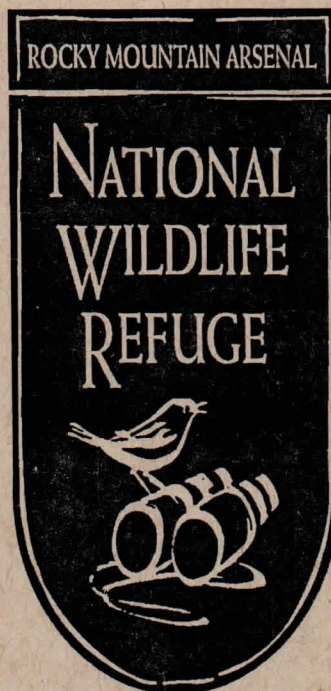


ROCKY MOUNTAIN ARSENAL NATIONAL WILDLIFE REFUGE



FISH AND WILDLIFE MANAGEMENT PLAN

July 1997



U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR



**ROCKY MOUNTAIN ARSENAL NATIONAL WILDLIFE REFUGE
MANAGEMENT PLAN**

FISCAL YEAR 1998



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**ROCKY MOUNTAIN ARSENAL NATIONAL WILDLIFE REFUGE
FISH AND WILDLIFE MANAGEMENT PLAN**

Fiscal Year 1998

**Prepared in Partial Fulfillment
of requirements 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**

July 1997

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INTRODUCTION

Contamination History

The Rocky Mountain Arsenal (Arsenal) was created in 1942 by the U.S. Army (Army) to manufacture mustard gas and incendiary munitions during World War II. Beginning in the 1950's, GB nerve agent also was produced at the Arsenal as part of the Cold War era.

Arsenal manufacturing plants and associated facilities were located near the center of the 17,000 acres of former farm and ranch land to provide security for Army operations and to protect the safety of nearby residents. The remaining acreage in outlying areas of the Arsenal provided undisturbed habitat for many species of wildlife.

In 1946, manufacturing facilities used for chemical weapons production at South Plants were leased to private companies and eventually Shell Oil Company. These facilities were modified to produce insecticides including chlordane, aldrin, dieldrin, endrin, and parathion, dibromochloropropane (a nematocide), and DD soil fumigant. Lubricant and lubricant additives also were produced by Shell until 1982.

Production of military and commercial chemical products before 1956 resulted in considerable chemical waste at the Arsenal (Trautman 1980). During World War II, the Arsenal produced approximately 87,000 tons of chemical munitions, 155,000 tons of incendiary munitions, and considerable quantities of toxic chemical waste. Liquid wastes were sometimes held in settling ponds in the South Plants area or were placed in Basin A—an open, unlined natural depression located north and down-gradient from South Plants near the center of the Arsenal. Basins B, C, D, and E received overflow from Basin A. Solid wastes were either burned or buried in pits in Sections 4, 20, 30, 33, and 36. In 1955, landowners adjoining the Arsenal complained that groundwater beneath their land was contaminated. In 1956, 93-acre Basin F was constructed with an asphalt lining to store all subsequent liquid wastes.

In 1962, Basin F reached its storage capacity. As an alternative disposal method, the Army Corps of Engineers drilled a 12,045-foot deep injection well and pumped 175 million gallons of liquid wastes into the well from 1962 to 1966. However, this well was dismantled after it was identified as a potential source of seismic disturbances in the Denver area in 1966. Thereafter, some liquid waste disposal was conducted by spray evaporation, carrying aerosol droplets of hazardous liquid wastes downwind.

In 1965, Shell Oil Company entered into an agreement with the Army to pay a negotiated rate for each 1,000 gallons of waste produced. The Arsenal also began accepting waste for disposal from Lowry Air Force Base and Fitzsimons Army Medical

Center in 1966. Solid and slurry wastes were often disposed of in the most convenient manner without regard to or knowledge of their environmental and public health hazards.

In 1975, the primary mission of the Arsenal was changed to demilitarizing and disposing of obsolete chemical munitions. The mission of the Arsenal was further refined in 1980 to direct the disposal of chemical agents and hazardous materials, including decontamination and cleanup of the installation. Most chemical munitions being stored at the Arsenal were transferred in 1981 to the Tooele Army Depot in Utah for demilitarization and disposal.

In 1987, the Arsenal was listed by the U.S. Environmental Protection Agency (EPA) on the National Priorities List for hazardous materials cleanup as a Superfund Site governed by provisions of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 as amended by the Superfund Amendments and Reauthorization Act of 1986. A Record of Decision outlining requirements for cleanup of the Arsenal was signed in June 1996. Final remedy of the Arsenal began in 1997 and is anticipated to require the next 10-14 years.

Environmental Setting

The Arsenal is 27 square miles of gently rolling, largely undeveloped grassland, with open prairie in upland areas interspersed with riparian, wetland, and open water habitats in low-lying areas. Elevations range from about 5300 feet above mean sea level (MSL) at the southeast corner to 5100 feet at the northwest corner. Average elevation is 5250 MSL. The Arsenal is located within the South Platte River drainage but has no direct surface water connection to the river. First Creek, an intermittent stream, enters the southeast corner of the Arsenal and runs northwestward beyond the north boundary and flows into the O'Brien Canal. Second Creek drains the extreme northeast corner. The remainder of the Arsenal lies within the Irondale Gulch basin. Surface and ground water flows are generally from southeast to northwest across the Arsenal.

Arsenal climatic conditions are semi-arid and typical of other parts of the Colorado Front Range. Mean annual temperature is a moderate 64 degrees Fahrenheit and the average growing season is 135 days. Average annual precipitation is 14.6 inches while average annual pan evaporation exceeds 30 inches of moisture.

Most native vegetation on short-grass and sand prairie habitats at the Arsenal was lost prior to 1942 by conversion to agriculture. These prairies were dominated by blue grama grass, western wheat grass, sand bluestem grass, needle and thread grass, and sand sagebrush. A variety of grasses and forbs can still be found on the Arsenal including four types of native grasslands which presently comprise about 20 percent of

the Arsenal. There is a relatively diverse combination of habitats at the Arsenal ranging from almost pure stands of native short-grass prairie to extensive fields of brome cheat grass, moist soils and adjacent wetlands, intermittent streams, and permanent lakes. These habitats in turn support an abundant and varied animal life.

History of Fish and Wildlife Management

Management of fish and wildlife resources has varied since the Arsenal began. During the 1960's, a Rod and Gun Club was established to provide recreation for civilian and military personnel working at the site. This club introduced a number of fish and wildlife species onto the Arsenal including bird species such as ringneck pheasants, bobwhite quail, and wild turkeys. Fish species introduced into the Arsenal's lakes in the 1960's included largemouth bass, northern pike, bluegill, and channel catfish.

During the Rod and Gun Club period, the Army conducted some wildlife management activities such as planting wildlife food plots of wheat, millet, corn, sorghum, and alfalfa. The acreage planted each year varied from 100 to 300 acres. The Army also permitted hunting for game birds and deer by Rod and Gun Club members during the 1960's and early 1970's, but hunting was eliminated in the mid-1970's.

History of U.S. Fish and Wildlife Service Involvement

The Arsenal was designed with substantial buffer zones surrounding chemical production facilities to protect the public if a catastrophic event occurred. These lands have remained largely undeveloped. Vegetation succession, the removal of livestock, and limited human access and disturbance since 1942 have resulted in wildlife habitat of considerable diversity. Surrounding urbanization and the expansion of agricultural practices have isolated the Arsenal, magnifying its overall importance to local wildlife communities. Construction of the new Denver International Airport, the E-470 beltway, and associated development will continue to isolate wildlife habitat within the Arsenal.

On March 23, 1989, the Army and the U.S. Fish and Wildlife Service entered into a Cooperative Agreement for Conservation and Management of Fish and Wildlife Resources at Rocky Mountain Arsenal (Cooperative Agreement). Under provisions of this agreement, a Service Field Office was established at the Arsenal to provide centralized coordination of fish and wildlife management and to provide technical assistance to the Army regarding Arsenal cleanup. The Cooperative Agreement has been revised four times to reflect the responsibilities of the Service at the Arsenal, which include conserving and enhancing populations of fish, wildlife and plants, protecting threatened and endangered species, preserving wetlands and other aquatic resources, and providing opportunities for fish- and wildlife-oriented public use, environmental education, and scientific research.

Authorities for Army-Service Cooperation

The Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 (Public Law 102-402) was enacted by Congress and signed by President Bush to establish a National Wildlife Refuge at the site following contaminant cleanup and to direct the Service to manage the site as if it were a National Wildlife Refuge during the cleanup process. This law required the Secretary of the Army and the Secretary of the Interior to enter into a Memorandum of Understanding (MOU) to define their respective Departmental roles and their level of cooperation at the Arsenal to transition the site into a National Wildlife Refuge. This MOU was signed on January 13, 1993. Subsequently, the Cooperative Agreement was revised in February 1993 and November 1994, based on the MOU, to clarify the responsibilities and define the roles of the Service at the Arsenal. An additional revision of the Cooperative Agreement was completed in June 1997 to make the agreement more consistent with the Record of Decision for Arsenal cleanup, define new funding categories, and to integrate Service responsibilities into the Remediation Venture Office (RVO), a new partnership to implement the remedy and deliver the Refuge (see below).

All versions of the Cooperative Agreement have identified the need for Service development and Army approval of annual Fish and Wildlife Management Plans for the Arsenal. As set forth in the June 1997 Cooperative Agreement (Section XII. C. 1.), the following Management Plan was prepared to guide Service activities for Fiscal Year 1998. Proposed activities included in this FY98 Management Plan are divided into the following six specific Service tasks as defined in the June 1997 Cooperative Agreement (Section XII. C. 2. a.-f.):

Task 1. Fish and Wildlife Health Status Monitoring Efforts

Task 2. Fish and Wildlife Habitat Mitigation, Restoration, and Protection Efforts

Task 3. Activities Coordination Program Efforts

Task 4. Planning/Public Participation

Task 5. Administrative Support Efforts

Task 6. Remedy Support Efforts

Funding Categories

Army funding to the Service for FY98 to support activities within the above Tasks is provided to conduct three main types of activities:

Cleanup--Service work directly supporting Army's cleanup efforts such as assisting with the design and location of the future hazardous waste landfill to minimize wildlife impacts;

Mitigation--Service projects to reduce adverse environmental impacts caused by cleanup activities such as planning and implementing short-grass prairie restoration in upland areas disturbed by the cleanup; and

Fish and Wildlife Management (Trustee)--Assisting the Army in managing and protecting all fish and wildlife resources at the site.

Two categories of Army dollars are provided to the Service for the above activities:

Base Funding--supports Service personnel, administrative, and other fixed costs. From FY96 to FY 2001, Army's annual base funding to the Service will decrease from \$2.5 million to \$1.35 million (June 1997 Cooperative Agreement, Section X. A. 3.). Base funding to the Service for FY98 is anticipated to be \$2.0 million and is equivalent to "baseline" funding within the RVO's Zero Based Budget system for FY98; and

Supplemental Funding--supports the operational costs for individual cleanup, mitigation, or trustee projects, and varies yearly depending on the number and complexity of projects conducted. Supplemental funding to the Service is equivalent to "project" funding within the RVO's Zero Based Budget system for FY98.

Remediation Venture Office

To implement the Record of Decision for cleanup of the Arsenal in a timely and cost-effective manner, while protecting human health and the environment, the Army, Shell Oil Company, and the Service have formed a unique partnership known as the Remediation Venture Office. This partnership is responsible for all aspects of the required remedy and relies on teams of Army, Shell, and Service personnel combined to accelerate productivity and decisionmaking for remedial design and remedial action. Each Service Task listed above will provide significant technical and other support to RVO teams during FY98 (and beyond) to achieve a faster, more effective, and more reliable remedy that anticipates the future of the Arsenal as a National Wildlife Refuge. RVO success in completing an effective remedy is critical to the Service, so RVO team

support by Service personnel is one of the highest priority activities for FY98. Staff time and dollar costs for this support have been factored into this Management Plan and will continue to be a part of future management plans until the remedy is completed. The RVO is a highly motivated and productive combination of people, skills, and talents in which the Service is proud to be a partner in making the remedy an environmental, economic, and technical success.

TASK 1- FISH AND WILDLIFE HEALTH STATUS MONITORING EFFORTS

TASK INTRODUCTION

Specific tasks outlined in the Cooperative Agreement for Fish and Wildlife Health Status Monitoring state that the Service shall provide for the conservation of fish and wildlife resources, especially listed species [threatened and endangered], by:

1. Conducting portions of the Army natural resource management responsibilities at the Arsenal;
2. Fulfilling Department of the Interior responsibilities specified in the Federal Facilities Agreement (FFA) and the Arsenal Refuge Act;
3. Providing technical guidance and comments on cleanup activities and contaminant exposure to minimize their impacts on fish and wildlife resources;
4. Providing a draft and final Biomonitoring Plan for approval by the Program Manager (to be part of the Annual Fish and Wildlife Resource Management Plan);
5. Conducting an approved Biomonitoring Plan which periodically evaluates the extent and effects of specific chemical contamination in Arsenal fish and wildlife;
6. Conducting or supervising specific studies to evaluate the quality of surface water coming onto the Arsenal and to assess the health and survival of Arsenal fish and wildlife species as these parameters may affect the interpretation of contamination impacts on the same or similar species;
7. Conducting censuses and other population assessment techniques for fish and wildlife populations on and near the Arsenal;
8. Designing, conducting, and supervising fish and wildlife resource studies;
9. Allowing, when appropriate, qualified scientists to carry out approved ecological or environmental field study programs;
10. Coordinating negotiations, implementing resolutions, and maintaining related records of all activities necessary to address listed species, wetlands, and other fish and wildlife issues at the Arsenal;

11. Providing input for the responsibilities described above into Service Fish and Wildlife Resource Management Plan, budgets, and reports; and
12. Developing and providing oversight for planning documents.

Funding Sources

58 percent will be from Cleanup

42 percent will be from Trustee

TASK 1- FISH AND WILDLIFE HEALTH STATUS MONITORING EFFORTS

TITLE: Planning

INTRODUCTION

Passage of the Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 resulted in the need to comply with Service planning procedures. These procedures call for the development of comprehensive management plans to guide decisions and support cleanup plans. The Refuge Act requires consultation with the Colorado Department of Natural Resources and local governments adjacent to the Refuge in the development of plans. Additionally, the National Environmental Policy Act (NEPA) and the National Wildlife Refuge System Administration Act require that the public be provided with opportunities to comment and provide input related to future uses of the site. Finally, the Cooperative Agreement for Conservation and Management of Fish and Wildlife Resources at Rocky Mountain Arsenal (U.S. Government 1997) requires the Service to develop and provide oversight of planning documents.

The Service, Army, and Shell recognized the need for a long-range plan which would provide the future vision of the Refuge and guide wildlife and habitat management decisions. In late FY93, Shell Oil Company provided an initial grant to the National Fish and Wildlife Foundation to begin this long-range Comprehensive Management Plan (CMP). In April 1994, the Foundation signed a contract with a planning contractor to assist the Service in developing the CMP for the Refuge. The CMP was developed through a 2-year-long planning process that had extensive public involvement. The Service received public input through public workshops, focus group discussions, meetings with non-profit organizations, government agencies, and one-on-one discussions with interested citizens. An Environmental Impact Statement (EIS) was prepared with a Record of Decision signed on December 8, 1995. The Final EIS was released to the public in February 1996. The final CMP was presented to the public in June 1996.

With the completion of the CMP and the implementation of the Record of Decision for the cleanup of the Arsenal, the primary function of the planning task is to ensure that the transition of the Arsenal from the Army to the Service complies with the goals and objectives of the Refuge CMP and other Service mandates.

OBJECTIVES

1. Ensure that the cost of maintaining, demolishing, or improving the Arsenal infrastructure conforms with the philosophy and development goals set forth in the Refuge CMP.
2. Ensure compliance with the National Historic Preservation Act, Archaeological Resources Protection Act, Native American Graves Protection Act, and National Environmental Policy Act through cleanup and transition to the Refuge.
3. Support the timely and efficient disposal of the Arsenal property Section 4, 9, and 33 in accordance with the Refuge Act of 1992.
4. Assist with the orientation of the Program Management Contractor concerning Refuge compliance issues.
5. Review remedy execution activities (e.g., landfill design, surface water and groundwater issues, boundary issues) for conformance with the CMP.
6. As the remedy is executed and the transition to the Refuge goes forward, ensure that all Department of the Interior and/or Service mandates for environmental compliance are being followed.

METHODS

The Service will work in partnership within the RVO to integrate cleanup together with the Service's long-range plan detailed in the CMP. Refuge compliance issues will be addressed under Program Controls within the RVO Organization. The Service will actively participate on the various teaming efforts with Army and Shell as the design of the final remedy takes form. As additional information becomes available with regard to future monitoring needs, haul and borrow roads, and other remediation needs are known, the Service will refine future planning of public tour routes or other infrastructure requirements.

TASK 1-FISH AND WILDLIFE HEALTH STATUS MONITORING EFFORTS

TITLE: Biomonitoring Program

INTRODUCTION

Since 1993, the U.S. Fish and Wildlife Service has conducted extensive biomonitoring investigations on the Refuge to assess contaminant-related effects on numerous sentinel species (kestrels, badgers, largemouth bass, etc.) that exist on the Refuge (U.S. Fish and Wildlife Service 1994). The goal of the Biomonitoring Program (BMP) is to ensure that cleanup is successful at protecting wildlife populations that inhabit the Refuge, and that the Refuge "ecosystem is restored" (U.S. Fish and Wildlife Service 1994). This document is only an outline of a proposed Service strategy for biomonitoring on the Refuge during cleanup. A formal long-term biomonitoring plan that includes monitoring plans for each species and a quality control/quality assurance document plan must still be prepared and reviewed by the Biological Advisory Subcommittee. In addition, projected budgets and staffing needs are still to be determined. The need for and approach for a Natural Resource Damage Assessment also may dictate future needs for data collection and use of biomonitoring data.

OBJECTIVES

1. Determine the influence of contaminants upon fish and wildlife health at the individual, population, and community levels using residue chemistry and health indices (establish the benchmark), and provide this supplemental data to the U.S. Army, Shell Oil Company, U.S. Fish and Wildlife Service, Environmental Protection Agency, and State of Colorado (Parties) and general public to assist in remedial action planning, risk management, and wildlife management on the Refuge.
2. Use the results of the BMP as part of a Natural Resource Damage Assessment.
3. Use the pre-remediation wildlife health status benchmark as a comparison against post-remediation conditions for long-term biomonitoring on the Refuge.

The initial phase of the BMP focused almost exclusively on assessing contaminant-related effects on wildlife (protection of wildlife from contamination) and the development of monitoring tools. Although the Service, through wildlife management programs, provided advice and guidance to Army and the other Parties on minimizing

wildlife disturbance and conflicts, little effort was expended on assessing the effects on wildlife from habitat disturbance, increased human activity, or other anthropogenic disturbance on wildlife. Realizing that other activities associated with remediation may also significantly affect fish and wildlife populations on the Refuge, the Service has added an additional objective to the BMP. This objective will be used to determine if the second portion of the BMP goal (restoration of the Refuge ecosystem) is met.

