistle, VETH1 = common mullein
[b] Acreages based on billing statements, not original GPS locations provided to subcontractor.

Collections and transplants from other established populations of various biocontrols at the site may continue to be made to further establish populations elsewhere across the site. Additional biocontrol insects for different weed species may be released as they become available. The integrated weed management approach at the site continues to address noxious weed issues through mapping and the use of various control methods.

A new noxious weed at the Site was observed in late August near the Lindsay Ranch in the POU on the Refuge. Common teasel has never been found at the Site previously, but approximately two dozen plants, already having flowered and gone to seed, were observed along the main branch of Rock Creek. USFWS was notified of the observation, and it was suggested that control

should be implemented to prevent the species from spreading throughout the adjacent wetlands and downstream.

Site ecology personnel participated in the Rocky Flats Weed Symposium held March 5, 2010, at the Broomfield Auditorium. A presentation entitled "Weed Control at Rocky Flats" was given discussing weed control activities at the Rocky Flats Site, both historically and ongoing. The purpose of the conference was to bring together surrounding landowners in the Rocky Flats area for networking and potentially to work toward more coordinated efforts for controlling noxious weeds.

3.2.2.3 Revegetation Activities in 2010

During winter, early spring, and fall 2010, interseeding was conducted on approximately 29 acres at the Site where vegetation cover was still sparse. At most of these locations, the seed was broadcast using an all-terrain-vehicle broadcast seeder. At some locations the seed was harrowed where conditions would allow.

For the past several years the Jefferson County Nature Association has been conducting volunteer seed-picking days to provide local ecotype seed for inclusion in the revegetation efforts at the Rocky Flats Site and other nearby revegetation projects. The seed provided to the Site has been interseeded into revegetation areas to provide more local genotypes in these areas. Until recently, forbs have not been desirable because of the need to conduct weed control at many of the revegetation locations. However, as the prairie grasses continue to establish, the introduction of forbs (wildflowers) is becoming more desirable to increase the diversity of plant life and increase habitat for other wildlife and insect species. In late 2009, four forb "nursery" areas were established (Figure 263). The forb seed collected in fall 2009 was broadcast throughout these four locations in the hope of establishing pockets, or islands, of forbs that could then expand outward. Weed control in these areas will be conducted by hand or by mowing/weed-whacking. The common forb species that were hand collected and broadcast into these areas included golden aster (*Chrysopsis villosa*), blazing star (*Liatris punctata*), groundsel (*Senecio spartioides*), and Porter's aster (*Aster porteri*).

In June 2010, the volunteers collected needle-and-thread grass (*Stipa comata*) and New Mexico feathergrass (*Stipa neomexicana*), both native grasses that occur on the prairie at the Site. These species are rarely available commercially, and when they are available, they are expensive. So the volunteers hand collected the seeds, and these were then hand broadcast into three locations for establishment (Figure 263). As with the forb islands, it is hoped that these species will establish at these locations and expand outward.

3.2.2.4 Revegetation Monitoring

As part of the cleanup and closure of the Site, the buildings, roads, and other infrastructure in the IA were removed. Approximately 650 acres were disturbed during cleanup activities, which were completed in fall 2005. Revegetation of the disturbed areas was conducted to prevent erosion and sedimentation of the Site streams and to meet water quality standards. Reestablishment of native plant species is also desirable to benefit wildlife and provide desirable vegetation and ground cover adjacent to the Rocky Flats National Wildlife Refuge. As part of the revegetation process, monitoring is conducted to determine whether success criteria, as stated in the *Rocky Flats,*

Colorado, Site Revegetation Plan (Revegetation Plan; DOE 2009b) are being met as well as to determine whether management of these revegetation areas is needed.

The success criteria from the Revegetation Plan are:

- The revegetation site will have a minimum of 30 percent relative foliar cover of live desired species (seeded or nonseeded native species). Relative cover is defined as the percentage of cover of a given species divided by the total amount of vegetation cover present. Example: Species A has 20 percent absolute cover, and total vegetation cover (all individual species cover values summed) is 80 percent. Relative cover = (20/80) × 100 = 25%.
- The revegetation site will have a minimum of 70 percent total ground cover that comprises litter cover, current-year live vegetation basal cover, and rock cover.
- A minimum of 50 percent of the seeded native species will be present at the revegetation site.
- No single species will contribute more than 45 percent of the relative foliar cover (except in areas where dominance by a single species is appropriate for long-term wildlife and habitat management objectives).

This report section summarizes the revegetation monitoring results for data collected during 2010. The objective of the revegetation monitoring in 2010 was to assess the success of the revegetation efforts. The methods and the large data summary tables are not presented here but may be found in the full report on the Ecology DVD included with this report. Figure 264 shows the locations at the Site where revegetation monitoring was conducted in 2010.

Species richness in 2010 ranged from a low of 11 species in unit L40 to a high of 32 species in unit L55 (the "L" is not shown for each location in Figure 264). The wide range in the number of species present is attributable to a number of factors, including how long ago the area was revegetated, the size of the location, the number of quadrats sampled in the location, the degree of disturbance in the area prior to revegetation, and the management actions (e.g., weed control) that have been conducted in the area. Fourteen different seeded graminoid species had become established and were growing at some locations in 2010. These included slender wheatgrass (*Agropyron caninum = Agropyron trachycaulum*), thickspike wheatgrass (*Agropyron dasystachyum*), western wheatgrass (*Agropyron smithii*), big bluestem (*Andropogon gerardii*), little bluestem (*Andropogon scoparius*), side-oats grama (*Bouteloua curtipendula*), blue grama (*Bouteloua gracilis*), buffalo grass (*Buchloe dactyloides*), Canada wildrye (*Elymus canadensis*), junegrass (*Koleria pyramidata*), switchgrass (*Panicum virgatum*), Indian grass (*Sorghastrum nutans*), sand dropseed (*Sporobolus cryptandrus*), and green needlegrass (*Stipa viridula*). Only western wheatgrass was established at all 25 locations. Several noxious weeds were also found in the revegetation areas. These included downy brome (*Bromus tectorum*), filaree (*Erodium cicutarium*), diffuse knapweed, Canada thistle (*Cirsium arvense*), chicory (*Cichorium intybus*), Dalmatian toadflax, and bindweed (*Convolvulus arvensis*). Downy brome averaged approximately 6.7 percent cover across all the sites combined, and the remainder of the weed species together averaged approximately 2.2 percent. Weeds will continue to be managed as needed to keep noxious weed populations down in the revegetation areas and enable the desired seeded species to become established more quickly and compete with the weeds.

