

**U.S. FISH AND WILDLIFE SERVICE  
ROCKY MOUNTAIN ARSENAL NATIONAL WILDLIFE AREA  
FISCAL YEAR 1992 ANNUAL PROGRESS REPORT**

**Prepared in Partial Fulfillment of the  
Cooperative Agreement for Conservation and  
Management of Fish and Wildlife Resources at  
Rocky Mountain Arsenal, U.S. Fish and  
Wildlife Service and U.S. Army**

**February 12, 1993**

**APPENDICES D - E**

**by**

**The U.S. Fish and Wildlife Service  
Rocky Mountain Arsenal National Wildlife Area  
Building 111  
Rocky Mountain Arsenal  
Commerce City, CO 80022-2182**

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**TECHNICAL WORK PLAN  
HEALTH AND SAFETY TRAINING AND PHYSICALS  
FOR TOTAL TERRAIN, USFWS CONTRACTOR  
TO CONDUCT  
USFWS HABITAT ENHANCEMENT PROJECTS**

**U.S. Fish and Wildlife Service  
Building 111  
Rocky Mountain Arsenal  
Commerce City, CO 80022**

**1992**

## **1.0 INTRODUCTION**

### **1.1 TASK DESCRIPTION**

This task is designed to provide the U.S. Fish and Wildlife Service's (Service) contractor, Total Terrain, with appropriate health and safety training and physicals for projects to be conducted on Rocky Mountain Arsenal (Arsenal, RMA).

### **1.2 SITE DESCRIPTION/HISTORY**

The Arsenal encompasses approximately 17,000 acres of land and is located 10 miles northeast of downtown Denver, Colorado. The Arsenal's current mission is to clean up contamination that resulted from on-site production of chemical weapons and pesticides.

The soils on the Arsenal vary considerably, but mostly consist of sandy loams and clay loams. A large buffer zone of vegetation surrounds the more contaminated interior areas. The major vegetation types are weedy forbs/cheatgrass (40%), native perennial grasslands (21%), crested wheatgrass communities (18%), shrublands/succulents (7%), wetlands (4%), tree groves (1%), and miscellaneous communities (9%). Numerous species of wildlife use these vegetation types for food and cover.

A portion of the Service's mission on the Arsenal is to mitigate losses of wildlife habitat caused by cleanup activities. The Service has therefore contracted Total Terrain to conduct reclamation related projects (Contract No. 14-16-0006-91-015).

## **2.0 OBJECTIVES**

The objective of this task is to provide Total Terrain with appropriate means for meeting health and safety requirements at the Arsenal. More specifically, this task addresses OSHA hazardous materials training and physicals.

## **3.0 APPROACH**

1. Initial OSHA Training: Most of Total Terrain's employees who will work at the Arsenal must have OSHA training. Supervisors who are only on site occasionally (e.g. 1-2 days/week) (e.g. project managers) must have the 24-hour OSHA hazardous materials course. On-site supervisors (e.g. superintendents) who will work at the Arsenal 40 hours/week must have the 24-hour OSHA training course plus the 8-hour OSHA supervisor's course. Additional administrators (e.g. purchasers, estimators, off-site project managers) who rarely visit the site (e.g. 1-6 days/month) and secretaries will not be required to take OSHA training unless their role at RMA changes. Other on-site workers must take the 40-hour OSHA training course prior to initiating projects at RMA. All OSHA courses must be taught by certified instructors who can demonstrate skills and knowledge of applicable subject matter.

2. Refresher OSHA Training: Each of Total Terrain's employees who is required to take initial OSHA training is also required to take the 8-hour refresher course each subsequent year.
3. Entrance Physicals: Each of Total Terrain's employees who is required to take initial OSHA training is also required to have a thorough entrance physical. The specific requirements of this physical are available from the Service.
4. Subsequent Physicals: Each of Total Terrain's employees who is required to have an entrance physical must subsequently receive an annual physical. Any employee who permanently leaves Total Terrain's RMA projects must also have an exit physical.
5. Each Total Terrain employee who works one or more days per week at RMA must attend an on-site health and safety tour provided by the Service.

#### 4.0 DELIVERABLES

1. List of employee names, titles, estimated hours per week or month at RMA, and type of training needed based on the above criteria. This requirement is due at the beginning of each fiscal year (i.e. September 1).
2. Copy of each OSHA training certificate for each employee required to take training courses.
3. Copy of results for each employee's physical.

**TECHNICAL WORK PLAN  
LANDSCAPING, REVEGETATION, AND CONSTRUCTION AT THE EAGLE WATCH  
USFWS HABITAT ENHANCEMENT PLAN 4B, PHASE 3**

**U.S. Fish and Wildlife Service  
Building 111  
Rocky Mountain Arsenal  
Commerce City, CO 80022**

**June 1992**

## 1.0 INTRODUCTION

### 1.1 TASK DESCRIPTION

This project is designed to implement Phase 3 of Task 4B, i.e. landscaping, revegetation, and construction at the Eagle Watch area (Figure 1) of Rocky Mountain Arsenal (RMA, Arsenal). Phase 1 was limited to renovation of the path to the Eagle Watch and purchase and installation of a secure rolling grille over the front of the blind. Portions of Phase 2 that have been completed include improvements to the gravel parking lot, installation of Geoweb for handicapped parking spaces, and provision of temporary benches along the path. Phase 3 will include (1) removing the wooden steps to the northern telescope, (2) lowering the height of the northern telescope for accessibility to children and people in wheelchairs, (3) installing a rail on the west side of the ramp to the southern telescope, (4) mounting wildlife silhouettes on the inside of the blind, (5) lowering the leaflet dispenser inside the blind, (6) painting the inside of the blind, (7) painting the outside of the blind, (8) installing snow fences north of the blind, (9) constructing a wooden fence from the blind to the western pullout of the path, (10) constructing a curb along both sides of the path over the culvert for wheelchair and vision impaired accessibility improvement, (11) removing large gravel at the handicap parking spaces, and (12) placing handicap signs on posts at the three handicap parking spaces. Much of the work from all phases will implement recommendations submitted by a landscape architect as completion of Task 4A. The entire project (i.e. all phases) is warranted under the Public Access provisions of the Federal Facility Agreement. The U.S. Fish and Wildlife Service (Service) will oversee the project. Total Terrain, the Service's landscape contractor, will conduct the work for Phase 3.

### 1.2 SITE DESCRIPTION/HISTORY

The Service currently staffs a facility in the eastern portion of the Arsenal (Figure 1) for public viewing of a winter bald eagle roost. This viewing blind, named the Eagle Watch, is located on the highest point in Section 5 (5320 ft elevation), approximately one half mile east of the roost. The Eagle Watch was first constructed by the U.S. Army (Army) in 1989 and was renovated during fall of 1990. While the blind is an excellent viewing facility, several aspects of the blind and surrounding area need improvement.

The soils in the area are mostly variations of sandy loam. A low area with almost level topography exists in front of (i.e. west of) the blind (Figure 2). A natural basin exists north of the center of the path. Numerous prairie dogs can be found near the path and west of the blind. The vegetation is characterized by weedy forbs, cheatgrass, some native perennial grasses and a few rabbitbrush plants. The path is approximately 1,030 ft long.

The blind was visited by approximately 5,115 visitors during winter of FY 1992, including a number of children and handicapped persons. A visit from the Service's Refuges and Wildlife 504 coordinator from Region 6 revealed that the facility can be improved for both of these groups. In addition, snow accumulation at the entrance to the blind has been a problem and can be improved dramatically by installation of temporary wooden snow fences. These

fences would provide protection until living snow fences (i.e. shrubs) could be established at a later date (not within the scope of this plan).

## **2.0 OBJECTIVES**

The objectives of Task 4B (all phases) are to:

1. Provide public access (enhance esthetics, improve interpretive features, and control movements of visitors in the area) as stated in the Federal Facility Agreement.
2. Produce native vegetation for wildlife habitat.
3. Enhance esthetics, improve interpretive features, and control movements of visitors in the area.

The specific objectives for Phase 3 are to:

1. Improve the accessibility of the site during inclement weather.
2. Improve the handicap accessibility of the site throughout the year.
3. Improve the accessibility of the telescopes, particularly for children.

## **3.0 METHODS, PHASE 3**

Service:

1. The Service shall accompany the contractor on a pre-work site visit or on the first day of work or both to provide information necessary to complete the project.
2. The Service shall clearly stake the sites for the snow fence installation.
3. The Service shall provide handicap parking signs and posts.
4. The Service shall provide regular inspections of the work to ensure adequate communication between the Service and the contractor.

Total Terrain:

1. The contractor shall provide a brief, site-specific health and safety plan. This plan shall be approved by the Service's Health and Safety Officer and Army's Health and Safety personnel before the contractor will commence fieldwork.



2. The contractor shall remove the wooden steps under the northern telescope inside the Eagle Watch blind. This action will reduce the potential for falling by children.
3. The contractor shall lower the northern telescope by cutting approximately 10-12 inches out of the support post. This action will provide accessibility of the scope to children and people in wheelchairs. The exact height of the telescope will be decided during a site visit with the Service.
4. The contractor shall install a wall-mounted handrail on the west side of the southern telescope to meet handicap accessibility standards. The grade of the ramp requires two rails.
5. The contractor shall mount six wildlife silhouettes onto the interior walls of the blind in locations identified by Service personnel during the pre-work site visit.
6. The contractor shall lower the leaflet dispenser inside the blind to be in reach of children and people in wheelchairs. The exact location will be identified during a site visit to ensure a usable but safe location.
7. The contractor shall paint the inside of the blind with two earthtone colors. Most of the room shall be painted with a tan similar to the color of the surrounding soil. The structures within the blind (e.g. cabinets, telescopes, posts, rails) shall be painted a darker earthtone color. Both colors shall be approved by the Service prior to use.
8. The contractor shall paint the exterior portion of the blind with the same earthtone color as used on the walls inside the blind.
9. The contractor shall purchase and install two snow fences as specified in Figure 3. The fences shall be 4 ft in height.
10. The contractor shall install a 2-rail split-rail fence on both sides of the path from the blind to the western pullout of the path. However, the fence shall be installed on both edges of the path (as opposed to the fence location in Figure 4). The fence shall not extend east of the western pullout (unlike Merlyn Paulson's depiction in Figure 4).
11. The contractor shall construct a curb 6 feet in length on both sides of the path over the culvert (Figure 4). The curb shall be constructed with at least 2 inches above the top of the path. The curb shall be no less than 4 inches thick.
12. The contractor shall install three handicap signs for the handicap parking spaces in the parking lot (Figure 5). The signs and posts shall be provided by the Service.

13. The contractor shall remove large gravel at the handicap parking spaces in the parking lot in order to make the site easier to roll a wheelchair across.
14. The contractor shall minimize disturbance to vegetation, especially shrubs, during all aspects of this project.
15. The contractor shall consult with the Service regarding the size of vehicles to be driven on the concrete path.
16. The contractor shall coordinate all construction activities with the Service's Operations section. All work shall be completed before 15 October 1992, when the Bald Eagle Management Area closes, regardless of starting date.

#### **4.0 HEALTH AND SAFETY PLANS**

The contractor shall work under an "umbrella" health and safety plan which will encompass all of the contractor's projects. The contractor shall also provide a brief health and safety plan specific to this project. This plan will be reviewed and approved by the Service's Health and Safety Officer and Army's Health and Safety Officer before work will be initiated.

#### **5.0 DELIVERABLES, PHASE 3**

The following deliverable items are required for the completion of Phase 3:

1. Site-specific health and safety plan.
2. Removal of wooden steps.
3. Telescope lowered.
4. Second rail for the handicap telescope.
5. Silhouettes mounted.
6. Dispenser lowered.
7. Painting.
8. Snow fence.
9. Wooden fence.
10. Curb on path over culvert.
11. Removal of gravel and placement of handicap signs in parking lot.

**6.0 SCHEDULE, PHASE 3**

Period of Performance:	90 calendar days following issue of delivery order.
Preferred Starting Date:	July 1, 1992
Deadline for Completion:	October 14, 1992

Rocky Mountain Arsenal  
Commerce City, Colorado

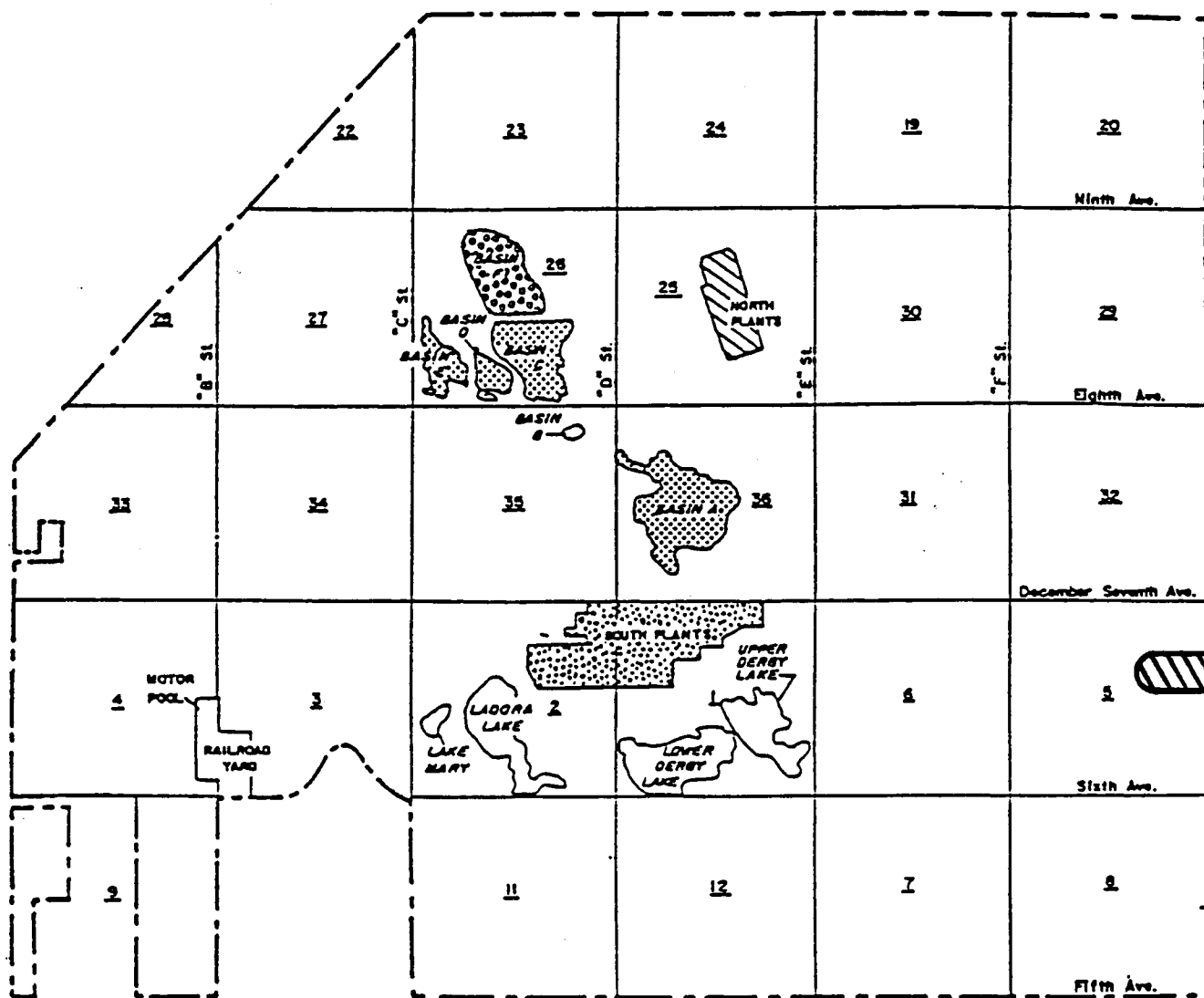


Figure 1. Proposed location of Task 4B, Phase 3 (Landscaping, Revegetation, and Construction at the Eagle Watch), Rocky Mountain Arsenal, 1992.

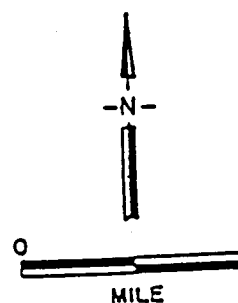
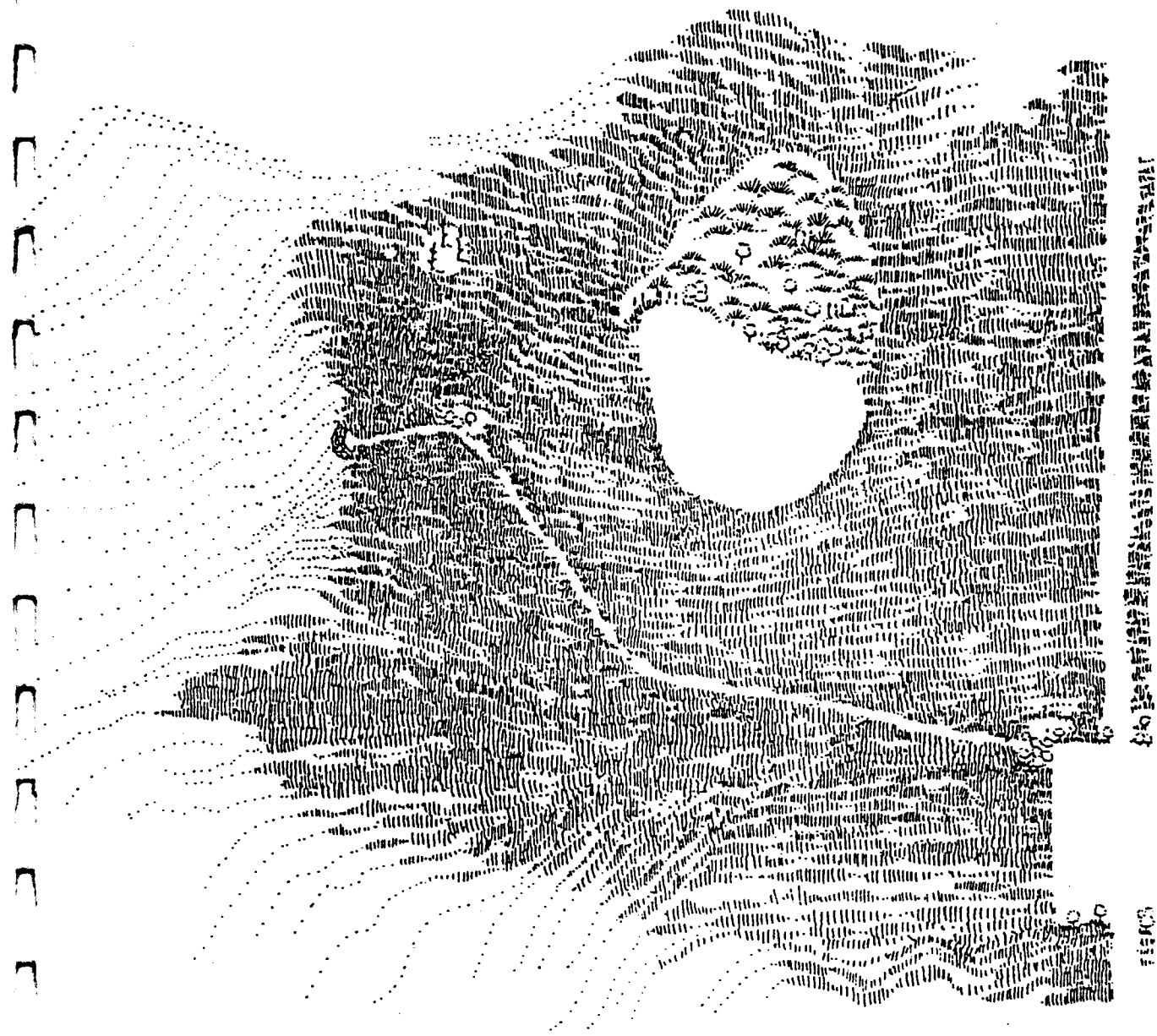
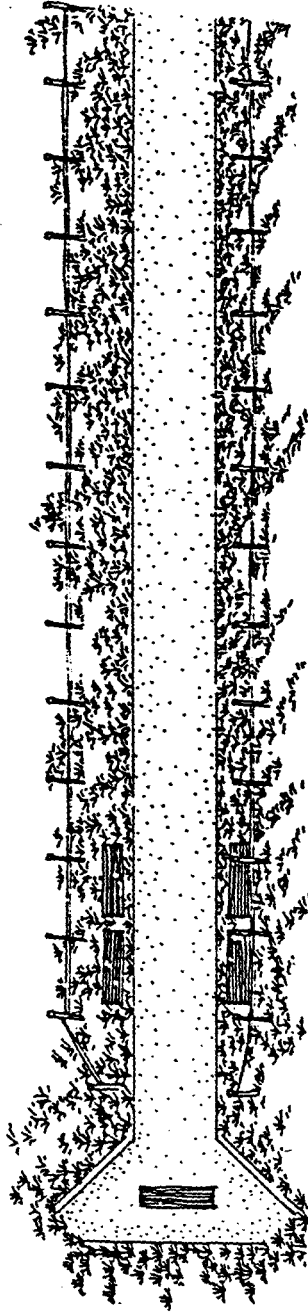


Figure 2. Path between the parking lot and the Eagle Watch blind, Section 5, Rocky Mountain Arsenal, 1992.



Eagle Watch Vicinity  
Scale 1"=200'-0"

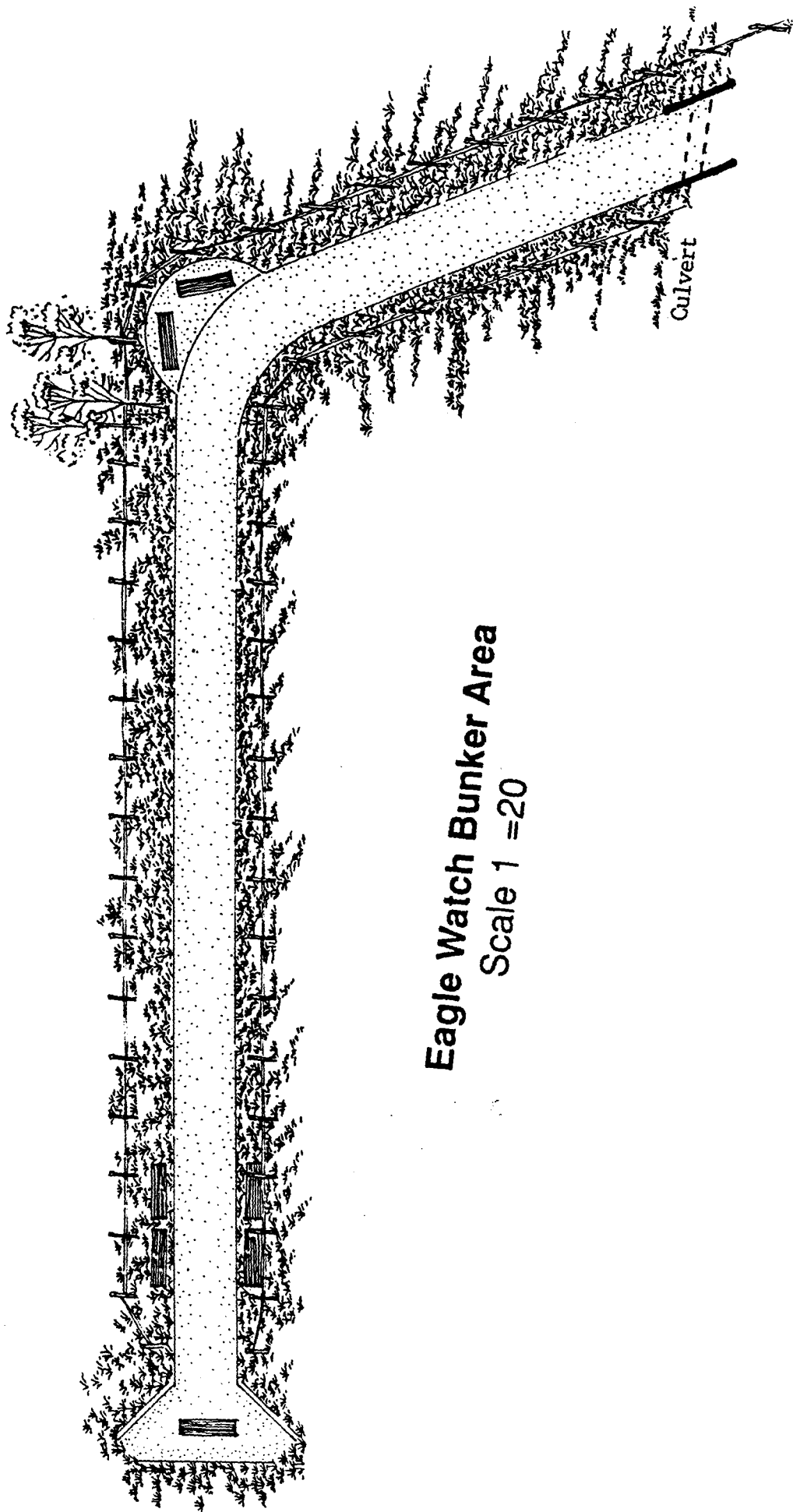
Figure 3. Proposed location for installation of snow fences north of the Eagle Watch blind, Section 5, Rocky Mountain Arsenal, 1992.



Eagle Watch Bunker Area



Figure 4.      Locations of Eagle Watch blind, western pullout and culvert,  
Section 5, Rocky Mountain Arsenal, 1992.

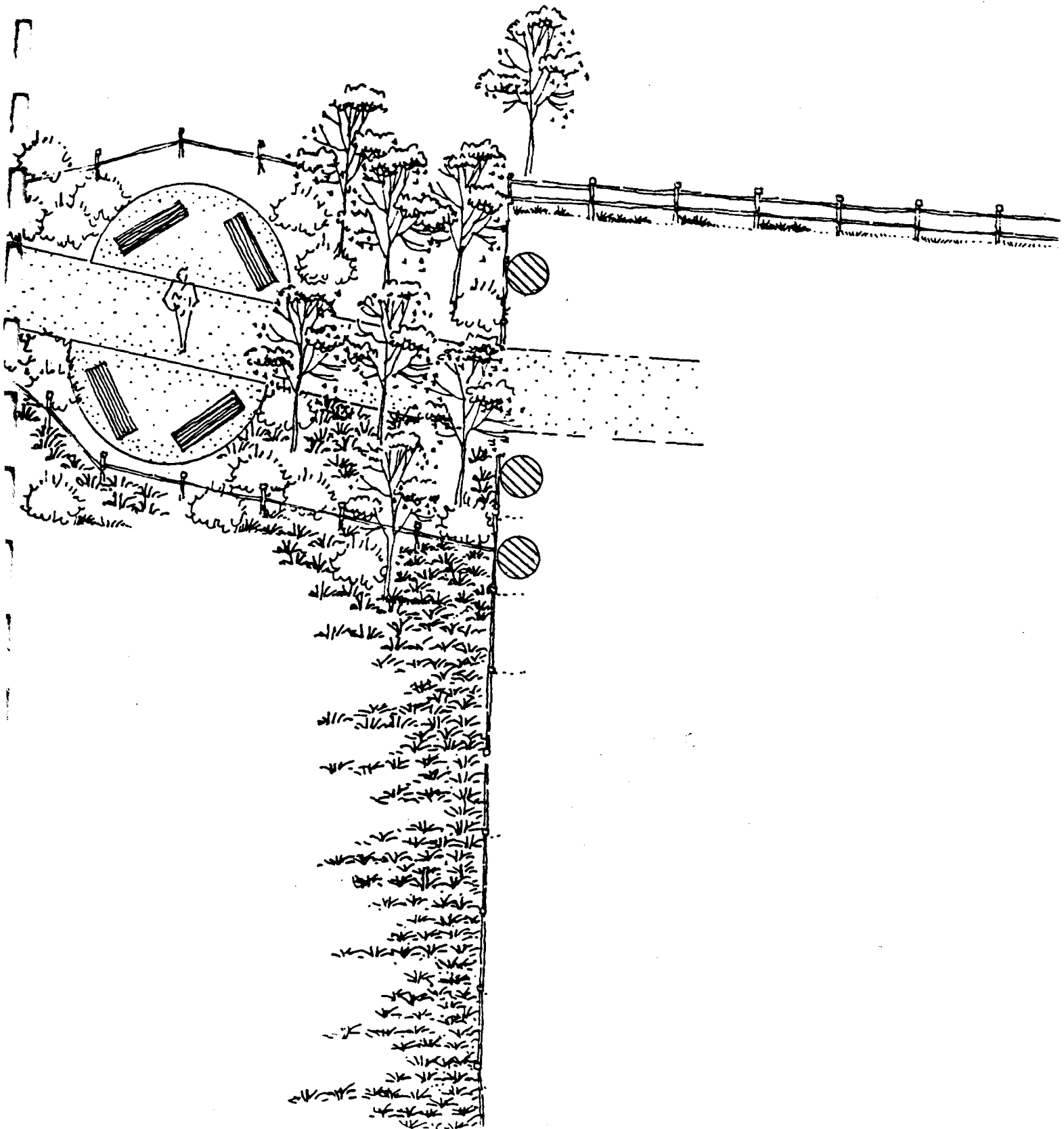


**Eagle Watch Bunker Area**  
Scale 1" = 20'

Figure 5. Proposed location for installation of handicap parking signs at the Eagle Watch parking lot, Section 5, Rocky Mountain Arsenal, 1992.



Proposed location for handicap parking signs



TECHNICAL WORK PLAN  
ENHANCEMENT OF WILDLIFE HABITAT IN SECTION 34  
USFWS HABITAT ENHANCEMENT PLAN 5

U.S. Fish and Wildlife Service  
Building 111  
Rocky Mountain Arsenal  
Commerce City, CO 80022

August 1991

## 1.0 INTRODUCTION

### 1.1 TASK DESCRIPTION

The U.S. Fish and Wildlife Service (Service) proposes to enhance the wildlife habitat in Section 34 (Map 1) of Rocky Mountain Arsenal (Arsenal, RMA) by planting several species of shrubs and trees and constructing a wildlife guzzler. This action would counteract some of the deleterious effects on habitat caused by RMA Interim Response Action K (IRA-K) for removal of asbestos, including a number of abandoned buildings that are commonly used by wildlife species. Preferred species of plants to be introduced and a watering strategy are submitted. The Service expects this project to not only improve wildlife habitat in Section 34 and therefore mitigate some cleanup actions, but also to provide valuable information on how to approach related future projects on a larger scale.

### 1.2 SITE DESCRIPTION/HISTORY

The Arsenal's current mission is to clean up contamination that resulted from on-site production of chemical weapons and pesticides since its initial purchase and development in 1942. Restoration of the Arsenal to a clean, safe environment has already led to some wildlife habitat destruction, including from cleanup of base facilities that were used in the production of that contamination (e.g. IRA K). The Service proposes to mitigate the effects of such projects by enhancing the wildlife habitat in Section 34.

The soils in Section 34 are mostly characterized by sandy loams although some clay loams exist in the proposed planting area. Crested wheatgrass and some patches of weedy forbs dominate the vegetation, accentuating the need for native species.

## 2.0 OBJECTIVES

The objectives of this project are to:

1. offset unavoidable losses to wildlife habitat caused by one type of cleanup activity,
2. enhance the habitat in an area dominated by exotic plant species with native shrubs and trees, and
3. learn more about the most appropriate species, planting strategies, and watering techniques that will help save time and money during future RMA mitigation projects.

### 3.0 METHODS

#### Service:

1. The Service shall clearly mark the location and species to be planted for each site.
2. A Service employee shall accompany the contractor on a pre-work site visit or on the first day of work or both to answer any questions.
3. The Service shall provide the contractor with potential suppliers of the required species for reasonable prices, if needed.
4. The Service shall furnish the materials and specifications (see Attachment 1) necessary for the contractor to construct a wildlife guzzler in Section 34.
5. The Service shall provide regular inspections of the work to ensure adequate communication between the Service and the contractor.
6. The Service shall water plants starting 7 calendar days after the contractor has planted them. Each watering shall be approximately 3 gallons/plant. Plants shall be watered on the following schedule:

Yr 1 (1992):	March - April	1 watering imm. upon planting; then 1 watering/mo
	May 1 - Sept 30	1-2 waterings/week
Yr 2 (92-93):	Oct 1 - April 30	1 watering/month
	May 1 - Sept 30	1 watering/week
Yr 3 (1994):	June 1 - Aug 31	1 waterings/ week.

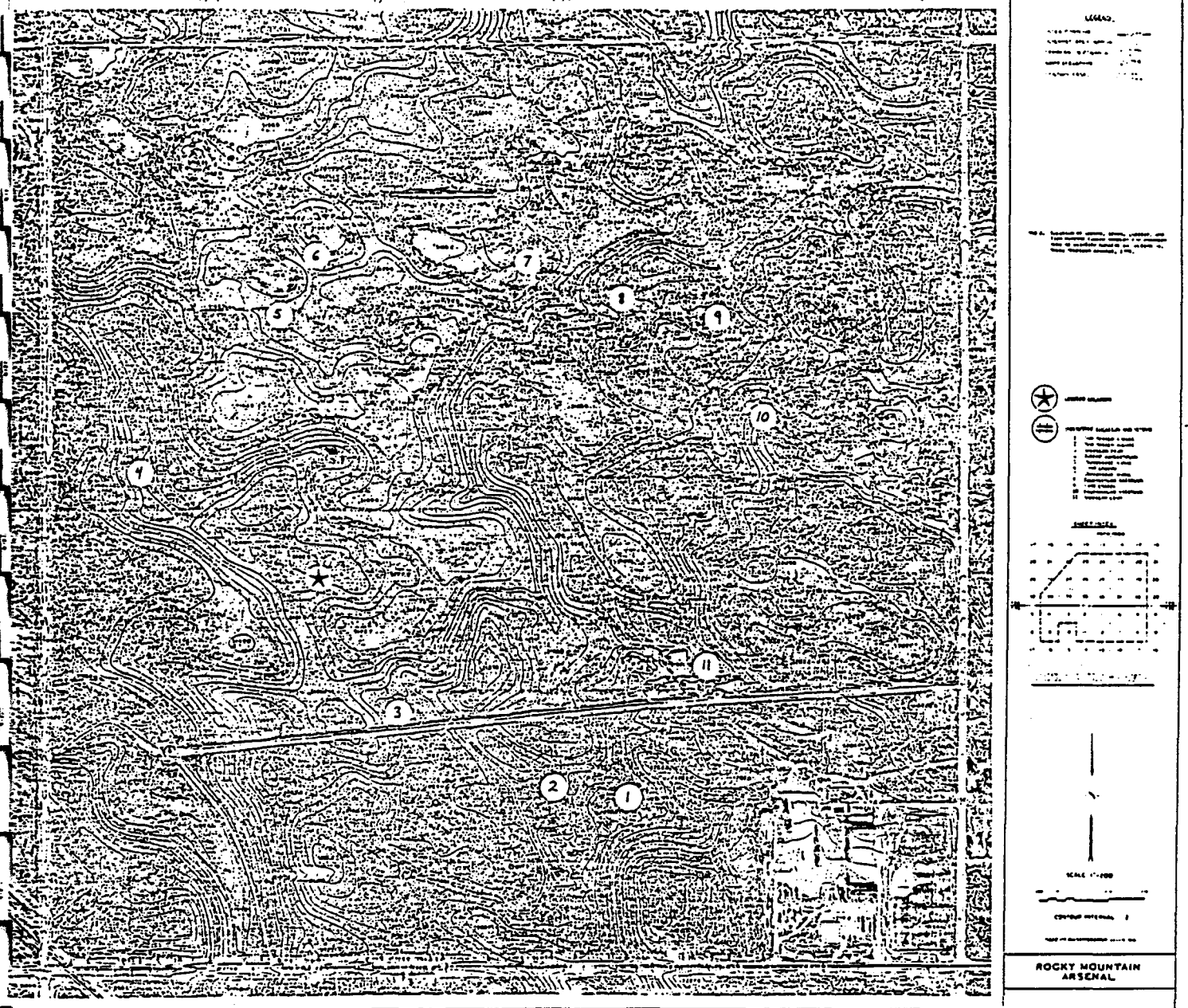
7. The Service shall minimize damage to vegetation.
8. The Service shall arrange for removal of the fencing around the shrubs and trees when it is considered appropriate. This will not be included in the contractor's delivery order for Year 1. It may or may not be assigned to the contractor during a future delivery order.
9. The Service shall write a brief task summary for completion of the project. This summary shall express details such as what type of equipment was used, how many employees were used, problems encountered, recommendations for the future, etc.