The fourth objective of the BMP is:

4. Determine the effects of increased human activity and habitat disturbance/destruction on wildlife and the efficacy of mitigation/revegetation programs by continued monitoring of Refuge-wide population trends and/or site-specific studies.

Several of the initial biomonitoring studies were completed in 1997 and theses and reports will be reviewed to assist in determination of long-term biomonitoring methods. A determination of how a Natural Resource Damage Assessment will be approached should be done in 1998 so that additional data representative of current and past conditions can be collected before cleanup begins, if needed.

METHODS

The long-term BMP, which will parallel the cleanup, will be less intensive than the original BMP (U.S. Fish and Wildlife Service 1994) because of anticipated funding and personnel cutbacks. In addition, it is believed by the Service that monitoring to follow trends need not be as intensive as establishing background conditions or method establishment. The long-term BMP will employ those sentinel species and measurement endpoints which are deemed to provide the best information on wildlife health but are "user friendly." The term "wildlife health" refers to the normal or expected productivity, mortality, growth, recruitment, survival, community structure, pathological conditions, immune function, etc., of individuals, populations, and/or communities (U.S. Fish and Wildlife Service 1994). Species and/or endpoints that are difficult to work with in the field and are extremely sensitive to handling or holding times may be dropped from the long-term BMP.

The long-term BMP will have five monitoring strategies to meet the stated objectives (Figure 1).

1. Some sentinel species (kestrels, badgers, largemouth bass, etc.) which were studied every year over a 2- to 4-year period will now be monitored every 4 years (quadrennially) (Figure 2). This periodic monitoring will result in four sampling

rounds per species over the life of the long-term BMP and allows for trend determinations of contaminant burdens and related effects without conducting extensive lethal collections.

2. Raptors (great horned owl, burrowing owls, Swainson's hawk, ferruginous hawks, bald eagles, etc.) which have had continuous population monitoring (e.g., nesting and/or wintering raptor surveys) will continue to be monitored on an annual basis. The annual monitoring is necessary to take into account the potentially high annual variability in the numbers of wintering or successfully breeding raptors using the Refuge. This annual variability is typically caused by prey abundance on the Refuge or climatic conditions. Contaminant monitoring (blood and fat) will be conducted quadrennially on nestlings of large raptors (great horned owls, Swainson's hawk, etc.). The wintering population and reproductive monitoring may allow the Service to document the affects from human activities, related to remedial actions, on birds of prey. Contaminant monitoring will provide information on long-term changes in contaminant exposure of large raptors on the Refuge.
3. Some sentinel species which have small home ranges (starlings, deer mice, and pocket gopher) will be used to assess site-specific contamination exposure and effects. These species will be used to assess the efficacy of remediation of a particular site by evaluating contaminant-related effects upon individual, population, and community parameters. Sites scheduled for remediation will be monitored pre-remediation and periodically post-remediation. These assessments will occur annually, but locations will vary from year to year. These species will also be used to assess sites where the need for remediation is in question.
4. Small mammal and passerine populations will be monitored annually to assess the success of revegetation/mitigation programs to ensure that benefits to wildlife are realized. Sites scheduled for revegetation/mitigation will be monitored pre-revegetation and periodically post-revegetation.
5. Fortuitous specimens will continue to be collected for necropsy and chemical analyses to evaluate the frequency of chemical exposure, although at a reduced number submitted.

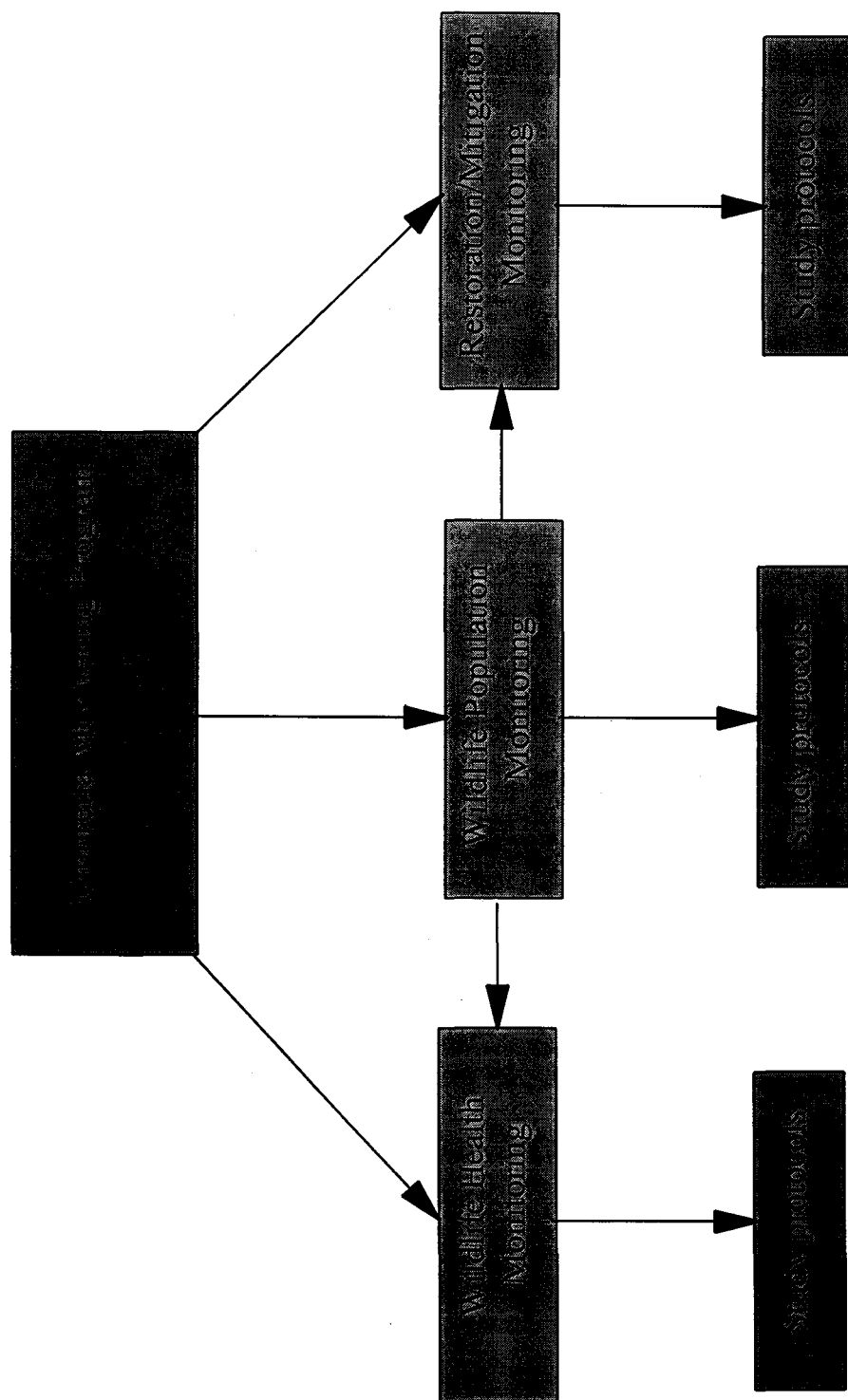
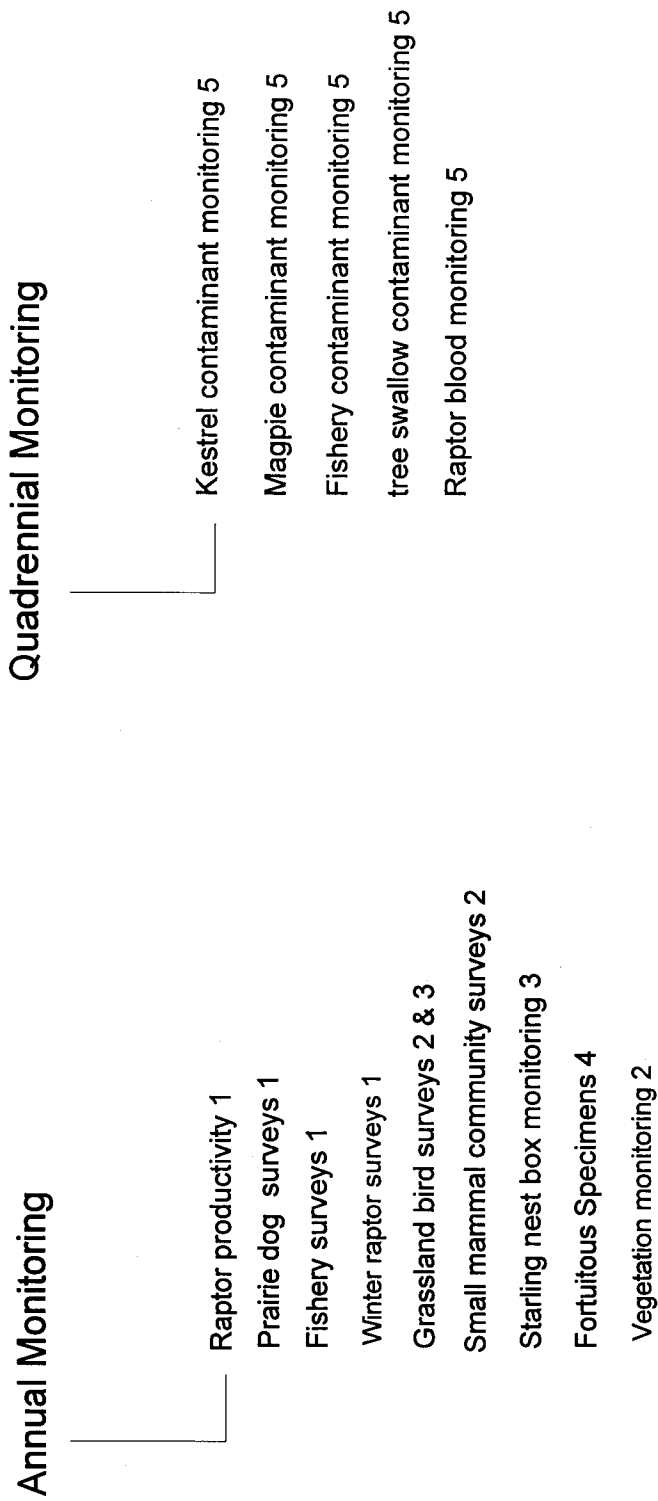


Figure 1. Umbrella Monitoring Program



- 1 = Refuge-wide population monitoring
- 2 = site-specific population monitoring
- 3 = site-specific contaminant monitoring (pre- and post-remediation)
- 4 = Continuous contaminant monitoring
- 5 = Refuge-wide contaminant monitoring

Figure 2. Monitoring strategies on RMANWR

Monitoring Study Outlines

1. Refuge-wide sentinel species monitoring:

American kestrel--The kestrel will be monitored quadrennially for contaminant concentrations in eggs beginning in 1997. Contaminant concentrations in eggs will be used to assess long-term changes in contaminant exposure of kestrels. The current nest box array will remain in order to maintain consistency with past biomonitoring methodology. This will allow for trend determinations in contaminant residues for core and peripheral areas of the Refuge and for each nest box location. During years when no collections are scheduled, kestrel productivity will be monitored (on- and off-Refuge). All kestrel nestlings and trapped adults will be individually marked with Service leg bands for future identification.

Black-billed magpie--Field work for research on the magpie was completed in 1997 and a final report is expected in 1998. The magpie will then be monitored quadrennially for contaminant burdens in eggs and reproductive parameters. Contaminant concentrations in eggs will be used to assess long-term changes in contaminant exposure of magpies. Magpie nests are located throughout the Refuge. The magpie has been shown to be a good indicator of environmental contamination on the Refuge and this species is the only year-round resident avian species proposed for monitoring. All magpie nestlings and trapped adults will be individually marked with Service leg bands for future identification.

Aquatic (fish, invertebrates, birds)--A final report from Colorado State University studies is due in December 1997, with monitoring recommendations that may modify the following plan. A final waterbird monitoring plan will be formulated. Red-winged blackbirds did not prove to be sensitive indicators of sediment contamination and could only be used on Lake Ladora. Tree swallows were experimented with in 1997 with limited success due to sample size. However, more boxes placed on the lakes may give a large enough sample size for monitoring purposes. At this time, collection of waterfowl is still the best method for indicating bioavailability of sediment contaminants, but does not sufficiently indicate effects from those contaminants. Fish may be the best indicators of contaminant effects for long-term monitoring. Whole-body fish (pike, bass, bluegill) will be analyzed for contaminant residue. Select fish samples will be submitted to fish pathologists for health monitoring. Contaminant concentrations in fish and health indices will be used to assess long-term changes in contaminant exposure and fish health in the lakes. Sediments will be collected and analyzed to monitor contamination trends, especially during South Plants remediation. Some invertebrate monitoring may also occur. In addition, during fish collections, population dynamics information will be collected to assess long-term trends which will be useful for managing the catch-and-release fishing program.

2. Refuge-wide raptor population monitoring:

Wintering raptor population trends--From October to May, weekly winter raptor (hawks, owls, eagles) surveys will occur throughout the Refuge. To the extent possible during cleanup, the survey routes will remain consistent with existing routes. This information should be useful in determining the influence of increased human activity on the number of raptors using the Refuge and reduce conflicts between cleanup activities and important raptor use areas. This information will also be used to assess long-term wintering raptor use of the Refuge.

Breeding raptor population trends--From late winter through July breeding raptor surveys will be conducted to determine number of nest attempts by species, location, and nest success. This information should be useful in determining the influence of contamination and increased human activity on raptor reproduction on the Refuge. In addition, locating active raptor nest sites on an annual basis may help to avoid or reduce conflicts because of cleanup activities. Blood and possibly fat will be collected quadrennially from nestlings to monitor long-term changes in contaminant exposure of large raptors on the Refuge.

3. Site-specific sentinel species monitoring:

Small mammal community surveys--Small mammal community structure will be monitored on sites scheduled for cleanup and on sites suspected of having soils contaminated above acceptable risk levels. Previous Service-sponsored studies has shown dramatic shifts in small mammal community structure in areas with elevated soil concentrations of dieldrin. Small mammal communities will also be monitored long-term after remediation of a site to determine efficacy of cleanup. Unfortunately, small mammal communities will not exist on a site immediately post-cleanup. Therefore, it will be a number of years before cleanup efficacy can be determined in regard to small mammal community structure.

European starling monitoring--Starling nest box arrays will be placed on sites that are scheduled for cleanup or are suspected of having soils contaminated above acceptable risk levels and reference sites. Starlings have been found to be good indicators of local contamination and effects on the Refuge. Starling eggs will be collected for contaminant residue analyses, and all nestlings will be sacrificed. Concentrations in eggs will be used to assess long-term changes in contaminant exposure of starlings on select sites. Nestlings will be used for biomarker analyses. Biomarkers will also be used to assess long-term changes in contaminant exposure to starlings on the Refuge. Reproductive parameters will also be monitored.

4. Site-specific population monitoring:

Small mammal community structure--Small mammal community structure will be monitored on sites scheduled for revegetation as part of mitigation programs. Small mammal communities will be assessed pre- and post-revegetation to evaluate the actions' effectiveness at benefitting wildlife and restoring the Refuge ecosystem.

Passerine community monitoring--Native grassland songbird communities will be monitored on sites scheduled for revegetation as part of the mitigation programs. Only sites large enough to support grassland-bird populations will be evaluated. Grassland songbird communities will be monitored pre- and post-revegetation to evaluate the actions' effectiveness at benefitting wildlife and restoring the Refuge ecosystem.

5. Fortuitous specimens:

Fortuitous specimens--Necropsies and chemical analyses will be performed on dead or moribund wildlife found on the Refuge when no immediate cause of the death or morbidity is known. Standard carcass search sites such as Building 111, Visitor Center, South Plants will continue to be monitored on an annual basis to determine if cleanup of surrounding areas results in a decrease of the number of birds determined to have succumbed to pesticide (especially dieldrin and endrin) poisoning. Management of vegetation in South Plants and other highly contaminated areas may be requested to reduce the attractions to birds and attempt reduction of mortalities since cleanup of surficial soils in these areas is not scheduled for several years. This management will be dependent on the determination of additional data needs for Natural Resource Damage Assessment. Management activities should influence bird use of contaminated areas and could thus affect any further data collection on contaminant accumulation in birds.

Assessment of avian mortality--A study was designed and initiated in FY97 to estimate the number of bird deaths attributed to organochlorine exposure on the Refuge with specific objectives as follows:

- a. to estimate the spatial distribution and provide an index to the level of avian mortality across the Refuge;
- b. to relate the level of avian mortality to habitat type, distance from organochlorine point sources, and mean organochlorine concentrations where carcasses are found;
- c. to establish standardized carcass search sites and methods for long-term monitoring of avian mortality through cleanup.

This study was designed with technical assistance from the University of Wyoming and associated expertise. All field work is being conducted by Service staff. Methods include avian use surveys and carcass searches on a systematic grid of 100 meter by 100 meter plots placed over the Refuge. There are 60 plots in an area defined as "core" sections which consists of Sections 1, 2, 25, 26, 35, and 36. Fifty plots were placed in the "noncore" area which consists of the rest of the Refuge.' An additional 26 plots comprised of habitats that may be particularly attractive to birds (i.e., tree groves) are also being sampled. A sampling protocol and standard operating procedures were developed. Data collection will continue in 1998.

TASK 1-FISH AND WILDLIFE HEALTH STATUS MONITORING EFFORTS

TITLE: Songbird population trends, habitat use, and management

INTRODUCTION

The presence of songbirds on the Refuge has been documented since the early species listings of Fairbanks and Thorne (1975) in which Army biologists noted whether or not a bird species had been seen or was expected to frequent this area. Two standard bird survey techniques, the Christmas Bird Count and the Breeding Bird Survey, have been conducted by Service staff and volunteers on the Refuge since 1988 and 1991, respectively. From 1991 to 1993, a study of grassland songbird abundance, and reaction to simulated Arsenal cleanup was conducted by the Denver Museum of Natural History (Preston et al. 1994). A study to determine songbird use of Refuge riparian areas during the breeding season was conducted from 1994 through 1996. The importance of the Refuge as a seasonal stopover for migratory songbirds has remained unexplored.

Recent goals of monitoring songbirds on the Refuge have been to ascertain their localized population status, their habitat needs, and the effects of cleanup on their numbers. Refuge songbirds must be considered as part of the Front Range songbird population, Colorado's songbird population, and that of the western United States. The multi-agency conservation program *Partners in Flight* organized in 1990 established guidelines for monitoring migratory songbirds. These guidelines attempt to standardize local, state, and national monitoring efforts (Butcher 1992). Monitoring techniques in this study plan reflect the most current and accepted methods for standardizing surveys.

The CMP was completed in 1996 (U.S. Fish and Wildlife Service 1996) and its contents detail the intended uses and landscape modifications envisioned by the Service for the future Refuge. Among the changes that may impact songbird use of the Refuge include (a) redesign of First Creek, (b) environmental education facilities at the wetlands, and © reestablishment of prairie grasslands.

OBJECTIVES

1. Monitor population trends, seasonal abundance, and habitat use of songbirds on the Refuge.
2. Monitor habitat components important to songbirds that may change with cleanup and recommend mitigation strategies.