Slightly different seed mixes were used at the revegetation locations depending on the year they were seeded and the slope position. According to a success criterion in the Revegetation Plan, at

least 50 percent of the seeded species must be present in an area for it to be considered successful. Twenty one locations (84 percent) had 50 percent or more seeded species present in 2010 and have thus met this success criterion (Table 93). One unit, L41, has failed to meet this criterion for the past 3 years (including 2010), even though it was seeded in 2002 and is the oldest revegetation unit within the COU. A major cause of the low percentage of seeded species present is that this was one of the few locations where topsoil was brought in as a test for the first revegetation effort after one of the initial buildings was taken down during closure. As a result, the non-native graminoid species that were present in the seed bank (sheep fescue [*Festuca ovina*], smooth brome [*Bromus inermis*], and intermediate wheatgrass [*Agropyron intermedium*]) now dominate the area. Additionally, the soil texture of unit L41 is quite different from Rocky Flats Alluvium, which is present elsewhere on the pediment at the Site. The xeric seed mix was designed for the typical rocky pediment surfaces at the Site; many of the species in the mix typically do not thrive in this finer-textured soil type and have never established. Because many of the species in the original seed mix have not established, it is unlikely that this area will ever meet the criterion of 50 percent seeded species present. If the species in the mesic seed mix (all of which were also in the seeded xeric seed mix) that would typically grow in this soil type at the site were used for comparison, five of seven seeded species (71 percent) are present, and the area would meet the criterion. Therefore, unit L41 will be considered to have met this criterion, since it is unlikely that it ever will achieve success using the original seed mix as a basis. This increases the number of units to 22 (88 percent) that met this criterion in 2010.

For the locations that did not meet this criterion in 2010, factors that may explain why many of the seeded species have not become established include inadequate or uneven initial seeding, poor soil conditions, competition from the more aggressive graminoid species in the seed mix, and drought. The monitoring method may also contribute to the lack of seeded species present, because the measure is based solely on the species list generated from the quadrat sampling. Given the small size of the total area measured on the ground through the quadrat method, it is possible that more of the seeded species are present at the revegetation locations but are simply outside the "footprint" of the randomly located quadrats in 2010. In 2011, additional observations beyond the "footprint" of the quadrats may be made.

Ground cover protection from rock, litter, and current-year live vegetation varied from 62 percent to over 100 percent at the revegetation locations in 2010. The occasional values over 100 percent are the result of the class system used for estimating cover, which estimates cover values into a range and uses the midpoint of the cover class for analysis. The Revegetation Plan states that a minimum of 70 percent total ground cover comprising litter cover, current-year live vegetation basal cover, and rock cover is to be present to help prevent erosion. Nineteen of the 25 locations (76 percent) met this criterion in 2010 (Table 93). Where overall cover is less than 70 percent, additional erosion control measures such as wattles and hay bales are in place to protect the areas and prevent erosion—or, bands of established vegetation are present between the revegetation areas and water resources.