Contractor:

1. The contractor shall provide a brief health and safety plan specific to this project to supplement the contractor's umbrella health and safety plan.
2. The contractor shall plant 440 shrubs/trees. All plants shall be purchased in 5 gallon containers. The plants shall consist of the following six species:
  - a. American plum (80 plants)
  - b. Three-leaf sumac (80 plants)
  - c. Sand cherry (80 plants)
  - d. Four-wing saltbush (80 plants)
  - e. Rubber rabbitbrush (40 plants)
  - f. New Mexico locust (80 plants).
3. Alternatives to the shrub and tree species listed above may be discussed only if all avenues to the purchase of these species have been exhausted. Any changes to the species composition shall be allowed only with prior approval from the Onsite Inspector and the Contracting Officer.
4. All shrubs and trees shall be planted during April 1 - July 1, 1992. Any changes to this planting period shall be allowed only with prior approval by the Onsite Inspector and the Contracting Officer.
5. All shrubs and trees shall be planted in the sites designated on Map 2 and as described below:
  - a. Site 1 New Mexico locust
  - b. Site 2 New Mexico locust
  - c. Site 3 American plum
  - d. Site 4 Rubber rabbitbrush
  - e. Site 5 Three-leaf sumac
  - f. Site 6 Sand cherry
  - g. Site 7 Three-leaf sumac
  - h. Site 8 Four-winged saltbush
  - i. Site 9 Sand cherry
  - j. Site 10 Four-winged saltbush
  - k. Site 11 American plum
6. All shrubs and trees shall be planted in clumps of 40 plants each. Clumps can be circular, oval, or rectangular if constructed in a somewhat irregular pattern. No clump should have easily distinguishable rows. The diameter of the clump should never exceed 45 feet.
7. Shrubs shall be planted 3-4 feet apart. New Mexico locusts shall be planted 4-5 feet apart.



8. Each clump of shrubs and trees shall be protected from wildlife damage (e.g. browsing from rabbits and deer, antler scraping by deer). Fences shall surround each clump; the size of the wire mesh shall not exceed 3 inches, the height shall be at least 6 feet above ground, and the bottom of the fence must be flush with the ground. A very inexpensive gate system shall be available for each fence to allow maintenance of the irrigation system. The Service will be responsible for fence removal.
9. Each planting site shall be mulched with wood chips immediately upon being transplanted to Section 34. The wood chips shall be 4-6 inches deep and be spread throughout the clump of shrubs/trees (versus just around the individual plants). The contractor shall contact the Service for sources of free or inexpensive wood chips if unable to locate such a source.
10. The contractor shall water each plant immediately (i.e. within 3 hours) upon transplanting them to Section 34. The contractor shall also water the each plant 2 additional times during the first week after transplanting, while informing the Service of transplanting within 2 days.
11. The Service recommends that water be supplied from the closest fire hydrant in the former barracks area (Map 2) if no alternative source is identified by the contractor. The contractor shall purchase and install a valve for the fire hydrant to avoid having to turn on/off the fire hydrant itself. The contractor shall also purchase and install an appropriate hose for releasing water into a plastic water tank.
12. The contractor shall construct a wildlife guzzler (water tank specially designed for wildlife) at the marked site in Section 34. All materials and specifications shall be furnished by the Service.
13. The contractor shall avoid disturbance to existing shrubs and yucca plants and minimize disturbance to other vegetation in Section 34 when conducting any type of work.
14. The contractor shall return to the Service any materials or equipment purchased for this project at project completion.
15. The contractor shall obtain prior permission to access portions of Section 34 on a weekly basis through the RMA Activities Coordination System.



Map 2. Location of shrubs, trees, guzzler, and fire hydrant (water source) for enhancement of wildlife habitat in Section 34, Rocky Mountain Arsenal, 1991.

#### 4.0 HEALTH AND SAFETY PLAN

The contractor shall work under an "umbrella" health and safety plan which will encompass all of the contractor's projects. The contractor shall also provide a brief health and safety plan specific to this project. This plan will be reviewed and approved by the Service Health and Safety Officer and Army's Health and Safety Office before work will be initiated.

#### 5.0 DELIVERABLES

Seven deliverable items are required for the contractor to complete this project:

1. Successful planting of 360 shrubs of the species specified above.
2. Successful planting of 80 trees, i.e. New Mexico locust.
3. Watering of each plant 3 times during the first week after transplanting.
4. Prompt notification (i.e. within 2 days of transplanting) to Service personnel that a clump of plants has been transplanted into Section 36.
5. Fencing around each clump of shrubs and trees as specified herein.
6. Successful construction of a wildlife guzzler.

#### 6.0 SCHEDULE

Period of Performance:

365 calendar days for Year 1  
delivery order.

Attachment 1. Wildlife guzzler installation instructions, Task  
5, Enhancement of Wildlife Habitat in Section 34,  
Rocky Mountain Arsenal, 1991.

FIBER ERECTOR  
P.O. Box 1009 — Red Bluff, C  
Telephone (916) 527-  
WILDLIFE GUZZLE  
INSTALLATION INSTR

Post-It™ brand fax transmittal memo 7671 # of pages 2

To	Scott Pelin	From	Ed Hurst
Co.	U.S. Forest Service	Co.	Fiber Erector
Dept.	Rocky Mt. Arsenal	Phone	916/527-2194
Fax #	302/289-0222	Fax #	527-6260

Select a site away from trees and bushes if possible to avoid digging into roots, and as level a spot as possible.

Select the center of your excavation and draw a circle in the dirt eight feet from the center. Dig a circular trench nine inches deep and nine inches wide outside of circle drawn.

Dig excavation using plywood template to shape hole. Use a level on top of plywood to assure that unit will sit as level as possible.

Turn bottom panels upside down. Use the 19 inch 2 x 4 provided to lean the halves on. Use a screw driver as a pry bar to align holes. Run a 1/2 inch silicone bead along one three inch flange using a whole tube. Bolt two panels together using stainless steel bolts. Don't completely tighten bolts until all bolts are in. Start bolting from the center of the unit and work out. Repeat the above step on the other two bottom panels, again not completely tightening bolts. You now have the bottom dish in two half circles. Place the 2 x 4 in the center of the unit. Lean the other half on the 2 x 4 also and this will align the bolt holes. Run a silicone bead down the 3 inch flanges and bolt the halves together using two tubes of silicone. When all bolts are in place finish tightening them. Turn the unit over and position in excavation. Don't be afraid to let the unit free fall, as the air resistance will break the fall. Before setting in excavation dig two, three inch deep, troughs across excavation to accomodate the seam flanges.

After unit is in excavation, use fifth tube of silicone to do all four inside seams, using a 1 inch putty knife. Silicone should be allowed 48 hours to dry before water is introduced to unit. If rain threatens, mask all openings after top is attached to bottom. Sheets of plastic are recommended.

Place pedestal in center, aligning four corners at the bottom with the four seams. Put silicone on bottom edges of pedestal. This centers the pedestal. Prop two top panels on the pedestal and join using black bolts. Continue adding top panels being sure the 24 inch opening is above the big game bottom panel.

Lay all four rib caps over bolted flanges and lay center cap over rib caps. Use self tapping screws to attach them to the dome. Location of screws are transcribed on caps. At the bottom end of each rib cap are four transcribed screw holes which attach the dome to the bottom dish.

Cover lip on bottom dish with dirt to 1 inch of top of lip. Excavate 18 inch deep area in front of big game panel.

TOOLS SUGGESTED

Template (Provided)	* 2 - 1/2 inch Ratchet Wrenches with 3/4" Sockets
19 inch 2 x 4 (Provided)	2 - 3/4 inch open end and box end Wrenches
Picks, Shovels, Rakes, Hoe	1 - 5/16 inch Magnetic Nut Setter (Provided)
Level	1 - Power Drill to attach above to, to set
2 Screwdrivers	self tapping screws
1 Caulking gun (Provided)	1 Sledge Hammer
1 Ax	1 Broom

\* Power Tool Can Be Used

**IRRIGATION ADDENDUM TO  
TECHNICAL WORK PLAN  
ENHANCEMENT OF WILDLIFE HABITAT IN SECTION 34  
USFWS HABITAT ENHANCEMENT PLAN 5**

**U.S. Fish and Wildlife Service  
Building 111  
Rocky Mountain Arsenal  
Commerce City, CO 80022**

**January 1992**

## **1.0 INTRODUCTION**

### **1.1 TASK DESCRIPTION**

The U.S. Fish and Wildlife Service (Service) has proposed to enhance the wildlife habitat in Section 34 (Map 1) of Rocky Mountain Arsenal (Arsenal, RMA) by planting several species of shrubs and constructing a wildlife guzzler. This action would counteract some of the deleterious effects on habitat caused by RMA Interim Response Action K (IRA-K) for removal of asbestos, including a number of abandoned buildings that are commonly used by wildlife species. The Service expects this project to not only improve wildlife habitat in Section 34 and therefore mitigate impacts from some cleanup actions, but also to provide valuable information on how to approach related future projects on a larger scale.

The Service and Army approved Task Plan 5 to conduct this work on August 27 and August 28, 1991, respectively. Negotiations for a delivery order to initiate this project have been delayed due to FY 1991 funding limitations. In the interim, the Service has recognized the necessity of providing drip irrigation instead of the originally proposed truck watering strategy. This addendum to Task Plan 5 serves as a technical plan for irrigation of these shrubs.

### **1.2 SITE DESCRIPTION/HISTORY**

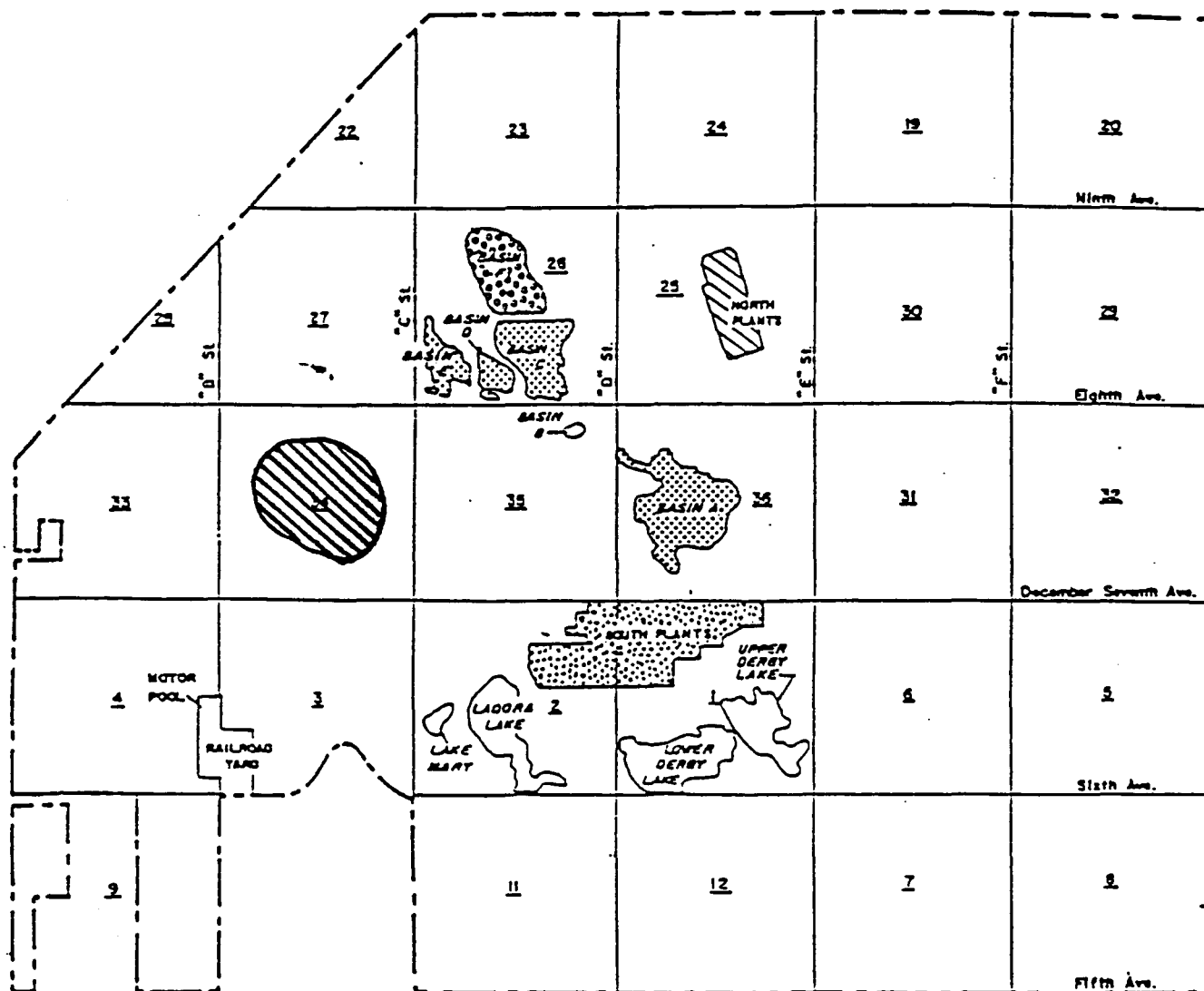
The Arsenal's current mission is to clean up contamination that resulted from on-site production of chemical weapons and pesticides since its initial purchase and development in 1942. Restoration of the Arsenal to a clean, safe environment has already led to some wildlife habitat destruction, including from cleanup of base facilities that were used in the production of that contamination (e.g. IRA K). The Service proposes to mitigate the effects of such projects by enhancing the wildlife habitat in Section 34.

The soils in Section 34 are mostly characterized by sandy loams although some clay loams exist in the proposed planting area. Crested wheatgrass and some patches of weedy forbs dominate the vegetation, accentuating the need for native species.

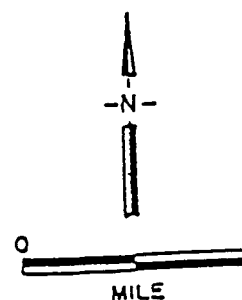
## **2.0 OBJECTIVES**

The objectives of Task 5 are to:

1. offset unavoidable losses to wildlife habitat caused by one type of cleanup activity,
2. enhance the habitat in an area dominated by exotic plant species with native shrubs and trees, and
3. learn more about the most appropriate species, planting strategies, and watering techniques that will help save time and money during future RMA mitigation projects.



Map 1. Proposed location for Task 5 (Enhancement of Wildlife Habitat in Section 34), Rocky Mountain Arsenal, 1991.





The objectives of this addendum to Task 5 are to:

1. increase the probability of shrub survival,
2. minimize maintenance (e.g. watering) time, and
3. minimize impacts on existing vegetation in Section 34.

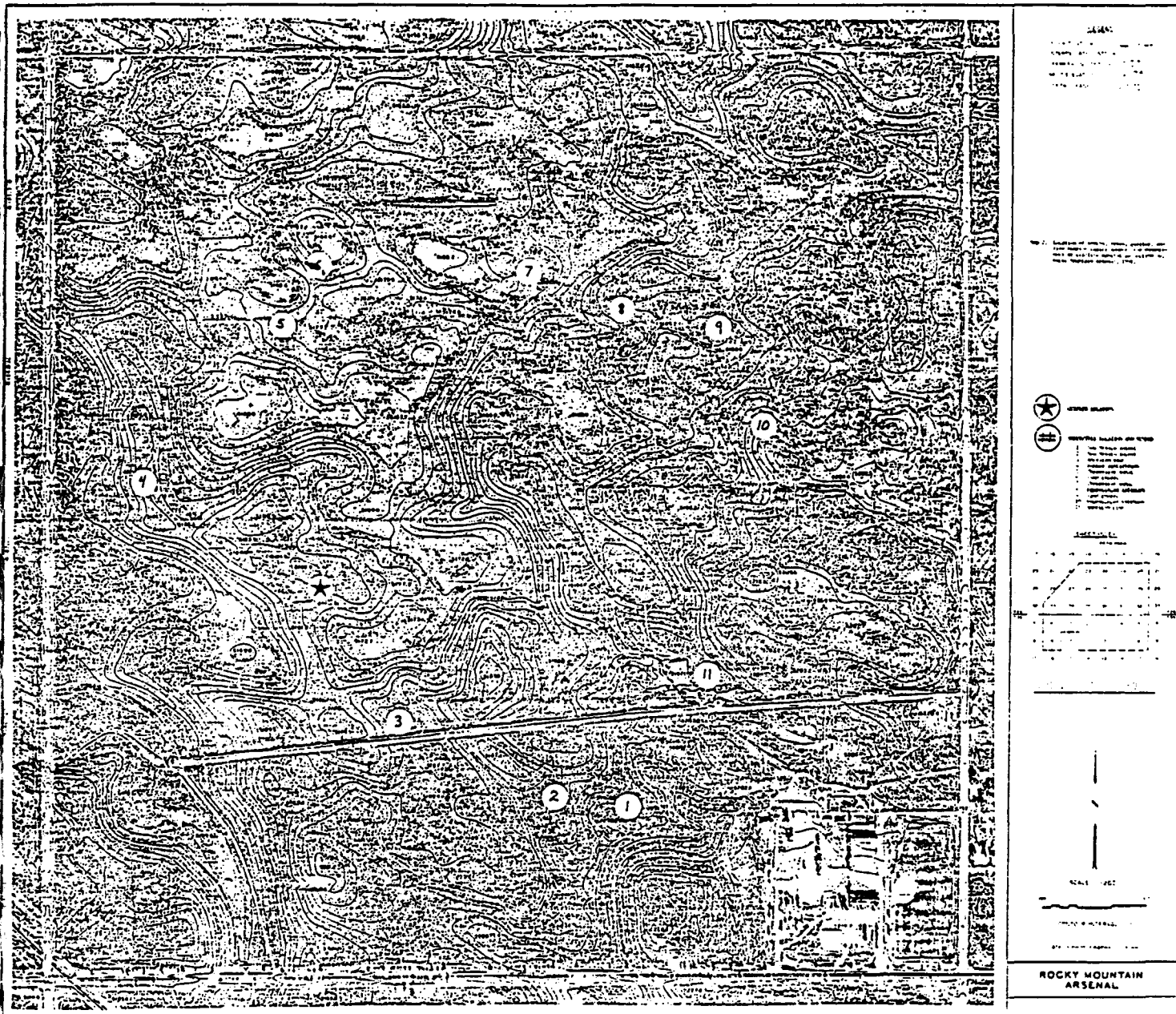
### 3.0 METHODS

#### Service:

1. The Service shall no longer be responsible for watering shrubs during FY 1992 unless mutually agreed upon during special circumstances by both the Service and the Contractor.
2. The Service shall assume responsibility for watering shrubs beginning with FY 1993 (i.e. October 1, 1992) by conducting the work itself, issuing a new deliver order for the work, or establishing another arrangement.

#### Contractor:

1. The Contractor shall address any potential hazards of constructing and maintaining an irrigation system within its site-specific health and safety plan for this project.
2. The Contractor shall assume responsibility for drip irrigating each plant during FY 1992.
3. The Contractor shall purchase and construct the irrigation system. Piping shall be left on top of the ground except where it is likely to be run over by vehicles (e.g. on the paved road at the fire hydrant and on the prominent dirt road traversing east to west in the lower one-third of Section 34) unless the irrigation material is capable of withstanding vehicular traffic. Depth and location of any trenching must be approved by the Service prior to initiation.
4. The Contractor shall obtain the Service's approval of the irrigation system prior to purchase of materials and construction. The Service recommends but does not necessarily require that the Contractor use the following irrigation strategy:
  - a. Obtain water from the closest fire hydrant in the former barracks area (Map 2).
  - b. Begin with a 6 inch line off the fire hydrant.
  - c. Purchase and place a valve to eliminate the need for turning the fire hydrant on and off. This is not optional.
  - d. Run the 6 inch line through a booster pump.
  - e. Divide the line into two 4 inch lines with a Wye adapter between Sites 1 and 11 within approximately 800 feet of the fire hydrant.



Map 2. Location of shrubs, trees, guzzler, and fire hydrant (water source) for enhancement of wildlife habitat in Section 34, Rocky Mountain Arsenal, 1991.

- f. Irrigate Sites 1-4 with one of the lines and Sites 5-11 with the other.
  - g. Reduce both lines to 3 inch lines approximately half way between the Wye adapter and their respective ends.
  - h. Water each individual plant with 1 inch lines.
- 5. The Contractor shall complete the irrigation system prior to transplanting shrubs.
- 6. The Contractor shall water each shrub by using the following strategy.
  - a. Water each plant within 3 hours upon being transplanted to Section 34.
  - b. Use approximately 3 gallons of water per plant.
  - c. During March and April of 1992, water one time per month, not including the initial watering.
  - d. During May 1 - September 30 of 1992, water 1-3 times per week, depending on need.
  - e. Obtain approval from the Service before deviating from the above schedule.
- 7. The contractor shall avoid disturbance to existing shrubs and yucca plants and minimize disturbance to other vegetation in Section 34 when constructing or maintaining the irrigation system.
- 8. The contractor shall return to the Service any materials or equipment purchased for this project at project completion.
- 9. The contractor shall obtain prior permission to access portions of Section 34 on a weekly basis through the RMA Activities Management System.

#### **4.0 HEALTH AND SAFETY PLAN**

The contractor shall work under an "umbrella" health and safety plan which will encompass all of the contractor's projects. The contractor shall also provide a brief health and safety plan specific to this project. This plan will be reviewed and approved by the Service Health and Safety Officer and Army's Health and Safety Office before work will be initiated.

#### **5.0 DELIVERABLES**

One deliverable item is required for the contractor to complete this project: construction and maintenance of a working drip irrigation system that will deliver the quantity and timing of water prescribed in Methods above.

#### **6.0 SCHEDULE**

Period of Performance: 365 calendar days for Year 1 delivery order.

**IRRIGATION ADDENDUM TO  
TECHNICAL WORK PLAN  
ENHANCEMENT OF WILDLIFE HABITAT IN SECTION 34  
USFWS HABITAT ENHANCEMENT PLAN 5**

**U.S. Fish and Wildlife Service  
Building 111  
Rocky Mountain Arsenal  
Commerce City, CO 80022**

**January 1992**

TECHNICAL WORK PLAN  
ENHANCEMENT OF WILDLIFE HABITAT IN SECTION 34  
USFWS HABITAT ENHANCEMENT PLAN 5

U.S. Fish and Wildlife Service  
Building 111  
Rocky Mountain Arsenal  
Commerce City, CO 80022

January 1992

## 1.0 INTRODUCTION

### 1.1 TASK DESCRIPTION

The U.S. Fish and Wildlife Service (Service) has proposed to enhance the wildlife habitat in Section 34 (Map 1) of Rocky Mountain Arsenal (Arsenal, RMA) by planting several species of shrubs and constructing a wildlife guzzler. This action would counteract some of the deleterious effects on habitat caused by RMA Interim Response Action K (IRA-K) for removal of asbestos, including a number of abandoned buildings that are commonly used by wildlife species. Preferred species of plants to be introduced and a watering strategy are submitted. The Service expects this project to not only improve wildlife habitat in Section 34 and therefore mitigate impacts from some cleanup actions, but also to provide valuable information on how to approach related future projects on a larger scale.

The Service and Army approved Task Plan 5 to conduct this work on August 27 and August 28, 1991, respectively. Negotiations for a delivery order to initiate this project have been delayed due to FY 1991 funding limitations. In the interim, the Service has recognized the necessity of providing drip irrigation instead of the originally proposed truck watering strategy.

### 1.2 SITE DESCRIPTION/HISTORY

The Arsenal's current mission is to clean up contamination that resulted from on-site production of chemical weapons and pesticides since its initial purchase and development in 1942. Restoration of the Arsenal to a clean, safe environment has already led to some wildlife habitat destruction, including from cleanup of base facilities that were used in the production of that contamination (e.g. IRA K). The Service proposes to mitigate the effects of such projects by enhancing the wildlife habitat in Section 34.

The soils in Section 34 are mostly characterized by sandy loams although some clay loams exist in the proposed planting area. Crested wheatgrass and some patches of weedy forbs dominate the vegetation, accentuating the need for native species.

## 2.0 OBJECTIVES

The objectives of this project are to:

1. offset unavoidable losses to wildlife habitat caused by one type of cleanup activity,
2. enhance the habitat in an area dominated by exotic plant species with native shrubs and trees,
3. learn more about the most appropriate species, planting strategies, and watering techniques that will help save time and money during future RMA mitigation projects,

4. increase the probability of shrub survival,
5. minimize maintenance (e.g. watering) time, and
6. minimize impacts on existing vegetation in Section 34.

### 3.0 METHODS

#### Service:

1. The Service shall clearly mark the location and species to be planted for each site.
2. A Service employee shall accompany the contractor on a pre-work site visit or on the first day of work or both to answer any questions.
3. The Service shall provide the contractor with potential suppliers of the required species for reasonable prices, if needed.
4. The Service shall furnish the materials and specifications (see Attachment 1) necessary for the contractor to construct a wildlife guzzler in Section 34.
5. The Service shall provide regular inspections of the work to ensure adequate communication between the Service and the contractor.
6. The Service shall minimize damage to vegetation.
7. The Service shall arrange for removal of the fencing around the shrubs and trees when it is considered appropriate.

#### Contractor:

1. The contractor shall provide a brief health and safety plan specific to this project to supplement the contractor's umbrella health and safety plan.
2. The contractor shall plant 440 shrubs/trees. All plants shall be purchased in 5 gallon containers. The plants shall consist of the following six species:
  - a. American plum (80 plants)
  - b. Three-leaf sumac (80 plants)
  - c. Sand cherry (80 plants)
  - d. Four-wing saltbush (80 plants)
  - e. Rubber rabbitbrush (40 plants)
  - f. New Mexico locust (80 plants).

3. Alternatives to the shrub and tree species listed above may be discussed only if all avenues to the purchase of these species have been exhausted. Any changes to the species composition shall be allowed only with prior approval from the Onsite Inspector and the Contracting Officer.
4. All shrubs and trees shall be planted during April 27 - July 1, 1992. Any changes to this planting period shall be allowed only with prior approval by the Onsite Inspector and the Contracting Officer.
5. All shrubs and trees shall be planted in the sites designated on Map 2 and as described below:
  - a. Site 1 New Mexico locust
  - b. Site 2 New Mexico locust
  - c. Site 3 American plum
  - d. Site 4 Rubber rabbitbrush
  - e. Site 5 Three-leaf sumac
  - f. Site 6 Sand cherry
  - g. Site 7 Three-leaf sumac
  - h. Site 8 Four-winged saltbush
  - i. Site 9 Sand cherry
  - j. Site 10 Four-winged saltbush
  - k. Site 11 American plum
6. All shrubs and trees shall be planted in clumps of 40 plants each. Clumps can be circular, oval, or rectangular if constructed in a somewhat irregular pattern. No clump should have easily distinguishable rows. The diameter of the clump should never exceed 45 feet.
7. Shrubs shall be planted 3-4 feet apart. New Mexico locusts shall be planted 4-5 feet apart.
8. Each clump of shrubs and trees shall be protected from wildlife damage (e.g. browsing from rabbits and deer, antler scraping by deer). Fences shall surround each clump; the size of the wire mesh shall not exceed 3 inches, the height shall be at least 6 feet above ground, and the bottom of the fence must be flush with the ground. A very inexpensive gate system shall be available for each fence to allow maintenance of the irrigation system. The Service will be responsible for fence removal.



9. Each planting site shall be mulched with wood chips immediately upon being transplanted to Section 34. The wood chips shall be 4-6 inches deep and be spread throughout the clump of shrubs/trees (versus just around the individual plants). The contractor shall contact the Service for sources of free or inexpensive wood chips if unable to locate such a source.
10. The contractor shall construct a wildlife guzzler (water tank specially designed for wildlife) at the marked site in Section 34. All materials and specifications shall be furnished by the Service.
11. The contractor shall avoid disturbance to existing shrubs and yucca plants and minimize disturbance to other vegetation in Section 34 when conducting any type of work.
12. The contractor shall return to the Service any materials or equipment purchased for this project at project completion.
13. The contractor shall obtain prior permission to access portions of Section 34 on a weekly basis through the RMA Activities Coordination System.
14. The Contractor shall address any potential hazards of constructing and maintaining an irrigation system within its site-specific health and safety plan for this project.
15. The Contractor shall assume responsibility for drip irrigating each plant through September 30, 1992.
16. The Contractor shall purchase and construct the irrigation system. Piping shall be left on top of the ground except where it is likely to be run over by vehicles (e.g. on the paved road at the fire hydrant and on the prominent dirt road traversing east to west in the lower one-third of Section 34) unless the irrigation material is capable of withstanding vehicular traffic. Depth and location of any trenching must be approved by the Service prior to initiation.
17. The Contractor shall obtain the Service's approval of the irrigation system prior to purchase of materials and construction. The Service recommends but does not necessarily require that the Contractor use the following irrigation strategy:
  - a. Obtain water from the closest fire hydrant in the former barracks area (Map 2).
  - b. Begin with a 6 inch line off the fire hydrant.
  - c. Purchase and place a valve to eliminate the need for turning the fire hydrant on and off. This is not optional.
  - d. Run the 6 inch line through a booster pump.

- e. Divide the line into two 4 inch lines with a Wye adapter between Sites 1 and 11 within approximately 800 feet of the fire hydrant.
  - f. Irrigate Sites 1-4 with one of the lines and Sites 5-11 with the other.
  - g. Reduce both lines to 3 inch lines approximately half way between the Wye adapter and their respective ends.
  - h. Water each individual plant with 1 inch lines.
18. The Contractor shall complete the irrigation system prior to transplanting shrubs.
19. The Contractor shall water each shrub by using the following strategy.
- a. Water each plant within 3 hours upon being transplanted to Section 34.
  - b. Use approximately 3 gallons of water per plant.
  - c. During April of 1992, water one time per month, not including the initial watering.
  - d. During May 1 - September 30 of 1992, water 1-3 times per week, depending on need.
  - e. Obtain approval from the Service before deviating from the above schedule.
20. The contractor shall write a brief task summary for completion of the project. This summary shall express details such as what type of equipment was used, how many employees were used, problems encountered, recommendations for the future, etc.

#### 4.0 HEALTH AND SAFETY PLAN

The contractor shall work under an "umbrella" health and safety plan which will encompass all of the contractor's projects. The contractor shall also provide a brief health and safety plan specific to this project. This plan will be reviewed and approved by the Service Health and Safety Officer and Army's Health and Safety Office before work will be initiated.

#### 5.0 DELIVERABLES

The following deliverable items are required for the contractor to complete this project:

- 1. Successful planting of 360 shrubs of the species specified above.
- 2. Successful planting of 80 trees, i.e. New Mexico locust.

3. Watering of each plant 3 times during the first week after transplanting.
4. Prompt notification (i.e. within 2 days of transplanting) to Service personnel that a clump of plants has been transplanted into Section 36.
5. Fencing around each clump of shrubs and trees as specified herein.
6. Successful construction of a wildlife guzzler.
7. Construction and maintenance of a working drip irrigation system that will delivery the quantity and timing of water prescribed in the Methods above.

#### 6.0 SCHEDULE

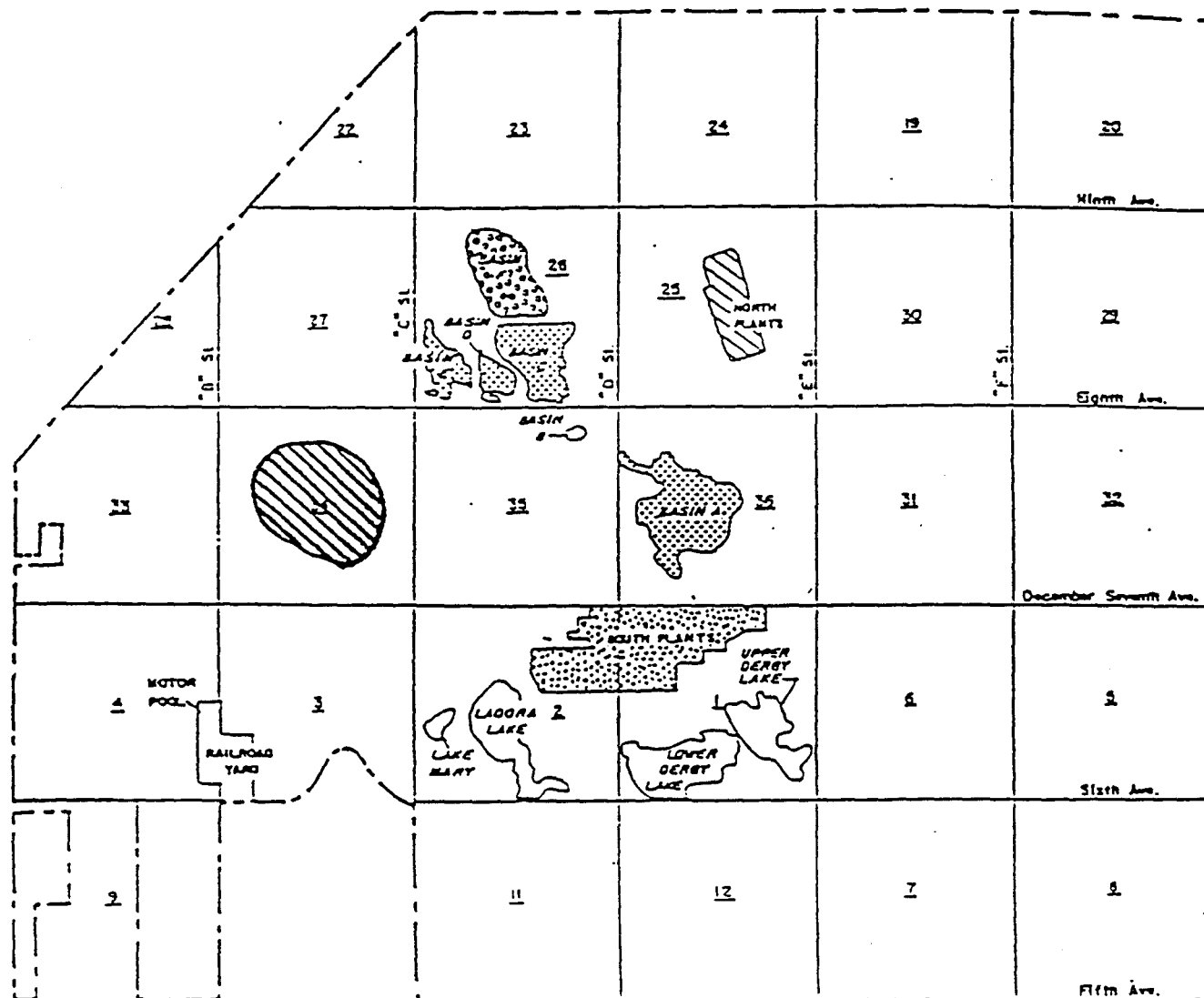
Period of Performance: Through September 30, 1992

#### 7.0 OPTIONS

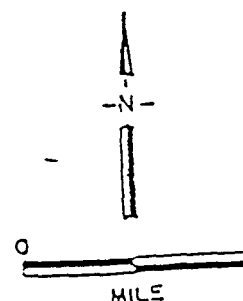
At the government's option additional delivery orders may be issued in Fiscal Years 1993 and 1994 for watering the trees and shrubs that will be planted during Fiscal Year 1992.