METHODS

Songbird Population Trend Surveys

Christmas Bird Count--The Service will continue to coordinate the Christmas Bird Count conducted annually on January 1 by the Denver Audubon Society and Denver Field Ornithologists. This standardized count of winter bird populations (Butcher 1990) has been slightly modified to accommodate the unique conditions at the Refuge. Only a part of the 24 km diameter circle defining the boundary of the count is on the Refuge.

Breeding Bird Survey--The Breeding Bird Survey (BBS) conducted in June and coordinated by the Service (Peterjohn and Sauer 1992) will be continued. Service personnel drive the BBS route which consists of 50 stops, at 0.8 km intervals recording all birds seen or heard at each stop in 3 minutes.

Songbird Habitat Use Surveys

Wetland area searches--One year of area searches conducted biweekly was completed on wetlands 3, 4, and 5 and the Highline Canal in 1996 and 1997. Data collected on species diversity and abundance will serve as a baseline prior to construction of trails and subsequent public use. If facilities construction is underway in 1998, area searches will be reinitiated for comparison. They also may be used on other sites prior to disturbance.

Grassland point counts--In 1997, 124 point count stations were placed 250 meters apart on a north/south grid system within sites that have been (BEMA sites) or were slated for restoration. As in 1997, grassland point counts will be conducted during FY98.

Each point count station will be visited at least once during the breeding season starting in mid-May through June. Counts will begin within a half hour of sunrise and end by 0930. Each point count is conducted for 5 minutes at a fixed station. Birds are noted as within 50 meters of the point or within 50-100 meters from the point. Additionally,

the bird's sex, age, behavior, and the habitat in which it is seen or heard is noted. It is estimated that 20 counts per observer can be done per day three times a week (to account for unfavorable weather conditions).

Subsequent to the bird count, a vegetative analysis that describes the coverage and structure of the vegetation surrounding the point-center will be conducted. The technique employed by Wiens (1969) addresses this vegetative physiognomy. Vegetation plots will be located a random distance between 15 and 100 meters from each point count in a random compass direction. At each plot the frequency of contacts of each physiognomic group (e.g., grass, shrub, succulent, etc.) with a thin metal rod at ten one-meter intervals is noted. Visual estimates of ground cover as well as presence of various features within 200 meters such as power lines, roads, fences, trees, groves, or water will be recorded.

Point counts will be done annually for no less than 5 years and up to 15 years. Point count data will be analyzed with respect to (1) relative abundance, (2) species richness, and (3) species diversity. Presence/absence may be used to discern species preference for certain habitats.

TASK 1 - FISH AND WILDLIFE HEALTH STATUS MONITORING EFFORTS

TITLE: Distribution, abundance, and management of the black-tailed prairie dog

INTRODUCTION

Black-tailed prairie dogs (Cynomys ludovicianus) form the prey base for a variety of predators on the Refuge, including the ferruginous hawk (Buteo regalis), badger (Taxidea taxus), coyote (Canis latrans) and threatened bald eagle (Haliaeetus leucocephalus). Prairie dogs also provide habitat for many wildlife species on the Refuge including burrowing owls (Athene cunicularia), desert cottontails (Sylvilagus auduboni) and prairie rattlesnakes (Crotalus viridis viridis). One study found that over 100 vertebrate species use prairie dog colonies as habitat (Clark et al. 1989). Large-scale plague epizootics (Yersinia pestis) in 1988-89 and 1994-95 reduced prairie dog distribution by 95 percent and 99 percent, respectively, and appears to be endemic on the Refuge. The Service deemed it crucial that prairie dog population levels be restored as quickly as possible following these epizootics. The focal point of this effort was through prairie dog relocations into areas of former occupation with the assistance of several private organizations. From 1989 to 1993, the Service relocated 5,800 prairie dogs to the Refuge from off-Refuge sources (U.S. Fish and Wildlife Service 1994). From an estimated distribution of nearly 1,750 hectares in 1987 (Environmental Sciences & Engineering 1988), to a low of less than 150 hectares by September 1989, prairie dogs rebounded to a distribution of nearly 1,000 hectares, with a population estimate of over 40,000 prior to the plague epizootic of 1994. The purpose of this proposal is to develop methods to track changes in the distribution and abundance of prairie dogs on the Refuge, and to delineate management guidelines to ensure maximum usage of available habitat by prairie dogs.

OBJECTIVES

1. Continue to monitor changes in prairie dog distribution and abundance.
2. Maintain and protect current prairie dog distribution.
3. Continue efforts to re-establish prairie dogs in appropriate areas.
4. Minimize human conflicts with Refuge prairie dogs for the duration of the cleanup mission.
5. Eliminate or minimize potential exposure of prairie dogs to chemically contaminated areas.

METHODS

Prairie dog distribution will be mapped using a Global Positioning System (GPS)(U.S. Fish and Wildlife Service 1995). Data is collected in the field using a TDC1 datalogger (Trimble Navigation Limited, Sunnyvale, CA). GPS positions are collected by walking the perimeters of prairie dog towns and recording positions at 10-15 second intervals. Only active prairie dog towns are included in the survey. The rover unit files are then downloaded to a computer with Pathfinder software. Differential correction (to increase accuracy to 2-5 meters) is completed using community base station files collected on-Refuge or downloaded from off-Refuge sources (i.e., U.S. Forest Service in Ft. Collins). Area features (i.e., prairie dog towns) are then read with the pathfinder software and the size of each area determined. Final maps are developed with the assistance of the Army's Geographic Information System (GIS) team and ArcView software.

Methods used to estimate population parameters are the same as those used in the 1991-94 surveys (U.S. Fish and Wildlife Service 1992, 1993, 1994, 1995), and are based on the methodology developed by the National Biological Service's Mid-Continent Ecological Science Center (MESC) in Fort Collins to evaluate black-footed ferret habitat (Biggins et al. 1989). Visual counts will be conducted to determine population densities and will be compared from year to year to determine population trends.

Visual counts will be conducted on study plots or, in some cases, entire prairie dog towns will be counted. Study plots are selected on a representative, rather than a random basis, due to certain site characteristics needed to conduct visual counts. Site characteristics include being able to see the entire study plot from a single location, vegetation height, size of prairie dog town, and topographic relief. The availability of suitable study sites (large, relatively flat prairie dog towns) will determine if plots are chosen or if entire towns are used to conduct visual counts. The plots are established using a Geodolite 404 surveying instrument (Geotronics AB, Danderyd, Sweden), and corners marked with 6-foot lengths of ½ inch PVC tubing. Pin flags are set out at regular intervals along the sides of the plots to further assist in determining whether prairie dogs are in or out of the plot during counts.

Visual counts will be performed for 3 consecutive days on each plot, or prairie dog town, starting approximately 1 half hour after sunrise and continuing (with 15 minutes between counts) until prairie dog numbers begin to decrease, usually mid-morning. The highest number of prairie dogs recorded during the 3 days of visual counts is then used to determine the density of each plot (highest count/area). All plots will be summed and divided by the number of plots to determine the mean density. Because

study plots will not be selected randomly, normal confidence interval estimates are not valid. Instead, the mean density determined from the raw visual count data represents the minimum estimated density. This minimum estimated density is then multiplied by the area determined by GPS to achieve the minimum estimated population.

Litter surveys may be conducted (as time/personnel constraints permit) as initiated in FY93 (U.S. Fish and Wildlife Service 1994) to ascertain and compare year-to-year reproductive success of prairie dogs on the Refuge. Reproductive success is defined as the number of juveniles produced per mature female. Other methods for calculating reproductive success include counts of corpora lutea, placental scars, as well as counts of actual embryos (King 1955, Koford 1958, Tileston and Lechleitner 1966, Knowles 1987, Stockrahm and Seabloom 1988). However, these methods may not yield accurate indicators of reproductive success because embryo absorption and/or infant mortality can significantly reduce litter size before emergence from the natal burrow. For prairie dogs, average observed litter size is the most accurate determination of reproductive success (King 1955, Kerwin 1972, Stockrahm and Seabloom 1988). This can be determined either from counts of juveniles at the burrow openings, or inferred from trapping data. Conducting counts of juveniles at burrow openings is the more accurate and efficient method. Counts will be initiated as soon as litters begin to emerge, usually late April/early May. Litters will be located by driving along roads adjacent to or through prairie dog towns and scanning with binoculars or a spotting scope. Burrows with litters will be marked with numbered pin flags and the location mapped. On subsequent one to two mornings, these burrows are revisited and the number of juveniles counted as they emerge from the burrow. After a few days post-emergence mixing of litters may occur, which makes accurate determination of litter sizes impossible. Therefore, litters must be located and counted within 1-3 days post-emergence. Sample size of litters will be dependent on personnel and time constraints. Means and standard errors will be calculated from the data collected and these values will be compared with previous years' data.

Large-scale plague (*Yersinia pestis*) outbreaks occurred on the Refuge in 1976 (Fairbanks and Telle 1976) 1988-89 and 1994-95 (U.S. Fish and Wildlife Service 1995). Additional limited-scale epizootics occurred in 1992 and 1993 (U.S. Fish and Wildlife Service 1993). Plague is a constant threat to the successful recovery of prairie dog populations (i.e., prairie dogs occupying all suitable habitat). The nature and extent of these epizootics can vary significantly as seen in the 1992 epizootic which affected approximately 8 percent of the prairie dog population. Service staff will continue to monitor occurrence of fleas and plague in Refuge prairie dogs. Casual surveys (i.e., daily field inspections) can detect the often sudden and catastrophic drops in prairie dog numbers normally associated with a plague epizootic. If plague is documented on the Refuge, pesticide (Permethrin) dusting procedures to kill plague vector fleas will be enacted to minimize plague epizootic spread.

Research aimed at controlling plague-vector (flea) populations was initiated in FY97. This involved the use of pyriproxyfen (Virbac, Inc.), an insect-growth regulator (sterilizing female fleas) as a prescriptive treatment to prevent plague epizootics from getting started. This research will involve a graduate student from the University of Wyoming as well as personnel from the Service and several other agencies (BRD/USGS, BLM, CDC, NPS, etc.) at different locations across the region. Permethrin kills fleas in burrows but has limited and variable effects in controlling active plague epizootics (U.S. Fish and Wildlife Service 1994, 1995). It is hoped that this research will enable Service personnel to limit the extent of plague epizootics on the Refuge and across the region.

Uncontaminated areas previously occupied by prairie dogs will continue to provide suitable relocation sites for prairie dogs displaced from areas of conflict on the Refuge and from off-Refuge sources. Some of these areas may be selected for vegetation enhancement (i.e., interseeding, or other nonintrusive methods) prior to re-introduction of prairie dogs. These areas will be enhanced for prairie dogs to mitigate for the loss of suitable habitat due to cleanup or other human activities. Identification of potential enhancement projects will be aided by maps of former prairie dog distribution, current contamination maps, and on-site field inspections. Success of these projects will be greater if adjacent to active prairie dog towns, which allows for gradual expansion into the new habitat.

Service staff will continue to work with Army and contractors through the Activities Coordination protocols to ensure minimal damage to active prairie dog towns by cleanup/operational activities. When and where conflicts arise, prairie dogs will be relocated from areas of conflict (e.g., boundary areas or construction sites) to other appropriate locations on the Refuge by Service staff.

TASK 1- FISH AND WILDLIFE HEALTH STATUS MONITORING EFFORTS

TITLE: The effects of pyriproxyfen and pyrethrin treatments on fleas and other insects associated with black-tailed prairie dogs (Cynomys ludovicianus)

INTRODUCTION

Application of pyrethrin (Pyraperm) powder to black-tailed prairie dog towns during plague epizootics on the Rocky Mountain Arsenal in Colorado, have met with mixed success (U.S. Fish and Wildlife Service 1995). In some cases application of pyrethrin within a few days of discovery of an epizootic led to a cessation of mortality in prairie dogs from plague (U.S. Fish and Wildlife Service 1995). Success seemed to be linked to how much time elapsed between when plague was discovered and when the pyrethrin was applied (U.S. Fish and Wildlife Service 1995), as well as weather conditions.

Because of its recent development, there is essentially no information related to the use of pyriproxyfen. Thus, all information pertaining to pyriproxyfen contained within this proposal comes from an application for a United States patent written by Miller (1994).

Pyriproxyfen is a fairly new insect growth (physical) regulator that was developed primarily to control ectoparasites on domestic homeothermic animals. Pyriproxyfen, combined with some carrier agent such as powder, oil, or gelatin, is fed orally to a host animal. The chemical then enters the blood stream, where it becomes available to parasites through a blood meal from the host. When ingested by fleas, the chemical causes a reduced rate of egg hatching and sterilization of males. Consequently, the life cycle of the flea is broken and flea control is achieved.

Successful tests (Miller 1994) indicating the effectiveness of pyriproxyfen made it apparent to a number of wildlife biologists, that this new drug may be quite useful for controlling flea populations and thus plague epizootics in prairie dog towns (Seery, Fish and Wildlife Service, pers. comm.).

The goals of this project are to test spray, powder, and rodent chow forms of pyriproxyfen (Nylar®) and powder form of pyrethrin (Pyraperm®) on black-tailed prairie dogs at the Rocky Mountain Arsenal, near Denver, Colorado, and determine their effects on relative abundance of flea and insect species.

OBJECTIVES

1. Investigate the effects of pyriproxyfen spray, powder, and rodent chow on reducing the relative abundance of flea species on black-tailed prairie dogs.
2. Determine the effects of pyriproxyfen spray, powder, and rodent chow on reducing the relative abundance of nontarget insects in black-tailed prairie dog towns.
3. Determine the effects of pyrethrin powder on reducing the relative abundance of flea species on black-tailed prairie dogs.
4. Determine the effects of pyrethrin powder on reducing the relative abundance of nontarget insects in black-tailed prairie dog towns.

METHODS

Prairie Dog Trapping

Procedures described in this section are similar to those used by Menkens (1987) and Heller (1991).

Five treatment sites (prairie dog towns) will be trapped during the summer of 1998. Trapping efforts will be carried out in mid-May to mid-June prior to application of treatments and again in July and August after application of the treatments. All treatment sites will be intensively trapped using Tomahawk live traps until a large enough sample size (approximately 50 prairie dogs) have been captured.

During the pre-treatment trapping session all captured prairie dogs, with the exception of current trapping period recaptures, will be sampled for fleas. However, during post-treatment trapping sessions, only marked prairie dogs, captured and sampled during that year's pre-treatment trapping period, will be re-sampled for fleas.

Prairie dog flea sampling will follow guidelines established by Heller (1991). Prairie dogs will be anesthetized in a air tight container containing Halothane (Halocarbon Laboratories, Inc., Hackensack, NJ), to facilitate handling during flea sampling.

Insect Sampling

Pitfall traps, yellow sticky traps, and sweep net transect methods of insect capture will all be used to estimate relative abundance of associated insect species before and after application of treatments.

TASK 1 - FISH AND WILDLIFE HEALTH STATUS MONITORING EFFORTS

TITLE: Population trends and management of mule deer and white-tailed deer

INTRODUCTION

Mule deer (*Odocoileus hemionus*) are found in a wide variety of habitat types and in all major western North American climatic zones except the arctic, tropics, and most extreme desert (Mackie et al. 1982). White-tailed deer (*Odocoileus virginianus*) have an extensive range and are found throughout North America with higher concentrations east of the Rocky Mountains (Halls 1984). Both white-tailed deer and mule deer are found in abundance in Colorado. While these two species can be found together, they may be separated ecologically in their choice of habitats (Halls 1984).

The Refuge supports a relatively high density of deer (U.S. Fish and Wildlife Service 1997). Approximately 230 mule deer and 70 white-tailed deer inhabited the site prior to completion of the perimeter fence in 1990 (J. Hanna, unpublished data). Survey data indicate that the mule deer population more than doubled since the installation of the perimeter fence, and the white-tailed population has fluctuated only slightly over the past 6 years (U.S. Fish and Wildlife Service 1997). Mule deer are known to utilize open plains habitats (cheat grass/weedy forbs) and locust thickets on the Refuge, while white-tailed deer prefer wetland and riparian habitats, with some degree of overlap between the two species in the use of dryland tree habitat (U.S. Fish and Wildlife Service 1992). Minimal human disturbance of deer and a prohibition of hunting/harvesting on the Refuge has contributed to an above average density, especially after perimeter closure in 1990.

OBJECTIVES

1. Monitor deer species population status and trends.
2. Monitor herd health through fortuitous and scheduled collections.
3. Protect and maintain essential deer habitat throughout the duration of cleanup.
4. Investigate artificial population regulation measures to maintain optimal population levels.

METHODS

A graduate study completed during FY 1993 examined various aspects of the sympatric mule and white-tailed deer populations on the Refuge. Study goals included determining inter- and intra-specific interactions of mule and white-tailed deer, recruitment and adult mortality, and comparing population statistics of the sympatric Refuge deer populations to allopatric and sympatric deer populations not on the Refuge. The results of this study have enabled the Service to manage the deer population including total numbers, age, and sex ratios for both mule and white-tailed deer populations.

To determine the population status for both species, ground and aerial surveys will be continued on an annual basis. Ground classification counts will be conducted beginning in October. These classification counts will yield information on buck/doe, and doe/fawn ratios. Classification counts will be performed by two observers per vehicle (usually three vehicles) driving a pre-determined route, covering all sections on the Refuge. Aerial photographs and Mylar overlays will be used to plot deer numbers and locations. Starting at the southwest corner of the Refuge at sunrise, each section will be surveyed before moving to the next. Herd composition, time, miles driven, and weather conditions will also be recorded on a separate sheet.

Aerial surveys will be conducted at least twice per year, during January and February when heavy snow cover is present. Aerial surveys will be conducted using a Bell Jet Ranger helicopter flying all transects. The surveys will be started at the southeast corner, progressing in an east-west direction and moving northward until the entire area is covered and a total count accomplished.

Herd health will be monitored by examining fortuitous and herd reduction specimens. Use of contaminated sites by deer will be monitored, and if such use is deemed harmful, barriers or repellents may be used to deter deer from using these sites.

The Service will continue to work with Army and contractors through Activities Coordination protocol to protect and maintain essential deer habitat throughout the duration of the cleanup mission. Defining areas of essential habitat will be based on the results of a recently completed graduate study, and may include fawning and winter foraging areas.

With the mule deer population tripling from 1990-1994, concerns over the effects of over-population on habitat quality are significant. Methods of deer population management include regulated hunting, trapping and translocating excess deer, supplemental feeding, reintroduction of predators, reproductive control, and allowing catastrophic die-offs caused by natural phenomenon such as disease or long-lasting snow cover (Ellingwood and Caturano 1988).

Regulated hunting is an effective deer population management tool (Hesselton, et al. 1965, McCullough 1979). It is also one of the most efficient and least expensive techniques for removing deer (Palmer et al. 1980). However, due to access restrictions imposed by the urban setting and cleanup activities (U.S. Government 1989, 1992), regulated hunting is not a feasible option on the Refuge.

Site restrictions and limitations also apply to trapping and translocating excess deer. Although effective for short-term reduction, this management technique is costly (Ishmael and Rongstad 1984, O'Bryan and McCullough 1985), often causes significant mortality (Rongstad and McCabe 1984), and requires a release site capable of absorbing large numbers of relocated deer. The Colorado Division of Wildlife (CDOW) has determined that there are no suitable relocation sites within Colorado for Refuge deer.