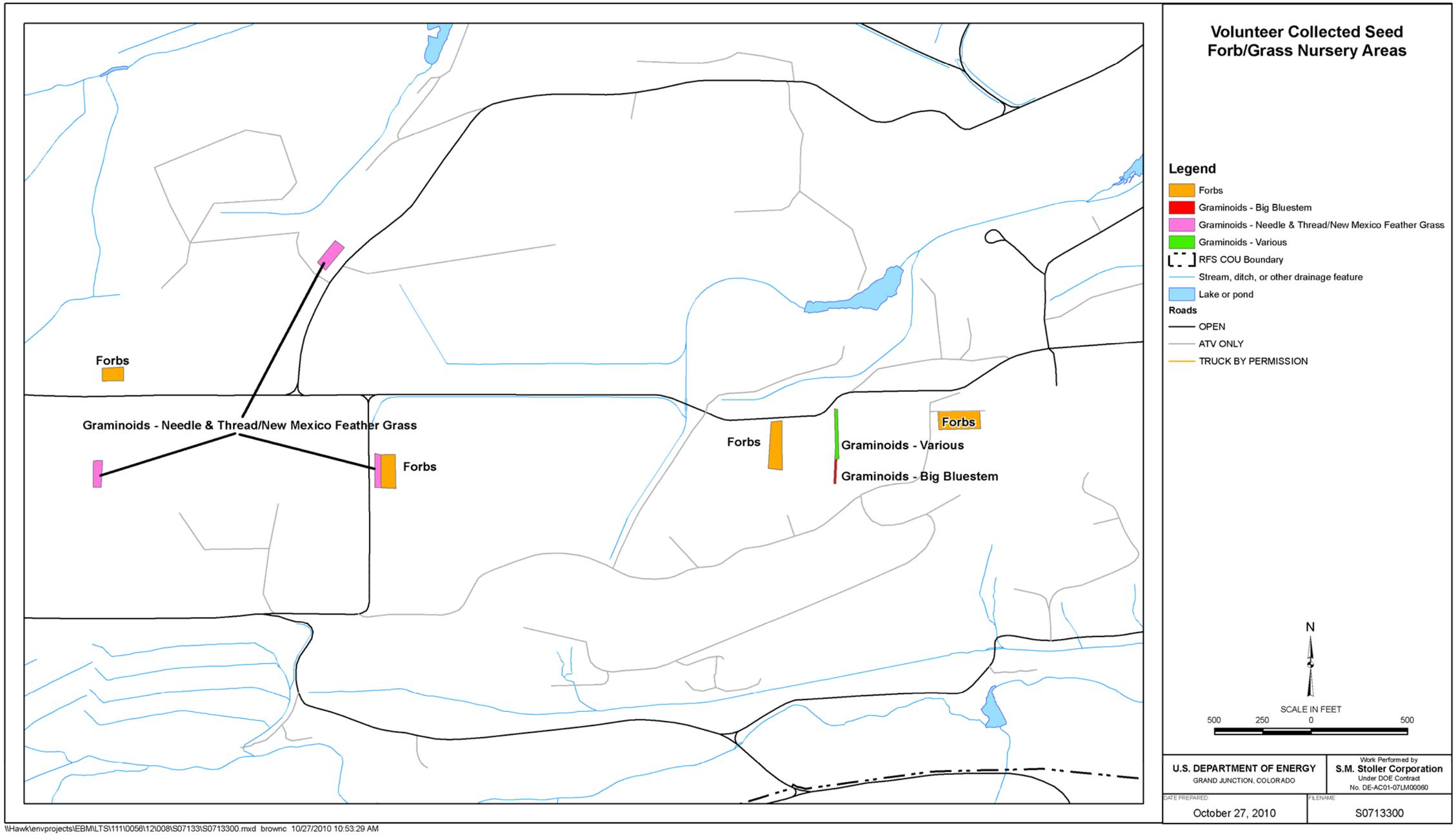

Figure 263. Volunteer Collected Seed Forb/Grass Nursery Areas

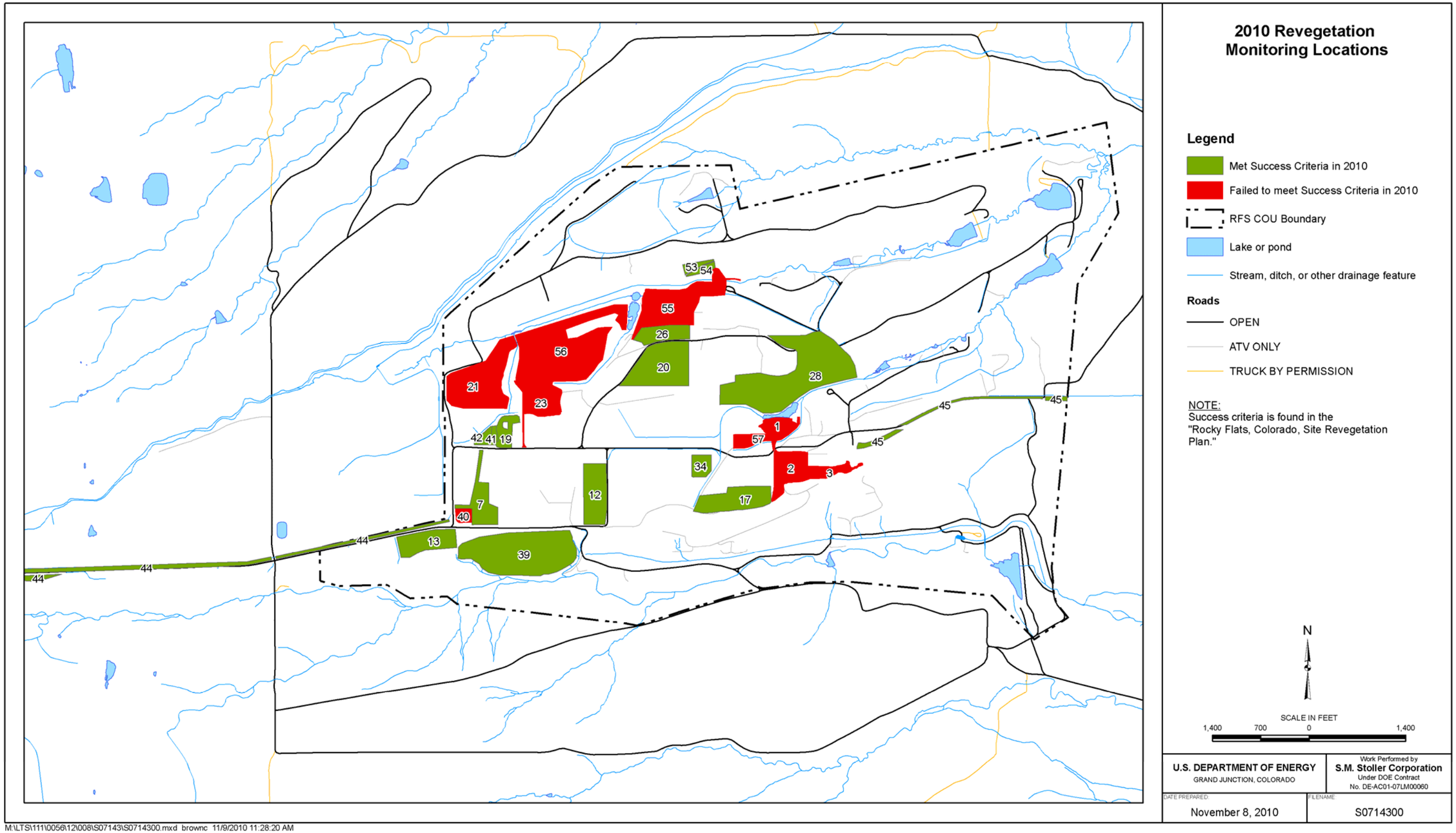

Figure 264. 2010 Revegetation Monitoring Locations

Table 93. Success Criteria Evaluation Summary 2010

Location	>30% Relative Cover of Desired Species	>70% Total Ground Cover (Litter, Rock, and Basal Veg Cover)	50% or More of Seeded Species Present	No Single Species With >45% Relative Foliar Cover	PASS/FAIL
L1	PASS	FAIL	PASS	PASS	FAIL
L2	PASS	FAIL	PASS	PASS	FAIL
L3	PASS	FAIL	PASS	PASS	FAIL
L7	PASS	PASS	PASS	PASS	PASS
L12	PASS	PASS	PASS	PASS	PASS
L13	PASS	PASS	PASS	PASS	PASS
L17	PASS	PASS	PASS	PASS	PASS
L19	PASS	PASS	PASS	PASS	PASS
L20	PASS	PASS	PASS	PASS	PASS
L21	PASS	FAIL	PASS	PASS	FAIL
L23	PASS	PASS	FAIL	PASS	FAIL
L26	PASS	PASS	PASS	PASS	PASS
L28	PASS	PASS	PASS	PASS	PASS
L34	PASS	PASS	PASS	PASS	PASS
L39	PASS	PASS	PASS	PASS	PASS
L40	PASS	PASS	FAIL	FAIL	FAIL
L41	PASS	PASS	PASS	PASS	PASS
L42	PASS	PASS	PASS	PASS	PASS
L44	PASS	PASS	PASS	PASS	PASS
L45	PASS	PASS	PASS	PASS	PASS
L53	PASS	PASS	PASS	PASS	PASS
L54	PASS	PASS	PASS	PASS	PASS
L55	PASS	FAIL	PASS	PASS	FAIL
L56	PASS	FAIL	PASS	PASS	FAIL
L57	PASS	PASS	FAIL	FAIL	FAIL
% Passing	100	76	84	76	64

Yellow-shaded cells indicate all success criteria were met in 2010.

Blue-shaded cells indicate all success criteria would be met in 2010 if the criterion of >45% cover of a single species was removed. As described in the text, these areas are considered to have passed as of 2010.

Green-shaded cells indicate all success criteria would be met in 2010 if the criterion of >50% of seed species present was removed for this location. As described in the text, this area is considered to have passed as of 2010.

The third success criterion states that a minimum of 30 percent relative cover of desired species must be present, and the fourth criterion states that no single species should constitute more than 45 percent of the total relative cover. Total relative vegetation cover of desired (native) species was greater than 30 percent at 100 percent (25) of the locations monitored in 2010 (Table 94). Six of the 25 revegetation locations (24 percent) had a single species that constituted greater than 45 percent of the relative cover in 2010 (Table 93). Four of these locations were dominated by western wheatgrass, one of the seeded native species. At the other two locations, buffalo grass and slender wheatgrass, also seeded native species, provided greater than 45 percent of the relative cover. Four of these locations—L7, L26, L44, and L45—failed to meet all four success criteria solely because they each had a single species that covered greater than 45 percent of the area (Table 93). At each of these locations the dominant species was western wheatgrass (62, 69, 46, and 57 percent total relative cover, respectively). Regarding the use of the success criteria, the Revegetation Plan states:

> "Success criteria and monitoring are an important component of a revegetation project. . . *These success criteria are provided as initial guidance; however, common sense combined with scientific data must be applied to final evaluations to determine whether further management actions are required*" [emphasis added].