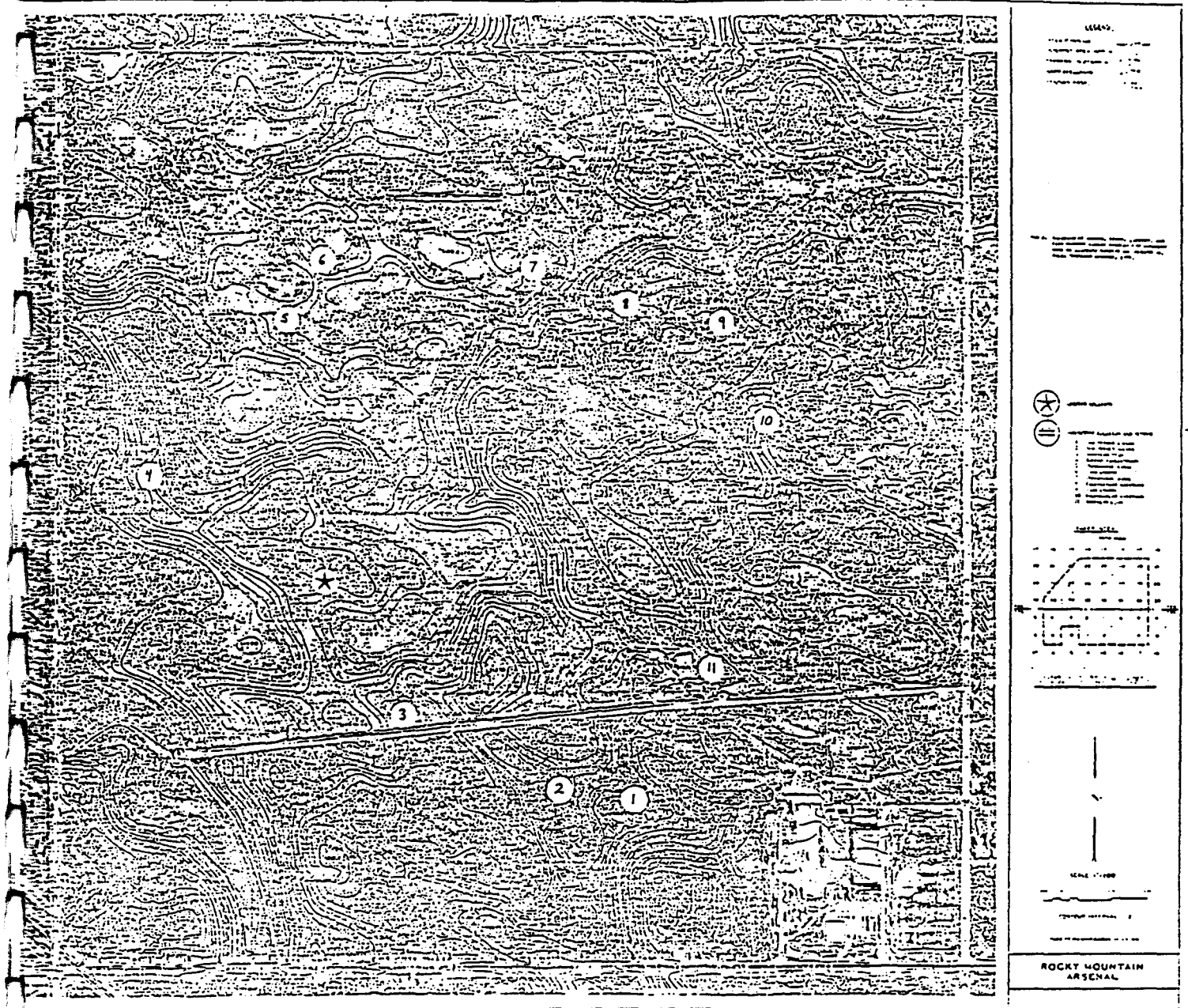
Please submit a proposal to cover each of the following:

Fiscal Year 1993	Oct 1 - April 30	1 watering/month
	May 1 - Sept 30	1 watering/week
Fiscal Year 1994	June 1- Aug 31	1 watering/week



Map 1. Proposed location for Task 5 (Enhancement of Wildlife Habitat in Section 34), Rocky Mountain Arsenal, 1991.





Map 2. Location of shrubs, trees, guzzler, and fire hydrant (water source) for enhancement of wildlife habitat in Section 34, Rocky Mountain Arsenal, 1991.

Attachment 1. Wildlife guzzler installation instructions, Task  
5, Enhancement of Wildlife Habitat in Section 34,  
Rocky Mountain Arsenal, 1991.

# FIBER ERECTOR

P.O. Box 1009 — Red Bluff, C  
Telephone (916) 527-

WILDLIFE GUZZLE  
INSTALLATION INSTR

To	Scott Pelton	From	Ed Hurst
Co.	U.S. Forest Service	Co.	Fiber Erector
Dept.	Rocky Mt. Arsenal	Phone	916/527-2194
Fax #	303/239-0232	Fax #	527-6260

Select a site away from trees and bushes if possible to avoid digging into roots, and as level a spot as possible.

Select the center of your excavation and draw a circle in the dirt eight feet from the center. Dig a circular trench nine inches deep and nine inches wide outside of circle drawn.

Dig excavation using plywood template to shape hole. Use a level on top of plywood to assure that unit will sit as level as possible.

Turn bottom panels upside down. Use the 19 inch 2 x 4 provided to lean the halves on. Use a screw driver as a pry bar to align holes. Run a 1/2 inch silicone bead along one three inch flange using a whole tube. Bolt two panels together using stainless steel bolts. Don't completely tighten bolts until all bolts are in. Start bolting from the center of the unit and work out. Repeat the above step on the other two bottom panels, again not completely tightening bolts. You now have the bottom dish in two half circles. Place the 2 x 4 in the center of the unit. Lean the other half on the 2 x 4 also and this will align the bolt holes. Run a silicone bead down the 3 inch flanges and bolt the halves together using two tubes of silicone. When all bolts are in place finish tightening them. Turn the unit over and position in excavation. Don't be afraid to let the unit free fall, as the air resistance will break the fall. Before setting in excavation dig two, three inch deep, troughs across excavation to accomodate the seam flanges.

After unit is in excavation, use fifth tube of silicone to do all four inside seams, using a 1 inch putty knife. Silicone should be allowed 48 hours to dry before water is introduced to unit. If rain threatens, mask all openings after top is attached to bottom. Sheets of plastic are recommended.

Place pedestal in center, aligning four corners at the bottom with the four seams. Put silicone on bottom edges of pedestal. This centers the pedestal. Prop two top panels on the pedestal and join using black bolts. Continue adding top panels being sure the 24 inch opening is above the big game bottom panel.

Lay all four rib caps over bolted flanges and lay center cap over rib caps. Use self tapping screws to attach them to the dome. Location of screws are transcribed on caps. At the bottom end of each rib cap are four transcribed screw holes which attach the dome to the bottom dish.

Cover lip on bottom dish with dirt to 1 inch of top of lip. Excavate 18 inch deep area in front of big game panel.

## TOOLS SUGGESTED

Template (Provided)	* 2 - 1/2 inch Ratchet Wrenches with 3/4" Sockets
19 inch 2 x 4 (Provided)	2 - 3/4 inch open end and box end Wrenches
Picks, Shovels, Rakes, Hoe	1 - 5/16 inch Magnetic Nut Setter (Provided)
Level	1 - Power Drill to attach above to, to set self tapping screws
2 Screwdrivers	1 Sledge Hammer
1 Caulking gun (Provided)	1 Broom
1 Ax	

**TECHNICAL WORK PLAN  
HABITAT RESTORATION FOR THE BALD EAGLE MANAGEMENT AREA  
USFWS HABITAT RESTORATION PLAN 27**

**U.S. Fish and Wildlife Service  
Building 111  
Rocky Mountain Arsenal  
Commerce City, CO 80022**

**April 1992**



## **1.0 INTRODUCTION**

### **1.1 PROGRAM/TASK DESCRIPTION**

A vegetation management program was initiated at seven sites within the Bald Eagle Management Area (BEMA) of Rocky Mountain Arsenal (RMA, Arsenal) in 1989 to diversify the habitat and prey base for bald eagles and other raptors (Figure 1). Two additional sites have since been added. Fiscal Year 1992 marks the fourth year of this five-year enhancement project designed to mitigate losses that occurred when Arsenal property was leased to Stapleton International Airport. Fieldwork was conducted by Facilities Engineering during 1989-1990 and Morrison Knudsen Environmental Services (MK, a Shell contractor) during 1991. MK will continue to conduct the fieldwork for the duration of the program. The U.S. Fish and Wildlife Service (Service) will continue to serve as manager of the program.

Work is proposed for eight of the nine previous sites. Most of the efforts are a continuation of previous sites, although some work includes minor extensions of those sites. One area outside of the BEMA (Section 29 Test Plots) is proposed for comparison with an area within the BEMA (Ladora Test Plots).

### **1.2 SITE DESCRIPTION/HISTORY**

#### **Site 1**

Site 1 includes Subsite 1A in southeastern Section 5, Subsite 1B in northwestern Section 8, and Subsite 1C in the northeastern corner of Section 7 (Figure 1). Subsites 1A and 1B are characterized by Bresser sandy loam soils. Subsite 1C is new and is characterized by Bresser sandy loam and some Ascalon sandy loam.

Subsite 1A encompasses 30 acres. The area was vegetated by cheatgrass and wild lettuce when first planted with a native seed mix in 1989. The seed mix included blue grama, needle-and-thread, sand bluestem, switchgrass, sand sagebrush, and fringed sagebrush. Cheatgrass and broadleaf weeds were difficult to control.

Subsite 1B includes 48 acres. This site was first planted with sorghum in 1990 to outcompete weeds. Unfortunately, this technique did not work and herbicides were employed to control both annual and perennial weeds.

Subsite 1C includes approximately 20 acres. It will be treated much as Subsites 1A and 1B, except that sorghum will not be used as a cover crop.

#### **Site 2**

Site 2 is located west of First Creek in south-central Section 5. The site encompasses 20 acres and is characterized by Bresser sandy loam soil. It was

vegetated mostly by crested wheatgrass and smooth brome when the project began in 1989. The area appears well suited for introduction of black-tailed jackrabbits because (1) woody vegetation provides cover immediately west of the site where a homestead once existed, (2) woody vegetation and tall grass along First Creek provide additional cover and shelter, and (3) an adequate food base exists in the form of grasses and forbs.

Mowing the vegetation and planting shrubs were initiated in 1989 to provide additional aspects of the habitat that may have been missing previously. Mowing was completed for the majority of the site each year, but with some strips of tall vegetation left alone. Two hundred shrubs (50 each of choke cherry, American plum, snowberry, and three-leaf sumac) were planted in clumps of 10 each and protected from premature browsing with wire cages.

#### Site 4

Site 4 includes 4A, 4B and 4C, all of which are located in central Section 31 east of First Creek. Soils are mostly characterized by aquic haplustolls. The goal for all three subsites is establishment of tallgrass prairie communities.

Subsite 4A encompasses 9 acres. The area was vegetated with a very tall, dense stand of Canada thistle and smooth brome before being treated with herbicides and planted with cereal rye in 1989 to stabilize the soil and outcompete weeds. Big bluestem, switchgrass, Indian grass, sideoats grama, and prairie cordgrass were planted in 1990 to establish a lowland tallgrass prairie community. Progress will be measured to determine future needs for the site.

Subsite 4B includes 15 acres bordering 4A to the east and south. A similar strategy was used for 4B as was described for 4A except that the process began 1 year later. Monitoring and spot application for cheatgrass is needed.

Subsite 4C encompasses 35 acres north of Subsites 4A and 4B. It is currently occupied by weedy forbs and cheatgrass.

#### Site 5

Site 5 includes three subsites located east of First Creek in western Section 30. Subsite 5A lies between two narrow strips of Subsite 5B, which in turn lies inside the two 5C strips. All sites are approximately 1 mile in length and were characterized by cheatgrass and weedy forbs at the beginning of the project. Initial work was designed to control weedy species and establish a shortgrass prairie. Early management indicated that a mixed grass prairie was more realistic for soil type and soil moisture conditions at the site.

Subsites 5A and 5B encompass 12 and 22 acres respectively. Native prairie has been established on much of these sites. Canada thistle remains as a problem in some spots.

Prairie establishment was initiated at Subsite 5C in 1990, which encompasses 62 acres. Both cheatgrass and thistle remain as problems.

## Site 6

Site 6 includes two subsites located in north-central Section 30. Both sites are characterized by Weld loam, Satanta loam, and Ascalon sandy loam soils. Although they were dominated by native perennial grasses prior to initiation of this project, the plant species involved were characteristic of highly disturbed land and were considered undesirable for many wildlife species. This area was intensively farmed before being purchased by the U.S. Army in 1942. The goal for both subsites was to establish shortgrass prairie dominated by western wheatgrass for resilient prairie dog habitat.

Subsites 6W and 6E consist of approximately 46 and 40 acres respectively. An excellent stand of western wheatgrass has been established in each site. Further work will be limited to fertilizer and some weed control.

## Site 7

Site 7 includes three subsites located in western Section 19. Both sites are characterized by Nunn clay loam, aquic haplustoll, and Ascalon sandy loam soils. The areas were dominated by smooth brome and thistles before revegetation efforts were initiated.

Subsite 7A consists of approximately 11 acres. Weed control and seeding of slender wheatgrass, western wheatgrass, thickspike wheatgrass, and fringed sage began in 1989 and were repeated in 1990. A stand of desirable mixed grass prairie community resulted.

Subsite 7B encompasses 18 acres between Subsite 7A and E Street. A similar strategy was initiated in 1990, but resulted in a stand of cheatgrass (a weedy exotic) and sand dropseed (a desirable native). Weed control and fertilization in 1991 improved the stand.

The third site exists just east of Site 7A and consists entirely of cottonwood poles that were planted in 1989 to increase diversity along the old First Creek channel. None of the plants survived, either due to not being planted deep enough to reach ground water, being scraped by deer antlers, or both.

## Needle-and-Thread Grass Harvest Area

This area consists of two subsites located in the southwestern corner of Section 5, one that currently exists (N&T-A) and one proposed for 1992 (N&T-B). Both are characterized by Bresser sandy loam soil.

Subsite N&T-A encompasses 20 acres that were originally dominated by needle-and-thread grass and weedy species before management resulted in a relatively monotypic stand of needle-and-thread. No further management is needed except haying for mulch.

Subsite N&T-B consists of 10 acres adjacent to the northern border of Subsite N&T-A, but is dominated by weedy species. Weed control is necessary before and during seeding operations. This site is new and is considered necessary because N&T-A only produces enough hay to mulch a 2-acre site.

## **Ladora Test Plots**

These plots are designed to test the difference between spring and fall seeding times of varied seed mixes in the Bresser sandy loam soil characteristic of the southern portions of the Arsenal and to demonstrate restoration efforts to visitors. The plots were established west of Lake Ladora during September 1991 in conjunction with a planned trail and recreation system. Approximately 30 acres were set aside for this purpose.

In late September 1991, eight 1-acre plots were staked within the test plot area. The four plots on the north end of the area were designated for fall seeding and the four plots on the south end were designated for spring seeding. Each of the four fall seeded areas received a different seed mix (Table 1). The corresponding spring seeded plots will receive the same seed mix as the fall seeded plots and be seeded in the spring of 1992.

## **Section 29 Test Plots**

These plots are designed to duplicate the Ladora Test Plots for comparisons between sandy soils found in the southern portion of the Arsenal and the soils with higher clay content (Weld loam) characteristic of the northern portion of the Arsenal.

## **2.0 OBJECTIVES**

The objectives of this program are to:

1. Mitigate losses to wildlife habitat that occurred when Stapleton International Airport leased RMA property to build a runway extension.
2. Diversify the prey base for bald eagles and other raptors.
3. Restore native vegetation to portions of Rocky Mountain Arsenal.
4. Control weedy species where appropriate.
5. Demonstrate habitat restoration efforts to the public where appropriate (Test Plots).
6. Verify suitability of standard seed mixes for site-specific RMA soil conditions.
7. Enhance RMA as a projected wildlife refuge.
8. Learn more about the most appropriate methods for restoration of native habitats in order to improve efficiency during future RMA mitigation projects.

### **3.0 METHODS**

#### **Service:**

1. The Service shall provide oversight for this project. Service employees shall provide guidance during planning stages, advice during fieldwork, and periodic inspections of progress.

#### **MK-Environmental Services:**

##### **General:**

1. The contractor shall provide recommendations for planning based on the literature and site-specific experience.
2. The contractor shall provide a health and safety plan specific to natural resources projects (including this task) to supplement the contractor's umbrella health and safety plan.
3. The contractor shall retain an appropriate buffer zone (as determined by the literature) between herbicide applications and water sources.
4. The contractor shall use herbicides only when project success is dependent upon them. The contractor shall continue throughout FY 1992 to investigate alternatives (e.g. burning, mowing, tilling, biological controls) to the future use of herbicides.
5. The contractor shall measure revegetated stands to quantitatively determine success.
6. The contractor shall inform the Service of any changes from the plan deemed necessary prior to initiation of these changes.
7. The contractor shall notify the Service in the event that the contractor's activities may affect wildlife (e.g. plowing prairie dog burrows, mowing in fawning areas). The contractor shall also take any other precautions necessary to minimize risk to wildlife.
8. The contractor shall investigate the potential of various species for use as a cover crop in replacement of sorghum.
9. The contractor shall provide the Service with a report of the project results and recommendations for future work.

##### **Site 1**

This site currently is composed of Subsites 1A and 1B. Subsite 1C shall be established during 1992.

Subsite 1A. Sand prairie grasses have been successfully established in this area. However, the shrub component of this habitat type has not been successfully established by drill seeding. Specific operations for FY 1992 include:

1. Investigate and propose a reasonable strategy to drip irrigate sand sagebrush seedlings to be planted in this area in FY 1993.
2. Implement appropriate control measures (Roundup, mowing, or possibly Diquat), if undesirable competing vegetation becomes problematic during the season.

Subsite 1B. Sand prairie species were seeded at this area in 1991. Specific operations for FY 1992 include:

1. Implement appropriate control measures (Roundup, mowing, or possibly Diquat), if undesirable competing vegetation becomes problematic during the season.
2. Investigate the possibility of testing a temporary irrigation system in FY 1993 to be constructed on one-half of this area in order to test the suitability of sprinkler irrigation for insuring the establishment of seeded grass and shrub sand prairie species. Water would be applied during July and August to supplement naturally occurring precipitation. At the beginning of July, an amount of water would be applied to supplement the precipitation received in June to bring the total amount of water for the time period to 2.5 inches. Irrigation would continue through July and August so that water received for each of these months equals 4.0 inches. No irrigation would be anticipated after August 1993.

Subsite 1C. Suitable agricultural methods that were determined during the initial phases of this program to establish sand prairie species will be used. This subsite will be designated 1C and comprise approximately 20 acres. A sorghum cover crop will not be planted at this site because sorghum did not provide adequate weed control in for Subsites 1A and 1B. Specific operations will include:

1. Mow the site on approximately April 15 to expose growing, undesirable vegetation for future herbicide application. (Well-timed burning would be the preferred method to realize this goal because it has the added benefit of destroying some weed seeds, but is not currently a viable alternative because of legal and public relations problems.)
2. Apply Roundup on approximately May 15 to control both annual weedy vegetation.
3. Spot treat the site with the Roundup during the summer and fall to control persistent weedy vegetation.
4. Prepare the site for seeding in September.

5. Apply triple super phosphate fertilizer at a rate of 150 lbs/acre.
6. The site shall be seeded and mulched prior to October 15. Mulch shall be weed-free tallgrass prairie hay applied at a rate of two tons per acre. The seed mix shall be composed of the following species at the specified rates.

<u>Species</u>	<u>Common name</u>	<u>Variety</u>	<u>Lbs PLS/ac</u>
<u>Chondrosum gracile</u>	Blue Grama	Hachita	0.75
<u>Calamovilfa longifolia</u>	Prairie Sandreed	Goshen	1.00
<u>Andropogon hallii</u>	Sand Bluestem	Woodward	5.00
<u>Panicum virgatum</u>	Switchgrass	Neb 28	0.30
<u>Oligosporus filifolius</u>	Sand Sagebrush	Native	0.05
<u>Artemisia frigida</u>	Fringed Sage	Native	0.01
<u>Liatrus punctata</u>	Balzing-star	Native	0.01
<u>Adenolinum lewisii</u>	Blue Flax	Native	0.01
<u>Penstemon angustifolia</u>	Penstemon	Native	0.01
<u>Gaillardia punctata</u>	Blanketflower	Native	0.01
	TOTAL		7.15

7. Investigate the potential of species (e.g. Sudan grass) other than sorghum to use as cover crops in this soil type in the future.

#### Site 2

The exclosure fencing for the 200 shrubs remains in place. Specific operations include:

1. Remove fencing in 1992 as early in the spring as weather and ground conditions permit. Monitor browsing of shrubs and be prepared to protect the shrubs if needed.
2. Mow 65% of Site 2 in a mosaic pattern on approximately May 15, 1992.

#### Site 4

Site 4 is currently divided into 2 subsites. A third subsite, 4C, will be initiated in 1992. The objective of this site is to establish tallgrass prairie species.

Subsite 4A. This site was planted in fall 1990. However, of the species seeded, only side-oats grama provided a substantial amount of cover in 1991. This site currently represents an early stage of plant succession. Management activities during 1992 will include:

1. Evaluate the area in early September for the need to overseed (i.e. interseed) prior to October 15. If seeding is needed, the same seed mix specified for the area in 1990 shall be used, except that side-oats grama shall be deleted from the mix.

Subsite 4B. This site was treated for weed control during the spring and summer of 1991. In the fall the site was seeded with a tallgrass prairie seed mix and mulch was applied. Management practices scheduled for 1992 include:

1. Conduct spot herbicide treatments with Roundup as needed during the summer and fall to control weedy vegetation.

Subsite 4C. This site shall be initiated in 1992 as a continuation of the tallgrass prairie establishment begun in 1990 on subsites 4A and 4B. Subsite 4C shall encompass approximately 35 acres directly north of 4A and 4B. Management practices to be implemented in 1992 include:

1. Mow or burn on approximately May 1 to expose growing undesirable vegetation for herbicide application.
2. Control annual and perennial weeds through herbicide application (Roundup, 2,4-D) on approximately May 15 and as needed to control the persistent weeds.
3. Prepare for seeding by chiseling, disking, and harrowing in September. Apply fertilizer (150 lbs triple super phosphate/acre) prior to the final harrowing.
4. Seed to tallgrass prairie using the following seed mix:

<u>Species</u>	<u>Common Name</u>	<u>Variety</u>	<u>Pounds PLS/acre</u>
<u>Andropogon gerardii</u>	Big Bluestem	Kaw	3.0
<u>Schizachyrium scoparium</u>	Little Bluestem	Pastura	1.7
<u>Sorghastrum avenaceum</u>	Yellow Indian	Holt	3.0
<u>Panicum virgatum</u>	Switchgrass	Neb 28	2.0
<u>Bouteloua curtipendula</u>	Side-oats Grama	Vaughn	2.3
TOTAL			12.0

5. Apply weed-free grass hay from a tallgrass prairie as mulch at a rate of 2 tons/acre.
6. Complete work by October 15.

## Site 5

Site 5 is divided into 3 subsites for the purpose of establishing mixed grass prairie. Minimal work is needed in Site 5.

Subsite 5A. This site shall be monitored for future weed control.

Subsite 5B. This site shall be monitored for future weed control.



Subsite 5C. The contractor shall ensure the establishment of desirable species through weed control and fertilizer application. Specific tasks include:

1. Apply Roundup prior to May 15 to control cheatgrass, and 2,4-D if absolutely necessary for perennial broadleaf weeds.
2. Continue to control weedy vegetation throughout the summer and fall through spot herbicide applications and mowing.

#### **Site 6**

Site 6 consists of two subsites, 6E and 6W. The goal for both subsites is to establish short grass prairie dominated by western wheatgrass that will provide resilient prairie dog habitat.

An excellent stand of western wheatgrass has been established in subsites 6E and 6W. Further work in these areas will be restricted to fertilizer application and weed control. Specific activities planned for 1992 include:

1. Apply 150 lbs/acre of ammonium nitrate on approximately May 1.
2. Apply Roundup as needed to control annual weeds.

#### **Site 7**

Site 7 consists of two subsites. Subsites 7A and 7B are designed to establish mixed grass prairie.

Subsite 7A. Management of this area has resulted in a stand of desirable vegetation and no further work is scheduled.

Subsite 7B. Further work in these areas shall be restricted to fertilizer application and weed control. Specific activities planned for 1992 include:

1. Apply 150 lbs/acre of ammonium nitrate on approximately May 1 if needed.
2. Apply Roundup as needed to control annual weeds.

#### **Needle-and-Thread Grass Harvest Area**

N&T-A. No further management is needed except for haying the site for a supply of native grass mulch.

N&T-B. This area shall be expanded to include a parcel of land approximately 10 acres in size and directly north of the present site for the purpose of additional native grass seed harvesting. The area is currently dominated by weedy vegetation. Specific tasks scheduled in 1992 include:

1. The site shall be mowed on approximately May 1 to expose growing weedy vegetation.
2. The new area shall be treated with Roundup on approximately May 15 to eliminate actively growing weeds, and 2,4-D on approximately June 15 for perennial weeds.
3. During summer, the area shall be deep plowed to 12-14 inches specifically to bury weed seeds.
4. Needle-and-thread grass hay shall be harvested from the adjacent area on approximately July 1 and stockpiled until fall.
5. After discing, the stockpiled hay shall be spread and crimped where appropriate.
6. Work shall be completed by October 15.

#### **Ladora Test Plots**

Specific tasks for 1992 at the Ladora test plots will include:

1. Seed the spring seeded plots by April 15 (Table 1).
2. Control weeds as needed.
3. Identify a 1-acre area to test two soil moisture retention products, i.e. Desert Bloom and Hydro Source. The products shall be applied at the manufactures' recommended rates in order to evaluate their effectiveness for : (1) late spring seeding of native grasses, (2) seeding of sand sagebrush, and (3) establishment of sand sagebrush seedlings.

#### **Section 29 Test Plots**

Specific tasks for 1992 at the Section 29 Test Plots shall essentially duplicate work that has been conducted at the Ladora Test Plots. For FY 92, it shall include:

1. Disc area for weed control in early May.
2. Seed the fall seeded plots by October 15 (Table 1).

#### **4.0 HEALTH AND SAFETY PLAN**

Service personnel shall abide by the Service's Station Safety Plan. MK personnel and their subcontractors shall work under MK's Health and Safety Plan. MK shall also work under a supplemental health and safety plan specific to natural resource projects on the Arsenal.

## **5.0 DELIVERABLES**

1. Control undesirable vegetation in Subsites 1A and 1B if problematic.
2. Recommendations for future irrigation in Subsites 1A and 1B.
3. Mowing and herbicide application in Subsite 1C.
4. Fertilizer application, seedbed preparation, seeding, and mulching in Subsite 1C.
5. Mowing and removal of shrub exclosures in Site 2.
6. Overseed Subsite 4A if necessary.
7. Herbicide application in Subsite 4B.
8. Mowing or burning in Subsite 4C.
9. Fertilizer application, seedbed preparation, seeding, and mulching in Subsite 4C.
10. Herbicide application in Subsite 5C.
11. Fertilizer and herbicide application in Subsites 6E and 6W.
12. Mowing and herbicide application in needle-and-thread harvest extension area (N&T-B).
13. Deep plowing N&T-B.
14. Hay harvesting N&T-B.
15. Discing, then spreading and crimping hay in appropriate area.
16. Spring seeding in Ladora Test Plots.
17. Testing of soil moisture retention products at Ladora Test Plots.
18. Spring discing in Section 29 Test Plots.
19. Fall seeding in Section 29 Test Plots.

## **6.0 SCHEDULE**

Starting date:	April 15, 1992
Completion date (fieldwork):	October 15, 1992
Completion date (annual report):	November 30, 1992

**Figure 1. Habitat Restoration Sites for the Bald Eagle Management Area,  
Rocky Mountain Arsenal, 1992.**

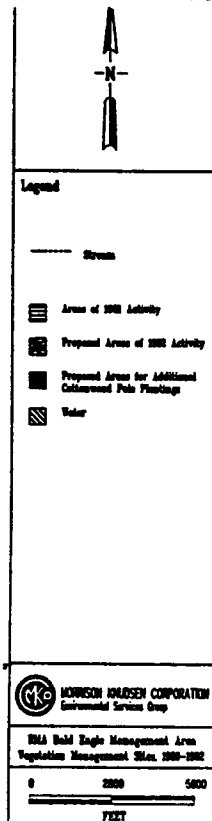
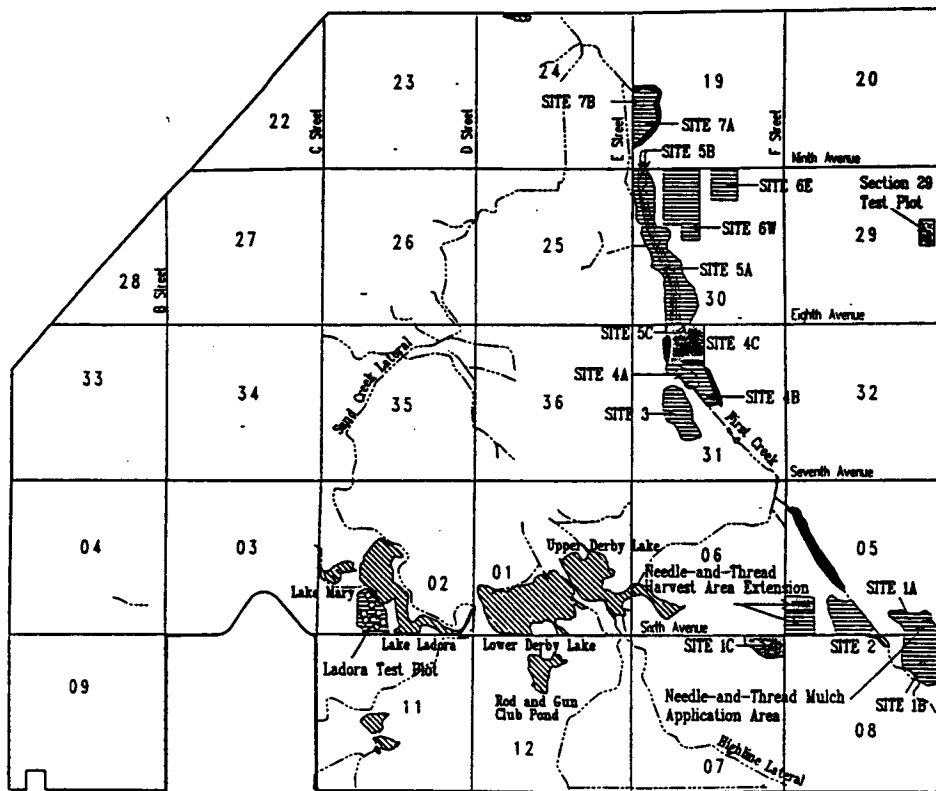


Table 1. Seed Mixes and Seeding Rates for Ladora Test Plots, Bald Eagle Management Area, Rocky Mountain Arsenal, 1992.

PLOT 1			
<u>Species</u>	<u>Common Name</u>	<u>Variety</u>	<u>Pounds PLS/acre</u>
<u>Andropogon hallii</u>	Sand Bluestem	Woodward	3.8
<u>Stipa comata</u>	Needle-and-thread	Native	3.6
<u>Oryzopsis hymenoides</u>	Indian Ricegrass	Nespar	3.4
<u>Calamovilfa longifolia</u>	Prairie Sandreed	Goshen	1.4
<u>Sporobolus cryptandra</u>	Sand Dropseed	Native	0.7
<u>Chondrosum gracile</u>	Blue Grama	Hachita	0.6
		TOTAL	13.5
PLOT 2			
<u>Species</u>	<u>Common Name</u>	<u>Variety</u>	<u>Pounds PLS/acre</u>
<u>Buchloe dactyloides</u>	Buffalograss	Sharp's Imp	8.0
<u>Pascopyrum smithii</u>	Western Wheatgrass	Arriba	4.9
<u>Chondrosum gracile</u>	Blue Grama	Hachita	0.7
		TOTAL	13.6
PLOT 3			
<u>Species</u>	<u>Common Name</u>	<u>Variety</u>	<u>Pounds PLS/acre</u>
<u>Stipa viridula</u>	Green Needlegrass	Lodorm	3.5
<u>Andropogon gerardii</u>	Big Bluestem	Pawnee	3.6
<u>Elytriga dasystachya</u>	Thickspike Wheat	Critana	2.6
<u>Sorghastrum avenaceum</u>	Indiangrass	Holt	2.3
<u>Panicum virgatum</u>	Switchgrass	Neb 28	1.2
		TOTAL	13.2
PLOT 4			
<u>Species</u>	<u>Common Name</u>	<u>Variety</u>	<u>Pounds PLS/acre</u>
<u>Pascopyrum smithii</u>	Western Wheatgrass	Arriba	4.9
<u>Elymus trachycaulus</u>	Slender Wheatgrass	Revenue	2.9
<u>Bouteloua curtipendula</u>	Side-oats Grama	Vaughn	2.8
<u>Schizachyrium scoparium</u>	Little Bluestem	Pastura	2.1
<u>Poa canbyii</u>	Canby Bluegrass	Canbar	0.6
		TOTAL	13.3

**Attachment 1. Background information on Desert Bloom and Hydro Source.**

# **What is Desert Bloom?**

**A LIQUID CONCENTRATE THAT IS DILUTED WITH  
WATER AND SPRAYED ONTO THE GROUND.**

**IT CREATES A SEMIPERMEABLE MEMBRANE  
UPON CONTACT WITH THE SOIL.**

**THE MEMBRANE RETAINS WATER AND INHIBITS  
EVAPORATION.**

## **Desert Bloom is NOT**

**A POLYMER... A SURFACTANT... A PENETRANT  
A FERTILIZER... A PESTICIDE...**

## **Desert Bloom IS**

**EASY TO APPLY... ECONOMICAL...  
ENVIRONMENTALLY SAFE...  
SUPPORTS CONSERVATION GOALS**

**DESERT BLOOM RETAINS MOISTURE  
IN THE SOIL KEEPING PLANTS  
HEALTHY AND GREEN. IT PAYS FOR  
ITSELF THROUGH SAVINGS IN WATER  
AND LABOR COST.**

**DESERT BLOOM, 1625 28th Street, San Diego CA, Suite 4000 (619)234-1444**



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## **DESERT BLOOM - HYDROSEEDING**

**"Superior water retention in soil."**

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### **THE PRODUCT**

Desert Bloom is a liquid concentrate that is diluted with water and sprayed onto the ground. On contact with silicon particles, it creates a semipermeable membrane in the first one to one-half inches of the soil. This membrane retains water, and inhibits evaporation of water from the soil.

Desert Bloom has two features which will benefit the user. First, less water is required when compared to an equivalent untreated area, and second, and most importantly, it will retain water in the soil over a longer period of time. Desert Bloom serves as an excellent tool to increase and extend "available water", and to assist landscape professionals in the challenge to make intelligent decisions in water management. Savings are achieved through the efficient use of water resources, and through the reduced cost of labor, equipment, and material.

Desert Bloom is recommended for use on all areas requiring a constant source of moisture; especially in hostile environments where extensive evaporation occurs from the soil, and where labor intensive watering is a factor, or where water scheduling is critical to the project success.

It is an excellent product for improved performance in the hydroseeding process. Inclusion in the hydroseeding mix specifications will insure maintenance of desirable moisture levels especially through the critical germination period, and will continue to benefit as the roots get established. It improves the chances of dense growth, and reduces the frequency and amount of water necessary for the desired product.

### **ENVIRONMENTAL IMPACT**

Desert Bloom is non toxic, biodegradable, and safe for plants and animals. It has been cleared by the Environmental Protection Agency and the Occupational Safety and Health Administration. When it disintegrates in one to three years, it is good plant food.

### **HISTORY OF DESERT BLOOM**

Desert Bloom was originally developed for agricultural use where the frequency and amount of rainfall is a significant variable in increasing the yields of crops such as cotton, alfalfa, and wheat. It's range of application is increasing dramatically as users realize it's value to their own unique applications in hydroseeding, dust control, and landscaping.

VF31-11/01/91

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**DESERT BLOOM, 1625 28th Street, Suite 4000, San Diego CA 92102 (619) 234-1444**

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# DESERT BLOOM - TECHNICAL DATA SHEET

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## SUPERIOR WATER RETENTION IN THE SOIL

### Chemical Reaction in the Soil

Desert Bloom is a water retaining compound which turns to a microscopic gel when it comes into contact with the OH- chemical function group in soil. Soil is almost entirely composed of  $\text{SiO}_2$  (Silica Dioxide). When the Silica Dioxide is hydrated, the silica atom is surrounded by four OH- groups and this is the ideal situation for Desert Bloom to react. The OH- groups react with the sand ( $\text{SiO}_2$ ) to form a hydrous gel.

This hydrous gel can retain water and at the same time act as a water transfer film between the soil moisture and water vapor in the air. When the relative humidity is greater than 25 per cent the gel is capable of drawing this moisture from the air and transporting it through the gel to the soil.

This is a simple vapor pressure membrane transfer mechanism. The Desert Bloom gel of hydrous metal oxides are geometrically arranged to layer water and to serve as a sieve. The sieve theory of semi-permeable membranes are applicable to the gel. The semi-permeable membrane inhibits evaporation from the soil. Water is retained for a longer period in the soil and available as the plant needs it.

### Characteristics

Uniform coverage on application is important. Dilute with water and keep solution sufficiently agitated to prevent separation. Desert Bloom should be diluted a minimum of 20 to 1 and may be diluted 1000 to 1 for some applications. The amount of Desert Bloom required per acre depends on the application objectives.

Desert Bloom is not UV sensitive and sets only on contact with the soil. Preferred method of application is via ground rigs for uniform coverage. Apply also through aero spray techniques (four gallons of diluted water per acre), or via injectors with a pivot irrigation system.

Like any membrane the gel may become dry after a period of time. When it rains, the liquid water is allowed to pass through the dry membrane, and after eight to twelve hours, the gel begins to rejuvenate acting as a membrane to retain the moisture in the soil.