The Service will continue to work closely with the Division in an effort to appropriately manage the existing deer herds. In 1997, Division population ecologists developed population model specific to the Refuge. This model allows the Service to scientifically decide how many deer need to be removed from the herd annually to maintain the existing number of deer on the Refuge. Information from the classification counts, and aerial surveys will be fed into the model, along with fetal sex ratios and a survival factor to come up with the best estimate for deer removal. This is a dynamic model and should allow the Service to manage deer somewhat conservatively.

TASK 1 - FISH AND WILDLIFE HEALTH STATUS MONITORING EFFORTS

TITLE: Monitoring of small mammal communities on restored grassland areas

INTRODUCTION

Restoration of short grass and sand prairie grasslands is currently being conducted on the Refuge. These restoration efforts will continue for a number of years and will be included as part of the remediation of contaminated lands on the Refuge. These restoration efforts will involve drastic alteration and removal of the existing vegetation and possibly soil, followed by the use of techniques such as irrigation, burning, and short-term establishment of cover crops, etc. The practice of prairie restoration is far from an exact science, and is very dependent upon local environmental factors such as soil type, precipitation, existing vegetation, and history of disturbance. Consequently, it is expected that restoration plans and strategies for the establishment of native plant communities will be a very adaptive process.

The most frequently used measure of the success of habitat restoration projects involves sampling vegetation to determine the presence and vigor of the reestablished plant species. Another measure of the functional value of these sites can be based on the knowledge of wildlife habitat relationships. The presence of animal species that are generally regarded to be associated with short-grass and sand prairie ecotypes will be used as an index of restoration success. This will be partially accomplished through monitoring the small mammal community in restored sites. Small mammals were selected as a group because of their importance as a prey base on the Refuge and their role in ecological processes such as nutrient recycling (Chew 1978). The short-term goal (first 5 years) in restored sites is to maintain representative small mammal densities. The long-term goal (5-15 years) will be to establish small mammal species diversity and richness that reflects a more established and mature prairie rather than just representative population densities. Restoration methods may be evaluated as part of an adaptive management process to ascertain those that best accomplish this and at the same time allow for the timely establishment of native vegetation. This will also enable the Service to gain a better understanding about the dynamics of habitat relationships.

The Refuge has a fairly diverse small mammal community as indicated by previous studies (Boone 1994, Allen 1996). Ten species of small mammals were recorded on the Refuge with the Deer mouse (*Peromyscus maniculatus*), western harvest mouse (*Reithrodontomys megalotis*), and thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*) generally being the most abundant. Boone (1994) found the most diverse community in sandsage habitats, and density was highest in sites dominated by yucca. They also concluded that individual plant species rather than vegetative

structure were better predictors of small mammal community composition. No published articles that reported on the response of small mammal communities to restoration of native short-grass prairie habitats could be located. However, Grant et al. (1977) documented changes in the small mammal community as a result of changes in the short-grass plant community in northeastern Colorado. The plots with the most dense and tallest stands of vegetation had the highest mammal biomass, primarily due to the increase in prairie voles (*Microtus ochrogaster*). The grasshopper mouse (*Onychomys leucogaster*) another native species of the short-grass prairie was absent from these plots, instead selecting dryer sites with less cover. The remaining two species, the deer mouse and the thirteen-lined ground squirrel, were less selective in their habitat use. The deer mouse is the usually most wide spread, abundant, and least selective small mammal species (Boone 1994, Allen 1996). As such, it is a good candidate to monitor short-term density to ensure maintenance of a prey base during the restoration process.

OBJECTIVES

1. Ascertain population densities and species richness and diversity twice a year on both treatment and control sites 1 to 2 years pre-treatment and up to 15 years post-treatment.
2. Use the deer mouse as the primary species to ascertain total density for short-term monitoring. Twenty individuals per hectare will be used as a reference point but not as quantitative value.
3. Use the information acquired in a feedback loop to guide future management actions as part of the adaptive management process.
4. Monitor vegetation annually on control sites and on restoration sites after the restoration process has been initiated.

METHODS

Small mammal trapping sessions will be conducted in June and September each year, to maximize the number of species and individuals captured. Sherman live traps will be placed at 10 meter intervals in 100 x 100 meter grids. Two grids, used as controls, will be placed in areas with a high native grass component. One grid will be located in the southeastern 1/4 of section 33 and a second will be located in northeastern 1/4 of section 3. Four grids will be located in sites planned for restoration. In this case, restoration refers to areas that will undergo complete removal of existing vegetation by mechanical processes. One restoration grid will be located in the southwestern 1/4 of section 2 and a second will be located in southwestern 1/4 of section 33. The site for

the two additional restoration grids has not been selected at this time. A 100-meter buffer strip will surround each trap grid so that emigration in response to disturbance and immigration from surrounding areas can be measured.

Live trapping will be conducted for 5 consecutive days, preceded by 2 days of prebaiting. A mixture of oats and peanut butter will be used as bait. Traps will be set each evening and checked the following morning. Each animal will be identified to species, individually marked, aged, and sexed.

TASK 1 - FISH AND WILDLIFE HEALTH STATUS MONITORING EFFORTS

TITLE: Raptor population trends, habitat use, and management

INTRODUCTION

The Refuge contains a diversity of habitat types ranging from wetlands and associated riparian habitats to a variety of grassland habitats. These habitats support a rich and diverse raptor population of up to 20 species that vary seasonally (U.S. Fish and Wildlife Service 1993). Fluctuations in raptor populations and changes in productivity may be influenced by changes in prey populations (Newton 1979, Garton et al. 1989, Johnsgard 1991). Data previously collected by the Service indicates that Refuge wintering populations of certain raptor species may be affected by changes in prey populations (U.S. Fish and Wildlife Service 1992, 1993). Ferruginous hawks were extremely common on surveys during the winter of 1988-1989. Numbers declined during the 1989-90 winter. This decrease parallels a similar decline in prairie dog distribution and abundance on the Refuge due to a plague epizootic (Ebasco Services, Inc. 1989, U.S. Fish and Wildlife Service 1992). Prairie dog populations have slowly increased during the last 4 years and a notable increase in ferruginous hawks has been observed (U.S. Fish and Wildlife Service 1993).

Raptor population and productivity parameters may also be affected by changes in prey availability through habitat modifications (Bechard 1980, 1982, Garton et al. 1989), contaminant exposure (Newton 1979, Risebrough and Monk 1989), and weather (Stinson 1980, Johnsgard 1991). Raptors are a top trophic level predator and the Service's raptor population and productivity monitoring projects will support efforts to assess overall Refuge habitat quality. These data along with data acquired from other Service surveys will facilitate habitat management and habitat mitigation/restoration projects for areas impacted during Refuge cleanup.

OBJECTIVES

1. Monitor population trends, seasonal abundance, and habitat use of raptors on the Refuge.
2. Monitor raptor reproductive success and productivity.
3. Minimize disturbances to raptors and raptor habitat.
4. Recommend strategies to mitigate for impacts and restore raptor habitats to compensate for habitat losses due to cleanup activities.

METHODS

Raptor Population Trends and Habitat Use Surveys

A road survey of raptors will be conducted weekly from August 1997 through May 1998. Raptor nest monitoring activities will be emphasized during June and July 1998. Roadside surveys will be used to determine raptor population trends and habitat use during migratory periods and critical winter periods. Surveying from roads is a cost-efficient method for studying widely distributed raptors and has been used extensively by a number of researchers to monitor raptor population trends (Johnson and Enderson 1972, Bauer 1982) and habitat/perch use (Marion and Ryder 1975, Fischer et al. 1984). A 38.6-km (24-mile) road survey will be driven beginning 2 hours after sunrise on calm days with no precipitation. Surveys will be conducted by a single observer from a vehicle driving at 24-32 km/hr (15-20 mph). Only birds observed with an unaided eye will be recorded. If birds are not readily identifiable, the observer will stop the vehicle and use binoculars or a spotting scope to make a positive identification. Species, age-class (when possible), activity, perching substrate, leg of transect, habitat type, and a specific location will be recorded for each raptor observed. An index of abundance will be computed for each species by calculating the mean number of raptors observed per survey for the entire survey period. Also, monthly indices will be computed for all raptors combined and the three most common wintering raptor species. These indices will allow comparisons between years.

Habitat use will be classified by two methods. First, use will be evaluated by comparing distributional peaks of raptors along the survey route with existing vegetation maps (Morrison-Knudsen Environmental Service, unpubl.). Second, raptor habitat use versus availability will be analyzed by Chi-square goodness of fit techniques (Neu et al. 1974, Byers et al. 1984). Habitat types will be recorded for birds perched within 300 meters of the survey route. Estimates of habitat availability will be calculated for seven habitat types using existing vegetation maps and acreage estimates (Morrison-Knudsen Environmental Service, unpubl.).

Monitoring of Breeding Raptors

Weekly surveys for breeding raptors will begin in December 1997. Estimates of raptor reproductive success and productivity permit comparisons between years and can be used to infer population status (Steenhof 1987). Comparisons between areas give estimates of habitat quality (Bechard 1982). Great horned and long-eared owls will be located by conducting systematic surveys on foot through available habitat. Barn owl and screech owl territories will be located by noting owl responses to tape recorded owl calls played during systematic road surveys of the Refuge and by searching all locust thickets twice during the breeding season. Breeding pairs of burrowing owls will be located by searching prairie dog towns. Breeding pairs/occupied territories of diurnal

raptors will be located by noting the behavior of adults during the breeding period (March-June) and systematically searching available nesting habitat. Once occupied territories/breeding pairs are located, the areas will be monitored weekly until the nest or territory is abandoned or the young have fledged. Data will be used to calculate estimates of reproductive success and productivity (Postupalsky 1974, Steenhof 1987).

Some nest locations may be posted with "Sensitive Wildlife" signs to minimize potential disturbances to nesting raptors. The information acquired will facilitate Service plans to establish artificial perch and nesting structures to maintain raptor populations during cleanup.

Other Management Programs and Studies

The Service will continue to use raptor data to facilitate habitat restoration and mitigation projects and to minimize conflicts between cleanup activities and raptor habitats. This will be accomplished through Service Activities Coordination functions and by directly working with Army and contractors. Habitat restoration and modifications to maintain and establish raptor prey populations within the Bald Eagle Management Area and Service prairie dog management and reestablishment efforts Arsenal-wide will continue. Coordination between the Service, Army, and contractors will allow the Service to develop management plans and furnish recommendations to minimize potential exposure of raptors to chemically contaminated areas.

TASK 1 - FISH AND WILDLIFE HEALTH STATUS MONITORING EFFORTS

TITLE: Waterfowl population trends, habitat use, management, and environmental education

INTRODUCTION

Waterfowl use of the Refuge follows expected patterns with dabbling ducks using shallow wetlands and diving ducks using deeper wetlands and lakes. Waterfowl abundance on the Refuge also follows expected patterns with waterfowl numbers increasing during migratory periods and declining during mid-winter months when most lakes and wetlands freeze over. Waterfowl surveys allow the Service to monitor wetland specific population trends that will provide an assessment of overall habitat quality. Waterfowl are a secondary prey item of wintering eagles along the Front Range including the Refuge (U.S. Fish and Wildlife Service 1992). Consequently, the surveys will facilitate proper waterfowl management to improve the quality of habitat for wintering eagles and migratory waterfowl. The presence of large numbers of migratory waterfowl on the Refuge provides an opportunity for environmental education on topics such as migration.

OBJECTIVES

1. Monitor the use of Refuge habitats by waterfowl.
2. Monitor species-specific seasonal abundance of Refuge waterfowl.
3. Provide environmental education opportunities on waterfowl and migration.

METHODS

Waterfowl will be counted biweekly beginning 2 hours after sunrise on calm days with no precipitation. Counts will be conducted from 21 fixed observation points as previously described (U.S. Fish and Wildlife Service 1994). An index of abundance per habitat type will be computed by combining the data acquired from the 21 observation points into seven areas representing similar habitats or individual wetlands. An index of abundance over time will be computed by calculating the mean number observed per month for Canada geese, American coots, and all duck species combined. Individual indices will also be computed for the five most common duck species. Ducks will be captured with baited funnel traps, and banded with USFWS leg bands (U.S. Fish and Wildlife Service 1956) for environmental education purposes in conjunction with National Wildlife Refuge week and for scout group projects. The emphasis on these education projects will be migration and flyways, waterfowl management, waterfowl as prey for bald eagles, and the National Wildlife Refuge System.

The Service will continue to provide recommendations to Army and contractors regarding techniques to minimize potential exposure of water birds to contaminants. This may include the placement of noise producing and hazing devices near areas where water birds could be exposed to contaminants.

TASK 1 - FISH AND WILDLIFE HEALTH STATUS MONITORING EFFORTS

TITLE: Bald eagle population trends, habitat use, and management

INTRODUCTION

The Northern States Bald Eagle Recovery Plan (Recovery Plan) (U.S. Fish and Wildlife Service 1983) defines locales supporting nesting pairs of bald eagles (*Haliaeetus leucocephalus*) or communal roosts supporting more than 15 eagles for over 2 weeks as essential habitat. During the winter of 1986-1987, a communal roost of wintering eagles was discovered on the eastern side of the Refuge. Subsequent surveys determined that the roost fit the definition of essential habitat in the Recovery Plan (Environmental Science and Engineering, Inc. 1988). Consequently, the Service initiated a 3-year study to ascertain the effects of Arsenal cleanup, construction of the new Denver International Airport, and highway development activities in the northeast metropolitan area on wintering eagles (U.S. Fish and Wildlife Service 1992).

Results from this study indicated that increased development associated with these activities may adversely affect bald eagles. Eagles used areas farther from development more than expected, based upon availability of suitable habitat. Increasing human contact may result in disturbance of bald eagle roosting, foraging, and loafing areas that may in turn affect bald eagle population stability if not properly managed (Stalmaster and Newman 1978, Steenhof 1978, U.S. Fish and Wildlife Service 1983, Harmata 1984).

The study report provided recommendations for long-term protection of bald eagles within the study area, including the maintenance of areas of quality habitat to offset losses due to development, cooperative and careful project planning, and easement or fee title acquisition for high-value habitats. Since the completion of the study, the Service continues to monitor bald eagle population trends and habitat use on the Refuge (U.S. Fish and Wildlife Service 1994). During the 1995-1996 winter, the Service documented impacts to eagles using the Refuge roost due to flight patterns of planes leaving the new Denver international Airport (U.S. Fish and Wildlife Service 1996). Impacts to eagles were documented again during the 1996-1997 winter. The Service will continue to work with the Federal Aviation Administration during 1997-1998 to resolve this issue. Due to the potential of continuing disturbance to eagles roosting on the Refuge, the Service will continue bald eagle monitoring efforts during 1997-1998 to evaluate the impacts of increased development, increased cleanup activity, and operations of the new Denver International Airport on wintering eagles. These efforts will allow the Service to provide appropriate recommendations for eagle protection as development progresses.

OBJECTIVES

1. Monitor population trends and age ratios of bald eagles on the Refuge, including eagles using the two Refuge communal roosts.
2. Potentially implement emergency interim management measures to promote winter bald eagle occupancy on the Refuge. This may include prairie dog relocations from off-Refuge sites and providing other supplemental food sources.

METHODS

Population Trends

Evening counts of bald eagles using the Refuge communal roosts will begin on October 15, 1997 and continue through April 15, 1998. Counts will be conducted every other night through the survey period by a single observer in a vehicle parked approximately 1/4 mile east of the traditional roost using a spotting scope to count all eagles present in the roost. Each survey of the traditional roost will begin 2 hours before sunset and terminate 45 minutes after sunset. The direction from which the eagle approaches the roost, age of the bird, and time it lands will be recorded for each eagle observed. Counts of the new roost will be conducted from 6th Avenue south of Lower Derby Lake at or just before dark. These techniques have been used during the last 9 years and will enable comparison between years. Seasonal comparisons between age classes will be made. Population trends of eagles observed along raptor road surveys during diurnal periods will be estimated.

General Management

The monitoring of eagle activity will allow the Service to provide appropriate recommendations to minimize disturbance of wintering eagles. This will be facilitated through the Service's Activities Coordination section and by direct communications among the Service, Army, and contractors. The data will enable the Service to provide timely input on projects which may adversely affect bald eagles. The Service will utilize new and existing data to assist with habitat restoration and enhancement projects to maintain high-quality bald eagle habitat. These projects include placement of artificial perch structures throughout the Refuge, vegetation modifications to increase prey for eagles and other raptors, and maintenance and reestablishment of prairie dog populations. The additional information acquired during 1997-1998 will add to the substantial database obtained over the last 11 years. This will assist the Service in providing appropriate recommendations regarding potential impacts of area projects on regional bald eagle wintering populations. This includes the potential impacts of flight operations at the Denver International Airport.

Emergency Management Actions

The slow recovery of prairie dog populations coupled with increased development and other human activity adjacent to and on the Refuge may impact wintering eagle use of the site, conceivably resulting in permanent bald eagle abandonment. Consequently, the Service may continue to relocate prairie dogs, the primary eagle prey item, from off-Refuge sites to increase their recovery rate, thereby providing a natural food source for bald eagles.

TASK 1 - FISH AND WILDLIFE HEALTH STATUS MONITORING EFFORTS

TITLE: Occurrence, distribution, and habitat use of bats

INTRODUCTION

Eighteen species of bats are known from Colorado (Armstrong et al. 1994), nine of which are listed as "Species of Concern." Most of the published literature regarding Colorado's bat fauna has focused on species distribution and/or habitat use in the western (Navo 1992) or southern (Freeman and Wunder 1988) portions of the state. Published specimen records show that few individuals of any species have been recorded from the eastern plains, especially those counties north and east of Douglas County (Armstrong et al. 1994). Collection of detailed data on bat species occurrence, habitat use, and exposure to environmental contaminants on the Refuge will be provided from this project. Field work will be conducted to determine the current distribution and relative abundance of bats and to identify areas that appear to be of particular importance to bats (e.g. roost sites and foraging areas). Using this information, the potential exposure of Refuge bats to environmental contaminants will be assessed.

OBJECTIVES

1. Compile, review, and synthesize all available information on the occurrence and status of bat species on the Refuge and the surrounding counties.
2. Collect original field data on occurrence, distribution, and habitat use on the Refuge.
3. Identify active bat roosts on the Refuge.
4. Provide samples of common bat species to assess potential impacts of contaminants.

METHODS

Biological Resource Division investigators of the U.S. Geological Survey will collect information on all bat species known from the Refuge and surrounding counties. Information gathered will include data on species and localities of occurrence, size of colonies, and other related information. Sources for information will be published literature, museums, government agencies, state health agencies, and universities. Investigators will then conduct intensive surveys of bat activities to collect data on occurrence, habitat use, and distribution of bats on the Refuge. To identify roost sites, a small number of bats will be instrumented with radio transmitters. Radio-tagged bats

will be followed to roosts so that roost sites, roosting habitat, colony sizes, and roosting associates can be determined. Radio-tagging will follow the approved protocol established for bats through the MESC's Animal Use and Care Committee. Roost locations will be recorded with photographs and Global Positioning Systems. Determination of the Refuge bat population's potential exposure to contaminants and the impacts of contaminants will entail collecting a minimum number of bats for analysis of arsenic, mercury, and several organochlorines.