Additionally, the Revegetation Plan's success criterion regarding dominance by a single species states that "[n]o single species will contribute more than 45 percent of the relative foliar cover (*except in areas where dominance by a single species is appropriate for long-term wildlife and habitat management objectives*)" [emphasis added].

Western wheatgrass is a desirable native species. At locations that fail only this last criterion but otherwise have a good stand of vegetation, several questions are worth considering:

- Is the dominance of these areas by a single species (with greater than 45 percent relative foliar cover) detrimental to long-term wildlife and habitat management?
- Is the dominance by these species likely to change in the future?
- Is there any other reason not to pass these four locations in 2010, just because they failed this last criterion?

One way to answer the first question is to evaluate the dominance of relative foliar cover of native species on the undisturbed native grassland areas of the Site. Do native species account for greater than 45 percent of the cover at some locations on the native grasslands? Monitoring in 2009 at two reference locations in native grassland used for Preble's mouse mitigation monitoring showed that western wheatgrass provided, respectively, 54 and 59 percent relative foliar cover (Table 94; OLF and A-Ponds reference areas). At TR06, a xeric grassland monitoring location, data collected over multiple years showed that needle-and-thread grass, a native grassland species, consistently provided greater than 45 percent relative foliar cover (Table 94). Because it is not uncommon for some of the native graminoid species to dominate the foliar cover at some locations, it is unlikely that the dominance of western wheatgrass at revegetation areas L7, L26, L44, and L45, will be detrimental to long-term wildlife and habitat management.

Relative foliar cover of different species and overall vegetation cover also fluctuate in response to environmental conditions, such as temperature and the amount and timing of precipitation. Table 94 shows some of this fluctuation for western wheatgrass at TR02 and TR04 (both mesic grassland monitoring locations) and the OLF revegetation area, for needle-and-thread grass at TR06 and TR11 (mesic grassland monitoring locations), for Japanese brome (*Bromus japonicus*) at TR11, and for overall foliar cover at TR02. Annual fluctuations in species cover are common in response to changing environmental conditions. Although locations L7, L26, L44, and L45, were dominated by species with greater than 45 percent cover in 2010, this may change over time as environmental conditions change. Given the evidence that dominance by a single species occurs on the native prairie, and annual fluctuations in foliar cover are common, there is no practical reason these locations cannot be considered to have passed all four criteria in 2010.