When the system begins to deteriorate, the by-products become plant foods. Desert Bloom is an environmentally friendly product.

Rev01/26/92VE91

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DESERT BLOOM, 1625 28th Street, Suite 4000, San Diego CA 92102 (619) 234-1444

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# HYDRA-SOIL INTERNATIONAL

"Solving Problems Through Chemistry"

P. O. Box 911

Kingfisher, Oklahoma 73750

PHONE  
(405) 375-3964

March 31, 1992

Mr. Peter McRae  
Chief Executive Officer  
Quattro Environmental  
1625 28th St. Suite 4000  
San Diego, CA 92102

Re: Composition of Desert Bloom

Dear Mr. McRae:

"Desert Bloom" is primarily an organic based product designed to retain moisture for an extended period of time. It contains the following:

Hydrous Oxides Organic	89.0%
Nitrogen Organic based	3.0% minimum
Iron as Ferric Oxides	2.0%
Sulphur	2.0%
Inert Clays	4.0%
	<u>100%</u>

"Desert Bloom" contains no known toxins and is non-phytotoxic.

We hope this information will be of benefit in your negotiations for marketing "Desert Bloom".

Sincerely,

*Max Armstrong*

Max M. Armstrong  
President

*An Innovative Associates Company*

SOUTHWELL LABORATORY  
P.O. BOX 25001  
OKLAHOMA CITY, OKLAHOMA 73125  
(405) 232-1966

HYDRA-SOIL INTERNATIONAL  
P.O. BOX 911  
KINGFISHER, OK 73750  
ATTN: MAX ARMSTRONG

DATE SAMPLED: 3/20/92  
DATE RECEIVED: 3/20/92  
DATE REPORTED: 3/27/92

### CERTIFICATE OF ANALYSIS

IDENTIFICATION: LAB NUMBER 9205136  
MISCELLANEOUS PRODUCTS/SPECIAL TESTING  
ID: SAMPLE DB

IRON	2.18 %
TOTAL KJELDAHL NITROGEN	5.13 %
SULFUR	1.45 %

.

	EPA METHOD	DETECTION LIMIT
IRON	236.1	.03 mg/L
TOTAL KJELDAHL NITROGEN	351.3	.02 %
SULPHUR	ASTM D129	.001 %

mg/L = MILLIGRAMS PER LITER, EQUIVALENT TO PARTS-PER-MILLION

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Letters and reports are for the exclusive use of the client to whom they are addressed. The use of our name must be our prior written approval. Our letters and reports apply only to the sample tested and/or inspected, and are not relative of the quantities of apparently identical or similar products. As notified in writing all samples are disposed of 15 days after the results are first reported.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460

Mr. Max Armstrong  
President  
Hydra-Soil International  
P.O. Box 911  
Kingfisher, Oklahoma 73750

APR 10 1990

OFFICE OF  
PESTICIDES AND TOXIC SUBSTANCES

RE: IC-3176

Dear Mr. Armstrong:

This responds to your letter of February 14, 1990 and two follow-up correspondences dated February 28, 1990 and March 12, 1990, respectively, from Dr. M. L. Beasley of your company regarding your product "Desert Bloom". You requested that the Agency advise you how to register this product for distribution in commerce in the United States.

Please be advised that EPA does not register chemicals and/or products for purposes of the Toxic Substances Control Act (TSCA). However, the Agency does require that manufacturers or importers of a chemical substance ascertain that the substance in question is listed on the TSCA Chemical Substance Inventory. If the substance is already included on the TSCA Inventory, commercial manufacture or importation of the substance may commence immediately. On the other hand, any chemical which is not listed on the TSCA Chemical Substance Inventory is considered to be a "new" substance for the purposes of TSCA. Under Section 5 (a) of TSCA, the manufacturer or importer of a new substance is required to submit a Premanufacture Notification (PMN) to the Agency for review at least 90 days before manufacture or importation of that substance begins.

TSCA identifies three types of materials: chemical substances, mixtures of chemical substances and articles comprised of chemical substances and/or mixtures. The TSCA Inventory lists only chemical substances, and does not include mixtures or articles. However, it does list chemical substances of which mixtures and articles are comprised. Although mixtures are not reportable under TSCA, the chemical components of the mixture are individually reportable and separately listed on the TSCA Chemical Substance Inventory. In the letter of March 12, 1990 you listed the components of your product "Desert Bloom" as follows:

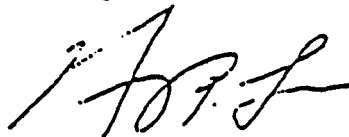
TSCA CONFIDENTIAL  
BUSINESS INFORMATION  
DOES NOT CONTAIN NATIONAL  
SECURITY INFORMATION (E.O. 12958)

In accordance with the information you provided, "Desert Bloom" appears to be a mixture which is exempt from the reporting requirements of TSCA. Since the individual components of the aforementioned mixture are found on the TSCA Chemical Substance Inventory, you may commercialize your product without submitting a PMN under Section 5 (a) of TSCA.

Should you have additional question concerning this matter, please reference IC-3176 and send your inquiries to:

Document Control Officer (TS-790)  
Office of Toxic Substances  
U.S. Environmental Protection Agency  
401 M Street, S.W.  
Washington, D.C. 20460  
Attention: Chemical Inventory Section

Very truly yours,

A handwritten signature in dark ink, appearing to read 'H. P. Lau', is written over the typed name.

Henry P. Lau  
Chief  
Chemical Inventory Section

# Material Safety Data Sheet

May be used to comply with  
OSHA's Hazard Communication Standard,  
29 CFR 1910.1200. Standard must be  
consulted for specific requirements.

U.S. Department of Labor  
Occupational Safety and Health Administration  
(Non-Mandatory Form)  
Form Approved  
OMB No. 1218-0072



IDENTITY (As Used on Label and Use)  
DESERT BLOOM

Note: Blank spaces are not permitted. If any item is not applicable or no  
information is available, the space must be marked to indicate this.

## Section I

Manufacturer's Name

HYDRA-SOIL INTERNATIONAL

Emergency Telephone Number

(405) 375-3964

Address (Number, Street, City, State, and ZIP Code)

223 N. 13th Kingfisher, OK 73750

Telephone Number for Information

(405) 375-3964

Date Prepared

February 7, 1990

Signature of Preparer (optional)

*M. L. Beasley P.D.*

## Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	in (optional)
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N/A

## Section III — Physical/Chemical Characteristics

Boiling Point	104°C	Specific Gravity (H <sub>2</sub> O = 1)	1.142
Vapor Pressure (mm Hg.)	N/A	Melting Point	-14.9°C
Vapor Density (AIR = 1)	N/A	Evaporation Rate (Butyl Acetate = 1)	N/A

Solubility in Water

GOOD

Appearance and Odor

Pink Liquid Gel Slight Odor

## Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used)	Flammable Limits	LEL	UEL
N/A	N/A		

Extinguishing Media

N/A

Special Fire Fighting Procedures

N/A

Unusual Fire and Explosion Hazards

NONE

## Section V — Reactivity Data

Stability	Unstable		Conditions to Avoid
	Stable	X	

Incompatibility (Materials to Avoid) **NONE**

Hazardous Decomposition or Byproducts **NONE**

Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur	X	

## Section VI — Health Hazard Data

Route(s) of Entry:      Inhalation?      Skin?      Ingestion?

Health Hazards (Acute and Chronic)  
**N/A NON TOXIC MATERIAL**

Carcinogenicity:      NTP?      IARC Monographs?      OSHA Regulated?

**N/A**

Signs and Symptoms of Exposure

**N/A**

Medical Conditions  
Generally Aggravated by Exposure

**N/A**

Emergency and First Aid Procedures  
**WASH WITH WARM WATER AND MILD SOAP**

## Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material Is Released or Spilled  
**DILUTE WITH WATER**

Waste Disposal Method  
**DISPOSE OF CONTAINERS AND WASTE IN ACCORDANCE WITH LOCAL/STATE/FEDERAL REGULATIONS**

Precautions to Be Taken in Handling and Storing  
**DO NOT STORE NEAR INTENSE HEAT**

Other Precautions

## Section VIII — Control Measures

Respiratory Protection (Specify Type)  
**NONE REQUIRED**

Ventilation	Local Exhaust	<b>NONE REQUIRED</b>	Special
	Mechanical (General)		Other

Protective Gloves **NONE REQUIRED**      Eye Protection **SAFETY GOGGLES**

Other Protective Clothing or Equipment  
**NONE REQUIRED**

Work/Hygiene Practices



## **HYDROSOURCE**

### **POLYACRYLAMIDE**

*The finest water-absorbing  
polymer in the world.*

- Agriculture •
- Landscaping •
- Revegetation •
- Gardening •
- Houseplants •
- Turf •

#### **Instructions:**

Place 1/2 contents of this packet into an 8 oz. glass of water. Watch for 10-15 minutes as the crystals fully absorb the water.

#### **Contents:**

94% co-polymer of polyacrylamide (cross linked); 5-6% moisture; residue less than 0.1% monomer.

---

## **A Brief Introduction to HYDROSOURCE**

• **HYDROSOURCE LONGEVITY:** HYDROSOURCE has superior longevity, compared with other similar products on the market. Tests in the United Kingdom show HYDROSOURCE is still more than 95% effective after five years in stable soil—thus leading experts within the industry to predict the actual lifespan may prove to be even longer.

• **HIGHEST QUALITY/PROVEN PERFORMANCE:** We believe HYDROSOURCE is the finest all-around water-absorbing polymer in the world. Initially developed six years ago in the United Kingdom, it is now a tried-and-proven product with more than five years use in countries throughout the world—including the Sudan, United Arab Emirates, England, Soviet Union, West Germany, Australia, as well as our neighbors to the north, Canada, and here in the United States.

The crystals are tough and durable, as evidenced by the fact that some hydrated HYDROSOURCE was taken through 100 freeze/thaw cycles in Colorado with no apparent ill effect in water-absorbing ability.

• **Absorption Rates:** HYDROSOURCE absorbs 400 times its density in deionized water and in the 150-350 range in most Rocky Mountain soils—with the limiting factor being the salt content of the soil and water. In practical terms, this means that one pound of crystals will absorb and hold from 15 to 40 gallons of water in the soil. After hydration, a plant's root system can draw out 96-99% of water stored in the crystals.

• **Reduces Watering Frequency:** When properly applied, HYDROSOURCE can reduce watering frequency by 50-75% in potted plants, 15-40% on lawns and golf courses, and in the 20-40% range for most irrigated field crops. Its water storage capability significantly reduces stress periods in virtually all plants by providing extra reserve water, stored in the hydrated crystals, available when natural precipitation is the sole source of moisture.

• **Improves Soil Conditions:** HYDROSOURCE significantly improves available water holding capacity of sandy soil—by as much as 600%—plus increases infiltration rates of water through clay soils by the constant hydraulic expansion and contraction of the crystals as they absorb and then release the water to thirsty plant roots.

• **Reduces Leaching Losses of Fertilizers/Nutrients:** Due to relatively free ion exchange, HYDROSOURCE absorbs, stores and releases soluble fertilizer and nutrients as readily as it handles water, therefore decreasing losses to leaching of both fertilizers—especially nitrogen—and nutrients.

Arkansas Valley Seed, Inc.  
4333 Hwy 66  
Longmont, CO 80504

• **Increased Germination and Improved Early Growth:** When banded near or placed in the seed row, HYDROSOURCE significantly increases germination in most crops, plus visibly improves early plant growth.

• **Trees and Shrubs:** HYDROSOURCE is especially beneficial in reducing losses in tree seedlings and shrub transplantings, also in providing long-term extra water to tree and shrub root systems.

• **Growth Regulators:** If growth regulators have been or are to be used in HYDROSOURCE treated fields or growing medium, it is recommended that trials first be carried out to determine the effect of HYDROSOURCE on the growth regulating characteristics. Normal fertilization practices should be included as part of the trials.

• **ECONOMICAL:** Due to previous high cost of the product in the United States, its use has been primarily limited to nursery, houseplant and landscaping applications. Now, with lower overhead and large bulk purchases from the manufacturer, we are making it economically available for most applications.

• **THE KEY TO SUCCESS:** HYDROSOURCE's long effective lifespan, its proven high performance, and low cost combine to make it a practical, profitable water-absorbing polymer of choice for literally hundreds of agricultural, landscaping, revegetation, turf, gardening and houseplant applications. More polyacrylamide is not necessarily better, and correct applications in the right places are **EXTREMELY** important to achieve maximum performance.

Please consult with your sales representative or other polyacrylamide application expert concerning both rates and application techniques, but also remember the basic rule. HYDROSOURCE is most effective when proper amounts are worked uniformly into soil zone areas where the plant's feeder roots normally grow.

*Manufactured For:*

Western Polyacrylamide Inc.  
P.O. Box 790, Castle Rock, Colorado 80104 • 303/688-3814

*Distributed by the following Arkansas Valley Seeds, Inc. offices:*

12th & Santa Fe Tracks  
P.O. Box 270  
Rocky Ford, CO 81067  
303/254-7469

4625 Colorado Blvd.  
P.O. Box 16025  
Denver, CO 80216  
303/320-7500

4333 Highway 66  
(Colo. Hwy. 66 East of I-25)  
Longmont, CO 80501  
303/535-4481

Colorado Seed Co.  
P.O. Box 68  
Monte Vista, CO 81144  
303/852-3505

Aby's Feed & Seed Co.  
410 5th Street  
Rapid City, SD 57701  
605/342-8414

**SAFETY HANDLING:** This product has been determined to be non-hazardous by 29 CFR 1910. 1200 (OSHA Hazard Communication Standard) Handle with good agricultural hygiene practices. Store away from children, food stuffs, pets and livestock. Wash hands after use.

**WARNING NOTICE:** The information contained within this leaflet is as accurate as to the product's capabilities and limitations as defined by present research. The leaflet is intended for general use of HYDROSOURCE. It should not be construed as a guarantee of its suitability for a particular application. Western Polyacrylamide, Inc. offers no warranties either expressed or implied, nor is liability accepted for errors or omissions in the information.

ALLIED COLLOIDS INC.  
Post Office Box 820  
Suffolk, VA 23434  
Telephone No. (804) 934-3700

MSDS No.: 0054  
Date Revised: 01-03-8

I. PRODUCT IDENTIFICATION

Product Name: ALCOSORB AB3S  
Product Type: Crosslinked Polyacrylamide Copolymer  
Product Description: White free flowing powder

II. HEALTH HAZARDS

1. HAZARD and FIRST AID STATEMENTS

Nature of Hazard:

This product has been determined to be non-hazardous in accordance with 29CFR 1910.1200; however, as with any chemical, this product should be handled with good industrial hygiene and safety practices as set forth in this material safety data sheet.

Primary routes of entry:

Ingestion, inhalation

Effects of Overexposure: (Signs and symptoms of exposure)  
not applicable (na)

Emergency and First Aid Procedures:

EYE CONTACT

If splashed into the eyes, flush with clear water to remove product.

INGESTION

If ingested, give emetic and seek medical advice.

2. HAZARDOUS INGREDIENTS (concentrations of 1% or greater)

Ingredients:

none

CAS NUMBER:

na

Exposure Limit:

none

ACGIH: none OSHA PEL: none MFRS Recommended: none

Carcinogenicity Determination by NTP, IARC, OSHA: None

### III. PHYSICAL HAZARDS AND PROPERTIES

#### 1. FIRE AND EXPLOSION HAZARD

Very low risk.

Flash Point - na

LEL - na

UEL - na

#### 2. EXTINGUISHING MEDIA and SPECIAL FIRE FIGHTING PROCEDURES

Carbon dioxide, dry chemical, foam

#### 3. REACTIVITY

##### Materials to Avoid:

Avoid contact with strong oxidants.

##### Stability:

This product is stable and will not react violently with water.  
Hazardous polymerization will not occur.

#### 4. PHYSICAL PROPERTIES

Density: 0.8 g/cc

### IV. HANDLING PROCEDURES

#### 1. PROTECTIVE EQUIPMENT

##### Eye Protection:

Use splash goggles or face shield when eye contact may occur.

##### Skin Protection:

Use gloves, if needed, to avoid prolonged or repeated skin contact.

##### Respiratory Protection:

Normally not needed, use dust mask if needed to prevent inhalation of airborne particles.

##### Ventilation:

Provide adequate ventilation to minimize dust inhalation.

#### 2. PERSONAL HYGIENE

Minimize breathing dust. Avoid prolonged or repeated breathing of dust and contact with skin. Remove contaminated clothing; launder or dry-clean before reuse. Cleanse skin thoroughly after contact before breaks and meals and at end of work period. Product is readily removed from skin by washing thoroughly with soap and water.

#### 3. PRECAUTIONARY STATEMENTS

Dust generated in handling of this product can be explosive if sufficient quantities are mixed in air in which case ignition sources should be avoided.

Product may create a slip hazard when mixed with water. Spills should be dealt with immediately.

## 4. SPILLS, LEAKS

Spills of dry product present a slip hazard when wet and should be cleaned up immediately. Do not wet spills of dry product. Sweep up dry and flush spill area with water. Spills of dilute solution may be flushed with copious amounts of water, or alternatively, they may be absorbed with an inert material such as earth or speedi-dry and contained for disposal. The product or its solutions should not be allowed to enter waterways without treatment. Product should be disposed of in accordance with applicable federal, state and local regulations.

The information and recommendations contained herein are, to the best of Allied Colloids' knowledge and belief, accurate and reliable as of the date issued. Allied Colloids does not warrant or guarantee their accuracy or reliability, and Allied Colloids shall not be liable for any loss or damage arising out of their use thereof.

The information and recommendations are offered for the users' consideration and examination, and it is the users' responsibility to satisfy itself that they are suitable and complete for its particular use.

**TECHNICAL WORK PLAN  
PROTECTION OF UNIQUE VEGETATIVE COMMUNITY AT RATTLESNAKE HILL  
USFWS HABITAT ENHANCEMENT PLAN 28**

**U.S. Fish and Wildlife Service  
Building 111  
Rocky Mountain Arsenal  
Commerce City, CO 80022**

**May 1992**

## **1.0 INTRODUCTION**

### **1.1 TASK DESCRIPTION**

The U.S. Fish and Wildlife Service (Service) proposes to protect a significant natural resource area (Rattlesnake Hill) from inadvertent and unnecessary disturbance. The sensitive area is located in Section 35 (Figure 1) of Rocky Mountain Arsenal (RMA, Arsenal) and is characterized by a variety of unique native prairie species. A one-strand barbless wire fence with appropriate signs is recommended as partial pre-mitigation for construction of the Arsenal's new sewage treatment facility to be constructed west of the proposed site within Section 35.

### **1.2 SITE DESCRIPTION/HISTORY**

The Arsenal's current mission is to clean up contamination that resulted from on-site production of chemical weapons and pesticides following its initial purchase and development in 1942. Restoration of the Arsenal to a clean, safe environment will include construction of several new facilities for cleanup-related staff. One such facility is the new sewage treatment area to be constructed northwest of Building 111. Construction on this site will destroy some wildlife habitat. The Service proposes to partially mitigate the effects of this action by protecting the vegetation on Rattlesnake Hill, an important natural resource area near the construction site.

Rattlesnake Hill is located in the center of Section 35 (Figure 1). The soil is mostly characterized by Ascalon sandy loam, although some petrocalcic paleustolls and weld loams are also present. A two-track, north-south road runs from 7th Avenue to the top of Rattlesnake Hill. The road traditionally has been used to reach the wildlife tracking station and the U.S. Geological Survey (USGS) marker, but both are easily accessed by foot. The portion of the road that is located on Rattlesnake Hill is unnecessary to cleanup or base operations.

The site encompasses approximately 25 acres of perhaps the most unique vegetation on the Arsenal (Figure 2). The South Platte River once meandered near the hill, leaving behind distinctive soils and thus unusual vegetation. Native prairie species include ring muhly, winterfat, Fendler three-awn, side-oats grama, and Sandberg bluegrass. This site must be protected from inadvertent disturbance during cleanup activities and base operations (e.g. construction of the sewage treatment facility). A single-strand wire fence with signs attached is proposed because signs alone have not always provided adequate protection in other portions of the Arsenal.

## **2.0 OBJECTIVE**

The objective of this project is to protect the unique prairie community and associated wildlife species on Rattlesnake Hill in Section 35 from inadvertent and unnecessary disturbance during cleanup and base operations by fencing the site and attaching appropriate signs.

### **3.0 METHODS**

#### **Service:**

1. The Service shall clearly mark the location for fence placement and of any sensitive plants to be avoided near the fence location.
2. The Service shall accompany the contractor on a pre-work site visit or on the first day of work to identify the location for fence placement and sensitive plants to be avoided, to observe an existing model fence in Section 4, and to answer any questions.
3. The Service shall provide 28 signs for the contractor to attach to the fence to increase awareness of the unique natural resource area.
4. The Service shall provide regular inspections of the contractor's work to ensure adequate communication between the Service and the contractor.

#### **Contractor:**

1. The contractor shall provide a brief health and safety plan specific to this project to supplement the contractor's umbrella health and safety plan.
2. The contractor shall submit Activity Coordination forms weekly to the Service Point of Contact.
3. The contractor shall purchase the following materials to construct a 4,200-ft single-wire fence:
  - a. 6 ft steel tee posts, and
  - b. 12.5 gauge twisted barbless wire.
4. The contractor shall install the tee posts approximately 12 ft apart (Figure 3) and in a manner that will not require construction of corner posts. No digging will be allowed on this project due to surficial soil contamination.
5. The contractor shall install the wire 3.5 feet above the ground (Figure 3).
6. The contractor shall attach one 18" X 24" metal sign (Figure 4) to the fence at the intersection of the fence and the two-track road and 27 signs at approximate intervals of 150-200 ft, such that at least one sign can be observed from any point near the fence.
7. The contractor shall avoid disturbance to existing shrubs and other sensitive vegetation at the site.
8. The contractor shall return to the Service any materials or equipment purchased for this project immediately following fieldwork.



9. The contractor shall provide the Service with a brief task summary to complete the project. The summary shall describe type of equipment used, number of employees used, problems encountered, recommendations for the future, etc.

#### **4.0 HEALTH AND SAFETY PLAN**

Service employees will work under the Service's RMA Station Safety Plan. The contractor shall work under an "umbrella" health and safety plan which will encompass all of the contractor's projects. The contractor shall also provide a brief health and safety plan specific to this project. This plan must be reviewed and approved by the Service Health and Safety Officer and Army's Health and Safety Office before the project can be initiated.

#### **5.0 DELIVERABLES**

Three deliverable items are required to complete this project:

1. Construction of the fence.
2. Attachment of the signs.
3. Task summary (general report and budget account).

#### **6.0 SCHEDULE**

Period of Performance: 30 calendar days following delivery order.

FISH AND WILDLIFE SERVICE  
FISH AND WILDLIFE ENHANCEMENT  
ROCKY MOUNTAIN ARSENAL FIELD OFFICE

Rocky Mountain Arsenal  
Commerce City, Colorado

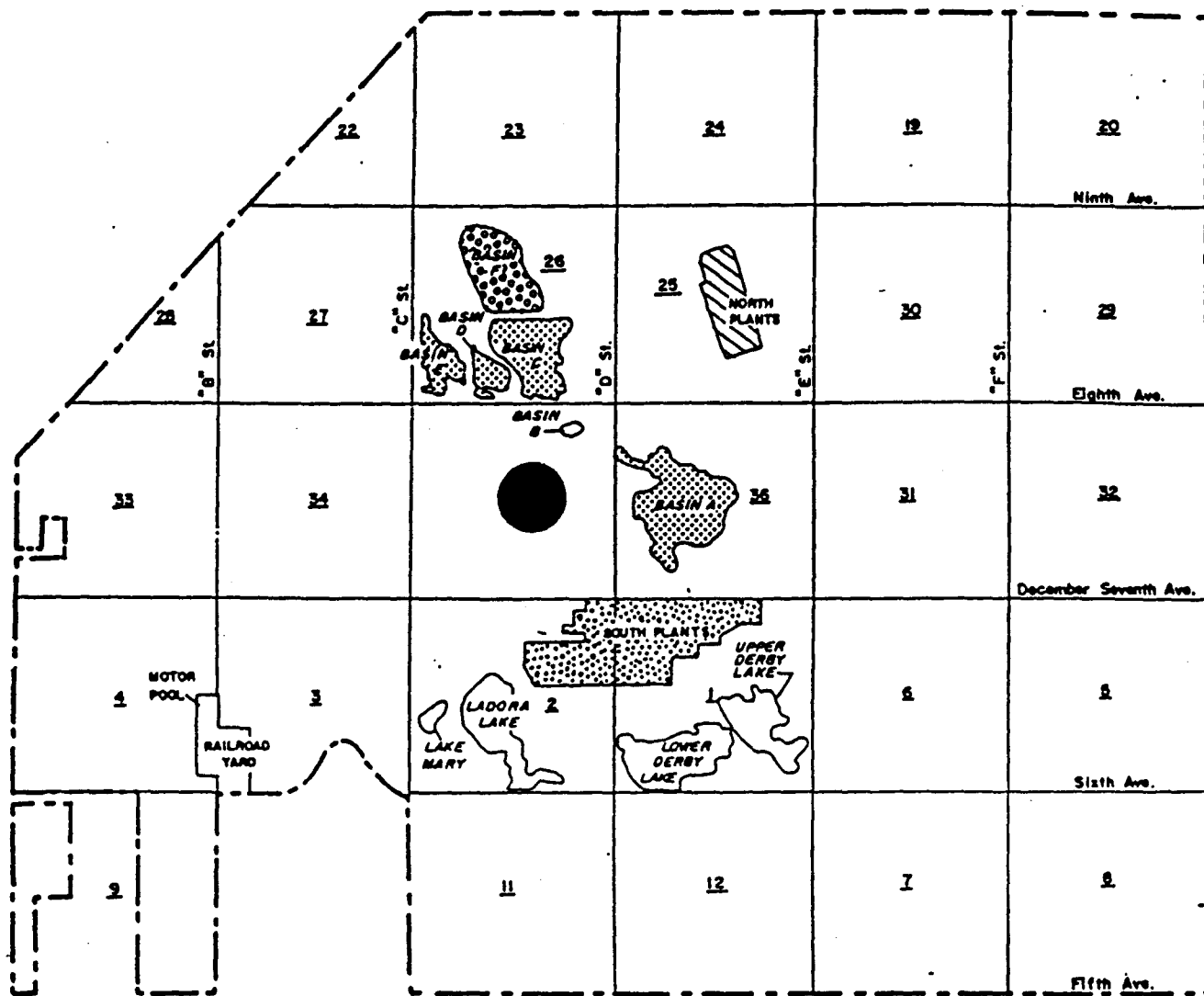


Figure 1. Location of Rattlesnake Hill, Section 35, Rocky Mountain Arsenal, 1992.

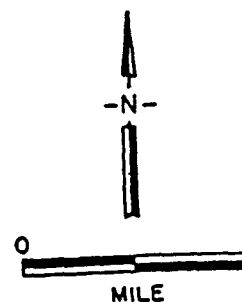
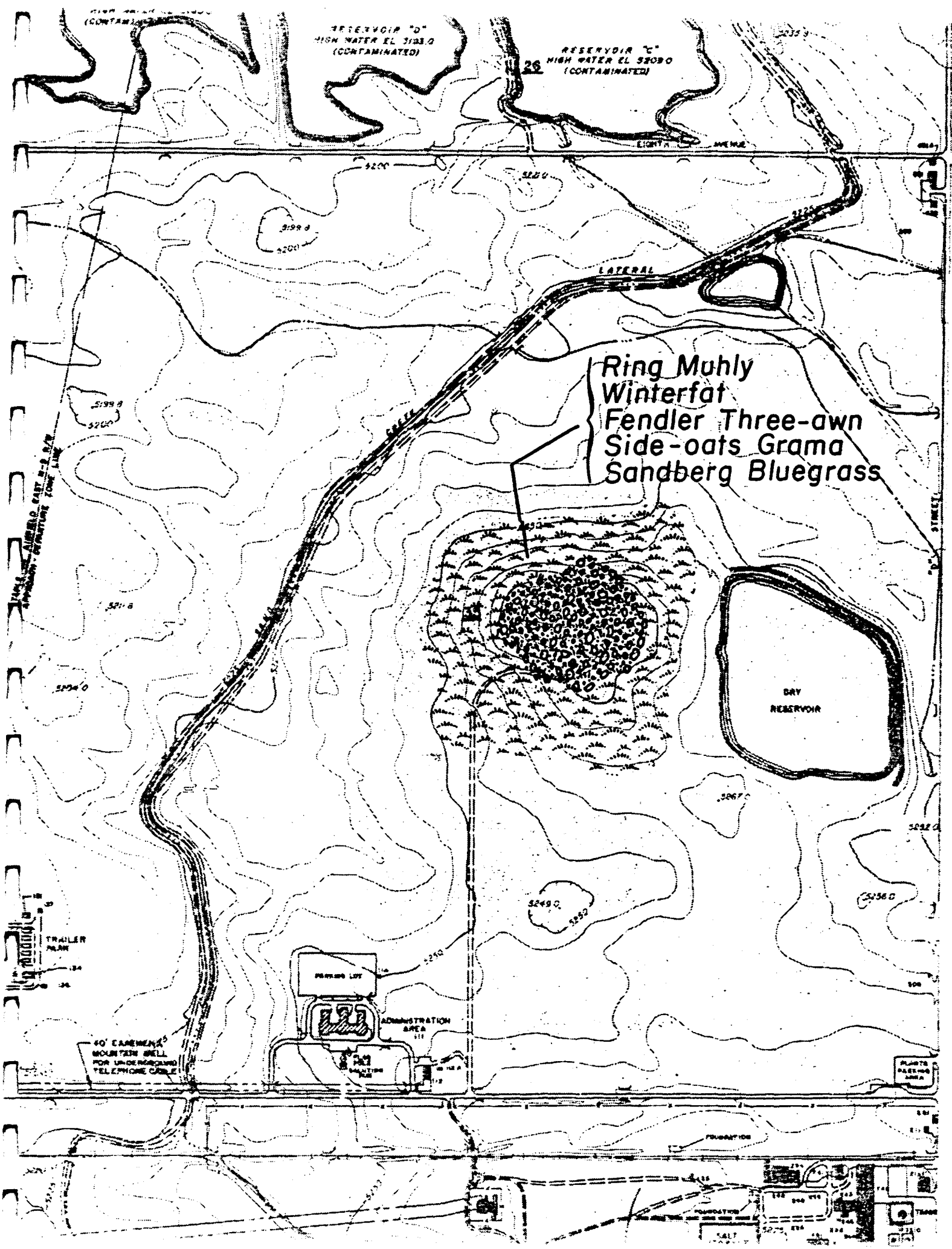


Figure 2. Specific location of unique vegetative community on and near  
Rattlesnake Hill, Section 35, Rocky Mountain Arsenal, 1992.



Ring Muhly  
Winterfat  
Fendler Three-awn  
Side-oats Grama  
Sandberg Bluegrass



Figure 3. Example of fence to be used for Task 28: Protection of Unique Vegetative Community at Rattlesnake Hill, Rocky Mountain Arsenal, 1992.

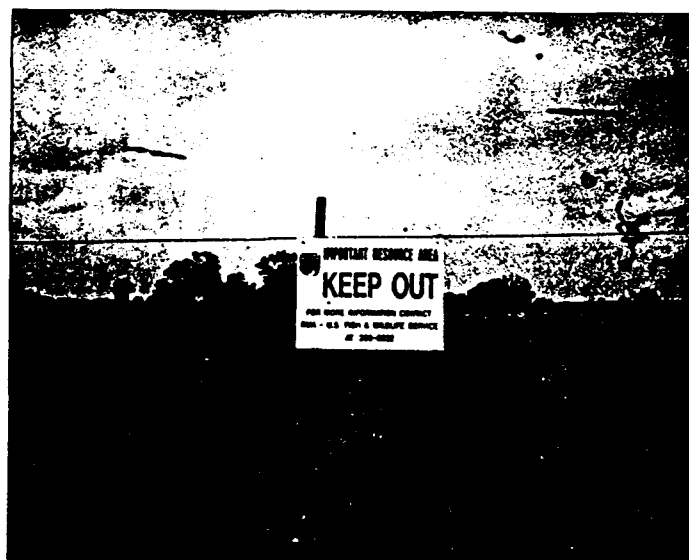


Figure 4. Example of signs to be used for Task 28: Protection of Unique Vegetative Community at Rattlesnake Hill, Rocky Mountain Arsenal, 1992.

**STATUS OF VEGETATION MANAGEMENT ACTIVITY  
IN THE BALD EAGLE MANAGEMENT AREA,  
ROCKY MOUNTAIN ARSENAL,  
ANNUAL REPORT FOR 1992**

**PREPARED FOR:  
HOLME ROBERTS & OWEN AND  
SHELL OIL COMPANY  
DENVER, COLORADO**

**FEBRUARY 1993**

**MK-ENVIRONMENTAL SERVICES  
1700 LINCOLN STREET, SUITE 4800  
DENVER, COLORADO 80203**

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## EXECUTIVE SUMMARY

Design of the five year vegetation management program for the Bald Eagle Management Area (BEMA) at Rocky Mountain Arsenal (RMA) was initiated in fall 1988. Field work began in spring 1989. The overall objective of the project is to improve habitat which will support a diverse prey base. Initial funding was provided by Stapleton International Airport as compensation for habitat lost when the airport expanded onto RMA. Subsequent funds have been provided by Shell Oil Company and the Army.

During 1992, the fourth year of the program, 59 acres were added to the actively managed acreage. In addition to the new areas, 320 acres seeded in previous years were managed to encourage the development of the desired species. Management activities included mowing, seeding, and herbicide application.

In total, approximately 350 acres have been revegetated with native prairie vegetation. An additional 25 acres have been managed for development of needle-and-thread grass seed to be used in revegetation efforts. An additional 10 acres is mowed annually to provide habitat more suitable for prey species, especially jackrabbits. Data collection is conducted annually to monitor revegetation success and follow trends in vegetation community development.

In general, the program has been very successful in terms of habitat diversification and restoration of native plant communities to abandoned land. Approximately 180 acres have developed native plant communities which do not warrant further management efforts other than to diversify some of the areas by adding shrubs and developing long term management plans which may include controlled burning in some cases. Native species have been seeded in an additional 170 acres during the past two years. These areas are young in terms of plant community development and

will require some management activity during the next two year in order to insure establishment of the seeded species.

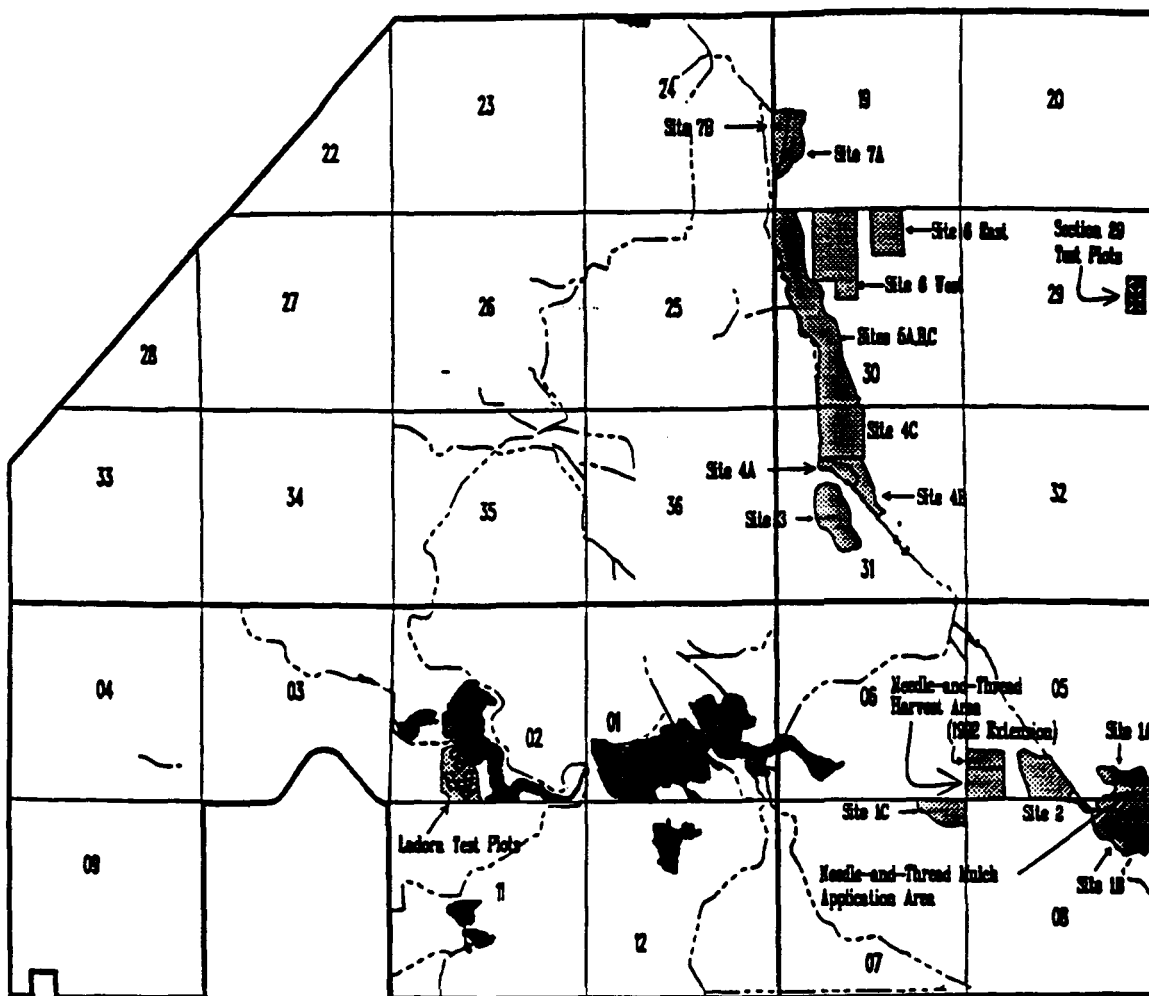
Shrub establishment from seed is the one area that continues to be problematic for restoration of native plant communities at Rocky Mountain Arsenal. Excellent success has been achieved with establishment of four-wing salt bush, but rubber rabbitbrush, sand sagebrush, fringed sagebrush, and other shrubs have not established readily with the seeding process as it has been conducted. Investigation of the synecological and autecological requirements of these species is continuing.