TASK 1 - FISH AND WILDLIFE HEALTH STATUS MONITORING EFFORTS

TITLE: Fishery Management

INTRODUCTION

The Refuge continues to support a trophy warmwater catch-and-release fishery in Lakes Mary, Ladora, Lower Derby (U.S. Fish and Wildlife Service 1993). Limited access fishing, low pressure, and good compliance with the catch-and-release regulations have resulted in large northern pike (Esox lucius), largemouth bass (Micropterus salmoides) and channel catfish (Ictalurus punctatus). Other aquatic resources include the North Bog, Toxic Storage Yard Pond, Rod and Gun Club Pond, Havana Pond, Bald Eagle Shallows, and the five constructed wetlands (U.S. Fish and Wildlife Service 1993). Baseline aquatic resources information was collected and monitored over the last 15 years (Rosenlund 1979, U.S. Fish and Wildlife Service 1995). Historically, the sport fishing program required yearly monitoring be conducted on the south lakes to maintain the fishing quality and aquatic habitats. However, extensive aquatic biomonitoring sampling during FYs 1995, 1996, and 1997 eliminated the need for further sampling. During 1998 aquatic resources sampling will only occur on Lake Mary. Ladora will be drained for dam embankment rehabilitation. Lower Derby Lake will be recovering from a renovation project completed in 1997. Plans developed during 1997 to salvage fish and minimize impacts of dam reconstruction on the fishery, aquatic resources, and the anglers will be implemented in 1998.

OBJECTIVES

1. Maintain a quality sport fishery in Lake Mary in order to support special children and physically challenged fishing events.
2. Monitor the lower lakes fishery resources. Assist in the recovery of Lakes Ladora and Lower Derby from impacts caused from dam rehabilitation and fish renovation projects.
3. Monitor other Refuge aquatic resources.

METHODS

Standardized gill net sampling sites were established in the south lakes during 1977 (Rosenlund 1979). During June 1998, two experimental mesh gill nets will be set in the evening in Lake Mary at the standardized locations. Each monofilament gill net is 45.7m long by 1.8m deep and consists of six 7.6m long panels with bar mesh sizes of 19, 25, 38, 51, 64, and 76mm. Nets will be set on the lake bottom extending

perpendicular from shore, and alternating small and large mesh sizes close to shore. Each net will be fished 4 hours during the late evening hours to minimize fish injury and mortality (Malvestuto 1983) .

Electrofishing will also be used to monitor fishery trends. Standardized, 15-minute electrofishing stations were established during 1991. Three stations will be electrofished on Lake Mary during May or early June. Electrofishing will be conducted at night using a Coffelt boat-mounted Mark 20 electrofisher, 5000-watt generator and single boom anode. Two persons will dipnet all species and sizes of fish that surface during each 15-minute station.

All fish sampled will be weighed (grams) and measured (mm). Additionally, all fish will be checked for a Portable Integrated Transponder tag. Growth data generated from recaptured PIT-tagged fish will be compared to other warm and coolwater fisheries along the Colorado Front Range.

Fish reproduction will be monitored in Lake Mary and Lower Derby using a small mesh seine. Five quadrant seine hauls will be conducted on each lake during late August using a 4m by 0.9m deep seine with 5mm mesh size. Young-of-the-year fish will be identified and numbers recorded to document successful spawning, recruitment, and year class strength of each species.

During 1998, forage fish will be evaluated for stocking in the south lakes. Results of the biomonitoring projects will provide good management insight into the deficiencies of the Refuge fishery. Additionally, the Biological Advisory Subcommittee (BAS) will determine if the south lakes will be part of the overall cleanup at the Arsenal, which will impact future fishery management decisions.

During 1998, aquatic areas Refuge-wide will be sampled. These areas include the North Bog, Rod and Gun Club Pond, Havana Pond, wetland sites #1-5, Bald Eagle Shallows, and the storage yard pond. In general, a 15.2m by 1.82m seine with 12.7m bar mesh will be pulled through each impoundment. All captured fish, invertebrates, amphibians and reptiles will be recorded. Additionally, general site conditions and water conditions will be recorded.

The reconstruction of Lake Ladora, and the subsequent fish salvage operation, require developing and implementing a plan for the restoration of the fishery. The goal will be to restore a useful, trophy catch-and-release fishery in Ladora and Lower Derby Lakes and minimize damage to existing lake habitats.

TASK 2A - FISH AND WILDLIFE HABITAT MITIGATION, RESTORATION, AND PROTECTION EFFORTS

TASK INTRODUCTION

Specific tasks outlined in the Cooperative Agreement for Fish and Wildlife Mitigation, Restoration, and Protection Efforts state that the Service shall propose habitat or other mitigation plans to offset the impact of Arsenal contamination or cleanup efforts on fish and wildlife by:

1. Proposing such actions as a part of the Annual Plan, or as amendments thereto, or through other procedures as appropriate;
2. Providing a draft and final Habitat Restoration Plan for approval by the Program Management, to be part of the Annual Fish and Wildlife Resource Management Plan;
3. Maintaining a complete record, including a photographic record of impacts to fish and wildlife resources and habitats and of mitigation responses to the same;
4. Coordinating with the Program Manager to integrate fish and wildlife mitigation plans into other Arsenal activities;
5. Providing input for the responsibilities described above into Fish and Wildlife Resource Management Plans, budgets, and reports; and
6. Providing supervision for identified staff of the Program Manager who will assist with habitat mitigation efforts.

Funding Sources

6 percent will be from Cleanup

81 percent will be from Mitigation

13 percent will be from Trustee

TASK 2A - FISH AND WILDLIFE HABITAT MITIGATION, RESTORATION, AND PROTECTION EFFORTS

TITLE: Habitat Protection and Restoration

INTRODUCTION

Due to the release of hazardous chemicals into the environment at Rocky Mountain Arsenal in the past, the Environmental Protection Agency placed the Arsenal on the National Priority List for environmental cleanup pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA, Superfund), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). Although exempt from the procedural requirements of the NEPA, like NEPA, CERCLA/SARA require responsible parties to assess and mitigate adverse impacts to natural resources caused by both the release and cleanup of hazardous materials. In June 1996, a Record of Decision was signed by the U.S. Army, EPA, and the State of Colorado which established a blueprint for contaminants to be remediated at the Arsenal.

The Cooperative Agreement between the Army and the Service defined the responsibilities at the Arsenal, which include mitigating adverse impacts to fish, wildlife, and habitat resources due to contaminant remediation and related activities. These responsibilities were clarified within the 1991 revision of the Agreement (U.S. Government 1991).

In 1991, the Service initiated a program to identify and quantify the adverse impacts of contaminant cleanup and other activities at the Arsenal and to develop site-specific habitat restoration plans to mitigate these impacts. This program has required the Service to coordinate extensively with Army, Shell, and other appropriate parties. The 1994 and 1997 revisions of the Agreement described specific methods by which the Service would conduct such a mitigation program (U.S. Government 1994, 1997).

In October 1992, the Rocky Mountain Arsenal National Wildlife Refuge Act was signed into law (Public Law 102-402), stipulating that the Arsenal would become a National Wildlife Refuge after contaminant remediation is complete. In the interim, the Refuge Act directs the Service to manage the Arsenal as if it were a Refuge. In 1996, the Service developed a Comprehensive Management Plan for the Rocky Mountain Arsenal National Wildlife Refuge, which outlines the long-term vision of this facility after cleanup is complete. The Service's mitigation program is consistent with the objectives of the CMP, as well as with applicable policies and guidelines as described below.

Mitigation Policy

The Council on Environmental Quality (CEQ) developed guidelines pursuant to NEPA that require federal agencies to assess and mitigate the impacts of their actions on the environment. The CEQ guidelines prescribe that mitigation shall first attempt to avoid adverse impacts to the greatest practicable extent. When adverse impacts are unavoidable, the CEQ preferred mitigation sequence is to minimize, rectify, or reduce impacts over time, and finally compensate for any remaining impacts. The Service will endeavor to avoid unnecessary impacts and minimize any unavoidable impacts by closely coordinating with Army and Shell throughout the cleanup process. However, the nature of cleanup activities at the Arsenal dictates that rectification of impacts, reduction of impacts over time, and compensation for impacts will be the principal forms of mitigation.

The Service (1981) developed a Mitigation Policy consistent with CEQ guidelines which directs the Service to assign fish and wildlife habitats to one of four resource categories based on their value for fish and wildlife and relative scarcity. Each resource category sets a specific mitigation planning goal to address impacts to these habitats.

The most valuable, rare, or unique habitats are assigned to Resource Category 1 and afforded the highest level of protection, no loss of existing habitat value. Disturbance or destruction of Resource Category 1 habitats should be avoided to the greatest practicable extent. However, no habitats at the Refuge have been assigned to this Resource Category.

Resource Category 2 habitats also are valuable for wildlife and are relatively scarce, though less so than Resource Category 1. At the Refuge, they include lakes, wetlands, riparian zones, native grasslands, shrub lands, and wooded uplands, which occupy more than 6,000 acres or 36 percent of the Refuge area. The mitigation planning goal for this category is no net loss of in-kind habitat value. When impacts are unavoidable, the preferred form of mitigation is to (1) restore in-kind habitat values on-site, wherever possible, (2) increase in-kind habitat values on-site, wherever possible, and (3) increase in-kind habitat values off-site, when necessary. Out-of-kind mitigation is not permitted.

Resource Category 3 habitats also may be valuable for wildlife, but are relatively more abundant than Resource Categories 1 or 2. At the Refuge this Category consists of weedy grasses and weedy forbs, which occupy more than 9,500 acres or 55 percent of the Refuge, including most of the area likely to be affected by the cleanup. No net loss of habitat value (in-kind or out-of-kind) is the preferred mitigation goal. However, in most cases, the Service prefers, and the CMP directs, us to replace weedy forbs and grasses with native forbs, grasses, and shrubs, although some remediation areas may be seeded with nonnative species to create temporary vegetative biota barriers.

Resource Category 4 is assigned to habitats which have relatively little value for wildlife. At the Refuge this category has been expanded to include those areas which pose a risk to wildlife, regardless of their habitat value, including buildings, waste disposal basins, and other areas previously disturbed by construction, production, disposal or cleanup activities, such as Interim Response Actions. Less than 4 percent (640 acres) of the Refuge is classified as disturbed, most of which lies within the core area slated for contaminant remediation. Another 5 percent (860 acres) of the Refuge is covered by roads, both paved and unpaved, which span the entire Refuge. Some disturbed areas, particularly buildings and other structures, may have value for wildlife, such as thermal cover and protection from predators. The mitigation planning goal for these areas is to minimize the loss of habitat value by replacing structures with vegetation (shrubs and trees) which performs a similar habitat function for wildlife. Areas covered by bare ground or pavement, likely will be revegetated with native grasses and forbs.

Integrated Pest Management

It is Service policy that the use of pesticides and herbicides be minimized on Refuges and other Service lands. These chemical agents should be replaced with other means (mowing, grazing, fire, biological controls). During habitat restoration activities, the Refuge may apply a variety of pest management techniques to control weedy species. Integrated pest management is covered under the title "Integrated Pest Management" within this Annual Management Plan, but it is appropriate to mention here that the Service will not only employ limited use of herbicides but also a host of alternative pest control technologies, including biological (insects, nematodes), mechanical (mowing, tilling, removal by hand or with hand tools), and prescribed fire.

Endangered Species Act

Section 7 of the Endangered Species Act requires federal agencies to ensure that their actions do not jeopardize the continued existence of any species federally listed as threatened or endangered. Federal actions include those actions authorized, funded, or conducted by a federal agency. Section 7 requires federal agencies to consult with the Service if they determine that their actions may affect threatened or endangered species. CERCLA/SARA does not exempt these agencies from fulfilling the provisions of the Endangered Species Act during the course of contaminant remediation activities. The Habitat Restoration Program will be carried out in a manner consistent with the conservation and protection of threatened and endangered species.

Cultural Resources Protection

All federal agencies are mandated to preserve historic and archeological resources on federal lands within their jurisdiction. The 1906 Antiquities Act (PL 59-209; 16 USC 431-433) enables the U.S. Government to set aside and protect historic and prehistoric

structures, historic landmarks, and other objects of historic or scientific interest. The 1935 Historic Sites Act (PL 74-292) expanded the responsibilities of the Department of the Interior to include determination and protection of historic and archaeological sites, buildings, and objects. The National Historic Preservation Act (NHPA) of 1966 (PL 89-665; 16 USC 470, as amended; 80 Stat. 915) requires federal agencies to consider the effects of their projects and programs on cultural resources listed or eligible for inclusion in the National Registry of Historic Places (NRHP). Later amendments (PL 91-243; PL 93-54; PL 94-422; PL 94-458; PL 96-199; PL 76-244; PL 96-515) require federal agencies to (1) inventory, evaluate and, where appropriate, nominate to the NRHP all significant cultural resources under agency ownership or control; (2) consider the impacts of a potential project on eligible or potentially eligible properties and allow the Advisory Council on Historic Preservation a reasonable opportunity to comment on the proposed project; and (3) complete a data recovery program for eligible or listed archaeological properties prior to damage or destruction. In 1971, NRHP sites and properties determined eligible for or nominated to the NRHP were protected further by Executive Order 1153, which requires federal agencies to cooperate with State Historic Preservation Offices in conserving cultural resources. The 1974 Archaeological and Historic Preservation Act (PL 93-291; 88 Stat. 174; 16 USC 469) mandates that the Secretary of the Interior be notified of any federal project that would adversely affect a significant archaeological or historical property and that a data recovery or mitigation program be implemented if appropriate. The Service will adhere to all relevant laws and policies while restoring habitats at the Refuge.

OBJECTIVES

This Annual Management Plan is part of a step-down process based on the goals of the Comprehensive Management Plan and the goals and objectives of the Refuge-wide Habitat Restoration Plan (HRP), a step-down plan that provides the framework for annual and project-specific plans. Habitat Restoration Program is specifically designed to: (1) replace wildlife habitat damaged during production and cleanup; (2) restore native plant communities; (3) develop stable vegetation communities for specific native wildlife; (4) restore the First Creek corridor; (5) maintain existing plant communities that are critical for existing wildlife communities, and (6) improve methods for restoring and enhancing wildlife habitat in the Northern Great Plains. Therefore, the Service has identified each of these items as HRP goals. These goals are interrelated, and the methods used to obtain one goal may be similar to those used for another goal. The HRP has also established specific objectives for each of its goals. The following Annual Management Plan objectives represent an FY98 step-down from the HRP objectives:

1. Ensure that impacts to habitat are avoided or minimized to the greatest practicable extent.

2. Plan and initiate five new mitigation projects to compensate for habitat lost during cleanup activities, including Phase II remediation activities, Interim Response Actions (IRAs), and unexpected small disturbances. Projects should total at least 190 acres of grassland restoration and approximately 1 acre of shrub land restoration.
3. Continue at least seven mitigation projects that were initiated during FY96 and FY97 that compensate for Phase I and II remediation activities. Project areas will total approximately 340 acres, mostly of grassland restoration.
4. Maintain vegetation on approximately 12 mitigation projects (six grassland, one woodland, and five shrub land restoration projects).
5. Monitor vegetation on approximately 28 mitigation projects (grassland and/or shrub land restoration) using standard techniques.
6. Continue monitoring Colorado State University revegetation research plots in southeastern Section 3.
7. Mitigate impacts to public uses of high value educational/recreational lands.
8. Ensure that potential conflicts between mitigation activities, management, operations, and proposed remedial actions are identified and resolved.
9. Maintain quality bald eagle habitat and promote the conservation of threatened and endangered species at the Refuge by enhancing, restoring, and managing habitats to buffer losses due to Arsenal cleanup activities.
10. Ensure that all programs, activities, and operations of the Service and other federal agencies at the Refuge do not jeopardize the continued existence of any threatened and endangered species.
11. Ensure that mitigation activities do not impact cultural resources.

METHODS

Impact Assessment

The Service will use a variety of methods to assess impacts to fish, wildlife, and habitat resources; identify mitigation needs; design and implement mitigation measures; and monitor mitigation success. Tools may include Habitat Evaluation Procedures (HEP) (U.S. Fish and Wildlife Service 1976) or other impact assessment methodology, aerial photo-interpretation, multi-spectral satellite photogrammetry, Global Positioning Systems, Geographic Information Systems, and other appropriate technologies.

Service personnel will attend meetings, such as Arsenal Committee meetings, Army staff meetings, contractors' meetings, legal briefings, meetings to discuss Refuge and adjacent land use planning and water management, and Remediation Venture Office team meetings for specific elements of remediation planning. The purpose of the Service's participation is to identify potential adverse impacts to fish and wildlife habitat resources due to cleanup and other on-site activities and to communicate the Service's position with respect to these activities. The Service also will review both internal review drafts and published documents to determine what specific actions are proposed, where and when they are proposed to occur, and to what extent they will impact fish and wildlife habitat resources at the Refuge.

The Service will coordinate with appropriate federal, state, and local agencies, as well as private developers and the public concerning water management, transportation, real property development, and other off-site activities that might affect fish, wildlife, and habitat resources at the Refuge. Significant parties to these discussions include the Stapleton Development Corporation, Stapleton 2000, Denver International Airport, Urban Drainage and Flood Control District, Denver Water Board, Denver Wastewater, Planning, and Parks and Recreation departments, and other agencies of the City and County of Denver, the Cities of Aurora and Commerce City, and Adams County.

Habitat Protection

The Service will provide timely recommendations to appropriate agencies as necessary to avoid habitat losses whenever possible and minimize unavoidable impacts resulting from on-site and off-site activities. Particular emphasis will be placed on avoiding impacts to areas whose wildlife value, uniqueness, and/or regional scarcity prompted the Service to classify them as Resource Category 2. For example, the Service may

recommend that a certain candidate borrow site, or portion thereof, be removed from further consideration if its development would unnecessarily damage valuable wildlife habitat and other borrow site alternatives are available.

When and where appropriate, the Service will develop site-specific plans to avoid or minimize impacts. Examples of potential projects include installation of single-strand smooth wire fences and/or signs around sensitive natural resource areas that might be impacted by nearby construction or cleanup activities.

Mitigation and Restoration

The Service will write site-specific habitat restoration plans, conduct its own restoration projects using both standard and experimental revegetation techniques, and monitor their effectiveness as mitigation for impacts to fish and wildlife habitat due to cleanup, operations and maintenance activities, and other habitat disturbances. Cleanup-related activities that will be mitigated include Phase I and II Remediation, Interim Response Actions, construction of roads, pipelines, parking lots, buildings, flood control measures, and other structures, removal of buildings and other structures which currently provide wildlife habitat, excavation of borrow sites, the hazardous waste landfill, the Basin A consolidation area and other caps/covers, and other surface disturbances. These plans will emphasize restoring habitat value on-site wherever possible and increasing habitat value off-site where necessary to compensate for losses of fish and wildlife habitat, particularly (1) native grasslands, shrub lands, and trees; (2) prairie dog colonies; (3) wetlands; and (4) riparian areas. Any losses of these Resource Category 2 habitats will be replaced in-kind, while losses of lower value weedy grasses and weedy forbs (Resource Category 3), and disturbed (Resource Category 4) habitats may be replaced out-of-kind with higher value habitats.