Table 94. Relative Foliar Cover of Selected Species on Native Grasslands at Rocky Flats

Location	Species	1993	1994	1995	1998	1999	2000	2001	2007	2008	2009	2010
TR02	*Agropyron smithii*	40.5	33.0	31.5		23.5	23.2					
TR02	*Total Foliar Cover*	68.2	88.0	97.2		77.4	71.6					
TR04	*Agropyron smithii*	28.6	15.7	19.3		13.7	10.0					
TR06	*Stipa comata*	61.5	62.4	49.4	50.8			45.7				
TR11	*Stipa comata*	11.6	8.7	3.2		6.6	12.6					
TR11	*Bromus japonicus*	3.0	25.8	39.1		19.2	4.5					
OLF Reference Area	*Agropyron smithii*								21.8	33.4	59.0	33.3
A-Ponds Reference Area	*Agropyron smithii*										54.2	18.0

These data are from various other studies that have been conducted at Rocky Flats. The sporadic nature of the timing of some studies is a result of the purpose of the individual studies. See the text for more information.

David Buckner, an ecologist under contract with EPA, conducted revegetation monitoring for EPA at Rocky Flats in 2009 and 2010. He noted similar conditions in the revegetation areas they sampled and has no concerns for areas with greater than 45 percent cover by a single species. In the 2010 report, he states, "The single sample showed that western wheatgrass comprised half of the cover, and though slightly in excess of the 45 percent DOE criterion, it is not likely that this represents a problem situation. Many native stands on finer-textured soils 'naturally' have as much western wheatgrass as is present here, or more" (EPA 2010a).

Table 93 and Figure 264 show which revegetation locations monitored in 2010 met or failed to meet the criteria listed. Sixteen of the 25 locations (64 percent; approximately 105 acres) met all four criteria in 2010 (including locations L7, L26, L41, L44, and L45, for the reasons described above). These areas have established good stands of vegetation that should be sustainable in the future. Areas that did not meet success criteria in 2010 need more time. A good stand of vegetation often takes 4 to 6 years to become established. Of those revegetation units that did not pass in 2010, units L1, L2, L3, L23, and L57 were reworked with additional soil amendments in either 2007 or 2008. Thus, they are only in their second or third year of revegetation. At units L21, L55, and L56, the soil conditions are very poor, and it has taken longer for the vegetation to establish. Additional seeding at these units along with unit L40 should help to increase vegetation cover.

3.2.2.5 Original Landfill Revegetation Monitoring

The OLF (unit L39, Figure 6) is one of two landfills at the Site. The vegetation at the Present Landfill met success criteria in 2009 and was not monitored in 2010 as part of this monitoring effort. The OLF was revegetated during Site closure, and vegetation is monitored as part of the overall revegetation monitoring and as specified in the M&M Plan for the OLF. In addition to this monitoring, the M&M Plan requires qualitative quarterly vegetation surveys that are reported in the quarterly and annual Rocky Flats Legacy Management Reports.

Total species richness in 2010 was 23 species. The percentage of seeded species present in 2010 was 86 percent. Thus, this criterion was met in 2010. The seeded species observed in 2010 included slender wheatgrass, western wheatgrass, side-oats grama, blue grama, buffalo grass, and green needlegrass. Ground cover protection from rock, litter, and current-year live vegetation averaged 84 percent, exceeding the success criterion of 70 percent. The percent relative cover of desired species on the OLF in 2010 was 88 percent, exceeding the required 30 percent. None of the species present on the OLF contributed more than 45 percent of the total relative cover and thus met this criterion. In 2010, all four success criteria were met on the OLF (Table 93). Tables with additional summary information, maps, and photomonitoring results for the OLF are available on the Ecology DVD included with this report.

Across most of the OLF the revegetation has been successful. At some localized areas where soil was recently disturbed during maintenance or repair activities, the vegetation is still somewhat sparse. Quarterly vegetation surveys are conducted on the OLF and will continue in accordance with the M&M Plan. However, because the revegetation success criteria have been met this year, annual vegetation monitoring per the Plan will not be continued in the future. Instead, the OLF may be incorporated into a multiyear monitoring rotation to document the long-term successional changes on the revegetation areas at the Site.

3.2.2.6 EPA Revegetation Assessments

In 2009 and 2010, EPA conducted their own revegetation monitoring to assess the status of the revegetation efforts at the Rocky Flats Site. The EPA reports for each year are available on the Ecology DVD included with this report.

3.2.2.7 Photomonitoring Results

Photomonitoring results are presented on the Ecology DVD included with this report.

3.2.3 Wildlife Monitoring

During 2010, wildlife surveys at the Site consisted of observing black-tailed prairie dogs (*Cynomys ludovicianus*), monitoring mountain bluebird (*Sialia currucoides*) boxes, and observing active raptor nests. More-detailed information for the wildlife monitoring is presented in the Ecology DVD included with this report.

3.2.3.1 Prairie Dog Monitoring

Black-tailed prairie dogs are not uncommon at the Site. Prairie dog towns in the upper elevations of the COU and POU are scarce due to the abundance of rocks in the pediment soils. However, they are common in the lower-elevation, deeper-soil areas on the eastern half of the POU and in one upper-elevation surface in the northeast corner of the POU where the soils are less rocky. Several prairie dog towns have existed for many years at these locations. From an ecological standpoint, the prairie dogs are an important component of the ecosystem, providing food for raptors and coyotes, and also a source of natural disturbance to the vegetation communities where the prairie dog towns are located. In recent years, conflicts between people and prairie dogs have increased along the Front Range. Prairie dogs are perceived as hindering recreational use and harming the quality of habitat on public lands. Numerous municipalities along the Front Range have instituted relocation programs to avoid or limit the outright killing of the prairie dogs. Several of these programs have resulted in prairie dogs being moved just outside the boundaries of the POU on the Site's eastern and northern boundaries. At some off-site locations, the increase in prairie dog populations has denuded the landscape and created bare soil areas that become sources of large dust clouds during high winds.