## 1.0 INTRODUCTION




The vegetation management program for the Bald Eagle Management Area (BEMA) at Rocky Mountain Arsenal (RMA) was initiated in the fall of 1988 by the US Fish and Wildlife Service (USFWS). Initial funds were provided by Stapleton International Airport as compensation for prey habitat lost when the airport expanded onto RMA. Funding since the first year has been provided by US Army and Shell Oil Company.

The basic objective of the program is to diversify habitat and consequently the prey base for bald eagles, raptors and other predators. Restoration of native prairie in areas dominated by weedy vegetation, and structural modification of existing non-native grassland are the basic methods used to provide more appropriate habitat for a variety of prey species. Four topographic prairie types are represented in the restoration effort. Establishment of sand prairie species is the goal for areas of sandy soils. Tall grass prairie species are restored in bottomland areas of deep loam soils and a shallow water table. Mixed grass prairie species have been established in shallow loam soils with less available water. Short grass prairie species are adapted to the driest upland sites. Vegetation structure is modified by mowing crested wheatgrass areas or planting shrubs. Locations of the sites are depicted in Figure 1. For ease of reading, specific literature citations have been excluded in favor of a Bibliography section at the end of the report.

Activity that occurred in 1992, the fourth year of the five year program, included soil preparation and seeding of approximately 25 acres, control of undesirable vegetation in areas seeded in previous years, and collection of vegetation data to monitor the status of all areas in the BEMA program.



# Legend

-  Stream
-  BEMA Site
-  Water

## Rocky Mountain Arsenal

## BEMA

## Vegetation Management Sites



Figure 1

January 29, 1993



MORRISON KNUDSEN CORPORATION  
Environmental Services Division

## 2.0 METHODS

This program involves both agricultural activity to establish prairie species and ecological data collection. Data collection facilitates the evaluation of the status of seeded communities, and the success of the agricultural methods employed. The following discusses the general methods used. Specific activities for each site are listed in log form in Appendix A and discussed in the Results and Discussion section of this report.

### 2.1 AGRICULTURAL METHODS

Initial efforts are aimed at control of undesirable vegetation through mowing, plowing and herbicide application. These activities are followed by preparation of the seed bed and seeding. Mulch is applied and crimped into the soil to complete the seeding process. Control of undesirable species continues until desirable species are adequately established.

#### 2.1.1 Vegetation Control

Vegetation control methods target two cool season weedy species--cheatgrass (Anisantha tectorum) and Canada thistle (Cersium arvense). These species pose the most serious threat to establishment and persistence of seeded species. Cheatgrass is widespread on the Arsenal and is problematic because of its propensity to deplete the surface soil of moisture thus discouraging establishment of native seedlings. Canada thistle is widespread on moist soils. It is extremely competitive, and once established can spread rapidly, preclude establishment of seeded species, and displace desirable established vegetation.

Both cheatgrass and Canada thistle have limited use for wildlife. Cheatgrass germinates in the fall and can provide green forage through winter and early spring. However, its depletion of soil

moisture decreases production by perennial native grasses, forbs, and shrubs which provide a more dependable and accessible source of winter forage. Flowers and seeds of Canada thistle may attract insects and birds. However, the rank, prickly nature of the plants may discourage use of habitat by deer.

Control of these two species is accomplished using a variety of methods in combination. Areas are tilled at the appropriate stages in the target species phenology to gain greatest detriment (e.g., tilling cheatgrass just prior to seed production).

Moldboard plowing the soils to a depth of up to 12" was conducted for the first time during 1992 in an effort to bury weed seed and prevent germination. Herbicides are utilized in situations where tilling is ineffective or inappropriate (e.g., to control Canada thistle both prior to and after seeding). Although active biological control methods have not been utilized, painted lady butterfly larvae were particularly active on Canada thistle and other vegetation at RMA during 1992.

#### 2.1.2 Soil Preparation

Soil is prepared for seeding through a variety of tillage operations. Areas that have not been moldboard plowed are chiseled to a depth of 12 inches to relieve compaction and loosen soil. Following this operation, the areas are disced to break up large soil clumps. A second discing or harrowing operation may be performed if clumpy soil conditions persist. Phosphorus may be spread prior to final soil preparation based upon soil fertility analyses.



### 2.1.3 Seeding

Seeding of native species is accomplished by both drill and broadcast methods followed by light harrowing. Shallow harrowing after seeding incorporates broadcast seed into soil and breaks up drill rows so that the established stand has a more natural appearance. Species are seeded separately based on seed size and density. Thirty-five to fifty seeds per square foot is the standard used to determine seeding rates. The percentage of each species in the mix is based upon composition in native stands and the autecological and synecological characteristics of each species.

### 2.1.4 Mulching

Weed free native grass hay mulch is spread over the seeded area at a rate of 2 tons per acre. This provides nearly 100% cover of the soil surface. Native grass hay is used to discourage volunteer of non-native grass species, as well as encourage volunteer by native forbs not included in seed mixes. The mulch is crimped into the soil to prevent deflation.

## 2.2 DATA COLLECTION METHODS

### Vegetation Cover Data

Vegetation cover data are collected annually for each seeded area on RMA. A number of permanent 50 meter transects are established on each area (coordinates are given in Appendix B). Permanent line-point transects allow for status and trend information to be interpreted for the developing vegetation community. Beginning in 1992 cover data were collected using an ESCO Cover-Point Optical Projection Device (Model 2). The device projects points 1/2 meter on each side of the transect line. Use of the device provides more precise data. Data are recorded for each species

encountered, litter, and bare soil. A species list is also made for species observed at the site but not encountered along the transects (site specific species lists in Appendix F).

Revegetation Information Monitoring and Analysis (RIMA) software was used to summarize the data and determine vegetation trends.

## 2.3 SITE DESCRIPTION/HISTORY/1992 ACTIVITIES

### 2.3.1 Site 1

Site 1 includes Subsite 1A in southeastern Section 5, Subsite 1B in northwestern Section 8, and Subsite 1C in the northeastern corner of Section 7 (Figure 1). Subsites 1A and 1B are characterized by Bresser sandy loam soils. Subsite 1C is new and is characterized by Bresser sandy loam and some Ascalon sandy loam.

Subsite 1A encompasses 30 acres. The area was vegetated by cheatgrass and wild lettuce (Lactuca serriola) when first planted with a native seed\*\*\* mix in 1989. The seed mix included blue grama (Chondrosum gracile), needle-and-thread (Stipa comata), sand bluestem (Andropogon hallii), switchgrass (Panicum virgatum), sand sagebrush (Artemisia filifolia), and fringed sagebrush (Artemisia frigida). Cheatgrass and broadleaf weeds were initially difficult to control. However, no further manipulations were needed during FY 1992.

Subsite 1B includes 48 acres. This site was first planted with sorghum (Sorghum vulgare) in 1990 to compete with weeds. Unfortunately, this technique was not effective and herbicides were employed to control both annual and perennial weeds. The area was mulched in October and March of 1992, and mowed on July 1.

Subsite 1C includes approximately 20 acres. It was mowed on May 6, 1992, disced on May 19, sprayed with glyphosate/2,4-D/Escort on September 19, disced again on September 30, and scheduled for harrowing, seeding, harrowing again, and mulching during early October.

### 2.3.2 Site 2

Site 2 is located west of First Creek in south-central Section 5. The site encompasses 20 acres and is characterized by Bresser sandy loam soil. It was vegetated mostly by crested wheatgrass (Agropyron cristatum) and smooth brome (Bromus inermis) when the project began in 1989. The area appears suited for introduction of black-tailed jackrabbits (Lepus californicus melanotis) because: (1) woody vegetation provides cover immediately west of the site where a homestead once existed; (2) woody vegetation and tall grass along First Creek provide additional cover and shelter; and (3) an adequate food base exists in the form of grasses and forbs.

Mowing the vegetation and planting shrubs were initiated in 1989 to provide additional aspects of the habitat that may have been missing previously. Mowing was completed for the majority of the site each year, but with some strips of tall vegetation left alone. Approximately 65 percent of the site was mowed on July 10, 1992.

Two hundred shrubs (50 each of choke cherry (Prunus virginiana), American plum (Prunus americana), snowberry (Symphoricarpos occidentalis), and three-leaf sumac (Rhus trilobata)) were planted in clumps of 10 each and protected from premature browsing with wire cages. All wire cages were removed from the shrubs during spring of 1992.

### 2.3.3 Site 4

Site 4 includes 4A, 4B and 4C, all of which are located in central Section 31 east of First Creek. Soils are mostly characterized by aquic haplustolls. The goal for all three subsites is establishment of tallgrass prairie communities.

Subsite 4A encompasses 9 acres. The area was vegetated with a very tall, dense stand of Canada thistle and smooth brome before being treated with herbicides and planted with cereal rye (Secale cereale) in 1989 to stabilize the soil and compete with weeds. Big bluestem (Andropogon gerardii), switchgrass, Indian grass (Sorghastrum avenaceum), sideoats grama (Bouteloua curtipendula), and prairie sandreed (Calamovilfa longifolia) were planted in 1990 to establish a lowland tallgrass prairie community. The area was interseeded on April 13, 1992.

Subsite 4B includes 15 acres bordering 4A to the east and south. A similar strategy was used for 4B as was described for 4A except that the process began 1 year later and mowing was also used for weed control. Mowing was conducted on July 7 and August 5, 1992.

Subsite 4C encompasses 35 acres north of Subsites 4A and 4B. It was thought to be occupied entirely by weedy forbs and cheatgrass; therefore, restoration was planned using the methods employed for 4B. Following mowing on May 1 and May 21, 1992, the area was determined to be dominated by more native vegetation than previously realized. Weed control was the only activity conducted, with weedy sites being sprayed with a mixture of 2,4-D, Escort, and Telar on September 17-21.

#### 2.3.4 Site 5

Site 5 includes three subsites located east of First Creek in western Section 30. Subsite 5A lies between two narrow strips of Subsite 5B, which in turn lies inside the two 5C strips. All sites are approximately 1 mile in length and were characterized by cheatgrass and weedy forbs at the beginning of the project. Initial work was designed to control weedy species and establish a shortgrass prairie. Early management indicated that a mixed grass prairie was more realistic for the soil type and soil moisture conditions at the site. The final seed mix included western wheatgrass (Pascopyron smithii), thickspike wheatgrass (Elytrigia dasystachya), slender wheatgrass (Elymus trachycaulus), side-oats grama, blue grama, fringed sagebrush, blanket flower (Gaillardia apistata), yarrow (Achillea lanulosa), black-eyed Susan (Rudbeckia hirta), and blue flax (Adenolium lewisii).

Subsites 5A and 5B encompass 12 and 22 acres respectively. Native prairie has been established on much of these sites. Canada thistle remained as a problem in some spots.

Prairie establishment was initiated at Subsite 5C in 1990, which encompasses 62 acres. Both cheatgrass and thistle remained as problems in 1992.

All subsites of Site 5 were mowed on June 4 and July 7, 1992 to control weeds. A mixture of 2,4-D, Escort, and Telar was applied in appropriate spots on September 17.

#### 2.3.5 Site 6

Site 6 includes two subsites located in north-central Section 30. Both sites are characterized by Weld loam, Satanta loam, and Ascalon sandy loam soils. Although they included a component of native perennial grasses prior to initiation of this project, the plant species involved were characteristic of highly disturbed land and were considered undesirable for many wildlife species. This area was intensively farmed before being purchased by the U.S. Army in 1942. The goal for both subsites was to establish shortgrass prairie dominated by western wheatgrass for resilient prairie dog habitat.

Subsites 6W and 6E consist of approximately 46 and 40 acres respectively. An excellent stand of western wheatgrass has been established in each site. Thus, FY 1992 activities were limited to monitoring.

#### 2.3.6 Site 7

Site 7 includes three subsites located in western Section 19. Both sites are characterized by Nunn clay loam, aquic haplustoll, and Ascalon sandy loam soils. The areas were dominated by smooth brome and thistles before revegetation efforts were initiated.

Subsite 7A consists of approximately 11 acres. Weed control and seeding of slender wheatgrass, western wheatgrass, thickspike wheatgrass, and fringed sage began in 1989. A stand of desirable mixed grass prairie community resulted.

Subsite 7B encompasses 18 acres between Subsite 7A and E Street. A similar strategy was initiated in 1990, but resulted in a stand of cheatgrass (a weedy exotic) and sand dropseed (a desirable native). Weed control and fertilization in 1991 improved the stand.

The third site exists just east of Site 7A and consists entirely of cottonwood poles that were planted in 1989 to increase diversity along the old First Creek channel. None of the plants survived, either due to not being planted deep enough to reach groundwater and being scraped by deer antlers.

#### 2.3.7 Needle-and-Thread Grass Harvest Area

This area consists of two subsites (N&T-S and N&T-N) of needle-and-thread located in the southwestern corner of Section 5. Establishment of needle-and-thread was determined to be appropriate because: (1) its seed is difficult to obtain; (2) it is an important component of some types of prairie; and (3) it can be used as a relatively weed free native grass hay mulch on sites where the species is desired. Both N&T-S and N&T-N are characterized by Bresser sandy loam soil.

Subsite N&T-S encompasses 20 acres that were originally dominated by needle-and-thread grass and weedy species before management resulted in a more monotypic stand of needle-and-thread. The subsite was mowed and baled on June 24-30, 1992. Thistles were mowed on July 1, 1992 and spot sprayed with a 2,4-D and Telar mixture on September 21, 1992.

Subsite N&T-N consists of 10 acres adjacent to the northern border of Subsite N&T-S that was dominated by weedy species. This site was new and was considered necessary because N&T-S only produces enough hay to mulch a 2-acre site. N&T-N was mowed on May 1, 1992. Two-thirds of the subsite was moldboard-plowed on May 7 and the other third chiselled on May 8 to compare weed control and erosive qualities of the two tilling systems. Both subsites were disced and harrowed on June 27. Hay was applied on July 3, immediately followed by harrowing. Another native grass hay mulch was then crimped on top of the soil.

#### 2.3.8 Ladora Test Plots

These plots were designed to test differences between spring and fall seeding times of varied seed mixes in the Bresser sandy loam soil characteristic of the southern portions of the Arsenal and to demonstrate restoration efforts to visitors. The plots were established west of Lake Ladora during September 1991 in conjunction with a planned trail and recreation system. Approximately 30 acres were set aside for this purpose.

In late September 1991, eight 1-acre plots were staked within the test plot area. The four plots on the northern end of the area were designated for fall seeding and the four plots on the southern end were designated for spring seeding. Each of the four fall seeded areas received a different seed mix (Table 1). All plots were mowed on June 3 and July 6 and sprayed with 2,4-D on July 21.

The spring plots were chiselled, disced, harrowed, seeded, and mulched on April 30-May 1, 1992. Mulch was applied on only two plots. Two were split into thirds. Desert Bloom (a soil additive for retaining soil moisture) was incorporated into the soil in one-third of the plots. Desert Bloom was also applied to the surface of this third and to another untreated third. The remaining third received a standard mulch.

Vegetation data will not be collected at this site until Fall 1993. Therefore, this site is not addressed in the Results and Discussion section of this report.



#### 2.3.9 Section 29 Test Plots

These plots were designed to duplicate the Ladora Test Plots for comparisons between sandy soils found in the southern portion of the Arsenal and the soils with higher clay content (Weld loam) characteristic of the northern portion of the Arsenal.

The entire site was mowed on May 8, 1992. On the same day, two-thirds of the site was moldboard-plowed and one-third chiselled. The entire site was disced on September 4 and scheduled for harrowing, seeding, harrowing again, and mulching on October 1-6.

Vegetation data will not be collected at this site until Fall 1993. Therefore, this site is not addressed in the Results and Discussion section of this report.

### 3.0 RESULTS AND DISCUSSION

In general, the habitat manipulation projects in the BEMA continued to be successful. Seeded species have established well, total percent cover by vegetation is adequate to prevent erosion, and species diversity continues to increase with plant community development. Establishment of shrub species through seeding is still problematic.

#### 3.1 SITE 1A

After three growing seasons, Site 1A has made considerable progress developing a stable sand prairie community. Perennial grasses, especially the seeded species, continue to increase in percent cover (Table 1). Annual and biennial forbs increased in percent cover by twice that of the previous season (21%-42%). Seventy-five percent of the annual forb cover was provided by white pigweed (Amaranthus blitoides), common sunflower (Helianthus annuus), wild lettuce, and sweetclover (Melilotus ssp). These annual forbs are all desirable and provide forage for a diversity of wildlife. The other twenty-five percent of cover provided by annual forbs was divided among twenty-one species. These additional plant species increased mean plant species diversity in the area from 7 species per transect in 1991 to 13.7 in 1992. Cover by perennial forbs decreased somewhat (13%-6%) compared to the previous growing season. This may be due to the use of herbicide for the control of Canada thistle during 1991. Perennial forbs should recover in the absence of herbicide use. Cover by cheatgrass increased (3%-10%) over 1991.

Needle-and-thread grass hay mulch was applied to a 2 acre subplot within Site 1A in 1991. This operation was conducted in an effort to promote volunteer of needle-and-thread grass from seed in the RMA harvested mulch. To evaluate the test, the area was stratified into twenty equal portions and 1/8 meter quadrates

were randomly placed within each. The number of needle-and-thread grass plants in each quadrat was counted. Needle-and-grass plant density was approximately the same in 1992 as in 1991 (30 and 29 plants per square meter respectively, Table 2). However, the plants were much larger in 1992. Estimated cover of needle-and-thread grass increased from 1-2% per quadrat in 1991 to over 13% per quadrat in 1992 (Table 2). Almost all of the needle-and-thread grass plants produced seed in 1992.

As in previous years, shrubs were notably absent from Site 1A. In general, there has been a lack of success in establishing shrubs from seed at areas within the BEMA vegetation management program. The shrub species {i.e. sand sagebrush (Oligosporus filifolius), fringed sagebrush, and rubber rabbitbrush (Chrysothamnus nauseosus)} that have been selected for these sites have seeds that are extremely small and may be very sensitive to depth of planting. Mulch may also be a factor effecting establishment of shrub seedlings. Although mulch may provide conditions suitable for establishment of native grass and forbs, those conditions may not be suitable for establishment of shrubs. Soil moisture may be high and soil temperature may be low in areas where mulch is applied. These conditions could be responsible for low seedling vigor of the shrub species selected.

Outside of the BEMA vegetation program, however, there is one notable exception to the lack of shrub establishment from seed. A pipeline construction project located adjacent to "D" street in Section 25 was revegetated with a native species mix that contained four-wing saltbush (Atriplex canescens) as the shrub species. Excellent establishment of this species occurred during the first season. At this site, shrub density averaged 2.4 per square meter. Many individuals were 12-15" tall and contained multiple stems. This species should be considered in future seeding efforts while requirements of establishment of other species are investigated.

Further intensive management of this Site 1A is not required. However, addition of shrubs and controlled burning of the site should be considered.

### 3.2 SITE 1B

Site 1B was seeded in the fall of 1991. After one season of growth, a diversity of perennial grasses was established, and there was moderate cover (14%) provided by annual, biennial, and perennial forbs. Plant species diversity and total vegetation cover are comparable to that occurring in Site 1A after one season (Table 2).

### 3.3 SITE 1C

Site 1C is an 18 acre site in the northeast corner of Section 7 initiated in 1992. After initial vegetation control, the seed bed was prepared and the area was seeded and mulched. Most of the area was seeded to a mixture of switchgrass, blue grama, prairie sandreed and sand bluestem. Two lowland areas with moist soils dominated by Canada thistle prior to control were seeded only with switchgrass. The primary goal for these sub-areas is to establish a dense cover of tall grass that will compete with Canada thistle and deter re-invasion. Of the grass species in the mix, switchgrass is the most appropriate to serve this function. A secondary benefit of this strategy is landscape diversification. Generally, when an area is revegetated with a species mix, numerous species are established rather regularly over the landscape. As the plant community develops over decades, species begin to sort out based on micro-site adaptations. Stratifying the area and seeding adapted species to specific microsites may be a technique to accelerate plant community development. A variety of forbs were also broadcast seeded by hand at discrete locations in the effort to break up the homogeneity of the reseeded site.

#### 3.4 SITE 2

Structural diversification of vegetation continued in Site 2. The area was mowed into a mosaic pattern to maximize the amount of edge between short and taller vegetation. USFWS constructed several brush piles in the area creating additional areas for cover.

#### 3.5 SITE 3

No management practices were conducted in Site 3 during 1992. Inspection of the existing rubber rabbitbrush plants indicated a decadent stand of old individuals. Many of the shrubs were dead and dying, and no seedling establishment was obvious. Investigation of environmental requirements and relationships for rabbitbrush is ongoing.

#### 3.6 SITE 4A

Site 4A is an exceptionally well developed area after three growing seasons. Perennial grasses, especially seeded species, perennial forbs, annual forbs, total vegetation cover, and diversity increased over previous years (Table 4). Two important aspects of this site are the diversity that has developed (a mean of 15.4 species per sample) and the height/productivity the vegetation has generated. Although neither height nor productivity data were collected at the site, much of the vegetation was over two meters tall and biomass production at this site is certainly greater than for any other area on RMA. It is estimated that dry weight production exceeds 150 grams per square meter at this site. The area was used extensively by deer during 1992 as evidenced by bedding areas and grazed vegetation, as well as the presence of deer during every inspection of the site. In order to maintain the high production level at this site, a controlled burning program may be necessary.

Two wildflowers that are uncommon on RMA (prairie coneflower (Ratibida columnifera) and tall evening primrose (Oenothera villosa) are well established at this site even though these were not included in the seed mix. Occurrence of these species add to the uniqueness of this site.

### 3.7 SITE 4B

Seeded species did not develop extensively at Site 4B during the first growing season. The same condition occurred at Site 4A during the first season. Annual weed species were extensive at Site 4B (29% cover, Table 5). These were mowed twice to encourage development of seeded species. The area will continue to be managed (e.g., mowing will likely be appropriate) and monitored for establishment of seeded tall grass prairie species.

### 3.8 SITE 4C

Site 4C, a 30 acre parcel north of 4A and 4B, was added to the BEMA program in 1992. The initial objective for this area was to re-seed with native species. However, upon more intensive survey of the site it was determined that the area contained a number of desirable species along with a serious component of Canada thistle and cheatgrass. The management plan for this area was changed to only conduct mowing for control of cheatgrass and application of herbicides for control of Canada thistle. In the fall, the area appeared to be improved (Table 6) and will continue to be monitored. Additional intensive vegetation control is not warranted at this time. However, productivity at the site could be increased by burning. The large amount of biomass in both vegetation and litter (Table 6) would be adequate for a spring burn.

### 3.9 SITE 5A

Although total vegetation cover (65%) increased at Site 5A, cover by perennial grasses decreased (25%-16%) primarily due to a decrease (11%-5%) in cover by warm season grasses (Table 7). The increase in total cover was primarily due to an increase in kochia (Bassia sieversiana) and other annual forbs. The increase in annual forbs at this site also resulted in a rise in species diversity. Cover by Canada thistle at this site also increased to 3.6% from 1.2% in previous years. This is a very aggressive perennial species with little use for wildlife. It has proven extremely difficult to control at all areas, but especially at Site 5A. Although further intensive management practices are not warranted for this site, control of the isolated patches of Canada thistle should be considered. Control may be feasible with volunteer labor.

### 3.10 SITE 5B

Cover by cool season perennial grasses (7%-9%), perennial forbs (3%-11%), annual forbs (5%-29%), as well as total vegetation cover (37%-71%) and diversity increased at Site 5B. Cover by warm season grasses decreased primarily due to a decrease in sand dropseed (Sporobolus cryptandrus) and buffalo grass (Buchloe dactyloides). Cover by blue grama increased, however. The moisture regime at this site may be better suited to mixed grass prairie species as evidenced by the increase in cover by western wheatgrass and foxtail barley (Critiesion jubatum). Several species of annual forbs desirable as wildlife forage provided considerable cover and resulted in an increase in diversity at the site. These included sweetclover, orache (Atriplex hastata), kochia, and white pigweed. As with Site 5A, a flag of caution is raised by the increase in cover by Canada thistle in 1992 over 1991 (Table 8).

### 3.11 SITE 5C

Site 5C was seeded in the fall of 1991. Management practices during 1992 consisted of weed control through mowing and herbicide application. Total vegetation cover was 70.5 percent. Annual and biennial forbs, especially kochia and sweetclover, dominated the area contributing 65 percent of the total vegetation cover. Seeded grasses comprised about 7% of the total vegetation cover, and many seedlings of western and slender wheatgrass were observed. Species diversity was relatively high (11.3 species per transect) in that the area has had only one season of development (Table 9).

### 3.12 SITE 6 EAST

Site 6 East continues to support a monotypic stand of western wheatgrass which contributes about 77% of the total vegetation cover of 53%. Cover by perennial and annual forbs decreased (42%-13%) at the site resulting in a decrease of total vegetation cover (83%-53%) compared with previous years. Plant species diversity also decreased and is low at a mean of 2.8 species per transect (Table 10). Prairie dogs are using the area which will likely result in an increase in species diversity as adventive species move into areas disturbed by prairie dogs.

### 3.13 SITE 6 WEST

Site 6 West supports a more diverse community even though it has been managed to promote establishment of western wheatgrass similarly to Site 6 East. Cover by western wheatgrass, as well as species diversity increased (6.0-9.4 species/transect) at this site compared to 1991. Cover by annual forbs, especially kochia and Russian thistle (Salsola australis), decreased significantly from 46% in 1991 to 16% in 1992. Cover by cheatgrass increase



dramatically from 3% in 1991 to 28% in 1992. There was no change in total vegetation cover (64%, Table 11).

### 3.14 SITE 7A

Site 7A continues to support a diverse grassland community. Perennial grass cover is somewhat lower (46%-36%) than in 1991, but continues to be high. Annual forb cover also decreased in 1992 (30%-16%) primarily due to a decrease in cover by kochia. Annual grass cover increased due to an increase in Japanese brome (Bromus japonicus). Species diversity also increased (8.0 to 11.0 species per transect) at this site in 1992. Cover by perennial grasses was somewhat lower (46%-36% in 1992, but cover by litter was considerably higher (15%-30%, Table 12). Standing biomass may be beginning to inhibit plant production. Controlled burning should be considered in future management planning.

### 3.15 SITE 7B

Site 7B continued to progress. Warm season grasses, especially sand dropseed, increased in cover (28%-35%), as did annual forbs (7%-20%) due to an increase in kochia. Total vegetation cover and species diversity also increased at this site in 1992. Cover by cool season perennial grasses decreased (5%-3%) due a decrease in cover by slender wheatgrass, a short lived species. Cover by annual grasses also decreased (14%-2%). Cheatgrass and Japanese brome combined contribute less the 1% cover (Table 13).

### 3.16 NEEDLE-AND-THREAD GRASS HARVEST AREA

The needle-and-thread harvest area is relatively unchanged from 1991 (Table 14). Annual forb cover and species diversity increased. This increase should not effect the management goals for this site. A 7.5 acre extension of the harvest area was seeded in 1992. The area was mowed to remove the tall vegetation

before plowing. To test the ability of two types of plows to bury weed seeds, one third of the area was chiseled and the other two thirds moldboard plowed. The moldboard plow turned the soil over much better and greatly reduced the germination of weedy species during the summer months. The composition of plant species that occurred in late summer on the moldboard plowed area was also different from the chiseled area. Native, broadleaf species dominated in the plowed area, whereas cheatgrass, bindweed and Canada thistle were more prevalent in the chiseled zone. Because of these differences, the chisel plowed area was moldboard plowed before final seed bed preparation. Needle-and-thread grass hay harvested from the plot just south of the new plot was applied as mulch and crimped into the soil. Some grass hay was added to provide sufficient mulch coverage of the soil surface.

### 3.17 LOWER DERBY LAKE SPILLWAY

Although not one of the areas being manipulated under the vegetation management program for BEMA, cover data has been collected on the area disturbed by the construction of the Lower Derby Lake spillway. Topsoil was salvaged and re-spread over the disturbed area. The area was then seeded with a native species mix. Barley straw was applied as a mulch over the area.

Over the two years of data collection, perennial grass cover increased from 4% to 7%, and annual forb cover dropped slightly from 46% to 38%. Total vegetative cover remained about the same at 51% (Table 14). The site remains in the early stages of plant community development.

This area was dominated by sand sagebrush prior to disturbance. Even though topsoil was salvaged and re-spread and a variety of shrub species were included in the seed mix used for revegetation, no shrub seedlings have been observed at this location.

Table 1

BEMA VEGETATION MANAGEMENT SITE 1A DATA SUMMARY FOR  
1990-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR  
CATEGORY.

Species	1990	1991	1992
Sample Size	5	6	6
COOL SEASON PERENNIAL GRASSES			
Aristida purpurea var. longise	0.00	0.00	0.01
Critesion jubatum	0.00	1.67	0.00
Pascopyrum smithii	0.40	0.01	0.00
Stipa comata	1.20	0.67	2.50
Subtotal	1.60	2.34	2.51
WARM SEASON PERENNIAL GRASSES			
Andropogon gerardi	0.00	0.00	0.50
Andropogon hallii	0.00	0.01	3.33
Buchloe dactyloides	0.40	0.00	0.00
Calamovilfa longifolia	0.00	0.67	0.83
Chondrosum gracile	0.00	4.33	6.83
Panicum virgatum	0.00	0.01	1.67
Sorghastrum avenaceum	0.00	0.00	0.50
Sporobolus cryptandrus	2.40	16.67	9.33
Subtotal	2.80	21.69	23.00
INTRODUCED PERENNIAL GRASSES			
Poa pratensis	0.00	0.00	0.01
Subtotal	0.00	0.00	0.01
ANNUAL GRASSES			
Anisantha tectorum	13.20	3.00	9.83
Cenchrus longispinus	0.00	0.33	0.00
Eragrostis cilianensis	0.80	2.00	0.00
Panicum capillare	0.00	2.00	0.17
Subtotal	14.00	7.33	10.00
PERENNIAL FORBS			
Ambrosia psilostachya	1.60	8.00	3.33
Argemone polyanthemom	0.00	0.01	0.00
Asclepias speciosa	0.00	0.01	0.01
Convolvulus arvensis	4.80	1.33	1.17
Lygodesmia juncea	0.40	0.33	0.17

Table 1 (cont.) BEMA VEGETATION MANAGEMENT SITE 1A DATA SUMMARY FOR  
1990-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR  
CATEGORY.

Species	1990	1991	1992
Medicago sativa	6.00	0.00	0.00
Nuttallia nuda	1.60	0.01	0.17
Oenothera villosa	1.20	0.00	0.00
Physalis virginiana	1.60	3.00	0.50
Tragopogon dubius	0.00	0.00	0.01
Verbascum thapsus	0.00	0.00	0.01
Subtotal	17.20	12.70	5.36
ANNUAL AND BIENNIAL FORBS			
Amaranthus arenicola	0.00	3.00	0.00
Amaranthus blitoides	0.00	2.00	0.00
Amaranthus retroflexus	2.40	0.00	0.00
Bassia sieversiana	1.20	0.00	0.17
Chamaesyce glyptosperma	0.00	4.00	0.00
Chamaesyce serpyllifolia	0.00	0.01	0.00
Chenopodium album	0.40	0.33	3.83
Chenopodium leptophyllum	0.00	0.00	0.83
Cleome serrulata	0.00	0.00	0.01
Conyza canadensis	0.00	0.00	0.50
Croton texensis	0.60	0.33	0.17
Cyclachaena xanthifolia	0.00	0.00	1.00
Eriogonum annuum	0.00	0.00	0.01
Gaura parviflora	0.00	0.00	0.01
Helianthus annuus	0.00	0.01	4.83
Lactuca serriola	0.40	1.00	17.33
Lappula redowskii	0.40	0.00	0.00
Machaeranthera canescens	0.80	0.00	0.00
Melolotis species	0.00	1.00	5.83
Poinsettia dentata	0.00	4.67	0.00
Polygonum aviculare	0.40	0.00	0.01
Polygonum ramocissiumum	0.00	0.00	0.50
Salsola australis	2.60	4.33	3.50
Sisymbrium altissimum	0.00	0.00	3.50
Verbena bracteata	0.00	0.00	0.01
Ximenesia encelioides	0.80	0.00	0.00
Subtotal	10.00	20.69	42.05
CACTI AND SUCCULENTS			
Opuntia polyacantha	0.40	0.01	0.01
Subtotal	0.40	0.01	0.01

Table 1 (cont.) BEMA VEGETATION MANAGEMENT SITE 1A DATA SUMMARY FOR  
1990-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR  
CATEGORY.

Species	1990	1991	1992
LITTER	34.00	25.67	14.00
TOTAL VEGETATION	46.80	64.67	82.83
LITTER/ROCK	34.00	25.67	14.00
BARE SOIL	19.20	9.67	3.17
TOTAL COVER	80.80	90.33	96.83
No. Species/Sample	8.60	8.00	13.67

Table 2  
BEMA SITE 1A NEEDLE-AND-THREAD GRASS MULCH SUBPLOT  
2 ACRES

	1991	1992
Number of quadrats	20	20
Total number of needle-and-thread grass plants	72	75
Average number of needle-and-thread grass plants per quadrat*	3.6	3.75
Average number of needle-and-thread grass plants per square meter	28.8	30
Needle-and-thread grass cover per quadrat (visual estimate)	NA	13.15
Total vegetation cover per quadrat (visual estimate)	26.85	43.4

\* quadrat = 1/8 square meter

Table 3

BEMA VEGETATION MANAGEMENT SITE 1B DATA SUMMARY FOR  
1991-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR  
CATEGORY.

Species	1991	1992
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Sample Size	5	8
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## COOL SEASON PERENNIAL GRASSES

Elymus trachycaulus	0.00	0.13
Pascopyrum smithii	0.00	0.13
Schedonnardus paniculatus	0.00	0.13
Subtotal	0.00	0.38

## WARM SEASON PERENNIAL GRASSES

Andropogon hallii	0.00	0.63
Panicum virgatum	0.00	0.38
Sporobolus cryptandrus	41.20	21.13
Subtotal	41.20	22.13

## ANNUAL GRASSES

Anisantha tectorum	4.80	0.25
Cenchrus longispinus	0.00	0.25
Echinochloa crus-galli	0.00	0.13
Eragrostis cilianensis	1.60	1.50
Panicum capillare	0.01	4.25
Setaria viridis	0.01	1.88
Subtotal	6.42	8.25

## PERENNIAL FORBS

Ambrosia psilostachya	0.01	0.50
Argemone polyanthemus	0.00	0.63
Asclepias speciosa	0.80	0.13
Cirsium arvense	1.20	0.50
Cirsium undulatum	0.01	0.00
Convolvulus arvensis	0.80	0.38
Lygodesmia juncea	0.80	0.13
Physalis heterophylla	0.80	0.00
Physalis virginiana	3.20	6.00
Verbascum thapsus	0.40	2.75
Subtotal	8.02	11.00

## ANNUAL AND BIENNIAL FORBS

Amaranthus retroflexus	0.01	0.00
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Table 3 (cont.) BEMA VEGETATION MANAGEMENT SITE 1B DATA SUMMARY FOR  
1991-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR  
CATEGORY.