The Service will also provide responsive mitigation plans to Army to offset unavoidable impacts due to routine Army operations, such as grading existing roads, creating new roads, including 2-tracks, mowing, removing or installing pipelines, etc. These plans will usually involve, but not be limited to, on-site revegetation with a native seed mix. In some cases, it may be desirable to reseed with crested wheat grass (*Agropyron cristatum*) to temporarily discourage use by wildlife, if further action is pending to remove contaminants or other hazards.

The Service will monitor approximately 28 mitigation projects completed prior to FY98 and develop additional plans to ensure that vegetation is successfully established and that the necessary and appropriate level of habitat quality is perpetuated. Monitoring of seeded areas will consist of recording vegetative cover along 50-meter line-point transects. The Revegetation Information Monitoring and Analysis (RIMA) system will be used to analyze the data. Plans may include the use of mechanical, chemical, or biological measures to control the spread of noxious weeds and encourage the

proliferation of desirable native plant species. Monitoring is discussed in depth elsewhere in this Management Plan under the title "Vegetation Monitoring."

The Service will ensure that potential conflicts between habitat restoration projects, wildlife management, facility operations and maintenance, and proposed remedial actions are identified and resolved. The Service will identify mitigation objectives, sites, prescriptions, and schedules to reduce or eliminate conflicts with other Service activities and minimize wildlife exposure to contaminants. The Service will coordinate with the Army and other appropriate parties before initiating any mitigation projects to ensure consistency with the overall objectives of the Service as well as cleanup-related activities. The Service will identify and design biota response actions to reduce potential wildlife exposure to contaminants while minimizing impacts to wildlife habitat.

Public Use Areas

The Service will treat impacts to public uses of high-value educational and recreational lands in much the same manner as described above for impacts to wildlife and wildlife habitats. The Service will work to avoid, minimize, and compensate for such losses. The Service will: (1) use established processes, such as Arsenal Committee meetings, Army staff meetings, planning meetings, and reviewing relevant documents to identify public use issues and concerns through all phases of Arsenal cleanup activities; (2) provide timely verbal and written recommendations to avoid and minimize impacts to high-value educational and/or recreational public uses; and (3) provide responsive mitigation plans for unavoidable losses of public use due to cleanup activities, base operations, or off-site projects.

Documentation

The Service will maintain an accounting system or "balance sheet" to tabulate measured habitat gains and losses and continue a detailed mitigation photography program to help document those gains and losses. Information obtained on each mitigation project regarding the acreage (or other relevant units) mitigation will be provided by employing GPS. Both the photo-documentation and the GPS are discussed in depth elsewhere in this Management Plan under the titles "Mitigation Photography Program" and "Geographical Data Collection and Analysis."

Revegetation Research

To improve its techniques, the Service will continue to support a 3-year Colorado State University graduate student revegetation research project. This project is designed to: (1) determine if supplemental water (irrigation) can improve establishment of seeded plant species, warm season species and woody species, and increase species diversity over sites not irrigated; (2) determine if the use of supplemental water in combination

with sucrose can accelerate establishment of native prairie by eliminating or shortening the time early seral (weedy) species dominate a restored site; (3) compare the effect of mulching with that of a cover crop on establishment of seeded plant species and overall species diversity of the established community; (4) determine if seeding technique (drill vs. broadcast) affects shrub establishment and overall species diversity of the established community; (5) clarify the role of nitrogen in treatment responses; and (6) define restoration "success" in the first year and subsequent years following restoration activity. The Service not only will continue to support this project with funding into early FY98, but provide assistance in sampling vegetation whenever possible and appropriate and either provide additional funding for further research and/or monitoring of current research plots or conduct additional monitoring with Service personnel.

Partnerships

The Service will broaden its resource base by expanding partnership programs. The Service will continue its partnership with the Denver Botanic Gardens (DBG) and Shell to fully develop prairie demonstration plots near the Visitor Center; the Service will assist DBG by providing advice, tools and materials, volunteers, laborers, and periodically, use of equipment operators and related equipment. The Service plans to involve Denver Zoo volunteers in one or more habitat restoration projects. The Service will work with the Colorado Wetlands Initiative Program to enhance Wetland 2 and the Rod and Gun Club Ponds. Other potential partners in this effort include the Army Reserve Center and the Denver Botanic Gardens. The Service will continue to work with Shell and MK on various restoration projects initiated in previous years on both the Refuge and the Shell Property just north of the Refuge. The Service plans to work with the Denver Botanic Gardens, the CSU Horticulture Department and Rocky Mountain National Park greenhouse personnel to plan construction of a greenhouse and nursery. The Service also anticipates working with the City and County of Denver to restore the Denver International Airport property between Peña Boulevard and Buckley Road east of the Refuge to native grasslands. The Service and the Army will continue to share equipment through a cooperative use program established in FY97.

Cultural Resources

When conducting habitat restoration projects, the Service will abide by both the letter and spirit of all applicable laws and policies pertaining to conservation of cultural resources. At least two members of the Refuge staff (one from Planning and another from Habitat Restoration) will serve as working members of the RVO Cultural Resources Team. These staff members will use the Team and the Service's Regional Archeologist to ensure restoration projects are reviewed by SHPO prior to soil disturbance. In addition, field staff will continue to be trained to recognize and avoid disturbing cultural resources within the guidelines of the Refuge Cultural Resources Management Plan.

TASK 2A - FISH AND WILDLIFE HABITAT MITIGATION, RESTORATION, AND PROTECTION EFFORTS

TITLE: Mitigation Photography Program

INTRODUCTION

The Service will continue its photography program to document impacts to fish and wildlife habitat caused by contaminant remediation and other activities, and various stages of mitigation and operational assistance projects. To the extent possible, photography will be used to chronicle site conditions before, during, and after any activities resulting in disturbance or destruction of fish and wildlife habitat. In addition, mitigation and operational assistance projects will be photographically documented during work-in-progress and at the completion of mitigation remedies. Compensatory (off-site) mitigation sites will be photographed prior to implementation to document existing conditions. Photography will also be used to document conditions prior to and following any prescribed fires carried out under the Refuge Fire Management Program, as well as activities of the Integrated Pest Management Program.

OBJECTIVES

1. Photograph disturbances to fish and wildlife habitat caused by cleanup related activities.
2. Photograph implementation of habitat restoration projects which respond to habitat disturbances.
3. Photograph prescribed burns and their effects on vegetation.

METHODS

The Service will use 35mm single-lens-reflex (SLR) camera equipment, including a variety of fixed focal length and zoom lenses, to record disturbance activities such as excavations of borrow sites, construction of contractor offices and support buildings, expansion or grading of roads and parking areas, removal of existing structures beneficial to fish and wildlife, installation of water control structures, removal of trees, shrubs, and other vegetation beneficial to fish and wildlife, restoration of prairie and riparian areas, tree and shrub plantings, road revegetation, native seed propagation, protection of the bald eagle winter roost, and installation of prairie dog barriers, fencing, irrigation systems, and artificial wildlife structures such as guzzlers and nest boxes. Positive color transparency (slide) film will be used for most photography, and all slides will be appropriately labeled, recorded in a computer database, and properly archived

to increase their longevity. Occasionally, as needed, negative color transparency (print) film may be used. Representative, high-quality images will be selected for professional scanning onto Photo CD media. These images will be used in publications, including Annual Accomplishment Reports and step-down plans, as well as in presentations.

TASK 2A - FISH AND WILDLIFE HABITAT MITIGATION, RESTORATION, AND PROTECTION EFFORTS

TITLE: Vegetation Monitoring

INTRODUCTION

Refuge staff routinely monitor vegetation before and after habitat restoration projects to determine the success of these efforts. Prior to FY95, Morrison-Knudsen (MK) staff carried out most vegetation data collection and analysis. The Service became increasingly involved in data collection beginning in FY95, and expanded its role in the following years. MK personnel continue to support this effort to the extent they are able. Their role now is limited mostly to surveying permanent transects locations for data collection. Once established, these transects may be used throughout the course of vegetation monitoring.

OBJECTIVES

1. Objectively assess the overall success of habitat restoration efforts by comparing baseline vegetation monitoring data with post-implementation data.
2. Determine if the seeded species are represented in the vegetative community in the same proportion as they were seeded.
3. Determine the establishment of individual species and overall seed mix, to reveal which species are most successful under what conditions and to compare the effects of different habitat restoration techniques on establishment of the various species.
4. Determine the composition, density, and diversity of seeded sites.

METHODS

Transects are selected and mapped for each project site using a stratified random computer-based protocol, using the general guideline of one transect per 6 acres, with no fewer than one transect per site, regardless of size. The adequacy of each sample size is determined according to its internal variance, and additional transects may be added, as necessary.

Each transect is located on a Universal Transverse Mercator (UTM) coordinate system, and is initially located by standard surveying techniques. The transect is established

and the position fixed by Global Positioning Systems, which allows the data to be easily incorporated into a Geographic Information System database and facilitates relocating the point in future years, using the GPS navigation feature.

Transects are linear, 50 meters in length, and randomly oriented in the field. Each transect is measured with a 50-meter tape, and data are collected at 1-meter intervals, ½-meter on either side of the transect (100 points per transect). An optical sighting device (OSD) is used to collect data perpendicular to and on both sides of each meter mark. The OSD is mounted on a pivot arm, ½-meter in length, attached to a tripod. This allows the data collector to sample two points at each interval along the transect, by sluing the device through a 180-degree arc with the tripod axis placed directly over the tape. Cross hairs in the OSD pinpoint a single feature (e.g. bare soil, plant, litter), each of which are recorded as "hit" at each of the 100 points along the transect. A list of incidental plant species not detected by the OSD also are recorded for each area, so that infrequent or occasional species are not under represented. Data were summarized using version 2.0 of RIMA software available through MK.

Baseline data will be collected at new habitat restoration sites prior to any soil disturbance. Comparative data will be collected at least once every 2 years for the first 6 years following revegetation, then once every 5 years thereafter. Some sites may be sampled more often as conditions and management objectives warrant.

TASK 2A - FISH AND WILDLIFE HABITAT MITIGATION, RESTORATION, AND PROTECTION EFFORTS

TITLE: Integrated Pest Management/Fire Management

INTRODUCTION

Integrated Pest Management

In FY96, the Refuge initiated an Integrated Pest Management (IPM) Program to evaluate and test a host of alternative pest control technologies, including biological (insects, nematodes), mechanical (mowing, tilling, removal by hand), and prescribed fire (U.S. Fish and Wildlife Service 1996). At this time, livestock grazing is not an option, due to the prohibition in the Federal Facilities Agreement against the consumption of wildlife/livestock taken from the Refuge. Nevertheless the Refuge CMP allows for the consideration of future introductions of wildlife native to the High Plains, including grazers such as American bison (*Bison bison*) and pronghorn antelope (*Antilocapra americana*).

In addition, the Refuge may need to apply certain herbicides to eradicate noxious weeds and control weedy species during habitat restoration activities. The Service requires its Refuges to review any proposed use of herbicides and other pesticides to control noxious weeds, insects, and other pests, and consider alternative methods of pest management (e.g., mechanical, biological, fire, grazing) to protect the environment from the adverse impacts of chemical contaminants. Service policy in this regard is specifically stated in Section 1.2.A of the Departmental Manual Part 517 as follows:

To use pesticides only after full consideration of alternatives - based on competent analyses of environmental effects, safety, specificity, effectiveness, and cost. The full range of alternatives including chemical, biological, and physical methods, and no action will be considered. When it is determined that a pesticide must be used in order to meet important management goals, the least hazardous material that will meet such goals will be chosen.

Fire Management

Prescribed fire is one tool in the IPM arsenal. It also may be used, and frequently is necessary, to maintain the vigor of established native grasses, control the invasion of woody species, or to meet wildlife management objectives. Fire was used by the Service for the first time at the Refuge in 1996. While the initial burn was done for wildlife management purposes (to open overgrown areas for burrowing owls to nest), the Service will employ fire routinely in the future to enhance habitat restoration efforts.

A second burn was carried out in April 1997 to reduce litter, promote vigor in native perennial grasses, and reduce competition from annual weedy species. The Refuge will continue to use fire as a management tool within the constraints of an urban setting.

Although the need for fire is dictated by habitat management objectives, the application of fire more often is determined by timing and the prevailing climatic conditions within the desired burn "window." Temperature, humidity, fuel moisture, fuel density, wind direction, and wind speed all play a role in whether a fire will be allowed and, if allowed, whether it will be "successful." If conditions are too hot, too dry, or too windy, fire could be difficult to control and contain. On the other hand, cool, moist conditions or light winds could inhibit ignition or the ability to carry a fire effectively. Air quality is another consideration, and prior to any prescribed fire, the Refuge will obtain all required permits and approvals. Fire prescriptions generally are written to avoid introducing high levels of smoke over developed, urbanized or other sensitive areas, such as Denver International Airport.

OBJECTIVES

1. Reduce reliance on chemical means of pest management, particularly weedy plants, and replace them to the greatest practicable extent with nonchemical alternatives.
2. Evaluate the effectiveness of all available means of pest management, including chemical, mechanical and biological, both individually and in combination, to identify the most effective and least environmentally damaging means of control.
3. Improving wildlife habitat by increasing the vigor of native plant communities, while minimizing competition from nonnative species.
4. Reduce vegetative litter and standing dead vegetation, as needed to stimulate new vegetative growth, recycle nutrients, and enhance seed germination.
5. Support research into alternative methods of weed control.

METHODS

Integrated Pest Management

By December 5, 1997, the Refuge will submit its annual Integrated Pest Management report to the Service's Regional Office specifying all means of pest control employed at the Refuge in calendar year 1997. This report will demonstrate our commitment to and document our use of alternative forms of pest management in fulfillment of Objective 1.

Certain species of insects were released in FY 1995, 1996 and 1997 to control Canada thistle (*Cirsium arvense*). These species target Canada thistle specifically, and have not been shown to attack native thistle or other nontarget plant species. The Service selected several different species of insects which attack different portions of plants, such as stems, seed heads, and leaves. These insects include the stem-mining weevil (*Ceutorhynchus litura*) and stem-and-shoot gall fly (*Urophora cardui*). In addition, seed head weevils (*Larinus planus*), another biological control species, has been found at the Refuge, apparently dispersed from release sites outside the Refuge (Table 1).

Nematodes (*Subanguina picridis*) also were released in FY 1996 to control Russian knapweed (*Centaurea repens*). Insects to control spotted knapweed (*C. maculosa*), diffuse knapweed (*C. diffusa*), and Canada thistle were purchased in FY96 and released in FY97 (Table 1). The results of early trials are encouraging, but are not as dramatic or immediate as might be achieved through the use of chemical controls. It is too soon to draw any conclusions from the 1997 releases. The Refuge will continue to use these biological control agents and possibly expand their use in FY98. Other biological controls may be considered for use as available and appropriate.

No later than January 15, 1998, the Service will write a separate Pesticide Use Proposal (PUP) for each chemical proposed to be used during the 1998 calendar year. The Refuge Project Leader will review each PUP and either approve, disapprove, or request a modification to the proposal. To control noxious weeds, such as Russian knapweed, the Service may need to use the herbicide glyphosate in conjunction with nonchemical measures, if mechanical methods (principally mowing) alone prove ineffective.

IPM will continue at the Visitor Center and Lake Mary where Denver Botanic Gardens volunteers are assisting with revegetation efforts. Glyphosate will be spot-sprayed to control noxious weeds in conjunction with hand pulling and mowing. The Service will continue to monitor a 1-acre imazameth/glyphosate test plot in Section 23. Some native grass and forb species have proven tolerant to imazameth, an herbicide which more effectively controls weedy species. Information from this plot will help the Service decide whether to use imazameth to control weeds at future habitat restoration sites.

Table 1. Noxious Weeds and Species-specific Biological Control Agents				
Noxious Weeds		Biological Control Agents		
Common name	Scientific name	Type	Common name	Scientific name*
Russian knapweed	<i>Centaurea repens</i>	Nematode	None	<i>Subanguina picridis</i> ¹
Spotted knapweed	<i>C. maculosa</i>	Insect Insect	Broad-nosed seed head weevil Sulphur knapweed moth	<i>Bangasternus fausti</i> ² <i>Agapeta zoegana</i> ²
Diffuse knapweed	<i>C. diffusa</i>	Insect Insect	Broad-nosed seed head weevil Sulphur knapweed moth	<i>Bangasternus fausti</i> ² <i>Agapeta zoegana</i> ²
Canada thistle	<i>Cirsium arvense</i>	Insect Insect Insect	Stem-and-shoot gall fly Stem mining weevil Seed head weevil	<i>Urophora cardui</i> ² <i>Ceutorhynchus litura</i> ² <i>Larinus planus</i> ³
Musk thistle	<i>Carduus nutans</i>	Insect Insect Insect Insect Fungus	Flower fly Seed head weevil Seed head weevil Flea beetle Musk thistle rust	<i>Cheilosa corydon</i> ⁴ <i>Rhinocyllus conicus</i> ³ <i>Trichosiocalus horridus</i> ⁴ <i>Psylliodes chalcamera</i> ⁴ <i>Puccinia carduorum</i> ⁴

***Availability, Use, and Occurrence:**

¹ Experimental biological controls in use at the Refuge, but not commercially available at this time.

² Species commercially available and currently in use by the Refuge.

³ Species which spread to the Refuge from release sites outside the Refuge.

⁴ Species not currently in use, proposed for use, nor otherwise found at the Refuge.

In FY96, the Service identified saltcedar (*Tamarix gallica*) infestations in wetland areas on the east shore of Lake Ladora in Section 2 (20-25 plants) and the north shore of the North Bog in Section 24 (40 - 45 plants). While the plants at the North Bog are relatively small (2-5 feet in height), the plants at Lake Ladora are well established, with some up to 15 feet tall. In FY98, the Service will continue to chemically control saltcedar by spot-spraying plants with a tank mix of imazapyr and glyphosate, which have been approved and labeled for aquatic use. This application may be expanded to Russian olives (*Elaeagnus angustifolia*) also known to be invading wetland areas.

Fire Management

The Refuge finalized its Fire Management Plan (FMP) in FY97 (U.S. Fish and Wildlife Service 1997) which outlines the Goals and Objectives of the Fire Management Program and strategies for achieving them. The Refuge will continue to use prescribed fire as one tool to assist with habitat restoration efforts and to manage wildlife habitat. The goal of improving wildlife habitat will be accomplished by meeting fire prescription objectives such as controlling and/or suppressing weeds, removing decadent vegetation and litter, and rejuvenating native grasses, forbs, and shrubs.

Step-down plans will be written for each fire prescription, identifying specific treatment sites, the objectives of each burn, site-specific conditions (nature of fuels, vegetation requiring special protection, terrain, natural fire breaks, etc.), and the climatic and fuel conditions required on the day of the burn. Safety zones and artificial fire breaks will be identified and cleared prior to initiating ignition activities. A preburn briefing will be held several days prior to each burn to ensure all fire management personnel involved are familiar with the objectives, ignition and control techniques, and safety measures of each plan. A debriefing will be held after each burn to assess the results of the burn, determine what, if anything, can be done differently to improve results in future burns, and identify any potential safety hazards or concerns.