The primary concern with the prairie dog colonies at the Site is the potential for the prairie dogs to create an erosional surface by removing vegetation cover. Two landfills are present at the Site, the Original Landfill and Present Landfill. The M&M Plans for both landfills prohibit the presence of burrowing animals on the landfill covers. Additionally, infrastructure is buried at some locations in the former Industrial Area (within the COU), and the prairie dogs' natural tendency to dig makes them undesirable at these locations. Thus, from a management standpoint, it is important to monitor the locations and abundance of prairie dogs at the Site.

Figure 265 shows the locations of prairie dog towns in the COU and on the adjacent POU property as of 2008. In July 2009, no prairie dogs were present at either of the two southern locations, and only three or four individuals were observed at the northern location. Investigation of the prairie dogs' disappearance revealed that an outbreak of plague had occurred in the colonies east of the POU on the adjacent Westminster Hills Open Space/Dog Park (Jefferson

County 2009). Plague is an infectious disease caused by *Yersinia pestis*, a bacterium found in fleas that pass on the bacterium to wild rodents by biting them. Prairie dogs are susceptible to plague, and it is not uncommon for colonies to be wiped out by plague every few years.

Throughout the remainder of 2009, no prairie dogs were observed within the COU. In 2010, observations of the towns throughout the year have shown that no prairie dogs have returned to the two southern locations shown, and only a few individuals have been seen at the northern location on the Refuge. In spring of 2010, three individual prairie dogs were observed roaming along the roads at the Site (Figure 265). They typically travel beyond their existing towns in search of other potential burrow locations at this time of year. However, except for the sightings at the north town, observations throughout the remainder of the year across the COU and at the previously occupied prairie dog towns have shown no presence of the animals. Fortuitous monitoring of these locations will continue throughout the year to determine whether the prairie dogs have returned.

3.2.3.2 Mountain Bluebird Nest Box Monitoring

All eight of the functioning nest boxes in the COU (one was destroyed when the tree fell over) showed evidence of nesting activity in 2010. Five boxes were used by house wrens (*Troglodytes aedon*), two with active nests (birds were observed entering and exiting the nest box, so it was presumed active) and three filled with twigs. The male house wrens fill nesting cavities with twigs, and the female then selects which ones are suitable for nesting. The other three nest boxes had active tree swallow (*Tachycineta bicolor*) nests in them. No mountain bluebirds were observed nesting in any of the nest boxes in 2010. General observations at the Site in spring 2010 did not note any mountain bluebirds migrating through this year. However, in October, some mountain bluebirds were observed at the Site, evidently starting their migration south. Monitoring of nesting activity in the nest boxes will continue in the future and additional nest boxes may be installed as funding allows.

3.2.3.3 Raptor Nesting Observations

Figure 266 shows the locations of three active raptor nests within the COU and one outside the COU on the Refuge. Two great-horned owl (*Bubo virginianus*) nests were present in the COU this year—one in North Walnut Creek and one in Woman Creek. Each nest had a pair of young birds that fledged. The owls in North Walnut Creek nested in an abandoned red-tailed hawk (*Buteo jamaicensis*) nest in the top of a plains cottonwood (*Populus deltoides*) tree. This nest is approximately 200 feet from the Solar Ponds Plume Treatment System (SPPTS), where work is conducted daily during the work week. This nest even had a nesting deterrent in the tree, which consisted of a rope tossed over a branch (just beneath the nest) with large trash bags tied into it and pulled into the top of the tree. In the past, the flapping of the trash bags had created enough noise and disturbance to prevent hawks from nesting there. However, it did not work as a deterrent for the owls, as they did not seem to mind the flapping bags or constant activity at the SPPTS. The owls were often observed watching the activities at the SPPTS or sleeping. The owl nest in Woman Creek was west of the C-2 Pond along the road in a peachleaf willow (*Salixamygdaloides*) tree. The young owls at both locations left their nests during the week of May 24, 2010.