Species	1991	1992
Bassia sieversiana	0.00	2.38
Chenopodium album	0.40	0.38
Croton texensis	0.00	0.25
Portulaca oleracea	0.80	0.00
Salsola australis	4.80	0.25
Subtotal	6.01	3.25
SHRUBS		
Oligosporus filifolius	0.01	0.00
Subtotal	0.01	0.00
CACTI AND SUCCULENTS		
Opuntia polyacantha	0.01	0.00
Subtotal	0.01	0.00
LITTER	26.80	42.00
TOTAL VEGETATION	62.00	45.00
LITTER/ROCK	26.80	42.00
BARE SOIL	11.20	13.00
TOTAL COVER	88.80	87.00
No. Species/Sample	5.80	9.00



Table 4

BEMA VEGETATION MANAGEMENT SITE 4A DATA SUMMARY FOR  
1991-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR  
CATEGORY.

Species	1991	1992
Sample Size	5	5
COOL SEASON PERENNIAL GRASSES		
Aristida purpurea var. longise	0.01	0.00
Elymus canadensis	0.00	2.20
Elymus trachycaulus	0.00	0.20
Subtotal	0.01	2.40
WARM SEASON PERENNIAL GRASSES		
Andropogon gerardi	0.00	0.01
Bouteloua curtipendula	10.40	10.60
Chondrosium gracile	0.01	0.00
Muhlenbergia asperifolia	0.00	0.20
Panicum virgatum	0.40	7.00
Sorghastrum avenaceum	0.00	0.60
Subtotal	10.81	18.41
INTRODUCED PERENNIAL GRASSES		
Agropyron cristatum	0.00	0.20
Bromopsis inermis	0.00	0.20
Subtotal	0.00	0.40
ANNUAL GRASSES		
Anisantha tectorum	0.40	0.01
Bromus japonicus	0.00	0.20
Echinochloa crus-galli	0.40	0.00
Eragrostis cilianensis	0.01	0.00
Panicum capillare	1.60	1.60
Setaria viridis	0.40	0.01
Sorghum vulgare	0.40	0.00
Subtotal	3.21	1.82
PERENNIAL FORBS		
Achillea lanulosa	0.01	0.01
Ambrosia psilostachya	0.00	0.20
Asclepias speciosa	0.01	0.01
Cirsium arvense	1.60	0.60

Table 4 (cont.) BEMA VEGETATION MANAGEMENT SITE 4A DATA SUMMARY FOR  
1991-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR  
CATEGORY.

Species	1991	1992
Convolvulus arvensis	2.00	10.00
Erigeron pumilus	0.00	0.60
Glycyrrhiza lepidota	1.20	0.00
Medicago sativa	0.80	0.00
Nepeta cataria	0.01	1.80
Oenothera villosa	0.01	3.20
Ratibida columnifera	0.00	0.01
Solidago canadensis	0.00	0.01
Tragopogon dubius	0.00	0.01
Urtica gracilis	0.00	0.20
Verbascum thapsus	0.01	0.60
Subtotal	5.65	17.25
ANNUAL AND BIENNIAL FORBS		
Amaranthus blitoides	5.20	0.00
Amaranthus retroflexus	0.80	0.00
Ambrosia trifida	0.00	0.01
Atriplex hastata	0.00	1.80
Bassia sieversiana	0.40	18.00
Carduus nutans ssp. macrolepis	6.00	10.80
Chenopodium album	0.80	0.40
Conyza canadensis	0.01	3.40
Cyclachaena xanthifolia	0.00	1.40
Fallopia convolvulus	17.60	0.00
Gaura parviflora	0.00	2.20
Lactuca serriola	0.40	3.80
Machaeranthera tanacetifolia	0.00	0.01
Melilotus alba	0.00	11.40
Polygonum ramocissiumum	0.00	0.20
Rumex triangulivalvis	0.40	0.01
Salsola australis	0.00	0.01
Sisymbrium altissimum	0.00	0.20
Solanum rostratum	0.01	0.00
Solanum triflorum	0.40	0.00
Verbena bracteata	0.40	0.20
Subtotal	32.42	53.84
LITTER	44.80	6.00
TOTAL VEGETATION	52.00	94.00

Table 4 (cont.) BEMA VEGETATION MANAGEMENT SITE 4A DATA SUMMARY FOR  
1991-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR  
CATEGORY.

Species	1991	1992
LITTER/ROCK	44.80	6.00
BARE SOIL	3.20	0.05
TOTAL COVER	96.80	100.00
No. Species/Sample	8.00	15.40

Table 5

BEMA VEGETATION MANAGEMENT SITE 4B INITIAL COVER DATA  
SUMMARY. BASED ON DATA COLLECTED IN OCTOBER 1992 FROM 5 50  
METER LINE-POINT TRANSECTS.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	Importance Value	Rank
<b>COOL SEASON PERENNIAL GRASSES</b>							
<i>Critesion jubatum</i>	1.80	3.28	0 - 9	20.00	1.56	4.85	13
<i>Distichlis spicata</i> var. <i>stricta</i>	0.80	1.46	0 - 2	40.00	3.13	4.58	14
<i>Elymus canadensis</i>	0.20	0.36	0 - 1	20.00	1.56	1.93	20
<i>Elymus trachycaulus</i>	0.40	0.73	0 - 2	20.00	1.56	2.29	19
<i>Pascopyrum smithii</i>	0.60	1.09	0 - 2	40.00	3.13	4.22	15
Sub-total	3.80	6.93					
<b>WARM SEASON PERENNIAL GRASSES</b>							
<i>Bouteloua curtipendula</i>	0.20	0.36	0 - 1	20.00	1.56	1.93	20
<i>Panicum virgatum</i>	0.40	0.73	0 - 1	40.00	3.13	3.85	17
Sub-total	0.60	1.09					
<b>ANNUAL GRASSES</b>							
<i>Anisantha tectorum</i>	2.00	3.65	0 - 8	60.00	4.69	8.34	9
<i>Bromus japonicus</i>	0.20	0.36	0 - 1	20.00	1.56	1.93	20
<i>Echinochloa crus-galli</i>	<0.01	<0.01	0 - <1	0.00	0.00	0.00	22
<i>Panicum capillare</i>	0.80	1.46	0 - 2	40.00	3.13	4.58	14
<i>Setaria viridis</i>	<0.01	<0.01	0 - <1	20.00	1.56	1.57	21
Sub-total	3.00	5.48					
<b>PERENNIAL FORBS</b>							
<i>Ambrosia psilostachya</i>	<0.01	<0.01	0 - <1	0.00	0.00	0.00	22
<i>Asclepias incarnata</i>	<0.01	<0.01	0 - <1	0.00	0.00	0.00	22
<i>Asclepias speciosa</i>	<0.01	<0.01	0 - <1	0.00	0.00	0.00	22
<i>Calyptophus serrulata</i>	<0.01	<0.01	0 - <1	0.00	0.00	0.00	22
<i>Cardaria draba</i>	2.40	4.38	0 - 5	80.00	6.25	10.63	6
<i>Cirsium arvense</i>	0.80	1.46	0 - 2	60.00	4.69	6.15	10
<i>Convolvulus arvensis</i>	11.60	21.16	0 - 25	80.00	6.25	27.41	2
<i>Erigeron pumilus</i>	<0.01	<0.01	0 - <1	0.00	0.00	0.00	22
<i>Glycyrrhiza lepidota</i>	0.20	0.36	0 - 1	20.00	1.56	1.93	20
<i>Nepeta cataria</i>	<0.01	<0.01	0 - <1	0.00	0.00	0.00	22
<i>Oenothera villosa</i>	3.40	6.20	0 - 9	60.00	4.69	10.89	5
<i>Tragopogon dubius</i>	<0.01	<0.01	0 - <1	0.00	0.00	0.00	22
<i>Verbascum thapsus</i>	<0.01	<0.01	0 - <1	0.00	0.00	0.00	22
Sub-total	18.42	33.59					

Table 5(cont'd).

BEMA VEGETATION MANAGEMENT SITE 4B INITIAL COVER DATA  
SUMMARY. BASED ON DATA COLLECTED IN OCTOBER 1992 FROM 5 50  
METER LINE-POINT TRANSECTS.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	Importance Value	Rank
ANNUAL AND BIENNIAL FORBS							
Ambrosia trifida	0.20	0.36	0 - 1	20.00	1.56	1.93	20
Atriplex hastata	11.40	20.79	1 - 33	100.00	7.81	28.61	1
Bassia sieversiana	3.60	6.57	0 - 11	80.00	6.25	12.82	4
Carduus nutans ssp. macrolepis	3.00	5.47	0 - 7	60.00	4.69	10.16	7
Chenopodium album	1.40	2.55	0 - 7	20.00	1.56	4.12	16
Conyza canadensis	1.00	1.82	0 - 3	40.00	3.13	4.95	12
Cyclachaena xanthifolia	0.40	0.73	0 - 2	20.00	1.56	2.29	19
Fallopia convolvulus	4.20	7.66	1 - 8	100.00	7.81	15.47	3
Lactuca serriola	0.60	1.09	0 - 1	60.00	4.69	5.78	11
Melolotis species	2.00	3.65	0 - 4	80.00	6.25	9.90	8
Polygonum aviculare	0.40	0.73	0 - 1	40.00	3.13	3.85	17
Polygonum ramocissiumum	<0.01	<0.01	0 - <1	0.00	0.00	0.00	22
Rumex triangulivalvis	<0.01	<0.01	0 - <1	0.00	0.00	0.00	22
Salsola australis	0.80	1.46	0 - 4	20.00	1.56	3.02	18
Sub-total	29.00	52.90					
SUM OF SPECIES COVER	54.82						
Litter	39.60		34 - 51	100.00			
TOTAL VEGETATION	54.80 +/-	5.72					
LITTER/ROCK	39.60 +/-	7.33					
BARE SOIL	5.60 +/-	3.58					
TOTAL COVER	94.40 +/-	3.58					
Number of Species/sample	12.80						

Table 6

BEMA VEGETATION MANAGEMENT SITE 4C INITIAL COVER DATA  
SUMMARY. BASED ON DATA COLLECTED IN OCTOBER 1992 FROM 6 50  
METER LINE-POINT TRANSECTS.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	Importance Value	Rank
<b>COOL SEASON PERENNIAL GRASSES</b>							
<i>Aristida purpurea</i> var. <i>longise</i>	<0.01	<0.01	0 - <1	0.00	0.00	0.00	22
<i>Carex nebraskensis</i>	0.17	0.29	0 - 1	16.67	1.22	1.51	21
<i>Distichlis spicata</i> var. <i>stricta</i>	2.17	3.75	0 - 13	16.67	1.22	4.96	15
<i>Elymus canadensis</i>	2.33	4.03	0 - 5	66.67	4.88	8.91	6
<i>Elymus trachycaulus</i>	8.17	14.12	1 - 21	100.00	7.32	21.43	2
<i>Pascopyrum smithii</i>	2.00	3.46	0 - 7	50.00	3.66	7.12	9
<i>Schedonnardus paniculatus</i>	<0.01	<0.01	0 - <1	0.00	0.00	0.00	22
<i>Stipa viridula</i>	2.33	4.03	0 - 13	33.33	2.44	6.47	11
Sub-total	17.17	29.68					
<b>WARM SEASON PERENNIAL GRASSES</b>							
<i>Muhlenbergia asperifolia</i>	0.17	0.29	0 - 1	16.67	1.22	1.51	21
Sub-total	0.17	0.29					
<b>INTRODUCED PERENNIAL GRASSES</b>							
<i>Agropyron cristatum</i>	0.33	0.58	0 - 1	33.33	2.44	3.02	18
<i>Bromopsis inermis</i>	2.50	4.32	0 - 15	16.67	1.22	5.54	13
<i>Poa pratensis</i>	6.50	11.24	0 - 13	66.67	4.88	16.11	3
Sub-total	9.33	16.13					
<b>ANNUAL GRASSES</b>							
<i>Anisantha tectorum</i>	1.67	2.88	0 - 4	66.67	4.88	7.76	7
<i>Bromus japonicus</i>	1.33	2.30	0 - 4	50.00	3.66	5.96	12
Sub-total	3.00	5.19					
<b>PERENNIAL FORBS</b>							
<i>Ambrosia psilostachya</i>	<0.01	<0.01	0 - <1	0.00	0.00	0.00	22
<i>Cirsium arvense</i>	1.50	2.59	0 - 3	66.67	4.88	7.47	8
<i>Convolvulus arvensis</i>	9.83	17.00	7 - 12	100.00	7.32	24.32	1
<i>Erigeron pumilus</i>	0.67	1.15	0 - 2	50.00	3.66	4.81	16
<i>Glycyrrhiza lepidota</i>	0.33	0.58	0 - 2	16.67	1.22	1.80	20
<i>Medicago sativa</i>	0.17	0.29	0 - 1	16.67	1.22	1.51	21
<i>Mentha arvensis</i>	0.17	0.29	0 - 1	16.67	1.22	1.51	21
<i>Physalis virginiana</i>	<0.01	<0.01	0 - <1	0.00	0.00	0.00	22
<i>Tragopogon dubius</i>	<0.01	<0.01	0 - <1	0.00	0.00	0.00	22
<i>Verbascum thapsus</i>	<0.01	<0.01	0 - <1	0.00	0.00	0.00	22
Sub-total	12.67	21.91					

Table 6(cont'd).

BEMA VEGETATION MANAGEMENT SITE 4C INITIAL COVER DATA  
SUMMARY. BASED ON DATA COLLECTED IN OCTOBER 1992 FROM 6 50  
METER LINE-POINT TRANSECTS.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	Importance Value	Rank
ANNUAL AND BIENNIAL FORBS							
Amaranthus retroflexus	0.33	0.58	0 - 1	33.33	2.44	3.02	18
Ambrosia trifida	<0.01	<0.01	0 - <1	0.00	0.00	0.00	22
Annual and Biennial Forbs	0.17	0.29	0 - 1	16.67	1.22	1.51	21
Atriplex hastata	0.50	0.86	0 - 2	33.33	2.44	3.30	17
Bassia sieversiana	1.17	2.02	0 - 4	66.67	4.88	6.89	10
Carduus nutans ssp. macrolepis	4.67	8.07	0 - 16	83.33	6.10	14.16	4
Chenopodium album	1.00	1.73	0 - 4	50.00	3.66	5.39	14
Chenopodium leptophyllum	0.17	0.29	0 - 1	16.67	1.22	1.51	21
Conyza canadensis	0.50	0.86	0 - 2	33.33	2.44	3.30	17
Gaura parviflora	0.17	0.29	0 - 1	16.67	1.22	1.51	21
Lactuca serriola	3.67	6.34	0 - 6	66.67	4.88	11.22	5
Machaeranthera tanacetifolia	<0.01	<0.01	0 - <1	0.00	0.00	0.00	22
Melilotus alba	0.67	1.15	0 - 4	16.67	1.22	2.37	19
Melilotis species	1.67	2.88	0 - 5	66.67	4.88	7.76	7
Polygonum aviculare	<0.01	<0.01	0 - <1	0.00	0.00	0.00	22
Polygonum ramocissiumum	0.17	0.29	0 - 1	16.67	1.22	1.51	21
Salsola australis	0.67	1.15	0 - 2	50.00	3.66	4.81	16
Sisymbrium altissimum	<0.01	<0.01	0 - <1	0.00	0.00	0.00	22
Sub-total	15.51	26.80					
SUM OF SPECIES COVER	57.85						
Litter	37.33		29 - 44	100.00			
TOTAL VEGETATION	57.83 +/-	5.49					
LITTER/ROCK	37.33 +/-	5.54					
BARE SOIL	4.83 +/-	2.14					
TOTAL COVER	95.17 +/-	2.14					
Number of Species/sample	13.67						

Table 7

BEMA VEGETATION MANAGEMENT SITE 5A DATA SUMMARY FOR  
1990-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR  
CATEGORY.

Species	1990	1991	1992
Sample Size	5	5	5
COOL SEASON PERENNIAL GRASSES			
Critesion jubatum	0.80	0.40	2.60
Elymus canadensis	0.00	0.80	0.20
Elymus trachycaulus	50.40	4.40	2.00
Pascopyrum smithii	3.60	7.20	6.40
Schedonnardus paniculatus	0.00	0.00	0.01
Subtotal	54.80	12.80	11.21
WARM SEASON PERENNIAL GRASSES			
Buchloe dactyloides	0.00	0.01	0.00
Chondrosium gracile	3.60	7.20	1.80
Muhlenbergia asperifolia	0.00	0.00	0.20
Panicum virgatum	0.00	0.00	0.01
Sporobolus cryptandrus	0.80	5.20	2.60
Subtotal	4.40	12.41	4.61
INTRODUCED PERENNIAL GRASSES			
Bromopsis inermis	0.00	0.00	0.80
Festuca pratensis	0.00	0.00	0.40
Lolium perenne	0.40	0.00	0.00
Subtotal	0.40	0.00	1.20
ANNUAL GRASSES			
Anisantha tectorum	4.00	0.00	0.80
Bromus japonicus	0.00	0.00	0.01
Eragrostis cilianensis	0.00	0.40	0.00
Panicum capillare	0.00	0.01	0.20
Subtotal	4.00	0.41	1.01
PERENNIAL FORBS			
Ambrosia psilostachya	0.40	0.00	0.60
Asclepias speciosa	0.80	0.40	0.40
Cardaria draba	0.00	0.00	0.20
Cirsium arvense	1.20	1.20	3.60
Convolvulus arvensis	5.20	8.40	7.60



Table 7 (cont.) BEMA VEGETATION MANAGEMENT SITE 5A DATA SUMMARY FOR  
1990-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR  
CATEGORY.

Species	1990	1991	1992
Erigeron pumilus	0.00	0.00	0.01
Medicago sativa	0.00	0.00	0.01
Oenothera villosa	0.00	0.00	0.01
Senecio spartioides	0.00	0.00	0.01
Subtotal	7.60	10.00	12.44
ANNUAL AND BIENNIAL FORBS			
Amaranthus blitoides	0.00	0.00	1.40
Ambrosia trifida	0.00	0.00	0.01
Atriplex hastata	0.00	0.00	1.40
Bassia sieversiana	1.60	5.60	22.60
Carduus nutans ssp. macrolepis	0.40	0.00	2.60
Chenopodium album	1.60	0.00	1.60
Chenopodium leptophyllum	1.60	0.00	0.00
Conyza canadensis	0.00	0.00	0.01
Croton texensis	0.00	0.00	0.20
Cyclachaena xanthifolia	0.00	0.00	2.20
Fallopia convolvulus	0.00	0.00	0.01
Gaura parviflora	0.00	0.00	0.01
Helianthus annuus	0.00	0.00	0.20
Lactuca serriola	0.00	0.00	0.80
Machaeranthera tanacetifolia	0.00	0.00	0.01
Melilotus alba	0.80	0.00	0.00
Melilotis species	0.00	0.00	1.20
Polygonum aviculare	0.40	0.00	0.01
Polygonum ramocissiumum	0.00	0.00	0.60
Rumex triangulivalvis	0.00	0.00	0.20
Salsola australis	0.40	0.00	0.00
Ximenesia encelioides	0.00	0.00	0.01
Subtotal	6.80	5.60	35.07
CACTI AND SUCCULENTS			
Opuntia polyacantha	0.00	0.00	0.01
Subtotal	0.00	0.00	0.01
LITTER	10.00	41.20	30.60
TOTAL VEGETATION	78.00	41.20	65.40

Table 7 (cont.) BEMA VEGETATION MANAGEMENT SITE 5A DATA SUMMARY FOR  
1990-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR  
CATEGORY.

Species	1990	1991	1992
LITTER/ROCK	10.00	41.20	30.60
BARE SOIL	12.00	17.60	4.00
TOTAL COVER	88.00	82.40	96.00
No. Species/Sample	7.40	5.60	12.00

Table 8

BEMA VEGETATION MANAGEMENT SITE 5B DATA SUMMARY FOR  
1990-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR  
CATEGORY.

Species	1990	1991	1992
Sample Size	10	10	10
COOL SEASON PERENNIAL GRASSES			
Critesion jubatum	1.00	3.20	5.10
Distichlis spicata var.stricta	0.00	0.40	0.00
Elymus canadensis	0.20	1.40	1.00
Elymus trachycaulus	1.20	1.60	0.30
Pascopyrum smithii	0.00	0.80	3.00
Schedonnardus paniculatus	0.00	0.01	0.00
Subtotal	2.40	7.41	9.40
WARM SEASON PERENNIAL GRASSES			
Buchloe dactyloides	0.00	9.60	4.10
Chondrosum gracile	0.40	3.80	5.10
Muhlenbergia asperifolia	0.00	0.00	0.10
Sporobolus cryptandrus	0.80	5.20	3.60
Subtotal	1.20	18.60	12.90
INTRODUCED PERENNIAL GRASSES			
Bromopsis inermis	0.00	0.00	0.20
Chloris verticillata	0.00	0.01	0.00
Poa pratensis	0.00	0.20	0.00
Subtotal	0.00	0.21	0.20
ANNUAL GRASSES			
Anisantha tectorum	5.60	1.60	3.20
Bromus japonicus	0.00	0.80	4.50
Cenchrus longispinus	0.00	0.01	0.00
Eragrostis cilianensis	0.00	0.40	0.20
Panicum capillare	0.00	1.00	0.10
Setaria viridis	0.00	0.01	0.00
Subtotal	5.60	3.82	8.00
PERENNIAL FORBS			
Ambrosia psilostachya	2.20	0.00	0.10
Asclepias speciosa	0.00	0.01	0.10
Cardaria draba	0.20	0.40	0.60

Table 8 (cont.) BEMA VEGETATION MANAGEMENT SITE 5B DATA SUMMARY FOR  
1990-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR  
CATEGORY.

Species	1990	1991	1992
Cirsium arvense	3.40	0.01	1.20
Convolvulus arvensis	15.40	1.40	8.30
Erigeron pumilus	0.00	0.00	0.20
Glycyrrhiza lepidota	0.00	0.00	0.20
Physalis heterophylla	0.00	0.20	0.00
Physalis virginiana	0.00	0.20	0.01
Senecio spartioides	0.00	0.00	0.10
Verbascum thapsus	0.00	0.60	0.30
Subtotal	21.20	2.82	11.11
ANNUAL AND BIENNIAL FORBS			
Amaranthus blitoides	0.00	0.20	0.00
Amaranthus retroflexus	0.00	0.00	2.00
Ambrosia trifida	0.00	0.00	0.10
Atriplex hastata	0.00	0.00	4.40
Bassia sieversiana	8.60	1.80	4.30
Carduus nutans ssp. macrolepis	5.60	0.00	0.50
Chenopodium album	2.40	0.00	2.40
Chenopodium leptophyllum	7.40	0.00	0.00
Conyza canadensis	0.00	0.00	0.01
Croton texensis	0.00	0.01	0.00
Cyclachaena xanthifolia	0.00	0.00	2.10
Fallopia convolvulus	0.00	0.60	0.01
Gaura parviflora	0.00	0.00	0.01
Helianthus annuus	0.00	0.00	0.01
Helianthus petiolaris	0.00	0.00	0.01
Lactuca serriola	0.00	0.00	0.60
Lappula redowskii	0.20	0.00	0.00
Lepidium densiflorum	0.00	0.00	0.01
Machaeranthera tanacetifolia	0.00	0.00	0.01
Melolotis species	11.40	0.00	9.80
Polygonum aviculare	0.00	0.00	0.01
Polygonum ramocissiumum	0.60	0.00	1.70
Portulaca oleracea	0.00	0.01	0.10
Salsola australis	1.60	0.40	1.40
Solanum triflorum	0.00	1.80	0.00
Verbena bracteata	0.00	0.00	0.01
Ximenesia encelioides	0.00	0.00	0.01
Subtotal	37.80	4.82	29.50
CACTI AND SUCCULENTS			
Opuntia polyacantha	0.00	0.01	0.00
Subtotal	0.00	0.01	0.00

Table 8 (cont.) BEMA VEGETATION MANAGEMENT SITE 5B DATA SUMMARY FOR  
1990-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR  
CATEGORY.

Species	1990	1991	1992
LITTER	12.00	48.80	26.70
TOTAL VEGETATION	68.20	37.40	71.00
LITTER/ROCK	12.00	48.80	26.70
BARE SOIL	19.60	13.80	2.30
TOTAL COVER	80.40	86.20	97.70
No. Species/Sample	8.20	7.00	13.50

Table 9

BEMA VEGETATION MANAGEMENT SITE 5C INITIAL COVER DATA  
SUMMARY. BASED ON DATA COLLECTED IN SEPTEMBER 1992 FROM 10  
50 METER LINE-POINT TRANSECTS.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	Importance Value	Rank
<b>COOL SEASON PERENNIAL GRASSES</b>							
<i>Aristida purpurea</i> var. <i>longise</i>	0.10	0.14	0 - 1	10.00	0.88	1.03	20
<i>Critesion jubatum</i>	<0.01	<0.01	0 - <1	0.00	0.00	0.00	21
<i>Elymus canadensis</i>	<0.01	<0.01	0 - <1	0.00	0.00	0.00	21
<i>Elymus trachycaulus</i>	3.40	4.82	0 - 12	50.00	4.42	9.25	9
<i>Pascopyrum smithii</i>	3.10	4.40	0 - 9	90.00	7.96	12.36	6
Sub-total	6.60	9.36					
<b>WARM SEASON PERENNIAL GRASSES</b>							
<i>Muhlenbergia asperifolia</i>	0.10	0.14	0 - 1	10.00	0.88	1.03	20
<i>Sporobolus cryptandrus</i>	0.20	0.28	0 - 2	10.00	0.88	1.17	19
Sub-total	0.30	0.43					
<b>INTRODUCED PERENNIAL GRASSES</b>							
<i>Bromopsis inermis</i>	<0.01	<0.01	0 - <1	0.00	0.00	0.00	21
<i>Festuca pratensis</i>	0.20	0.28	0 - 2	10.00	0.88	1.17	19
Sub-total	0.20	0.29					
<b>ANNUAL GRASSES</b>							
<i>Anisantha tectorum</i>	6.00	8.51	0 - 18	60.00	5.31	13.82	5
<i>Bromus japonicus</i>	1.40	1.99	0 - 5	50.00	4.42	6.41	12
<i>Eragrostis cilianensis</i>	<0.01	<0.01	0 - <1	0.00	0.00	0.00	21
<i>Panicum capillare</i>	1.10	1.56	0 - 7	30.00	2.65	4.21	15
Sub-total	8.50	12.06					
<b>PERENNIAL FORBS</b>							
<i>Achillea lanulosa</i>	<0.01	<0.01	0 - <1	0.00	0.00	0.00	21
<i>Ambrosia psilostachya</i>	0.30	0.43	0 - 2	20.00	1.77	2.20	16
<i>Argemone polyanthemus</i>	<0.01	<0.01	0 - <1	0.00	0.00	0.00	21
<i>Asclepias speciosa</i>	<0.01	<0.01	0 - <1	0.00	0.00	0.00	21
<i>Cardaria draba</i>	0.30	0.43	0 - 2	20.00	1.77	2.20	16
<i>Cirsium arvense</i>	0.90	1.28	0 - 3	50.00	4.42	5.70	14
<i>Convolvulus arvensis</i>	7.20	10.21	1 - 19	100.00	8.85	19.06	3
<i>Erigeron pumilus</i>	<0.01	<0.01	0 - <1	0.00	0.00	0.00	21
<i>Glycyrrhiza lepidota</i>	0.30	0.43	0 - 3	10.00	0.88	1.31	18
<i>Oenothera coronopifolia</i>	0.10	0.14	0 - 1	10.00	0.88	1.03	20
<i>Physalis virginiana</i>	0.10	0.14	0 - 1	10.00	0.88	1.03	20
<i>Senecio spartioides</i>	<0.01	<0.01	0 - <1	0.00	0.00	0.00	21
Sub-total	9.21	13.05					

Table 9(cont'd).

BEMA VEGETATION MANAGEMENT SITE 5C INITIAL COVER DATA  
SUMMARY. BASED ON DATA COLLECTED IN SEPTEMBER 1992 FROM 10  
50 METER LINE-POINT TRANSECTS.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	Importance Value	Rank
ANNUAL AND BIENNIAL FORBS							
Amaranthus retroflexus	0.20	0.28	0 - 2	10.00	0.88	1.17	19
Ambrosia trifida	0.10	0.14	0 - 1	10.00	0.88	1.03	20
Atriplex hastata	3.70	5.25	0 - 15	50.00	4.42	9.67	8
Bassia sieversiana	11.80	16.73	0 - 31	90.00	7.96	24.70	2
Carduus nutans ssp. macrolepis	5.80	8.22	0 - 14	90.00	7.96	16.19	4
Chenopodium album	2.00	2.84	0 - 10	60.00	5.31	8.15	10
Chenopodium leptophyllum	0.20	0.28	0 - 2	10.00	0.88	1.17	19
Cleome serrulata	<0.01	<0.01	0 - <1	0.00	0.00	0.00	21
Conyza canadensis	<0.01	<0.01	0 - <1	0.00	0.00	0.00	21
Croton texensis	<0.01	<0.01	0 - <1	0.00	0.00	0.00	21
Cyclachaena xanthifolia	0.30	0.43	0 - 3	10.00	0.88	1.31	18
Gaura parviflora	<0.01	<0.01	0 - <1	0.00	0.00	0.00	21
Helianthus annuus	0.10	0.14	0 - 1	10.00	0.88	1.03	20
Lactuca serriola	1.30	1.84	0 - 7	50.00	4.42	6.27	13
Machaeranthera tanacetifolia	<0.01	<0.01	0 - <1	0.00	0.00	0.00	21
Melolotis species	13.80	19.57	0 - 46	70.00	6.19	25.76	1
Plantago patagonica	<0.01	<0.01	0 - <1	0.00	0.00	0.00	21
Polygonum ramocissiumum	2.60	3.69	0 - 16	40.00	3.54	7.23	11
Portulaca oleracea	<0.01	<0.01	0 - <1	0.00	0.00	0.00	21
Rumex triangulivalvis	0.20	0.28	0 - 2	10.00	0.88	1.17	19
Salsola australis	3.40	4.82	0 - 13	60.00	5.31	10.13	7
Sisymbrium altissimum	<0.01	<0.01	0 - <1	0.00	0.00	0.00	21
Solanum triflorum	0.20	0.28	0 - 1	20.00	1.77	2.05	17
Verbena bracteata	<0.01	<0.01	0 - <1	0.00	0.00	0.00	21
Sub-total	45.71	64.82					
SUM OF SPECIES COVER	70.52						
Litter	25.90		17 - 40	100.00			
TOTAL VEGETATION	70.50 +/-	7.60					
LITTER/ROCK	25.90 +/-	6.59					
BARE SOIL	3.60 +/-	2.27					
TOTAL COVER	96.40 +/-	2.27					
Number of Species/sample	11.30						

Table 10

BEMA VEGETATION MANAGEMENT SITE 6 EAST DATA SUMMARY FOR  
1990-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR  
CATEGORY.

Species	1990	1991	1992
Sample Size	5	5	5
COOL SEASON PERENNIAL GRASSES			
Aristida purpurea var. longise	0.00	0.01	0.00
Elymus canadensis	0.40	0.01	0.01
Pascopyrum smithii	17.20	40.00	40.40
Schedonnardus paniculatus	0.00	0.01	0.00
Subtotal	17.60	40.03	40.41
WARM SEASON PERENNIAL GRASSES			
Buchloe dactyloides	0.01	0.00	0.00
Chondrosum gracile	0.01	0.01	0.01
Sporobolus cryptandrus	0.00	0.40	0.00
Subtotal	0.02	0.41	0.01
INTRODUCED PERENNIAL GRASSES			
Agropyron cristatum	0.00	0.00	0.01
Subtotal	0.00	0.00	0.01
ANNUAL GRASSES			
Anisantha tectorum	0.00	0.01	0.01
Bromus japonicus	0.00	0.40	0.20
Subtotal	0.00	0.41	0.21
PERENNIAL FORBS			
Convolvulus arvensis	4.80	6.00	1.40
Machaeranthera pinnatifida	0.00	0.01	0.00
Sphaeralcea coccinea	0.00	0.00	0.05
Subtotal	4.80	6.01	1.45
ANNUAL AND BIENNIAL FORBS			
Bassia sieversiana	30.00	35.60	10.60
Carduus nutans ssp. macrolepis	0.00	0.01	0.00
Conyza canadensis	0.00	0.40	0.01
Descurainia pinnata	0.00	0.00	0.05



Table 10 (cont.) BEMA VEGETATION MANAGEMENT SITE 6 EAST DATA SUMMARY FOR  
1990-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR  
CATEGORY.

Species	1990	1991	1992
Helianthus annuus	0.00	0.00	0.05
Lactuca serriola	0.40	0.01	0.01
Plantago patagonica	0.00	0.00	0.05
Salsola australis	7.60	0.01	0.00
Sisymbrium altissimum	0.00	0.00	0.01
Subtotal	38.00	36.03	10.78
LITTER	8.80	8.80	42.00
TOTAL VEGETATION	60.40	82.80	52.60
LITTER/ROCK	11.20	8.80	42.00
BARE SOIL	29.20	8.40	5.40
TOTAL COVER	70.80	91.60	94.60
No. Species/Sample	4.20	3.40	2.60

Table 11

BEMA VEGETATION MANAGEMENT SITE 6 WEST DATA SUMMARY FOR  
1991-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR  
CATEGORY.

Species	1991	1992
Sample Size	5	5
COOL SEASON PERENNIAL GRASSES		
Aristida purpurea var. longise	1.20	0.20
Elymus canadensis	0.00	0.01
Pascopyrum smithii	8.00	14.60
Schedonnardus paniculatus	0.40	0.20
Subtotal	9.60	15.01
WARM SEASON PERENNIAL GRASSES		
Chondrosium gracile	0.40	0.60
Sporobolus cryptandrus	0.80	0.20
Subtotal	1.20	0.80
ANNUAL GRASSES		
Anisantha tectorum	3.20	28.40
Bromus japonicus	0.00	0.01
Eragrostis cilianensis	0.01	0.00
Panicum capillare	0.01	0.01
Subtotal	3.22	28.42
PERENNIAL FORBS		
Cirsium arvense	0.01	0.20
Convolvulus arvensis	0.40	0.00
Erigeron pumilus	0.00	0.40
Lygodesmia juncea	0.00	0.01
Machaeranthera pinnatifida	0.01	0.00
Oenothera caespitosa	0.01	0.00
Oenothera coronopifolia	0.00	1.00
Oenothera villosa	0.00	0.01
Psoralegium tenuiflorum	0.00	0.01
Ratibida columnifera	0.00	0.01
Sphaeralcea coccinea	0.01	0.20
Tragopogon dubius	0.00	0.40
Verbascum thapsus	0.01	0.20
Subtotal	0.45	2.44
ANNUAL AND BIENNIAL FORBS		
Bassia sieversiana	24.00	11.00

Table 11 (cont.) BEMA VEGETATION MANAGEMENT SITE 6 WEST DATA SUMMARY FOR  
1991-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR  
CATEGORY.

Species	1991	1992
Carduus nutans ssp.macrolepis	0.00	0.01
Chamaesyce serpyllifolia	1.20	0.00
Conyza canadensis	0.00	1.00
Lactuca serriola	0.00	1.80
Machaeranthera tanacetifolia	0.00	0.20
Plantago patagonica	0.00	0.01
Portulaca oleracea	0.80	0.01
Salsola australis	20.00	0.20
Sisymbrium altissimum	0.00	0.60
Verbena bracteata	0.00	1.80
Ximenesia encelioides	0.40	0.01
Subtotal	46.40	16.64
SEMI-SHRUBS OR HALF-SHRUBS		
Gutierrezia sarothrae	1.60	0.60
Subtotal	1.60	0.60
SHRUBS		
Eriogonum effusum	0.00	0.60
Subtotal	0.00	0.60
CACTI AND SUCCULENTS		
Opuntia polyacantha	0.00	0.01
Subtotal	0.00	0.01
LITTER	25.60	30.00
TOTAL VEGETATION	62.40	64.40
LITTER/ROCK	25.60	30.00
BARE SOIL	12.00	5.60
TOTAL COVER	88.00	94.40
No. Species/Sample	5.60	8.80

Table 12

BEMA VEGETATION MANAGEMENT SITE 7A DATA SUMMARY FOR  
1990-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR  
CATEGORY.