The Service will continue to train and qualify personnel as wildland firefighters. The Service will maintain a crew of at least twelve qualified firefighters for prescribed burn operations at the Refuge, but will continue to rely on the Army's RMA Fire Department to serve as on-scene commander and provide fire suppression equipment and crews.

TASK 2A - FISH AND WILDLIFE HABITAT MITIGATION, RESTORATION, AND PROTECTION EFFORTS

TITLE: Geographical Data Collection and Analysis

INTRODUCTION

The Service will use Global Positioning System technology to collect geographic (spatial) data which locate impacts to fish and wildlife habitat caused by cleanup and other activities, mitigation projects, and fire management burn sites. GPS utilizes satellite telemetry to locate specific points on the earth using a predetermined coordinate system such as latitude and longitude (degrees, minutes, seconds or DMS) or UTM coordinates. The resulting polygon, line, and point data are used for cartography, navigation, and spatial data analysis.

OBJECTIVES

1. Collect GPS data for wildlife habitat disturbances, habitat restoration projects which respond to habitat disturbances, for prescribed burns specified by the Refuge Fire Management Program, and other activities in support of the Refuge Habitat Restoration Program.
2. Incorporate GPS data into a desktop GIS program.

METHODS

Using hand-held GPS data collectors (Trimble Navigation Pro XL and Rockwell PLGR), Service personnel will determine the UTM coordinates of line/area/point data of such features as borrow sites, ditches and culverts, access roads, graded areas, removal of trees and shrubs and other vegetation disturbances, prescribed burn sites, habitat restoration sites, tree and shrub plantings, road closure and revegetation, seed propagation/collection sites, fencing, prairie dog barriers, research plots, vegetation control areas, irrigated areas, and artificial wildlife structures. These data will be transferred into the desktop GIS program ArcView 3.0 on a personal computer (PC) using Windows 3.11 or Windows NT for spatial analyses and map making purposes.

These data will be shared with Army, Shell, and their designated contractor personnel, as needed. Data will be used to the extent practicable to identify any conflicts between programs, as well as opportunities for scheduling around conflicts or for undertaking mutually beneficial joint activities, such as borrow site/wetland development.

TASK 2A - FISH AND WILDLIFE HABITAT MITIGATION, RESTORATION, AND PROTECTION EFFORTS

TITLE: Endangered Species Consultation

INTRODUCTION

Threatened and endangered species potentially could be affected by a variety of federal actions at the Arsenal, including Interim Response Actions and other cleanup related activities, routine operations and maintenance of facilities, construction projects, nearby off-post commercial development, transportation and flood control projects, and infrastructure maintenance activities, as well as fish and wildlife management, habitat restoration, activities coordination, wildlife-related research, public education and recreation, and other Service programs.

Pursuant to Section 7 of the Endangered Species Act (ESA), in FY96, Foster Wheeler Environmental Corporation began a Biological Assessment to address the impacts of the "Conceptual Remedy" on threatened and endangered species. Refuge staff provided Foster Wheeler with information relevant to threatened and endangered species known to occur or species which potentially could occur at the Refuge. Due to uncertainties as to both the source and quantity of water required for cleanup and related activities, the Service agreed to segregate the impacts of water use on threatened and endangered species from impacts directly related to cleanup. The impacts of water use are potentially farther ranging, affecting species as remote as the central Platte River Valley of Nebraska. These species will be considered separately.

Service policy also requires its Refuges to review their actions, including actions taken on behalf of other agencies, and enter intra-Service Section 7 consultation on any actions that may affect threatened or endangered species. In FY93, the Refuge initiated informal intra-Service consultation with the Colorado Field Office and completed the consultation in early FY94. The Service concluded, with the concurrence of the Colorado Field Office, that Service activities at the Refuge would not adversely affect any proposed, listed, or candidate threatened or endangered species. Furthermore, Service activities at the Refuge were found to benefit the bald eagle (*Haliaeetus leucocephalus*) and ferruginous hawk (*Buteo regalis*).

In FY96, the bald eagle was "down listed" from endangered to threatened status due to the success of the recovery program for this species. Also, in a proposed rule dated February 28, 1996 (61 FR 7596), the designation of candidate species was amended. Species formerly classified as Category 1 Candidates are the only species considered to be "Candidates" under the new rule; species formerly classified as Category 2 and 3 Candidates are no longer considered Candidates. Of the species likely to occur at the

Refuge, only the mountain plover (*Charadrius montanus*) and swift fox (*Vulpes velox*) are still considered Candidate species. Noteworthy by its absence from the list is the ferruginous hawk, formerly a Category 2 Candidate, which is one of the high profile winter inhabitants of the Refuge. However, the ferruginous hawk receives protection under the Migratory Bird Treaty Act, which carries similar penalties to the ESA.

OBJECTIVES

1. Protect listed, proposed, and candidate threatened and endangered species from the impacts of federal actions at the Refuge.
2. Protect listed, proposed, and candidate threatened and endangered species at the Refuge from the impacts of federal actions in proximity to the Refuge.
3. Protect listed, proposed, and candidate threatened and endangered species at locations outside the Refuge from impacts due to federal actions at the Refuge.
4. Provide technical assistance to the Army to ensure compliance with all relevant provisions of the Endangered Species Act.

METHODS

The Service will take appropriate measures to protect threatened and endangered species and their habitats which may be affected by the Service or other federal actions at the Refuge and vicinity. The Service shall review its own actions to ensure they do not jeopardize the continued existence of any listed threatened or endangered species or adversely modify critical habitat. In addition, the Service will provide timely responses to requests of other federal agencies for information and technical assistance regarding threatened and endangered species. The Service shall undertake informal consultations with the Army concerning the proposed cleanup to determine if its proposed actions or those of its agents may affect threatened and endangered species. Determinations will be made in consultation with recognized experts on the affected species using the latest biological and project information available.

As the federal action agency for cleanup-related activities at the Arsenal, the Army is primarily responsible for evaluating the impacts of its own actions on threatened and endangered species. However, the Service may review the proposed actions of other federal agencies and advise them of any potential unforeseen impacts. The Service and the Army shall attempt to resolve any conflicts through informal consultation. The Service may provide technical assistance to the Army to eliminate adverse effects on threatened and endangered species by modifying project plans or work schedules, or implementing restoration plans, as appropriate.

TASK 2B - FISH AND WILDLIFE HABITAT MITIGATION, RESTORATION, AND PROTECTION EFFORTS (SUPPLEMENTAL)

TASK INTRODUCTION

Specific tasks outlined in the Cooperative Agreement for Fish and Wildlife Mitigation, Restoration, and Protection Efforts state that the Service shall propose habitat or other mitigation plans to offset the impact of Arsenal contamination or cleanup efforts on fish and wildlife by:

1. Implementing approved mitigation and restoration actions, such as revegetation, through Service personnel and equipment and oversight of other personnel or equipment involved in restoration activities.

Funding Sources

100 percent will be from Mitigation - Supplemental

TASK 2B - FISH AND WILDLIFE HABITAT MITIGATION, RESTORATION, AND PROTECTION EFFORTS (SUPPLEMENTAL)

TITLE: Habitat Protection and Restoration

INTRODUCTION

See **TASK 2A**, Page 48.

OBJECTIVES

See **TASK 2A**, Page 51.

METHODS

Mitigation and Restoration

The Service will conduct its own restoration projects using both standard and experimental revegetation techniques, and monitor their effectiveness as mitigation for impacts to fish and wildlife habitat due to cleanup, operations and maintenance activities, and other habitat disturbances. Cleanup-related activities that will be mitigated include Phase I and II Remediation, Interim Response Actions, construction of roads, pipelines, parking lots, buildings, flood control measures, and other structures, removal of buildings and other structures which currently provide wildlife habitat, excavation of borrow sites, the hazardous waste landfill, the Basin A consolidation area and other caps/covers, and other surface disturbances. These projects will emphasize restoring habitat value on-site wherever possible and increasing habitat value off-site where necessary to compensate for losses of fish and wildlife habitat, particularly (1) native grasslands, shrub lands, and trees; (2) prairie dog colonies; (3) wetlands; and (4) riparian areas. Any losses of these Resource Category 2 habitats will be replaced in-kind, while losses of lower value weedy grasses and weedy forbs (Resource Category 3), and disturbed (Resource Category 4) habitats may be replaced out-of-kind with higher value habitats.

The Service will also implement mitigation plans to Army to offset unavoidable impacts due to routine Army operations, such as grading existing roads, creating new roads, including 2-tracks, mowing, removing or installing pipelines, etc. These plans will usually involve, but not be limited to, on-site revegetation with a native seed mix. In some cases, it may be desirable to reseed with crested wheat grass (*Agropyron cristatum*) to temporarily discourage use by wildlife, if further action is pending to remove contaminants or other hazards.

All Refuge revegetation will be conducted by Service personnel, volunteers, and cooperators (e.g., Denver Botanic Gardens intern) during FY98. The Service will continue at least seven projects initiated prior to October 1997. In addition, the Service plans to initiate site preparation in at least five new sites (Figure 3) during FY98.

Seedbed preparation techniques will vary depending on the soil type, existing vegetation, anticipated wildlife use, time since last preparation, etc.

Weedy sites with irrigation

Many areas have not been tilled in several decades and are currently dominated by highly competitive weedy species, such as cheat grass, crested wheat grass, and Canada thistle. The Service will follow a sequence similar to the following in highly weedy sites when irrigation is available:

- Mow (to facilitate plowing).
- Chisel (to facilitate plowing in some clayey soils).
- Plow 9-14 inches (to bury weeds and weed seed).
- Disc 4-6 inches (to break up soil).
- Harrow (to level the soil surface).
- Seed native mix (usually broadcast, but sometimes drilled).
- Harrow (to lightly bury seeds or erase row effect from drill seeder).
- Irrigate for one growing season.

Weedy sites with irrigation and significant native component

Sites that are weedy but have a native component worth saving may be approached in the following manner:

- Spot-spray weedy patches with glyphosate in late spring.
- Interseed by drill seeding native mix into untilled soil in late spring.
- Irrigate throughout summer.

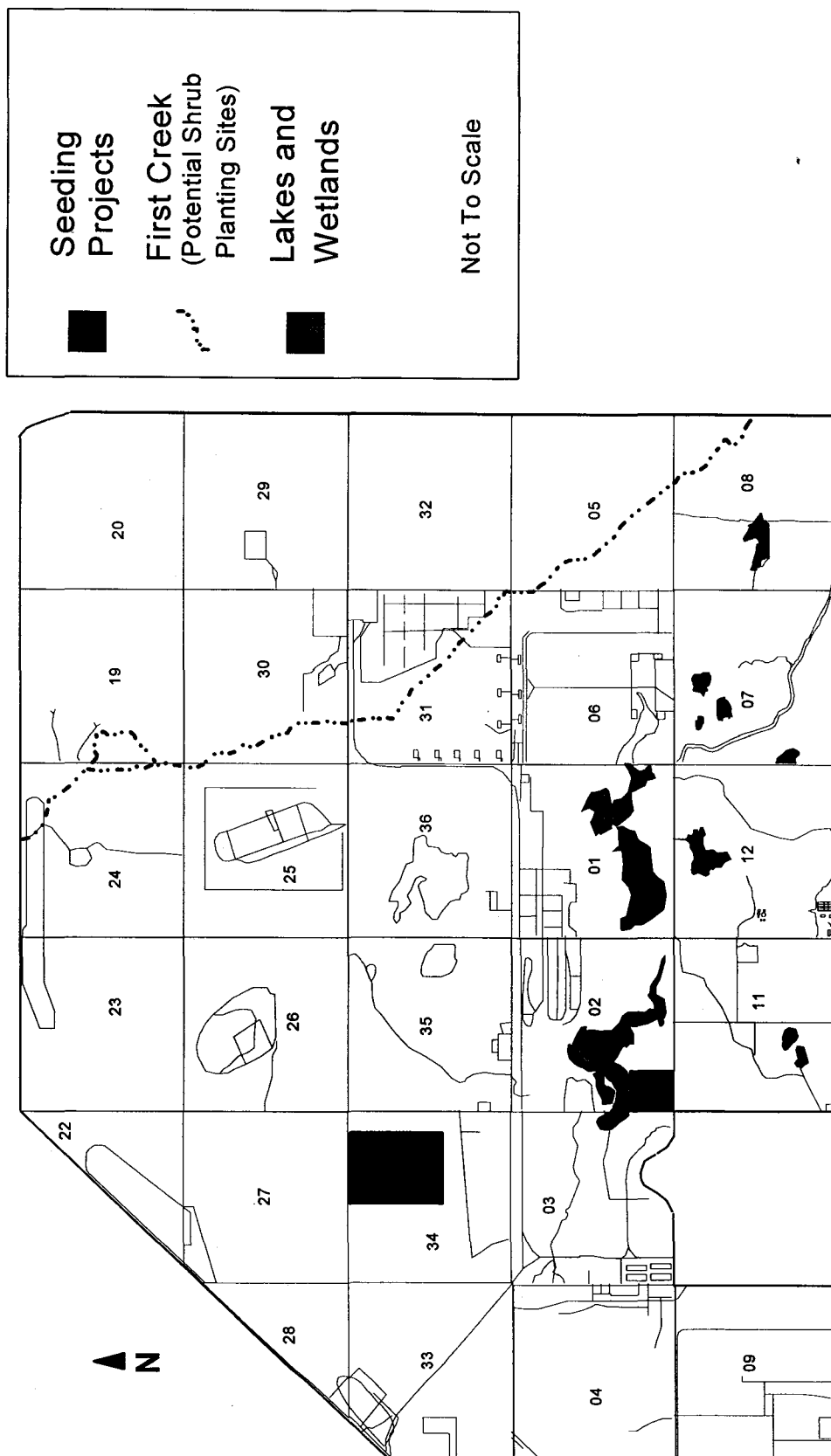


Figure 3. Habitat Restoration Projects to be Initiated at Rocky Mountain Arsenal National Wildlife Refuge During FY 1998.

Weedy sites with no irrigation

For those sites that are highly weedy but no irrigation is available, the Service will probably conduct a multi-year strategy as outlined below:

- Mow (to facilitate plowing).
- Chisel (to facilitate plowing in some clayey soils).
- Plow 9-14 inches (to bury weeds and weed seed).
- Disc 4-6 inches (to break up soil).
- Harrow (to level the soil surface).
- Seed summer cover crop (usually drilled) in late May.
- "Sweep" site with blade plow or cultivator (or spray with glyphosate) as needed.
- Interseed winter cover crop (drilled) in late August.
- Repeat summer cover crop if necessary.
- Disk 4-6 inches to kill weeds in early spring.
- Harrow.
- Seed native mix (either drilled or broadcast).
- Harrow (to lightly bury seeds or erase row effect from drill seeder).

The summer cover crop may be sorghum (*Sorghum vulgare*) and the winter crop may be winter wheat (*Triticum aestivum*), although the Service is investigating additional species that may be able to fill these roles. Cover crops should provide interim wildlife habitat (cover and perhaps food) and prevent erosion. Their main purpose, though, is to allow the Service time to control weeds that germinate on-site before planting an expensive native seed mix.

Sweeping is a process that involves moving a blade plow or cultivator just under the soil surface to kill weeds by cutting roots without turning over the soil. Interseeding (also called overseeding) uses drill seeding equipment to seed a site without tilling the area.

The timing of these soil preparation steps will vary. In general, the seed mixes will be planted in the fall, winter, or early spring, depending on whether the seed mix is dominated by cool or warm season species. If moisture is certain to be adequate (i.e., from irrigation), the timing of planting is less critical. Restoration sites usually would be swept the following spring immediately before interseeding. However, the timing and methodologies used must be flexible, because numerous unpredictable factors, particularly daily and seasonal climatic conditions, greatly affect the outcome of the project.

The Service will monitor approximately 28 mitigation projects completed prior to FY98 and develop additional plans to ensure that vegetation is successfully established and that the necessary and appropriate level of habitat quality is perpetuated. Monitoring of seeded areas will consist of recording vegetative cover along 50-meter line-point

transects. The Revegetation Information Monitoring and Analysis (RIMA) system will be used to analyze the data. Plans may include the use of mechanical, chemical, or biological measures to control the spread of noxious weeds and encourage the proliferation of desirable native plant species. Monitoring is discussed in depth elsewhere in this Management Plan under the title "Vegetation Monitoring."

The Service will ensure that potential conflicts between habitat restoration projects, wildlife management, facility operations and maintenance, and proposed remedial actions are identified and resolved. The Service will identify mitigation objectives, sites, prescriptions, and schedules to reduce or eliminate conflicts with other Service activities and minimize wildlife exposure to contaminants. The Service will coordinate with the Army and other appropriate parties before initiating any mitigation projects to ensure consistency with the overall objectives of the Service as well as cleanup-related activities. The Service will identify and design biota response actions to reduce potential wildlife exposure to contaminants while minimizing impacts to wildlife habitat.

Revegetation Research

To improve its techniques, the Service will continue to support a 3-year Colorado State University graduate student revegetation research project. This project is designed to: (1) determine if supplemental water (irrigation) can improve establishment of seeded plant species, warm season species and woody species, and increase species diversity over sites not irrigated; (2) determine if the use of supplemental water in combination with sucrose can accelerate establishment of native prairie by eliminating or shortening the time early seral (weedy) species dominate a restored site; (3) compare the effect of mulching with that of a cover crop on establishment of seeded plant species and overall species diversity of the established community; (4) determine if seeding technique (drill vs. broadcast) affects shrub establishment and overall species diversity of the established community; (5) clarify the role of nitrogen in treatment responses; and (6) define restoration "success" in the first year and subsequent years following restoration activity. The Service not only will continue to support this project with funding into early FY98, but provide assistance in sampling vegetation whenever possible and appropriate and either provide additional funding for further research and/or monitoring of current research plots or conduct additional monitoring with Service personnel.

Partnerships

The Service will broaden its resource base by expanding partnership programs. The Service will continue its partnership with the Denver Botanic Gardens and Shell Oil Company to fully develop prairie demonstration plots near the Visitor Center and immediate vicinity; the Service will assist DBG by providing advice, tools and materials, volunteers, laborers, and periodically, use of equipment operators and related equipment. The Service hopes to involve the Denver Zoo volunteers in one or more

habitat restoration projects. The Service will work with the Colorado Wetlands Initiative Program to enhance Wetland 2 and the Rod and Gun Club Ponds. Other potential partners in this effort include the Army Reserve Center and the Denver Botanic Gardens. The Service will continue to work with Shell and MK on various restoration projects initiated in previous years on both the Refuge and the Shell Property just north of the Refuge. The Service plans to work with the Denver Botanic Gardens, the CSU Horticulture Department and Rocky Mountain National Park greenhouse personnel to plan construction of a greenhouse and nursery. The Service also anticipates working with the City and County of Denver to restore the Denver International Airport property between Peña Boulevard and Buckley Road east of the Refuge to native grasslands. The Service and the Army will continue to share equipment through a cooperative use program established in FY97.

**TASK 2B - FISH AND WILDLIFE HABITAT MITIGATION, RESTORATION, AND
PROTECTION EFFORTS (SUPPLEMENTAL)**

TITLE: Vegetation Monitoring

See **TASK 2A**, Page 59.