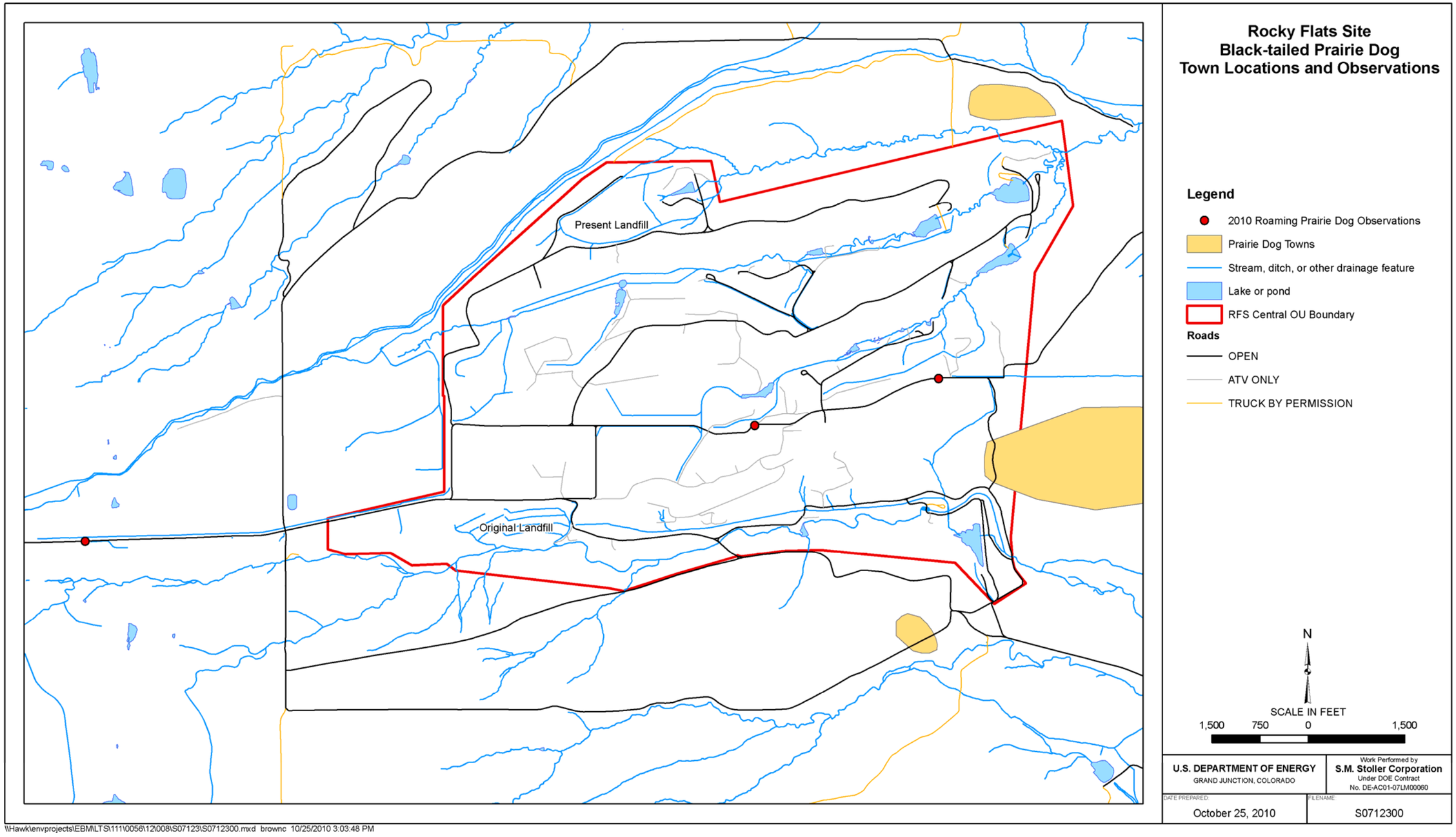

Figure 265. Rocky Flats Site Black-tailed Prairie Dog Town Locations and Observations

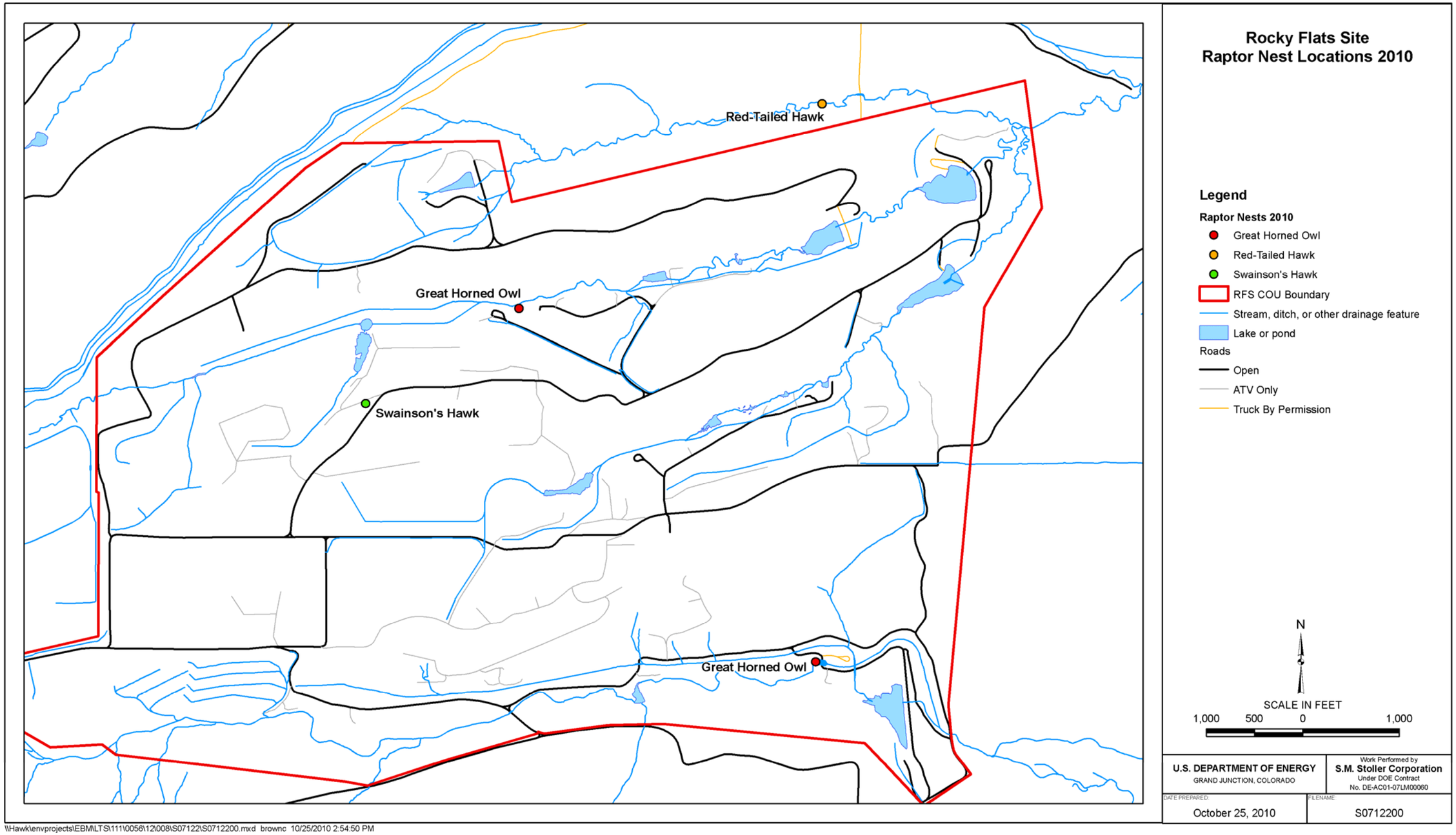

Figure 266. Rocky Flats Site Raptor Nest Locations 2010

A pair of Swainson's hawks (*Buteo swainsoni*) built a nest in the top of a plains cottonwood tree near the center of the COU along a road. The nest was first observed being built the week of May 10. A single bird fledged, and it left the nest by the end of August.