Species	1990	1991	1992
Sample Size	5	5	5
COOL SEASON PERENNIAL GRASSES			
Critesion jubatum	0.40	1.20	1.60
Elymus canadensis	2.80	4.40	1.80
Elymus trachycaulus	29.60	20.40	10.60
Hordeum brachyantherum	0.00	0.00	0.01
Pascopyrum smithii	2.80	16.00	21.00
Subtotal	35.60	42.00	35.01
WARM SEASON PERENNIAL GRASSES			
Calamovilfa longifolia	0.80	0.00	0.00
Chondrosum gracile	1.20	2.40	0.40
Sporobolus airoides	0.00	0.00	0.01
Sporobolus cryptandrus	0.00	1.20	0.40
Subtotal	2.00	3.60	0.81
INTRODUCED PERENNIAL GRASSES			
Agropyron cristatum	0.00	0.00	0.01
Bromopsis inermis	0.00	0.00	0.20
Poa pratensis	0.00	0.00	0.20
Subtotal	0.00	0.00	0.41
ANNUAL GRASSES			
Anisantha tectorum	23.60	2.00	2.60
Bromus japonicus	0.40	0.80	11.00
Eragrostis cilianensis	0.00	0.40	0.01
Panicum capillare	0.00	0.40	0.00
Subtotal	24.00	3.60	13.61
PERENNIAL FORBS			
Ambrosia psilostachya	0.00	0.00	0.40
Asclepias pumilus	0.00	0.00	0.20
Asclepias speciosa	0.40	0.40	0.01
Cirsium arvense	2.80	0.80	2.00
Convolvulus arvensis	2.80	3.20	1.40
Erigeron pumilus	0.00	0.00	0.01

Table 12 (cont.) BEMA VEGETATION MANAGEMENT SITE 7A DATA SUMMARY FOR  
1990-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR  
CATEGORY.

Species	1990	1991	1992
Grindelia squarrosa	0.00	0.00	0.01
Lygodesmia juncea	0.40	0.40	0.00
Nuttallia nuda	0.00	0.00	0.01
Physalis virginiana	0.00	0.01	0.01
Tragopogon dubius	0.00	0.00	0.01
Verbascum thapsus	0.00	0.00	0.01
Subtotal	6.40	4.81	4.07
ANNUAL AND BIENNIAL FORBS			
Amaranthus retroflexus	2.80	0.00	0.01
Atriplex hastata	0.00	0.00	0.80
Bassia sieversiana	16.40	28.40	9.20
Carduus nutans ssp. macrolepis	0.00	0.00	0.60
Chenopodium album	0.00	0.01	0.60
Conyza canadensis	0.00	0.00	1.60
Cyclachaena xanthifolia	0.00	0.00	1.20
Descurainia pinnata	0.00	0.00	0.01
Gaura parviflora	0.00	0.01	0.01
Lactuca serriola	0.00	0.01	0.60
Machaeranthera tanacetifolia	0.00	0.00	0.01
Melilotus alba	0.00	0.01	0.01
Melilotus officinalis	0.00	0.00	0.01
Other Annual/Biennial Forbs	0.00	0.40	0.00
Polygonum aviculare	0.40	0.00	0.00
Polygonum ramocissiumum	0.00	0.00	1.20
Salsola australis	0.80	0.80	0.00
Sisymbrium altissimum	0.00	0.00	0.01
Ximenesia encelioides	0.00	0.00	0.01
Subtotal	20.40	29.64	15.88
LITTER	5.20	14.80	29.60
TOTAL VEGETATION	88.40	83.60	69.60
LITTER/ROCK	5.20	14.80	29.60
BARE SOIL	6.40	1.60	0.80
TOTAL COVER	93.60	98.40	99.20
No. Species/Sample	8.00	7.60	11.00

Table 13

BEMA VEGETATION MANAGEMENT SITE 7B DATA SUMMARY FOR  
1990-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR  
CATEGORY.

Species	1990	1991	1992
Sample Size	5	5	5
COOL SEASON PERENNIAL GRASSES			
Critesion jubatum	0.40	0.01	0.60
Elymus canadensis	0.00	0.01	0.00
Elytrigia dasystachya	0.00	0.00	0.40
Elymus trachycaulus	3.20	3.60	0.40
Pascopyrum smithii	0.00	1.20	1.40
Subtotal	3.60	4.82	2.80
WARM SEASON PERENNIAL GRASSES			
Chondrosium gracile	0.00	0.01	0.01
Sporobolus cryptandrus	16.40	28.40	35.00
Subtotal	16.40	28.41	35.01
INTRODUCED PERENNIAL GRASSES			
Agropyron cristatum	0.00	0.00	0.01
Elytrigia intermedia var. barb	0.00	0.00	0.20
Festuca pratensis	0.00	0.00	0.01
Lophopyrum elongatum	0.00	0.00	0.01
Poa pratensis	0.00	0.00	0.20
Subtotal	0.00	0.00	0.43
ANNUAL GRASSES			
Anisantha tectorum	12.00	6.00	0.60
Bromus japonicus	0.00	4.00	0.01
Eragrostis cilianensis	1.60	0.80	0.01
Panicum capillare	3.60	3.20	0.20
Setaria viridis	0.00	0.01	0.80
Subtotal	17.20	14.01	1.62
PERENNIAL FORBS			
Ambrosia psilostachya	0.40	0.80	0.20
Asclepias speciosa	0.80	0.01	0.01
Cirsium arvense	2.00	0.01	0.60
Convolvulus arvensis	3.60	1.60	4.20
Erigeron pumilus	0.00	0.00	0.01

Table 13 (cont.) BEMA VEGETATION MANAGEMENT SITE 7B DATA SUMMARY FOR  
1990-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR  
CATEGORY.

Species	1990	1991	1992
Grindelia squarrosa	0.00	0.00	0.01
Lygodesmia juncea	0.40	0.80	1.00
Physalis virginiana	0.00	0.01	0.00
Psoralidium tenuiflorum	0.40	0.00	0.01
Sphaeralcea coccinea	0.40	0.00	0.00
Verbascum thapsus	0.00	0.00	0.20
Subtotal	8.00	3.23	6.24
ANNUAL AND BIENNIAL FORBS			
Amaranthus retroflexus	0.40	0.00	0.00
Bassia sieversiana	8.80	4.80	15.20
Carduus nutans ssp. macrolepis	0.00	0.00	3.60
Chenopodium album	0.00	0.01	0.00
Cyclachaena xanthifolia	0.00	0.00	0.01
Fallopia convolvulus	0.00	0.00	0.01
Gaura parviflora	0.00	0.01	0.00
Helianthus annuus	0.00	0.00	0.01
Lactuca serriola	0.00	0.01	0.00
Machaeranthera tanacetifolia	0.00	0.00	0.20
Melolotis species	0.00	0.01	0.20
Other Annual/Biennial Forbs	0.00	0.40	0.00
Polygonum ramocissiumum	0.00	0.00	0.20
Portulaca oleracea	0.00	0.00	0.01
Salsola australis	4.00	1.60	0.01
Solanum rostratum	0.00	0.00	0.01
Verbena bracteata	0.00	0.00	0.20
Ximenesia encelioides	0.00	0.00	0.40
Subtotal	13.20	6.84	20.06
SEMI-SHRUBS OR HALF-SHRUBS			
Artemisia frigida	0.00	0.00	0.01
Subtotal	0.00	0.00	0.01
CACTI AND SUCCULENTS			
Opuntia polyacantha	0.00	0.00	0.01
Subtotal	0.00	0.00	0.01

Table 13 (cont.) BEMA VEGETATION MANAGEMENT SITE 7B DATA SUMMARY FOR  
1990-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR  
CATEGORY.

Species	1990	1991	1992
LITTER	9.20	24.80	24.80
TOTAL VEGETATION	58.40	57.20	66.00
LITTER/ROCK	9.20	24.80	24.80
BARE SOIL	32.40	18.00	9.20
TOTAL COVER	67.60	82.00	90.80
No. Species/Sample	7.60	7.00	8.20



Table 14

NEEDLE-AND-THREAD GRASS HARVEST AREA SITE A DATA SUMMARY  
FOR 1991-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES  
OR CATEGORY.

Species	1991	1992
Sample Size	5	5
COOL SEASON PERENNIAL GRASSES		
Aristida purpurea var. longise	0.01	2.00
Elymus canadensis	0.40	0.00
Pascopyrum smithii	0.01	0.01
Stipa comata	26.80	21.20
Subtotal	27.22	23.21
WARM SEASON PERENNIAL GRASSES		
Chondrosium gracile	0.00	0.01
Sporobolus cryptandrus	29.60	16.80
Subtotal	29.60	16.81
INTRODUCED PERENNIAL GRASSES		
Agropyron cristatum	0.00	0.01
Bromopsis inermis	0.00	0.01
Subtotal	0.00	0.02
ANNUAL GRASSES		
Anisantha tectorum	0.00	0.40
Eragrostis cilianensis	0.01	0.00
Panicum capillare	0.40	1.00
Subtotal	0.41	1.40
PERENNIAL FORBS		
Ambrosia psilostachya	0.40	0.80
Ambrosia tomentosa	0.01	0.00
Argemone polyanthemos	0.01	0.20
Cirsium arvense	0.00	0.01
Cirsium undulatum	0.00	0.01
Convolvulus arvensis	0.01	0.20
Erigeron pumilus	0.00	0.01
Heterotheca villosa	0.00	0.20
Lygodesmia juncea	0.01	0.20
Nuttallia nuda	0.00	0.01
Physalis hederifolia	0.01	0.00

Table 14 (cont.) NEEDLE-AND-THREAD GRASS HARVEST AREA SITE A DATA SUMMARY  
FOR 1991-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES  
OR CATEGORY.

Species	1991	1992
Physalis heterophylla	0.00	0.01
Physalis virginiana	0.80	0.01
Psoralidium tenuiflorum	0.00	0.01
Sphaeralcea coccinea	0.01	0.01
Taraxacum officinale	0.01	0.01
Tragopogon dubius	0.00	0.01
Tradescantia occidentalis	0.01	0.00
Verbascum thapsus	0.00	0.20
Subtotal	1.28	1.90
ANNUAL AND BIENNIAL FORBS		
Amaranthus retroflexus	0.00	0.01
Bassia sieversiana	0.00	0.01
Carduus nutans ssp. macrolepis	0.00	1.60
Chamaesyce glyptosperma	0.40	0.00
Conyza canadensis	0.00	0.20
Croton texensis	0.00	0.40
Cyclachaena xanthifolia	0.00	0.01
Eriogonum annuum	0.00	0.01
Gaura parviflora	0.00	0.01
Helianthus annuus	0.01	0.20
Lactuca serriola	0.00	0.80
Machaeranthera tanacetifolia	0.00	0.01
Melolotis species	0.00	4.00
Other Annual/Biennial Forbs	0.00	0.20
Plantago patagonica	0.00	0.01
Poinsettia dentata	0.01	0.00
Polygonum aviculare	0.00	0.01
Salsola australis	0.01	1.20
Sisymbrium altissimum	0.00	0.01
Verbena bracteata	0.01	0.00
Ximenesia encelioides	0.01	0.00
Subtotal	0.45	8.69
SHRUBS		
Oligosporus filifolius	0.00	0.01
Subtotal	0.00	0.01
CACTI AND SUCCULENTS		
Opuntia polyacantha	0.01	0.20
Subtotal	0.01	0.20

Table 14 (cont.) NEEDLE-AND-THREAD GRASS HARVEST AREA SITE A DATA SUMMARY  
FOR 1991-92. VALUES ARE PERCENT COVER BY VEGETATION SPECIES  
OR CATEGORY.

Species	1991	1992
LITTER	36.40	35.00
TOTAL VEGETATION	58.80	52.00
LITTER/ROCK	36.40	35.00
BARE SOIL	4.80	13.00
TOTAL COVER	95.20	87.00
No. Species/Sample	3.00	9.00

Table 15

LOWER DERBY SPILLWAY VEGETATION DATA SUMMARY FOR 1991-92.  
VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR CATEGORY.

Species	1991	1992
Sample Size	5	5
COOL SEASON PERENNIAL GRASSES		
Aristida purpurea var. longise	0.00	0.20
Critesion jubatum	0.01	0.40
Oryzopsis hymenoides	1.20	0.20
Schedonnardus paniculatus	0.00	0.20
Stipa comata	0.00	2.20
Stipa viridula	0.01	0.00
Subtotal	1.22	3.20
WARM SEASON PERENNIAL GRASSES		
Andropogon hallii	0.01	0.40
Bouteloua curtipendula	0.00	0.01
Chondrosium gracile	0.40	1.60
Schizachyrium scoparium	0.00	0.01
Sporobolus cryptandrus	2.00	1.40
Subtotal	2.41	3.42
INTRODUCED PERENNIAL GRASSES		
Agropyron cristatum	0.00	0.20
Subtotal	0.00	0.20
ANNUAL GRASSES		
Anisantha tectorum	0.00	0.80
Eragrostis cilianensis	0.00	0.20
Monroa squarrosa	0.40	0.40
Panicum capillare	0.00	0.40
Vulpia octoflora	0.01	0.00
Subtotal	0.41	1.80
PERENNIAL FORBS		
Abronia fragrans	0.00	0.01
Ambrosia psilostachya	0.01	2.40
Argemone polyanthemom	0.01	0.01
Erigeron pumilus	0.00	1.20
Heterotheca villosa	0.00	0.01
Nuttallia nuda	0.00	0.01

Table 15 (cont.) LOWER DERBY SPILLWAY VEGETATION DATA SUMMARY FOR 1991-92.  
VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR CATEGORY.

Species	1991	1992
Oenothera villosa	0.00	0.80
Physalis hederifolia	0.40	0.00
Senecio spartioides	0.00	0.01
Sphaeralcea coccinea	0.01	0.00
Tragopogon dubius	0.00	0.01
Tradescantia occidentalis	0.01	0.00
Verbascum thapsus	0.00	0.01
Subtotal	0.44	4.47
ANNUAL AND BIENNIAL FORBS		
Amaranthus albus	22.40	0.00
Amaranthus retroflexus	0.40	0.00
Carduus nutans ssp.macrolepis	0.00	0.20
Chamaesyce glyptosperma	0.40	0.00
Conyza canadensis	0.00	5.60
Croton texensis	1.20	0.01
Cryptantha minima	0.40	0.00
Dyssodia papposa	0.01	0.00
Helianthus annuus	0.00	0.01
Lactuca serriola	0.00	0.20
Machaeranthera tanacetifolia	0.00	0.01
Melilotus alba	0.40	4.40
Melolotis species	0.00	0.60
Oenothera albicaulis	0.01	0.00
Plantago patagonica	0.01	0.01
Portulaca oleracea	0.00	0.01
Salsola australis	9.20	23.20
Salsola collina	0.01	0.00
Sisymbrium altissimum	0.00	0.80
Solanum rostratum	0.40	0.00
Solanum triflorum	6.40	0.01
Verbena bracteata	2.00	2.00
Ximenesia encelioides	2.80	1.20
Subtotal	46.04	38.26
LITTER	10.40	23.60
TOTAL VEGETATION	50.40	51.20
LITTER/ROCK	10.40	23.60
BARE SOIL	39.20	25.20

Table 15 (cont.) LOWER DERBY SPILLWAY VEGETATION DATA SUMMARY FOR 1991-92.  
VALUES ARE PERCENT COVER BY VEGETATION SPECIES OR CATEGORY.

Species	1991	1992
TOTAL COVER	60.80	74.80
No. Species/Sample	7.00	11.80

#### 4.0 RECOMMENDATIONS

- Add shrub plantings at appropriate locations.
- Continue vegetation control at appropriate sites, but especially where Canada thistle occurs in bottomland locations.
- Develop a controlled burning program to stimulate production in grassland sites.

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**APPENDIX A**  
**LOG OF 1992 ACTIVITIES**

BEMA SITE 1A MANAGEMENT PRACTICES FOR 1992  
25 ACRES

DATE                      MANAGEMENT PRACTICE

6/17/92      Collected data in 2 acre needle-and-thread grass mulch area within 1A. Counted needle-and-thread grass plants within 20 1/8 meter random quadrats.

Comparison of data between 1991 and 1992

	1991	1992
Number of quadrats	20	20
Total number of needle-and-thread grass plants	72	75
Average number per quadrat	3.6	3.75
Average number per square meter	28.8	30
Needle-and-thread cover per quadrat (visual estimate)	NA	13.15
Total vegetation cover per quadrat (visual estimate)	26.85	43.4

Comments: approximately the same number of needle-and-thread grass plants were counted in 1992 as in 1991 when the program was initiated. The plants in 1992 were much larger and all appeared to be vigorous. The great majority of plants had seed heads with 3-8 culms per plant.

9/15/92      Cover data was collected on 6 permanent cover transects.

BEMA SITE 1B MANAGEMENT PRACTICES FOR 1992  
46 ACRES

DATE	MANAGEMENT PRACTICE
4/4/92	Mulching and crimping area of the area of 1B that was not completed in the fall of 1991 because of the presence of eagles was completed.
7/7/92	Entire site was mowed for weed control. Weeds at the time of mowing were up to 2 meters in height.
7/21/92	Herbicide application.  Target species: All broadleaves  Herbicides applied: 2,4-D (6# active/gal) 1.4 qts/acre surfactant 0.4 pints/acre  Conditions: Sunny, 60-75°F, Winds-calm to NW @ 3-6 mph
9/3/92	Cover data collected on 8 transects.
9/17/92	Herbicide application.  Target species: Canada thistle, musk thistle, and bindweed  Herbicides used: 2,4-D 2.0 qts/acre Escort 1.0 oz/acre Telar 2.0 oz/acre Surfactant 0.5 pint/acre  Conditions: Mostly sunny, 60-80°F, Winds-west @ 3-8 mph

BEMA SITE 1C MANAGEMENT PRACTICES FOR 1992  
18 ACRES

DATE	MANAGEMENT PRACTICE
5/7/92	Site was mowed for weed control.
5/17/92	Site was disced in two directions for weed control. Attempted to destroy cheatgrass and annual forbs before they set seed.
7/21/92	Herbicide application.  Target species: All weeds with an emphasis on Canada thistle.  Herbicides applied: 2,4-D (6# active/acre) 1.0 qt/acre Round-up 2.67 qt/acre Surfactant 0.4 qt/acre  Conditions: Sunny, 75°F, Winds - NE @ 0-4 mph
9/16/92	Herbicide applied to 4 acres in bottom of 1C.  Target species: Canada thistle and bindweed  Herbicides used: Round-up 5.0 qt/acre Escort 0.1 oz/acre Surfactant 0.2 qt/acre  Conditions: Sunny, 60-75°F, Winds - calm to SW @ 5 mph
9/28/92	Site disced in preparation for seeding.
9/29/92	Five forbs were hand broadcast seeded. Blanketflower <u>Gaillardia aristata</u> Purple prairie clover <u>Petalostemon purpurea</u> Sand verbena <u>Abronia fragrans</u> Blazing-star <u>Liatris punctata</u> Coreopsis <u>Coreopsis tinctoria</u>  After forb seeding the site was S-tined.

9/30/92 Forb seed collected during the summer by kids from rec center summer activities program was broadcast seeded over entire site.

Seedbed preparation was completed and site was drill seeded. Switchgrass was seeded in the bottom 5 acres and the rest of the seed mix in the remaining 13 acres.

Seed mixes:

<u>Panicum virgatum</u>	Neb 28	1.5 pls/acre
<u>Bouteloua gracilis</u>	Hachita	0.75 pls/acre
<u>Calamovilfa longifolia</u>	Goshen	1.0 pls/acre
<u>Andropogon hallii</u>	Woodward	5.0 pls/acre

10/1/925 Seeding operations were completed by mulching and crimping 2 tons/acre weed free grass hay.

BEMA SITE 2 MANAGEMENT PRACTICES FOR 1992  
6.6 ACRES

DATE	MANAGEMENT PRACTICE
6/11/92	All cages protecting planted shrubs had been removed.
7/13/92	Approximately 60% of the site was mowed into a mosaic to maximize edge area for lagomorph habitat. There was a noticeable difference between the mowed and unmowed vegetation.
9/12/92	USFWS had placed 3-5 brush piles and/or trees in Site 2 to provide cover for lagomorphs.

BEMA SITE 3 MANAGEMENT PRACTICES FOR 1992  
40 ACRES

DATE	MANAGEMENT PRACTICE
10/9/92	Site suevey was conducted to check the status of the rubber rabbitbrush ( <u>Chrysothamnus nauseosus</u> ) for possible seed collection. No new seedlings were evident. A significant reduction (dead or dying) of existing rubber rabbitbrush was noted. Only a very few appeared healthy. The cause of the die-back is unknown.

BEMA SITE 4A MANAGEMENT PRACTICES FOR 1992  
8.5 ACRES

DATE                      MANAGEMENT PRACTICE

4/13/92      Site was over-seeded because of poor growth of seeded species in 1991.

Seed mix:

Panvir	Switchgrass	Neb 28	1.1 pls/acre
Andger	Big bluestem	Pawnee	3.1 pls/acre
Sornut	Yellow indiangrass	Holt	2.4 pls/acre
Schsco	Little bluestem	Pastura	1.4 pls/acre

9/4/92      Site survey to analyze seeding success.  
Seeding was very successful. The vegetation was very dense and tall (2 meters). Many seeded grasses were present along with a weedy component. Site was very suitable for wildlife use providing both food and shelter.

9/16/92      Cover data was collected on 5 transects.



BEMA SITE 4B MANAGEMENT PRACTICES FOR 1992  
14.5 ACRES

DATE	MANAGEMENT PRACTICE
7/7/92	Site was mowed for weed control. A first attempt at mowing in June 1992 was aborted because of a fawn or the possibility of a fawn hiding in the site.
8/21/92	Five permanent cover transects were established.
10/5/92	Cover data was collected on all 5 transects.

BEMA SITE 4C MANAGEMENT PRACTICES FOR 1992  
30 ACRES

DATE	MANAGEMENT PRACTICE
5/1/92	Site was roary mowed for weed control.
8/19/92	Six permanent cover transects were established.
9/15/92	Cover data was collected on all six cover transects.
9/17/92	Herbicide application to areas of thistle investation.

Target species:  
Canada and musk thistle

Herbicides applied:

2,4-D	1.2 qt/acre
Telar	1.67 oz/acre
Surfactant	3.0 oz/acre

Conditions:  
Sunny, 60-75°F, Winds - WSW @ 0-9 mph

BEMA SITE 5 MANAGEMENT PRACTICES FOR 1992  
93 ACRES

DATE	MANAGEMENT PRACTICE
6/4/92	5A, 5B, and 5C Sites were mowed for weed control.
7/12/92	5A, 5B, and 5C Sites were mowed for weed control.
9/17/92	5A, 5B, and 5C Herbicide application.
	Target species: Canada and musk thistle
	Herbicides applied:
	5A
	2,4-D                      1.2 qt/acre
	Escort                    1.67 oz/acre
	Surfactant               2.67 qt/acre
	5B
	2,4-D                      1.2 qt/acre
	Escort                    1.67 oz/acre
	Surfactant               2.67 qt/acre
	5C
	2,4-D                      1.2 qt/acre
	Telar                     1.67 oz/zcre
	Surfactant               2.67 qt/acre
	Conditions:
	Sunny, 60-75°F, Winds - WSW @ 0-9 mph
9/8/92-	5A, 5B, and 5C
9/28/92	Cover data collected on all 25 transects.

BEMA SITES 6 EAST AND 6 WEST MANAGEMENT PRACTICES FOR 1992  
6 EAST 24 ACRES  
6 WEST 46 ACRES

DATE	MANAGEMENT PRACTICE
10/1/92	6 EAST Cover data collected on all 5 cover transects
10/5/92	6 WEST Cover data collected on all 5 transects.

BEMA SITES 7A AND 7B MANAGEMENT PRACTICES FOR 1992

7A 11 ACRE

7B 18 ACRES

DATE	MANAGEMENT PRACTICE
------	---------------------

9/29/92	7A and 7B Completed cover data collection on all transects.
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NEEDLE-AND-THREAD GRASS HARVEST AREA  
MANAGEMENT PRACTICES FOR 1992  
29 ACRES

DATE	MANAGEMENT PRACTICE
4/14/92	Needle-and-thread grass harvest area expansion was established just north of the main harvest area. It contains 11 acres.
4/15/92	Five permanent cover transects were established.
4/30/92	Baseline cover data was collected on expansion area.
5/1/92	The expansion area was mowed in preparation of tilling.
5/7/92	Two-thirds of the expansion area was moldboard plowed to a depth of 6".
5/8/92	The remaining one-third of the area was chisel plowed twice to a depth of 12". The two different plowing methods were used to test their weed burial capabilities.
6/26/92	The main harvest area was sickle mowed to make mulch for the expansion area.
6/29/92	Mowed needle-and-thread grass hay was windrowed and baled. 32 bales of hay were produced.
	Samples of the needle-and-thread grass hay were sent to the Colorado Seed Lab at Colorado State University. The results of the analysis:
	1878 seeds/lb
	10% germination
	36% dormant seed
	46% total live seed
7/1/92	The chisel plowed area of the expansion area was moldboard plowed because the moldboard plow was much better at burying weed seeds and preventing their germination.
7/3/92	Needle-and-thread grass mulch hay was applied to the expansion area. After mulch application, the area was harrowed. After harrowing, grass hay was applied to bring the total amount of mulch to 2 tons/acre. The area was then crimped in two different directions.

NEEDLE-AND-THREA GRASS HARVEST AREA  
MANAGEMENT PRACTICES FOR 1992  
(continued)

9/21/92     Herbicide application to main harvest area.     Herbicide  
             spotted in areas of thistle investation.

Target speices:  
Canada and musk thistle

Herbicides applied:

Telar	2.0	oz/acre
2,4-D	1.2	qt/acre
Surfactant	0.25	qt/acre

Conditions:  
Partly sunny, 63-70°F, Winds - NNW @ 0-8 mph

**APPENDIX B**  
**TRANSECT COORDINATES**



# COORDINATES FOR 50 METER LINE-POINT TRANSECTS

TRANSECT	NORTHING	EASTING
SITE 1A		
1	175975.445 175888.074	2198221.955 2198083.231
2	176071.163 175919.705	2198502.201 2198440.085
3	175981.710 175875.188	2198822.549 2198698.086
4	175723.965 175619.489	2198738.531 2198611.982
5	175757.778 175615.209	2198332.372 2198251.463
6	175672.905 175818.635	2198909.924 2198834.983
SITE 1B		
1	175226.131 175104.296	2198713.177 2198822.845
2	174514.139 174667.107	2198855.291 2198913.911
3	174416.333 174541.341	2198334.576 2198228.340
4	174824.132 174974.668	2198389.817 2198324.583
5	175011.946 175142.813	2198024.139 2197924.834
6	174190.759 174161.149	2199002.350 2198840.890
7	174042.865 174117.542	2198570.698 2198454.308
8	174486.524 174639.942	2197865.041 2197807.542

# COORDINATES FOR 50 METER LINE-POINT TRANSECTS

TRANSECT	NORTHING	EASTING
SITE 4A		
1	183957.751 183988.452	2191041.887 2190880.986
2	184152.384 184294.439	2190773.230 2190692.226
3	184268.128 184251.113	2190514.427 2190351.737
4	184459.293 184356.341	2190066.719 2190193.501
5	184450.867 184443.926	2190253.979 2190417.393
SITE 4B		
1	183362.235 183187.549	2191456.048 2191775.114
2	183889.493 183618.323	2191185.340 2191222.585
3	184062.276 184225.116	2191164.264 2191185.123
4	184539.071 184392.519	2190808.319 2190882.524
5	184559.063 184529.458	2190149.613 2190311.243
SITE 4C		
1	185520.104 185495.811	2190568.191 2190730.596
2	185167.856 185022.005	2190524.902 2190449.202
3	185178.659	2190170.118

# COORDINATES FOR 50 METER LINE-POINT TRANSECTS

TRANSECT	NORTHING	EASTING
	185330.965	2190107.754
4	184911.727 184813.338	2190208.670 2190340.213
5	184980.318 185075.988	2190656.942 2190790.537
6	184707.456 184738.337	2190933.417 2190771.455

## SITE 5A

1	190863.000 190706.364	2189142.219 2189095.968
2	190178.824 190019.323	2189227.262 2189191.157
3	189512.760 189349.675	2189371.165 2189359.056
4	188507.061 188386.908	2189670.990 2189780.409
5	187029.057 186869.003	2190237.503 2190204.171

## SITE 5B

1 EAST	190961.495 190804.921	2189157.377 2189207.330
2 EAST	190282.158 190120.977	2189285.393 2189259.664
3 EAST	189584.141 189420.370	2189425.675 2189427.934
4 EAST	188463.958 188335.353	2189777.190 2189878.832

# COORDINATES FOR 50 METER LINE-POINT TRANSECTS

TRANSECT	NORTHING	EASTING
5 EAST	187191.970 187032.738	2190290.183 2190251.409
1 WEST	190991.356 190829.430	2189036.695 2189061.183
2 WEST	190304.384 190152.964	2189094.594 2189153.275
3 WEST	189586.256 189457.205	2189218.477 2189319.305
4 WEST	188455.394 188297.489	2189678.411 2189720.330
5 WEST	186921.369 186757.945	2190164.297 2190151.397

## SITE 6 EAST

1	191121.666 190974.463	2191930.739 2191858.070
2	190798.226 190677.154	2191083.175 2191972.531
3	190227.709 190109.907	2192041.153 2191927.347
4	190521.703 190384.860	2191780.769 2191690.749
5	190935.739 190780.026	2191676.087 2191625.244

## SITE 6 WEST

1	190939.888 190812.593	2190705.952 2190602.819
2	190595.429 190471.170	2190430.494 2190537.907

# COORDINATES FOR 50 METER LINE-POINT TRANSECTS

TRANSECT	NORTHING	EASTING
3	189999.361 190045.411	2190405.974 2190248.539
4	189525.061 189572.053	2190600.726 2190757.695
5	189984.627 190112.844	2190802.757 2190700.549

## SITE 7A

1	192318.488 192430.071	2188923.795 2189043.792
2	192520.617 192681.071	2189238.396 2189205.481
3	192894.156 192923.687	2189121.081 2189260.729
4	192939.004 193061.530	2189464.570 2189356.328
5	193338.548 193450.967	2189400.133 2189518.685

## SITE 7B

1	192812.278 192952.263	2188872.883 2188957.657
2	193028.646 193141.607	2188877.827 2188995.450
3	193341.239 193459.103	2189128.410 2189014.992
4	193583.990 193647.539	2188933.249 2189083.631
5	193497.722 193656.957	2189320.623 2189283.896

# COORDINATES FOR 50 METER LINE-POINT TRANSECTS

TRANSECT	NORTHING	EASTING
NEELDLE-AND-THREAD GRASS HARVEST AREA		
1	176655.331 176515.618	2194710.074 2194796.263
2	176609.183 176543.510	2194397.417 2194547.552
3	176366.084 176514.148	2194328.679 2194258.221
4	176778.127 176822.409	2194499.426 2194657.107
5	176447.236 176313.314	2194833.471 2194738.191
LOWER DERBY SPLILLWAY		
1	177483.414 177399.205	2183513.024 2183371.775
2	177421.162 177310.656	2183148.848 2183269.790
3	177494.341 177550.429	2183025.309 2182872.499
4	177432.428 177357.623	2182663.065 2182516.933
5	177290.728 177387.687	2182315.244 2182183.045

**APPENDIX C**  
**SEED MIXES**

SEED MIX FOR SITE 1C  
18 ACRES

SPECIES		VARIETY	PLS/ACRE
Switchgrass	( <u>Panicum virgatum</u> )	Neb 28	1.5
Blue Grama	( <u>Bouteloua gracilis</u> )	Hachita	0.75
Prairie Sandreed	( <u>Calamovilfa longifolia</u> )	Goshen	1.0
Sand Bluestem	( <u>Andropogon hallii</u> )	Woodward	<u>5.0</u>
		TOTAL	8.25

NOTE: The Switchgrass was seeded by itself in the 3 acre bottomland. The remaining species were seeded together over the remaining 13 acres.

Forb seeds were broadcast seeded by hand over the entire 18 acres.

Blanketflower	<u>Gaillardia aristata</u>
Purple prairie clover	<u>Petalostemon purpurea</u>
Sand verbena	<u>Abronia fragrans</u>
Blazing-star	<u>Liatris punctata</u>
Coreopsis	<u>Coreopsis tinctoria</u>
Locoweed	<u>Oxytropis lambertii</u>

SEED MIX SITE 4A OVER-SEEDING  
8.5 ACRES

SPECIES		VARIETY	PLS/ACRE
Switchgrass	( <u>Panicum virgatum</u> )	Neb 28	1.1
Big Bluestem	( <u>Andropogon gerardii</u> )	Pawnee	3.1
Yellow Indinagrass	( <u>Sorghastrum nutans</u> )	Holt	2.4
Little Bluestem	( <u>Schizachyrium scoparium</u> )	Pastura	<u>1.4</u>
		TOTAL	8.0

Site 4A was over-seeded on 4/13/92.



# LOWER DERBY SPILLWAY SEED MIX

SPECIES	VARIETY	PLS/ACRE
Sand Bluestem ( <u>Andropogon hallii</u> )	Garden	4.0
Prairie Sandreed ( <u>Calamovilfa longifolia</u> )	Goshen	2.0
Blue Grama ( <u>Bouteloua gracilis</u> )	Lovington	1.0
Needle-and-thread ( <u>Stipa comata</u> )	Native	1.0
Indian Ricegrass ( <u>Oryzopsis hymenoides</u> )	Nezpar	<u>3.0</u>
	TOTAL	11.0

**APPENDIX D**  
**SITE-SPECIFIC SPECIES LIST**

Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Critesion jubatum</i>	Foxtail Barley	Gramineae
<i>Pascopyrum smithii</i>	Western Wheatgrass	Gramineae
<i>Stipa comata</i>	Needle-and-thread Grass	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Andropogon gerardi</i>	Big Bluestem	Gramineae
<i>Andropogon hallii</i>	Sandhills Bluestem	Gramineae
<i>Buchloe dactyloides</i>	Buffalo Grass	Gramineae
<i>Calamovilfa longifolia</i>	Prairie Sandreed	Gramineae
<i>Chondrosum gracile</i>	Blue Grama	Gramineae
<i>Panicum virgatum</i>	Switchgrass	Gramineae
<i>Sorghastrum avenaceum</i>	Yellow Indiangrass	Gramineae
<i>Sporobolus cryptandrus</i>	Sand Dropseed	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Anisantha tectorum</i>	Cheatgrass	Gramineae
<i>Cenchrus longispinus</i>	Sand Bur	Gramineae
<i>Eragrostis cilianensis</i>	Stinking Lovegrass	Gramineae
<i>Panicum capillare</i>	Witchgrass	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Asclepias speciosa</i>	Showy Milkweed	Asclepiadaceae
<i>Convolvulus arvensis</i>	Field Bindweed	Convolvulaceae
<i>Lygodesmia juncea</i>	Skeleton Plant	Compositae
<i>Medicago sativa</i>	Alfalfa	Leguminosae
<i>Nuttallia nuda</i>	Blazingstar	Loasaceae
<i>Oenothera villosa</i>	Tall Evening-primrose	Onagraceae
<i>Physalis virginiana</i>	Ground Cherry	Solanaceae
<b>ANNUAL AND BIENNIAL FORBS</b>		
<i>Amaranthus arenicola</i>	Sand Pigweed	Amaranthaceae
<i>Amaranthus blitoides</i>	Prostrate Pigweed	Amaranthaceae
<i>Bassia sieversiana</i>	Summer-cypress	Chenopodiaceae
<i>Chamaesyce glyptosperma</i>	Spurge	Euphorbiaceae
<i>Chenopodium album</i>	Goosefoot	Chenopodiaceae
<i>Chenopodium leptophyllum</i>	Narrowleaf Goosefoot	Chenopodiaceae
<i>Conyza canadensis</i>	Horseweed	Compositae
<i>Croton texensis</i>	Croton	Euphorbiaceae

Scientific Name	Common Name	Family Name
<i>Cyclachaena xanthifolia</i>	Marsh Elder	Compositae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae
<i>Lappula redowskii</i>	Beggars-tick	Boraginaceae
<i>Machaeranthera canescens</i>	Silvery Aster	Compositae
<i>Melilotis species</i>	Sweetclover	Leguminosae
<i>Poinsettia dentata</i>	Poinsettia	Euphorbiaceae
<i>Polygonum aviculare</i>	Devil's Shoestrings	Polygonaceae
<i>Polygonum ramocissiumum</i>	Branched Knotweed	Polygonaceae
<i>Salsola australis</i>	Russian-thistle	Chenopodiaceae
<i>Sisymbrium altissimum</i>	Tumbling Hedge Mustard	Cruciferae
<i>Ximenesia encelioides</i>	Cow-pen Daisy	Compositae
SEMI-SHRUBS OR HALF-SHRUBS		
<i>Artemisia frigida</i>	Fringed Sagewort	Compositae
CACTI AND SUCCULENTS		
<i>Opuntia polyacantha</i>	Plains Prickly Pear	Cactaceae

Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Elymus trachycaulus</i>	Slender Wheatgrass	Gramineae
<i>Pascopyrum smithii</i>	Western Wheatgrass	Gramineae
<i>Schedonnardus paniculatus</i>	Tumblegrass	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Andropogon hallii</i>	Sandhills Bluestem	Gramineae
<i>Panicum virgatum</i>	Switchgrass	Gramineae
<i>Sporobolus cryptandrus</i>	Sand Dropseed	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Anisantha tectorum</i>	Cheatgrass	Gramineae
<i>Cenchrus longispinus</i>	Sand Bur	Gramineae
<i>Echinochloa crus-galli</i>	Barnyard Grass	Gramineae
<i>Eragrostis cilianensis</i>	Stinking Lovegrass	Gramineae
<i>Panicum capillare</i>	Witchgrass	Gramineae
<i>Setaria viridis</i>	Green Foxtail	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Argemone polyanthemus</i>	Prickly Poppy	Papaveraceae
<i>Asclepias speciosa</i>	Showy Milkweed	Asclepiadaceae
<i>Cirsium arvense</i>	Canada Thistle	Compositae
<i>Convolvulus arvensis</i>	Field Bindweed	Convolvulaceae
<i>Lygodesmia juncea</i>	Skeleton Plant	Compositae
<i>Physalis hederifolia</i>	Ground Cherry	Solanaceae
<i>Physalis heterophylla</i>	Ground Cherry	Solanaceae
<i>Physalis virginiana</i>	Ground Cherry	Solanaceae
<i>Verbascum thapsus</i>	Common Mullein	Scrophulariaceae
<b>ANNUAL AND BIENNIAL FORBS</b>		
<i>Bassia sieversiana</i>	Summer-cypress	Chenopodiaceae
<i>Carduus nutans ssp. macrolepis</i>	Bristle Thistle	Compositae
<i>Chenopodium album</i>	Goosefoot	Chenopodiaceae
<i>Croton texensis</i>	Croton	Euphorbiaceae
<b>CACTI AND SUCCULENTS</b>		
<i>Opuntia polyacantha</i>	Plains Prickly Pear	Cactaceae
<b>ANNUAL AND BIENNIAL FORBS</b>		
<i>Portulaca oleracea</i>	Purslane	Portulacaceae

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Scientific Name	Common Name	Family Name
<i>Salsola australis</i>	Russian-thistle	Chenopodiaceae
<i>Solanum rostratum</i>	Buffalo Bur	Solanaceae

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Scientific Name	Common Name	Family Name
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**COOL SEASON PERENNIAL GRASSES**

<i>Aristida purpurea</i> var. <i>longise</i>	Red Three-awn	Gramineae
<i>Elymus canadensis</i>	Canada Wildrye	Gramineae
<i>Elymus trachycaulus</i>	Slender Wheatgrass	Gramineae

**WARM SEASON PERENNIAL GRASSES**

<i>Andropogon gerardi</i>	Big Bluestem	Gramineae
<i>Bouteloua curtipendula</i>	Side Oats Grama	Gramineae
<i>Chondrosium gracile</i>	Blue Grama	Gramineae
<i>Muhlenbergia asperifolia</i>	Alkali Muhly	Gramineae
<i>Panicum virgatum</i>	Switchgrass	Gramineae
<i>Schizachyrium scoparium</i>	Little Bluestem	Gramineae
<i>Sorghastrum avenaceum</i>	Yellow Indiangrass	Gramineae

**INTRODUCED PERENNIAL GRASSES**

<i>Agropyron cristatum</i>	Crested Wheatgrass	Gramineae
<i>Bromopsis inermis</i>	Smooth Brome	Gramineae

**ANNUAL GRASSES**

<i>Anisantha tectorum</i>	Cheatgrass	Gramineae
<i>Bromus japonicus</i>	Japanese Brome	Gramineae
<i>Echinochloa crus-galli</i>	Barnyard Grass	Gramineae
<i>Eragrostis cilianensis</i>	Stinking Lovegrass	Gramineae
<i>Panicum capillare</i>	Witchgrass	Gramineae
<i>Setaria viridis</i>	Green Foxtail	Gramineae

**PERENNIAL FORBS**

<i>Achillea lanulosa</i>	Western Yarrow	Compositae
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Asclepias speciosa</i>	Showy Milkweed	Asclepiadaceae
<i>Calylophus serrulata</i>	Serrate Evening Primrose	Onagraceae
<i>Cirsium arvense</i>	Canada Thistle	Compositae
<i>Convolvulus arvensis</i>	Field Bindweed	Convolvulaceae
<i>Erigeron pumilus</i>	Low Daisy	Compositae
<i>Glycyrrhiza lepidota</i>	Wild Licorice	Leguminosae
<i>Mentha arvensis</i>	Field Mint	Labiatae
<i>Nepeta cataria</i>	Catnip	Labiatae
<i>Oenothera villosa</i>	Tall Evening-primrose	Onagraceae
<i>Ratibida columnifera</i>	Prairie Coneflower	Compositae
<i>Solidago canadensis</i>	Canada Goldenrod	Compositae

Scientific Name	Common Name	Family Name
<i>Urtica gracilis</i>	Stinging Nettle	Urticaceae
<i>Verbascum thapsus</i>	Common Mullein	Scrophulariaceae
ANNUAL AND BIENNIAL FORBS		
<i>Amaranthus blitoides</i>	Prostrate Pigweed	Amaranthaceae
<i>Amaranthus retroflexus</i>	Pigweed	Amaranthaceae
<i>Ambrosia trifida</i>	Giant Ragweed	Compositae
<i>Atriplex hastata</i>	Aster	Chenopodiaceae
<i>Bassia sieversiana</i>	Summer-cypress	Chenopodiaceae
<i>Carduus nutans</i> ssp. <i>macrolepis</i>	Bristle Thistle	Compositae
<i>Chenopodium album</i>	Goosefoot	Chenopodiaceae
<i>Conyza canadensis</i>	Horseweed	Compositae
<i>Cyclachaena xanthifolia</i>	Marsh Elder	Compositae
<i>Fallopia convolvulus</i>	Black Bindweed	Polygonaceae
<i>Gaura parviflora</i>	Little-flowered Gaura	Onagraceae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae
<i>Machaeranthera tanacetifolia</i>	Tansy-leaved Tansy-leaved Mach	Compositae
<i>Melilotus alba</i>	White Sweetclover	Leguminosae
<i>Polygonum ramocissium</i>	Branched Knotweed	Polygonaceae
<i>Rumex triangulivalvis</i>	Dock	Polygonaceae
<i>Rumex triangulivalvis</i>	Dock	Polygonaceae
<i>Sisymbrium altissimum</i>	Tumbling Hedge Mustard	Cruciferae
<i>Solanum rostratum</i>	Buffalo Bur	Solanaceae
<i>Solanum triflorum</i>	Nightshade	Solanaceae
<i>Verbena bracteata</i>	Creeping Charlie	Verbenaceae



Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Critesion jubatum</i>	Foxtail Barley	Gramineae
<i>Distichlis spicata</i> var. <i>stricta</i>	Inland Saltgrass	Gramineae
<i>Elymus canadensis</i>	Canada Wildrye	Gramineae
<i>Elymus trachycaulus</i>	Slender Wheatgrass	Gramineae
<i>Pascopyrum smithii</i>	Western Wheatgrass	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Bouteloua curtipendula</i>	Side Oats Grama	Gramineae
<i>Panicum virgatum</i>	Switchgrass	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Anisantha tectorum</i>	Cheatgrass	Gramineae
<i>Bromus japonicus</i>	Japanese Brome	Gramineae
<i>Echinochloa crus-galli</i>	Barnyard Grass	Gramineae
<i>Panicum capillare</i>	Witchgrass	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Asclepias speciosa</i>	Showy Milkweed	Asclepiadaceae
<i>Cardaria draba</i>	White Weed	Cruciferae
<i>Cirsium arvense</i>	Canada Thistle	Compositae
<i>Convolvulus arvensis</i>	Field Bindweed	Convolvulaceae
<i>Erigeron pumilus</i>	Low Daisy	Compositae
<i>Glycyrrhiza lepidota</i>	Wild Licorice	Leguminosae
<i>Mentha arvensis</i>	Field Mint	Labiatae
<i>Oenothera villosa</i>	Tall Evening-primrose	Onagraceae
<i>Tragopogon dubius</i>	Salsify	Compositae
<i>Verbascum thapsus</i>	Common Mullein	Scrophulariaceae
<b>ANNUAL AND BIENNIAL FORBS</b>		
<i>Ambrosia trifida</i>	Giant Ragweed	Compositae
<i>Atriplex hastata</i>	Aster	Chenopodiaceae
<i>Bassia sieversiana</i>	Summer-cypress	Chenopodiaceae
<i>Carduus nutans</i> ssp. <i>macrolepis</i>	Bristle Thistle	Compositae
<i>Chenopodium album</i>	Goosefoot	Chenopodiaceae
<i>Conyza canadensis</i>	Horseweed	Compositae
<i>Cyclachaena xanthifolia</i>	Marsh Elder	Compositae
<i>Fallopia convolvulus</i>	Black Bindweed	Polygonaceae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae

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Scientific Name	Common Name	Family Name
Melolotis species	Sweetclover	Leguminosae
Polygonum aviculare	Devil's Shoestrings	Polygonaceae
Polygonum ramocissiumum	Branched Knotweed	Polygonaceae
Rumex triangulivalvis	Dock	Polygonaceae
Salsola australis	Russian-thistle	Chenopodiaceae

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Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Aristida purpurea</i> var. <i>longise</i>	Red Three-awn	Gramineae
<i>Distichlis spicata</i> var. <i>stricta</i>	Inland Saltgrass	Gramineae
<i>Elymus canadensis</i>	Canada Wildrye	Gramineae
<i>Elymus trachycaulus</i>	Slender Wheatgrass	Gramineae
<i>Pascopyrum smithii</i>	Western Wheatgrass	Gramineae
<i>Schedonnardus paniculatus</i>	Tumblegrass	Gramineae
<i>Stipa viridula</i>	Green Needle Grass	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Muhlenbergia asperifolia</i>	Alkali Muhly	Gramineae
<b>INTRODUCED PERENNIAL GRASSES</b>		
<i>Agropyron cristatum</i>	Crested Wheatgrass	Gramineae
<i>Bromopsis inermis</i>	Smooth Brome	Gramineae
<i>Poa pratensis</i>	Kentucky Bluegrass	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Anisantha tectorum</i>	Cheatgrass	Gramineae
<i>Bromus japonicus</i>	Japanese Brome	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Cirsium arvense</i>	Canada Thistle	Compositae
<i>Convolvulus arvensis</i>	Field Bindweed	Convolvulaceae
<i>Erigeron pumilus</i>	Low Daisy	Compositae
<i>Glycyrrhiza lepidota</i>	Wild Licorice	Leguminosae
<i>Medicago sativa</i>	Alfalfa	Leguminosae
<i>Mentha arvensis</i>	Field Mint	Labiatae
<i>Physalis virginiana</i>	Ground Cherry	Solanaceae
<i>Tragopogon dubius</i>	Salsify	Compositae
<i>Verbascum thapsus</i>	Common Mullein	Scrophulariaceae
<b>ANNUAL AND BIENNIAL FORBS</b>		
<i>Amaranthus retroflexus</i>	Pigweed	Amaranthaceae
<i>Ambrosia trifida</i>	Giant Ragweed	Compositae
<i>Atriplex hastata</i>	Aster	Chenopodiaceae
<i>Bassia sieversiana</i>	Summer-cypress	Chenopodiaceae
<i>Carduus nutans</i> ssp. <i>macrolepis</i>	Bristle Thistle	Compositae

Scientific Name	Common Name	Family Name
<i>Chenopodium album</i>	Goosefoot	Chenopodiaceae
<i>Chenopodium leptophyllum</i>	Narrowleaf Goosefoot	Chenopodiaceae
<b>SHRUBS</b>		
<i>Chrysothamnus nauseosus</i>	Rubber Rabbitbrush	Compositae
<b>ANNUAL AND BIENNIAL FORBS</b>		
<i>Conyza canadensis</i>	Horseweed	Compositae
<i>Gaura parviflora</i>	Little-flowered Gaura	Onagraceae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae
<i>Machaeranthera tanacetifolia</i>	Tansy-leaved Tansy-leaved Mach	Compositae
<i>Melilotus alba</i>	White Sweetclover	Leguminosae
<i>Melilotis species</i>	Sweetclover	Leguminosae
<i>Polygonum aviculare</i>	Devil's Shoestrings	Polygonaceae
<i>Polygonum ramocissiumum</i>	Branched Knotweed	Polygonaceae
<i>Salsola australis</i>	Russian-thistle	Chenopodiaceae
<i>Sisymbrium altissimum</i>	Tumbling Hedge Mustard	Cruciferae

Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Critesion jubatum</i>	Foxtail Barley	Gramineae
<i>Elymus canadensis</i>	Canada Wildrye	Gramineae
<i>Elymus trachycaulus</i>	Slender Wheatgrass	Gramineae
<i>Pascopyrum smithii</i>	Western Wheatgrass	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Chondrosium gracile</i>	Blue Grama	Gramineae
<i>Muhlenbergia asperifolia</i>	Alkali Muhly	Gramineae
<i>Panicum virgatum</i>	Switchgrass	Gramineae
<i>Sporobolus cryptandrus</i>	Sand Dropseed	Gramineae
<b>INTRODUCED PERENNIAL GRASSES</b>		
<i>Bromopsis inermis</i>	Smooth Brome	Gramineae
<i>Festuca pratensis</i>	Meadow Fescue	Gramineae
<i>Lolium perenne</i>	Perennial Rye	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Anisantha tectorum</i>	Cheatgrass	Gramineae
<i>Bromus japonicus</i>	Japanese Brome	Gramineae
<i>Eragrostis cilianensis</i>	Stinking Lovegrass	Gramineae
<i>Panicum capillare</i>	Witchgrass	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Asclepias speciosa</i>	Showy Milkweed	Asclepiadaceae
<i>Cardaria draba</i>	White Weed	Cruciferae
<i>Cirsium arvense</i>	Canada Thistle	Compositae
<i>Convolvulus arvensis</i>	Field Bindweed	Convolvulaceae
<i>Erigeron pumilus</i>	Low Daisy	Compositae
<i>Medicago sativa</i>	Alfalfa	Leguminosae
<i>Oenothera villosa</i>	Tall Evening-primrose	Onagraceae
<i>Senecio spartioides</i>	Broom Butterweed	Compositae
<b>ANNUAL AND BIENNIAL FORBS</b>		
<i>Amaranthus blitoides</i>	Prostrate Pigweed	Amaranthaceae
<i>Ambrosia trifida</i>	Giant Ragweed	Compositae
<i>Atriplex hastata</i>	Aster	Chenopodiaceae
<i>Bassia sieversiana</i>	Summer-cypress	Chenopodiaceae

Scientific Name	Common Name	Family Name
<i>Carduus nutans</i> ssp. <i>macrolepis</i>	Bristle Thistle	Compositae
<i>Chenopodium album</i>	Goosefoot	Chenopodiaceae
<i>Chenopodium leptophyllum</i>	Narrowleaf Goosefoot	Chenopodiaceae
<i>Conyza canadensis</i>	Horseweed	Compositae
<i>Croton texensis</i>	Croton	Euphorbiaceae
<i>Cyclachaena xanthifolia</i>	Marsh Elder	Compositae
<i>Fallopia convolvulus</i>	Black Bindweed	Polygonaceae
<i>Gaura parviflora</i>	Little-flowered Gaura	Onagraceae
<i>Helianthus annuus</i>	Annual Sunflower	Compositae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae
<i>Machaeranthera tanacetifolia</i>	Tansy-leaved Tansy-leaved Mach	Compositae
<i>Melilotus alba</i>	White Sweetclover	Leguminosae
<i>Melilotis species</i>	Sweetclover	Leguminosae
CACTI AND SUCCULENTS		
<i>Opuntia polyacantha</i>	Plains Prickly Pear	Cactaceae
ANNUAL AND BIENNIAL FORBS		
<i>Polygonum aviculare</i>	Devil's Shoestrings	Polygonaceae
<i>Polygonum ramocissiumum</i>	Branched Knotweed	Polygonaceae
<i>Rumex triangulivalvis</i>	Dock	Polygonaceae
<i>Salsola australis</i>	Russian-thistle	Chenopodiaceae
<i>Ximenesia encelioides</i>	Cow-pen Daisy	Compositae

Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Critesion jubatum</i>	Foxtail Barley	Gramineae
<i>Distichlis spicata</i> var. <i>stricta</i>	Inland Saltgrass	Gramineae
<i>Elymus canadensis</i>	Canada Wildrye	Gramineae
<i>Elymus trachycaulus</i>	Slender Wheatgrass	Gramineae
<i>Pascopyrum smithii</i>	Western Wheatgrass	Gramineae
<i>Schedonnardus paniculatus</i>	Tumblegrass	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Buchloe dactyloides</i>	Buffalo Grass	Gramineae
<i>Chondrosium gracile</i>	Blue Grama	Gramineae
<i>Muhlenbergia asperifolia</i>	Alkali Muhly	Gramineae
<i>Sporobolus cryptandrus</i>	Sand Dropseed	Gramineae
<b>INTRODUCED PERENNIAL GRASSES</b>		
<i>Bromopsis inermis</i>	Smooth Brome	Gramineae
<i>Chloris verticillata</i>	Windmill Grass	Gramineae
<i>Poa pratensis</i>	Kentucky Bluegrass	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Anisantha tectorum</i>	Cheatgrass	Gramineae
<i>Bromus japonicus</i>	Japanese Brome	Gramineae
<i>Cenchrus longispinus</i>	Sand Bur	Gramineae
<i>Eragrostis cilianensis</i>	Stinking Lovegrass	Gramineae
<i>Panicum capillare</i>	Witchgrass	Gramineae
<i>Setaria viridis</i>	Green Foxtail	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Asclepias speciosa</i>	Showy Milkweed	Asclepiadaceae
<i>Cardaria draba</i>	White Weed	Cruciferae
<i>Cirsium arvense</i>	Canada Thistle	Compositae
<i>Convolvulus arvensis</i>	Field Bindweed	Convolvulaceae
<i>Erigeron pumilus</i>	Low Daisy	Compositae
<i>Glycyrrhiza lepidota</i>	Wild Licorice	Leguminosae
<i>Medicago sativa</i>	Alfalfa	Leguminosae
<i>Physalis heterophylla</i>	Ground Cherry	Solanaceae
<i>Physalis virginiana</i>	Ground Cherry	Solanaceae
<i>Senecio spartioides</i>	Broom Butterweed	Compositae
<i>Verbascum thapsus</i>	Common Mullein	Scrophulariaceae

Scientific Name	Common Name	Family Name
<b>ANNUAL AND BIENNIAL FORBS</b>		
<i>Amaranthus blitoides</i>	Prostrate Pigweed	Amaranthaceae
<i>Amaranthus retroflexus</i>	Pigweed	Amaranthaceae
<i>Ambrosia trifida</i>	Giant Ragweed	Compositae
<i>Atriplex hastata</i>	Aster	Chenopodiaceae
<i>Bassia sieversiana</i>	Summer-cypress	Chenopodiaceae
<i>Carduus nutans</i> ssp. <i>macrolepis</i>	Bristle Thistle	Compositae
<i>Chenopodium album</i>	Goosefoot	Chenopodiaceae
<i>Chenopodium leptophyllum</i>	Narrowleaf Goosefoot	Chenopodiaceae
<i>Conyza canadensis</i>	Horseweed	Compositae
<i>Croton texensis</i>	Croton	Euphorbiaceae
<i>Cyclachaena xanthifolia</i>	Marsh Elder	Compositae
<i>Fallopia convolvulus</i>	Black Bindweed	Polygonaceae
<i>Gaura parviflora</i>	Little-flowered Gaura	Onagraceae
<i>Helianthus annuus</i>	Annual Sunflower	Compositae
<i>Helianthus petiolaris</i>	Prairie Sunflower	Compositae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae
<i>Lappula redowskii</i>	Beggars-tick	Boraginaceae
<i>Machaeranthera tanacetifolia</i>	Tansy-leaved Tansy-leaved Mach	Compositae
<i>Melilotis species</i>	Sweetclover	Leguminosae
<b>CACTI AND SUCCULENTS</b>		
<i>Opuntia polyacantha</i>	Plains Prickly Pear	Cactaceae
<b>ANNUAL AND BIENNIAL FORBS</b>		
<i>Polygonum aviculare</i>	Devil's Shoestrings	Polygonaceae
<i>Polygonum ramocissiumum</i>	Branched Knotweed	Polygonaceae
<i>Portulaca oleracea</i>	Purslane	Portulacaceae
<i>Salsola australis</i>	Russian-thistle	Chenopodiaceae
<i>Salsola australis</i>	Russian-thistle	Chenopodiaceae
<i>Solanum rostratum</i>	Buffalo Bur	Solanaceae
<i>Solanum triflorum</i>	Nightshade	Solanaceae
<i>Ximenesia encelioides</i>	Cow-pen Daisy	Compositae



Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Aristida purpurea</i> var. <i>longise</i>	Red Three-awn	Gramineae
<i>Critesion jubatum</i>	Foxtail Barley	Gramineae
<i>Elymus canadensis</i>	Canada Wildrye	Gramineae
<i>Elymus trachycaulus</i>	Slender Wheatgrass	Gramineae
<i>Pascopyrum smithii</i>	Western Wheatgrass	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Muhlenbergia asperifolia</i>	Alkali Muhly	Gramineae
<i>Sporobolus cryptandrus</i>	Sand Dropseed	Gramineae
<b>INTRODUCED PERENNIAL GRASSES</b>		
<i>Bromopsis inermis</i>	Smooth Brome	Gramineae
<i>Festuca pratensis</i>	Meadow Fescue	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Anisantha tectorum</i>	Cheatgrass	Gramineae
<i>Bromus japonicus</i>	Japanese Brome	Gramineae
<i>Eragrostis cilianensis</i>	Stinking Lovegrass	Gramineae
<i>Panicum capillare</i>	Witchgrass	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Achillea lanulosa</i>	Western Yarrow	Compositae
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Argemone polyanthemus</i>	Prickly Poppy	Papaveraceae
<i>Asclepias speciosa</i>	Showy Milkweed	Asclepiadaceae
<i>Cardaria draba</i>	White Weed	Cruciferae
<i>Cirsium arvense</i>	Canada Thistle	Compositae
<i>Convolvulus arvensis</i>	Field Bindweed	Convolvulaceae
<i>Erigeron pumilus</i>	Low Daisy	Compositae
<i>Glycyrrhiza lepidota</i>	Wild Licorice	Leguminosae
<i>Oenothera coronopifolia</i>	Evening Primrose	Onagraceae
<i>Physalis virginiana</i>	Ground Cherry	Solanaceae
<i>Senecio spartioides</i>	Broom Butterweed	Compositae
<b>ANNUAL AND BIENNIAL FORBS</b>		
<i>Amaranthus retroflexus</i>	Pigweed	Amaranthaceae
<i>Ambrosia trifida</i>	Giant Ragweed	Compositae
<i>Atriplex hastata</i>	Aster	Chenopodiaceae

Scientific Name	Common Name	Family Name
<i>Bassia sieversiana</i>	Summer-cypress	Chenopodiaceae
<i>Carduus nutans</i> ssp. <i>macrolepis</i>	Bristle Thistle	Compositae
<i>Chenopodium album</i>	Goosefoot	Chenopodiaceae
<i>Chenopodium leptophyllum</i>	Narrowleaf Goosefoot	Chenopodiaceae
<i>Cleome serrulata</i>	Rocky Mt. Bee Plant	Capparidaceae
<i>Conyza canadensis</i>	Horseweed	Compositae
<i>Croton texensis</i>	Croton	Euphorbiaceae
<i>Cyclachaena xanthifolia</i>	Marsh Elder	Compositae
<i>Gaura parviflora</i>	Little-flowered Gaura	Onagraceae
<i>Helianthus annuus</i>	Annual Sunflower	Compositae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae
<i>Machaeranthera tanacetifolia</i>	Tansy-leaved Tansy-leaved Mach	Compositae
<i>Melilotis species</i>	Sweetclover	Leguminosae
<i>Plantago patagonica</i>	Pursh's Plantain	Plantaginaceae
<i>Polygonum ramocissium</i>	Branched Knotweed	Polygonaceae
<i>Portulaca oleracea</i>	Purslane	Portulacaceae
<i>Rumex triangulivalvis</i>	Dock	Polygonaceae
<i>Salsola australis</i>	Russian-thistle	Chenopodiaceae
<i>Sisymbrium altissimum</i>	Tumbling Hedge Mustard	Cruciferae
<i>Solanum triflorum</i>	Nightshade	Solanaceae
<i>Verbena bracteata</i>	Creeping Charlie	Verbenaceae

Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Elymus canadensis</i>	Canada Wildrye	Gramineae
<i>Pascopyrum smithii</i>	Western Wheatgrass	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Chondrosum gracile</i>	Blue Grama	Gramineae
<i>Sporobolus cryptandrus</i>	Sand Dropseed	Gramineae
<b>INTRODUCED PERENNIAL GRASSES</b>		
<i>Agropyron cristatum</i>	Crested Wheatgrass	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Anisantha tectorum</i>	Cheatgrass	Gramineae
<i>Bromus japonicus</i>	Japanese Brome	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Convolvulus arvensis</i>	Field Bindweed	Convolvulaceae
<i>Sphaeralcea coccinea</i>	Scarlet Globe Mallow	Malvaceae
<b>ANNUAL AND BIENNIAL FORBS</b>		
<i>Bassia sieversiana</i>	Summer-cypress	Chenopodiaceae
<i>Conyza canadensis</i>	Horseweed	Compositae
<i>Descurainia pinnata</i>	Tansy Mustard	Cruciferae
<i>Helianthus annuus</i>	Annual Sunflower	Compositae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae
<i>Plantago patagonica</i>	Pursh's Plantain	Plantaginaceae
<i>Salsola australis</i>	Russian-thistle	Chenopodiaceae
<i>Sisymbrium altissimum</i>	Tumbling Hedge Mustard	Cruciferae

Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Aristida purpurea</i> var. <i>longise</i>	Red Three-awn	Gramineae
<i>Elymus canadensis</i>	Canada Wildrye	Gramineae
<i>Pascopyrum smithii</i>	Western Wheatgrass	Gramineae
<i>Schedonnardus paniculatus</i>	Tumblegrass	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Chondrosum gracile</i>	Blue Grama	Gramineae
<i>Sporobolus cryptandrus</i>	Sand Dropseed	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Anisantha tectorum</i>	Cheatgrass	Gramineae
<i>Bromus japonicus</i>	Japanese Brome	Gramineae
<i>Panicum capillare</i>	Witchgrass	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Cirsium arvense</i>	Canada Thistle	Compositae
<i>Convolvulus arvensis</i>	Field Bindweed	Convolvulaceae
<i>Erigeron pumilus</i>	Low Daisy	Compositae
<i>Lygodesmia juncea</i>	Skeleton Plant	Compositae
<i>Oenothera coronopifolia</i>	Evening Primrose	Onagraceae
<i>Oenothera villosa</i>	Tall Evening-primrose	Onagraceae
<i>Psoralidium tenuiflorum</i>	Slimflower Scurfpea	Leguminosae
<i>Ratibida columnifera</i>	Prairie Coneflower	Compositae
<i>Sphaeralcea coccinea</i>	Scarlet Globe Mallow	Malvaceae
<i>Tragopogon dubius</i>	Salsify	Compositae
<i>Verbascum thapsus</i>	Common Mullein	Scrophulariaceae
<b>ANNUAL AND BIENNIAL FORBS</b>		
<i>Bassia sieversiana</i>	Summer-cypress	Chenopodiaceae
<i>Carduus nutans</i> ssp. <i>macrolepis</i>	Bristle Thistle	Compositae
<i>Chamaesyce serpyllifolia</i>	Thyme-leaved Spurge	Euphorbiaceae
<i>Conyza canadensis</i>	Horseweed	Compositae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae
<i>Machaeranthera tanacetifolia</i>	Tansy-leaved Tansy-leaved Mach	Compositae
<i>Plantago patagonica</i>	Pursh's Plantain	Plantaginaceae
<i>Portulaca oleracea</i>	Purslane	Portulacaceae
<i>Salsola australis</i>	Russian-thistle	Chenopodiaceae
<i>Sisymbrium altissimum</i>	Tumbling Hedge Mustard	Cruciferae
<i>Verbena bracteata</i>	Creeping Charlie	Verbenaceae

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Scientific Name	Common Name	Family Name
<i>Ximenesia encelioides</i>	Cow-pen Daisy	Compositae
SEMI-SHRUBS OR HALF-SHRUBS		
<i>Gutierrezia sarothrae</i>	Broom Snakeweed	Compositae
SHRUBS		
<i>Eriogonum effusum</i>	Bushy Eriogonum	Polygonaceae
CACTI AND SUCCULENTS		
<i>Opuntia polyacantha</i>	Plains Prickly Pear	Cactaceae

Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Critesion jubatum</i>	Foxtail Barley	Gramineae
<i>Elymus canadensis</i>	Canada Wildrye	Gramineae
<i>Elymus trachycaulus</i>	Slender Wheatgrass	Gramineae
<i>Hordeum brachyantherum</i>	Little Barley	Gramineae
<i>Pascopyrum smithii</i>	Western Wheatgrass	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Calamovilfa longifolia</i>	Prairie Sandreed	Gramineae
<i>Chondrosium gracile</i>	Blue Grama	Gramineae
<i>Panicum virgatum</i>	Switchgrass	Gramineae
<i>Sporobolus airoides</i>	Alkali Sacaton	Gramineae
<i>Sporobolus cryptandrus</i>	Sand Dropseed	Gramineae
<b>INTRODUCED PERENNIAL GRASSES</b>		
<i>Agropyron cristatum</i>	Crested Wheatgrass	Gramineae
<i>Bromopsis inermis</i>	Smooth Brome	Gramineae
<i>Poa pratensis</i>	Kentucky Bluegrass	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Anisantha tectorum</i>	Cheatgrass	Gramineae
<i>Bromus japonicus</i>	Japanese Brome	Gramineae
<i>Eragrostis cilianensis</i>	Stinking Lovegrass	Gramineae
<i>Panicum capillare</i>	Witchgrass	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Asclepias pumilus</i>	Little Milkweed	Asclepiadaceae
<i>Asclepias speciosa</i>	Showy Milkweed	Asclepiadaceae
<i>Cirsium arvense</i>	Canada Thistle	Compositae
<i>Convolvulus arvensis</i>	Field Bindweed	Convolvulaceae
<i>Erigeron pumilus</i>	Low Daisy	Compositae
<i>Grindelia squarrosa</i>	Curlycup Gumweed	Compositae
<i>Lygodesmia juncea</i>	Skeleton Plant	Compositae
<i>Nuttallia nuda</i>	Blazingstar	Loasaceae
<i>Physalis virginiana</i>	Ground Cherry	Solanaceae
<i>Tragopogon dubius</i>	Salsify	Compositae
<i>Verbascum thapsus</i>	Common Mullein	Scrophulariaceae
<b>ANNUAL AND BIENNIAL FORBS</b>		
<i>Amaranthus retroflexus</i>	Pigweed	Amaranthaceae

Scientific Name	Common Name	Family Name
<i>Atriplex hastata</i>	Aster	Chenopodiaceae
<i>Bassia sieversiana</i>	Summer-cypress	Chenopodiaceae
<i>Carduus nutans</i> ssp. <i>macrolepis</i>	Bristle Thistle	Compositae
<i>Chenopodium album</i>	Goosefoot	Chenopodiaceae
<i>Conyza canadensis</i>	Horseweed	Compositae
<i>Cyclachaena xanthifolia</i>	Marsh Elder	Compositae
<i>Descurainia pinnata</i>	Tansy Mustard	Cruciferae
<i>Gaura parviflora</i>	Little-flowered Gaura	Onagraceae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae
<i>Machaeranthera tanacetifolia</i>	Tansy-leaved Tansy-leaved Mach	Compositae
<i>Melilotus alba</i>	White Sweetclover	Leguminosae
<i>Melilotus officinalis</i>	Yellow Sweetclover	Leguminosae
<i>Polygonum aviculare</i>	Devil's Shoestrings	Polygonaceae
<i>Polygonum ramocissiumum</i>	Branched Knotweed	Polygonaceae
<i>Salsola australis</i>	Russian-thistle	Chenopodiaceae
<i>Sisymbrium altissimum</i>	Tumbling Hedge Mustard	Cruciferae
<i>Ximenesia encelioides</i>	Cow-pen Daisy	Compositae

Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Critesion jubatum</i>	Foxtail Barley	Gramineae
<i>Elytrigia dasystachya</i>	Thickspike Wheatgrass	Gramineae
<i>Elymus trachycaulus</i>	Slender Wheatgrass	Gramineae
<i>Pascopyrum smithii</i>	Western Wheatgrass	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Chondrosium gracile</i>	Blue Grama	Gramineae
<i>Sporobolus cryptandrus</i>	Sand Dropseed	Gramineae
<b>INTRODUCED PERENNIAL GRASSES</b>		
<i>Agropyron cristatum</i>	Crested Wheatgrass	Gramineae
<i>Elytrigia intermedia</i> var. <i>barb</i>	Pubescent Wheatgrass	Gramineae
<i>Festuca pratensis</i>	Meadow Fescue	Gramineae
<i>Lophopyrum elongatum</i>	Tall Wheatgrass	Gramineae
<i>Poa pratensis</i>	Kentucky Bluegrass	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Anisantha tectorum</i>	Cheatgrass	Gramineae
<i>Bromus japonicus</i>	Japanese Brome	Gramineae
<i>Eragrostis cilianensis</i>	Stinking Lovegrass	Gramineae
<i>Panicum capillare</i>	Witchgrass	Gramineae
<i>Setaria viridis</i>	Green Foxtail	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Asclepias speciosa</i>	Showy Milkweed	Asclepiadaceae
<i>Cirsium arvense</i>	Canada Thistle	Compositae
<i>Convolvulus arvensis</i>	Field Bindweed	Convolvulaceae
<i>Erigeron pumilus</i>	Low Daisy	Compositae
<i>Grindelia squarrosa</i>	Curlycup Gumweed	Compositae
<i>Lygodesmia juncea</i>	Skeleton Plant	Compositae
<i>Psoraleidum tenuiflorum</i>	Slimflower Scurfpea	Leguminosae
<i>Sphaeralcea coccinea</i>	Scarlet Globe Mallow	Malvaceae
<i>Verbascum thapsus</i>	Common Mullein	Scrophulariaceae
<b>ANNUAL AND BIENNIAL FORBS</b>		
<i>Amaranthus retroflexus</i>	Pigweed	Amaranthaceae
<i>Bassia sieversiana</i>	Summer-cypress	Chenopodiaceae



Scientific Name	Common Name	Family Name
Verbascum thapsus	Common Mullein	Scrophulariaceae
Verbascum thapsus	Common Mullein	Scrophulariaceae
ANNUAL AND BIENNIAL FORBS		
Amaranthus retroflexus	Pigweed	Amaranthaceae
Bassia sieversiana	Summer-cypress	Chenopodiaceae
Carduus nutans ssp. macrolepis	Bristle Thistle	Compositae
Chenopodium album	Goosefoot	Chenopodiaceae
Chenopodium leptophyllum	Narrowleaf Goosefoot	Chenopodiaceae
Conyza canadensis	Horseweed	Compositae
Croton texensis	Croton	Euphorbiaceae
Cyclachaena xanthifolia	Marsh Elder	Compositae
Eriogonum annuum	Annual Buckwheat	Polygonaceae
Gaura parviflora	Little-flowered Gaura	Onagraceae
Helianthus annuus	Annual Sunflower	Compositae
Lactuca serriola	Prickly Lettuce	Compositae
Machaeranthera tanacetifolia	Tansy-leaved Tansy-leaved Mach	Compositae
Melilotus officinalis	Yellow Sweetclover	Leguminosae
Melilotis species	Sweetclover	Leguminosae
Poinsettia dentata	Poinsettia	Euphorbiaceae
Polygonum aviculare	Devil's Shoestrings	Polygonaceae
Salsola australis	Russian-thistle	Chenopodiaceae
Sisymbrium altissimum	Tumbling Hedge Mustard	Cruciferae
Verbena bracteata	Creeping Charlie	Verbenaceae
Ximenesia encelioides	Cow-pen Daisy	Compositae
SHRUBS		
Oligosporus filifolius	Sand Sagebrush	Compositae
CACTI AND SUCCULENTS		
Opuntia polyacantha	Plains Prickly Pear	Cactaceae