A red-tailed hawk nest was also observed north of the COU fence on the RFNWR in the No Name Gulch drainage downstream of the Present Landfill. It is not known if any young fledged from this nest.

3.2.3.4 Elk Observations

Over the past decade, the elk (*Cervus elaphus*) population has continued to increase at the Site. Throughout the final few years of site closure activities, elk were observed coming on Site during the spring to calve in the upper drainages of Rock Creek, where abundant cover is available in the shrublands and riparian woodlands. Since site closure, fewer people are working at the Site, and the elk population continues to increase each year. No census data are available, but fortuitous observations of the elk herd continues to suggest a general increase in the number of individuals present at the Site. Additionally, they tend to be staying longer during the year. In the early years, they stayed only during the spring and early summer months then left the Site. In 2010, elk were observed throughout most of the year. Observations of 20 to 40 elk in a herd are not uncommon at the Site, with 7 to 9 young of the year running with the group. Bull elk with large racks and occasional bugling in the fall have also been observed.

3.2.4 Regulatory Mitigation Monitoring Summary

3.2.4.1 Preble's Meadow Jumping Mouse Mitigation Monitoring

The Preble's meadow jumping mouse is a federally listed threatened species under the Endangered Species Act that lives in most of the stream drainages at the Site. Prior to site closure, DOE conducted Section 7 consultation with the USFWS on a Programmatic Biological Assessment (PBA) that addressed closure and post-closure activities that could have a potential impact on the Preble's mouse. The resulting Biological Opinion gave approval for the activities listed in the PBA. Mitigation was required for impacts to Preble's mouse habitat. As part of the mitigation process, monitoring of the mitigation efforts and reporting was also required. In 2010, vegetation monitoring and photopoint monitoring was conducted at various Preble's mouse mitigation locations in the COU. The results were summarized in an annual report that is due to the USFWS by December 1 each year. Although the 2010 results are not discussed in this annual report, they are available in the *2010 USFWS Biological Opinion Reports for the Rocky Flats Site* (DOE 2010g).

3.2.4.2 Wetland Mitigation Monitoring

During the cleanup and closure of the Site, approximately 7.8 acres of wetlands were disturbed. In order to maintain a "no net loss" of wetlands at the Site, several mitigation wetlands were constructed to create or reestablish 7.8 acres of wetlands. Additionally new seeps and wet areas have developed at several locations throughout the COU where wetlands are developing naturally. DOE also paid for the Standley Lake Wetland Mitigation Bank that could be used if in situ wetland mitigation did not provide the total number of needed acres on site. The *Rocky Flats, Colorado, Site Wetland Mitigation Monitoring and Management Plan* (DOE 2006b)

provides guidance for monitoring the mitigation wetlands and reporting. During 2010, a total of 87 mitigation locations were monitored. Of these, 58 had final wetland delineations conducted. The remaining 29 locations will continue to be monitored until the final delineations on them are completed in the next few years. The 2010 results are not presented here, but are found in the *Rocky Flats, Colorado, Site, 2010 Annual Wetland Mitigation Monitoring Report* (DOE 2011c). This report is due to the EPA by March 1 each year.

3.2.5 Summary

The Ecology Program at the Site conducts monitoring of the ecological resources to ensure regulatory compliance and to preserve, protect, and manage those resources. Proactive management of the natural resources is critical to the long-term sustainability of the ecosystems at the Site. Noxious weeds continue to be a top priority, as does the revegetation of the COU. Data from 2010 documented the continuing establishment of vegetation at revegetation locations; several met success criteria. Noxious weed control activities and additional revegetation activities were conducted during 2010 to improve and enhance the vegetation at the Site. The monitoring results continue to provide useful information for management activities. Full, detailed reports and analyses for each field monitoring effort are presented as stand-alone reports on the Ecology DVD included with this report.

3.3 Data Management

3.3.1 Water Data

Data from samples submitted to an analytical laboratory are received in both hard copy and electronic data deliverable formats. The electronic data are loaded into an Oracle-based relational database. The environmental monitoring data are accessible using the SEEPro application. The hard-copy analytical reports are archived in the records library in Grand Junction, Colorado, along with the original field data forms and other relevant hard-copy forms or documents containing project data. Well construction and lithology logs are maintained for previously drilled wells and are produced for all new wells drilled. These logs are archived in the records library and can also be accessed electronically via the SEEPro database and the Geospatial Environmental Mapping System.

SEEPro uses Oracle software for data management and Microsoft Access for data retrieval and display. It compiles water quality, air quality, field parameter, sample-tracking, sample location, and water-level data for groundwater, surface water, boreholes, soils, and sediment samples. Field parameter data include such information as sample location, sample date, pH, turbidity, conductivity, and temperature. Chemical information (Chemical Abstracts Service registry numbers, analytical results, and detection limits) is also included. Data managers follow specific procedures for verification of database information received from subcontractors or verification of data input directly into SEEPro. These procedures provide quality assurance (QA) documentation, which ensures that available data have been incorporated and entered or uploaded properly into SEEPro. Data integrity is maintained with standardized error-checking routines used when loading data into SEEPro. Other procedures address database system security and software change control.