**TASK 2B - FISH AND WILDLIFE HABITAT MITIGATION, RESTORATION, AND
PROTECTION EFFORTS (SUPPLEMENTAL)**

TITLE: Integrated Pest Management/Fire Management

See **TASK 2A**, Page 61.

TASK 3A - ACTIVITIES COORDINATION PROGRAM EFFORTS

TASK INTRODUCTION

Specific tasks outlined in the Cooperative Agreement for Activities Coordination Program Efforts state that the Service shall revise as necessary and implement the Program Manager's Activities Coordination Plan which controls access to the Arsenal and assist Arsenal law enforcement officers by:

1. Reviewing and revising as necessary the Activities Coordination Plan for Program Manager approval;
2. Implementing the Activities Coordination Plan by jointly conducting the Program Manager's weekly Activities Coordination Meeting with the RVO safety, health, and compliance groups;
3. Compiling a weekly list of proposed activities at the Arsenal, along with a related map indicating matched locations, for approval and/or revision by the safety, health, and compliance groups;
4. Providing central coordination and approval, as appropriate, for Arsenal activities that may impact fish and wildlife species and/or their habitats, subject to Scope of Work XII.B.4. Utilize its efforts to minimize adverse impacts on fish and wildlife resources through consultation with other entities working at the Arsenal. This responsibility includes monitoring the compliance of all Arsenal activities with Fish and Wildlife Resource Management Plans and advising the Project Officers for the Service and for the Program Manager of any conflicts;
5. Assisting the Program Manager's law enforcement with any situation they encounter that may involve fish and wildlife resources;
6. Conducting annual internal reviews with recommendations of Service-related Arsenal law enforcement efforts and of Program Manager law enforcement activities related to fish and wildlife resources;
7. Providing appropriate training to Service and Program Manager law enforcement officers;
8. Providing input for the responsibilities described above into Service Fish and Wildlife Resource Management Plans, budgets, and reports; and

9. Providing supervision for identified staff of the Program Manager who will assist the Service in fulfilling its obligations under this Agreement.

Funding Sources

80 percent will be from Cleanup

20 percent will be from Trustee

TASK 3A - ACTIVITIES COORDINATION PROGRAM EFFORTS

TITLE: Activities management

INTRODUCTION

Two separate programs, Activities Coordination, and Bald Eagle Management Area (BEMA) access, are included in Activities Management at the Refuge.

A Standard Operating Procedure describing access control at the Arsenal was distributed by the Army in July 1997. Supervised jointly by the Service and the Army Safety, Health, and Environment Office, the Activities Coordination program was established to coordinate all remediation, scientific research, and public use activities taking place on the Refuge. During 1996, approximately 22,000 activities occurred at the Rocky Mountain Arsenal completed by 35 different contractors and agency personnel.

BEMA was established in 1988, and expanded in 1989, as a protective zone that encompasses approximately 7,000 acres of sensitive bald eagle winter habitat. Between October 15 and April 15, all access into the BEMA is regulated by Service personnel to minimize disturbance to wintering bald eagles.

OBJECTIVES

1. Minimize conflicts between, and ensure the safety of, all Arsenal employees, contractors, and other entities.
2. Minimize impacts of remediation activities on fish and wildlife resources.
3. Provide a list of current field activities for use in the Army's Contingency Plan.
4. Minimize disturbance to wintering bald eagles.

METHODS

Activities Coordination

Personnel responsible for Activities Coordination will produce a map and schedule of all contractor and agency activities each week throughout FY98. Maps will indicate locations of activities, with a special designation for tasks that could present a significant hazard to other field workers. Schedules will include type, location, and

duration of activity, level of Personal Protective Equipment (PPE) required, and a specified point of contact. All Arsenal entities planning to conduct field activities will be required to submit this information concerning prospective activities on a standard activities coordination form 1 week prior to beginning work. Approval for the upcoming week's activities will be faxed to contractors by the preceding Friday. Schedules and maps will then be distributed to contractors, Army, and Service personnel at a weekly contractor's meeting. Attempts to develop an automated system will continue in 1998.

Activities coordination will also involve the participation of team members on Cleanup Planning teams. The goal of participation is to provide the Service perspective on the cleanup, ensure compatibility with the comprehensive management plan, and ensure cleanups' effectiveness for natural resources.

BEMA Access

Except for routine security patrols and Fire Department access, all entry into the BEMA during its winter closure period must be approved in advance by Service personnel. Information such as date, entity name, activity to be performed, duration, and work location will be recorded for each entry. Activities management personnel will also document any denied requests for BEMA access and associated conflicts.

Numbered magnetic vehicle hood cones will be distributed to all entities entering the BEMA to conduct legitimate activities. Routes into the BEMA and specific times of day will be recommended for access in order to avoid specific areas and times when eagles may be feeding, loafing, or roosting. Activities management personnel will conduct periodic patrols through the BEMA to ensure compliance with established protocol.

TASK 3A - ACTIVITIES COORDINATION PROGRAM EFFORTS

TITLE: Health and Safety

INTRODUCTION

Historically, the Arsenal was used by the Army to produce chemical warfare agents and by private companies to produce pesticides. Thus, hazardous wastes are present at various locations on the Arsenal. Many field hazards exist at the Arsenal including, but not limited to, old munitions, decomposing contaminants, abandoned buildings, enclosures, wood, glass, metal, and other sharp objects. Possible animal related threats include bites and scratches, Lyme disease, and plague. Hazards typical of an office environment may cause slips and falls, back strain, and fatigue.

Service employees and volunteers conduct a wide variety of scientific and public use tasks. This health and safety management element will address issues for all Service employees and visitors at the Refuge.

OBJECTIVES

1. Maintain a safe working environment for all Service employees, biological volunteers, and contractors.
2. Provide an interactive health and safety program that prevents occupational accidents and addresses new health and safety issues.
3. Maintain and update a Field Office health and safety plan.
4. Provide an Refuge visitor safety program.

METHODS

Maintenance of a safe working environment for all Service employees will require interaction between several entities. The RVO Health and Safety Office and the Regional Service Health and Safety Office are invaluable resources and provide guidance for the continued safe operation of the Refuge field office. The Service will actively participate in Arsenal fire inspections, Regional Office inspections, and inspections from the Army Material Command Center. Deficiencies noted during inspection will be corrected in a timely fashion. The Refuge Health and Safety Officer will attend all safety meetings and disseminate information to staff, supervisors, and the Project Leader.

Service employees will be offered physical examinations according to the medical monitoring policy outlined in the Service memorandum dated February 18, 1993 (U.S. Government 1993).

Health and safety training will include courses such as 4- and 8-hour OSHA, all terrain vehicle use (ATV), aircraft safety (OAS), equipment operation, hazardous waste protection procedures (OSHA), cardiopulmonary resuscitation (CPR), and first aid. Additionally, health and safety videos will be shown and a yearly Arsenal safety orientation will be conducted for all employees. A two-way radio communication system will be maintained to enable expedient reporting of any emergency situation.

The health and safety program will be tailored to interact with current office operations and address future safety concerns. All aspects of field work will follow guidelines in the Army policy letter "Authorized and allowable activities on Rocky Mountain Arsenal" dated April 15, 1995. Any exceptions to this policy will require written permission of the Health and Safety Officer and the Project Leader. The program will include a monthly health and safety meeting, and will inform staff of significant health and safety events and issues during weekly staff meetings.

The existing field station health and safety plan will be reevaluated during 1998 to ensure its continued accuracy and relevance. The Service employee address and phone list will be updated and emergency phone numbers and the emergency response plan reviewed for accuracy. Material Safety Data Sheets (MSDS) will be added or eliminated as needed and organized to be readily available. Additionally, the new employee orientation packet (derived from the station health and safety plan) will be updated and evaluated for accuracy.

Refuge visitor programs will be evaluated on an ongoing basis during 1998 to ensure that safe conditions exist. Bus tour routes will be reviewed on a daily basis to ensure their compatibility with other Arsenal field activities. Health and safety concerns regarding anglers and special fishing programs for children and the physically challenged will also be addressed. As new public programs are developed, health and safety issues will be studied prior to implementation.

TASK 3A - ACTIVITIES COORDINATION PROGRAM EFFORTS

TITLE: Law Enforcement

INTRODUCTION

Currently, four Service employees at the Refuge have Refuge law enforcement authority. Future public use plans at the Refuge will require larger Service law enforcement staff. During 1998, the comprehensive law enforcement plan will be completed. Service officers will be responsible for monitoring the fishing program.

OBJECTIVES

1. Develop and implement the law enforcement program at the Rocky Mountain Arsenal NWR.
2. Provide officers annual training required to maintain law enforcement authority.
3. Assist local, state, and federal agencies as requested to maintain law enforcement skills.
4. Issue Special Use permits for activities occurring on Rocky Mountain Arsenal.
5. Oversee the raptor electrocution prevention program.

METHODS

During FY96, the Service developed a comprehensive law enforcement plan (CLEP) which outlines Service responsibilities for future Refuge law enforcement efforts. During 1998, the Service will begin phased initiation of this plan, including the hiring of seven Park Rangers to operate the Arsenal West and South entrance gates. Park Rangers will continue to operate the South and West gates from 0600 hours to 2130 hours seven days per week (U.S. Government, 1997).

The Service's Law Enforcement officers will undergo 40 hours of refresher law enforcement training annually, and will qualify biannually with their weapons as specified in the Refuge Administrative Manual. The Service has submitted an application for inclusion into Title 50 Code of Federal Regulations Subchapter C - The National Wildlife Refuge System. With this inclusion, the Service will have authority to enforce regulations governing fish and wildlife resources and public use activities at the Arsenal. The Service expects approval near the beginning of FY98.

TASK 3B - ACTIVITIES COORDINATION PROGRAM EFFORTS (SUPPLEMENTAL)

TASK INTRODUCTION

Specific tasks outlined in the Cooperative Agreement for Activities Coordination Program Efforts state that the Service shall revise as necessary and implement the Program Manager's Activities Coordination Plan which controls access to the Arsenal and assist Arsenal law enforcement officers by:

1. Assisting the program Manager's responsibilities with gate security; and
2. Assisting the Program Manager's responsibilities with central communications dispatcher.

Funding Sources

100 percent will be from Cleanup - Supplemental

TASK 3B - ACTIVITIES COORDINATION PROGRAM EFFORTS (SUPPLEMENTAL)

TITLE: Gate Operations

INTRODUCTION

The Army Law Enforcement staff historically operated the Arsenal entrance gates and conducted patrols of the site. However, due to employee attrition, the law enforcement staff has been reduced to 13 employees. This staff is too small to conduct all facets of law enforcement at the Arsenal. At the request of the U.S. Army, the Service developed a gate operations plan and hired eight term Park Rangers during FY97 to operate the entrance gates. These gates will continue to be operated by the Service during FY98 using Army funds.

OBJECTIVES

1. Regulate access and egress from the site in a safe, professional manner consistent with the access policy.
2. Help ensure the safety of Arsenal employees and the public by actively controlling or regulating access to the site.
3. Provide useful, current and accurate information to Arsenal employees and visitors.

METHODS

Park Rangers are provided 52 hours of site orientation and training on Arsenal operations, trained in OSHA hazardous waste recognition, CPR, and first aid. Park Rangers are expected to regulate access and egress from the site in a safe, professional manner consistent with the access policy. While operating the gates the staff will be attentive and ensure proper authorization of entering vehicles.

The Park Rangers are expected to maintain familiarity with the site and its activities to better inform employees and the public. These individuals will be tasked with other activities such as activities coordination, relief of Central Communications Dispatchers, health and safety presentations, BEMA operations, mitigation work, and other activities on a lower priority.

TASK 3B - ACTIVITIES COORDINATION PROGRAM EFFORTS (SUPPLEMENTAL)

TITLE: Central Dispatch

INTRODUCTION

Historically, each Arsenal agency or division operated on separate radio frequencies, and each maintained and staffed their own radio base stations. During FY97, a central radio dispatch office was established at the Arsenal fire station located at 7th and D Streets. The centralized dispatch center provides increased safety and reliability for fire and law enforcement emergencies, requires fewer total staff, and improves communication abilities among agencies at the Arsenal. Currently the dispatch office is staffed by Army and Service staff.

OBJECTIVES

1. Operate the central dispatch office to support communication needs at the Arsenal.
2. Provide professional, accurate, and clear assistance or information for the Arsenal Fire Department staff, law enforcement staff, or other Arsenal agency or employee.
3. Maintain a record log of incident calls received and transmitted through the Central Dispatch Office.

METHODS

The Central Dispatch Office will be staffed by Fire Department personnel, Army employees, or Service employees 24 hours per day year round. Central Dispatch staff will monitor Arsenal radio traffic at all times. Dispatch staff will promptly answer and provide responses for information or emergency situations called in over the radio. Their role is to provide support for all office and field personnel.

Central Dispatch staff are provided extensive site orientation and training on Arsenal operations. Dispatchers are expected to maintain familiarity with the site and its activities to better perform their duties.

Dispatchers also are trained CPR and first aid. To provide professional, prompt service the dispatchers are trained in emergency dispatch procedures and required to follow established protocols during emergency response actions. Emergency "exercises" are conducted at random times to ensure readiness of the Central Dispatch Office.

Additionally, the dispatchers will receive one training course each year to improve communication or dispatch skills.

Central Dispatch will maintain a permanent record of incidents or calls placed to the office. Most calls are computer recorded and stored for clarification at a later time.

TASK 4 - PUBLIC PARTICIPATION

TASK INTRODUCTION

Specific tasks outlined in the Cooperative Agreement for Public Participation state that the Service shall provide community relations information to the public and others on behalf of the Program Manager regarding interpretation of fish and wildlife resources at the Arsenal as they relate to chemical contamination or other Superfund site issues, especially listed species [threatened and endangered], by:

1. Developing and providing oversight for outreach and public involvement;
2. Conducting Shuttle Bus service as coordinated and approved by the Program Manager;
3. Conducting Arsenal tours for the public which explain the value of fish and wildlife resources and the balance between environmental protection and remediation;
4. Staffing the Arsenal Visitor Center;
5. Conducting off-site activities to facilitate public understanding of Arsenal activities;
6. Proposing, as part of the RVO's public outreach program, community relations activities necessary to educate and inform the public;
7. Providing educational and interpretive support services to fulfill Superfund community relations goals, including but not limited to maintaining a complete photographic record of Arsenal fish and wildlife species and their habitats, incorporating this product into appropriate publications and other media;
8. Administering other visitor programs at the Arsenal such as, but not limited to, fishing, school visits, handicap outdoor programs, and watchable wildlife programs;
9. Providing input for the responsibilities described above to the RVO's public outreach group and into the Management Plan, budgets, and reports; and

10. Providing educational and interpretive support regarding the archeological and cultural resources of the Arsenal and the history of the site.

Funding Sources

100 percent Cleanup

TASK 4 - PUBLIC PARTICIPATION

TITLE: Remediation Venture Public Relations Office Support

INTRODUCTION

In 1997, the Senior Management Group (SMG) of the Remediation Venture Office (RVO) formed the Remediation Venture Public Relations Office (RVPRO) to ensure that timely and accurate information is provided to the public regarding interpretation of listed species and other fish and wildlife resources, the remediation of Rocky Mountain Arsenal, and its transition into a national wildlife refuge. The RVPRO consists of representatives of the Army, the Service, and Shell Oil Company.

OBJECTIVES

1. Consistent with the Record of Decision and the Comprehensive Management Plan, an integrated communications program will be provided to support the remediation of the Arsenal and its transition into a National Wildlife Refuge.

METHODS

The Service will develop and provide oversight for outreach and public involvement that supports the RVO's public outreach office. Support will include providing staff to serve on a management team tasked with coordinating implementation of the overall program and coordinate and conduct visitor services and outreach activities as follows:

- Conduct shuttle bus service as coordinated and approved by the Program Manager;
- Conduct Arsenal tours for the public which explain the value of fish and wildlife resources and the balance between environmental protection and remediation;
- Operate and plan improvements for visitor facilities on-site to include the West Gate bus shelter, Visitor Center, lakes facilities, Rattlesnake Hill, the wetlands, Eagle Watch, and Angler lots and trails;
- Coordinate visitor activities on-site such as, but not limited to, fishing, school visits, and watchable wildlife programs. Conduct activities off-site to facilitate public understanding of Arsenal activities;
- Provide educational and interpretive support services to fulfill Superfund community relations goals, including but not limited to maintaining a complete photographic

record of Arsenal fish and wildlife species and their habitats, incorporating this product into appropriate publications and other media;

- Provide educational and interpretive support regarding the archeological and cultural resources of the Arsenal and the history of the site;
- Propose, as part of the RVO's public outreach program, an operating budget for transportation, maintenance, supplies, and equipment necessary to support the activities described above. These public outreach program costs have not been provided to the Service as described in the attached memorandum.



IN REPLY REFER TO.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Rocky Mountain Arsenal National Wildlife Refuge
Building 111
Commerce City, Colorado 80022-1748
Telephone (303) 289-0232
Fax (303) 289-0579

April 18, 1997

MEMORANDUM

TO: Lead Supervisors

FROM: Project Leader, Rocky Mountain Arsenal National Wildlife Refuge

SUBJECT: FY 98 Army Funding Reductions

The Cooperative Agreement between Army and the Service mandates funding reductions each year for a period of five years, FY 98 will be the second year of these cuts and will total a reduction of Army funding to the Service in the amount of \$300,000.

This reduction will be taken by the following tasks and amounts:

Task 1	-\$ 50,000
Task 4	-\$250,000

Task 1 and 4 Supervisors will prepare a list of activities, by amounts, and funding categories, that they recommend to eliminate or reduce no later than May 5, 1997. Both supervisors will coordinate these reductions through their appropriate supervisor prior to submission and utilize the results of the "Funding and FTE Summary for Rocky Mountain Arsenal NWR by Tasks" complete in the summer of 1996.

I will prepare a document for review by Army and Regional Office for concurrence. This document will be included in the FY 1998 Management Plan.

cc: RO-COKANUT (John Hamill)

TASK 5 - ADMINISTRATIVE SUPPORT EFFORTS

TASK INTRODUCTION

Specific tasks outlined in the Cooperative Agreement for Administrative Support Efforts state the Service shall provide administrative support for Tasks 1 through 6 by:

1. Providing personnel, contracting, procurement, budget, and other support for its activities at the Arsenal;
2. Maintaining an accounting of all funds expended for each task that it conducts;
3. Coordinating budget proposals for submission to the Program Manager;
4. Providing public outreach and management analysis support to the Program Manager; and
5. Providing input for the responsibilities described above into the annual Fish and Wildlife Resource Management Plan, budgets, and reports.

Funding Sources

75 percent Cleanup

15 percent Mitigation

10 percent Trustee

TASK 5 - ADMINISTRATIVE SUPPORT EFFORTS

TITLE: Administrative Support

INTRODUCTION

Task 5 will provide administrative support, pursuant to its Annual Fish and Wildlife Management Plan. Administrative support includes the Project Leader who has oversight responsibilities of all Service activities at the Arsenal. Support staff includes the Biological Systems Manager, Refuge Manager, and various administrative positions. The Cooperative Agreement, between the Army and the Service, serves as the basis for all work performed at the Refuge that is funded by the Army. Administrative support assists staff with all daily functions that pertain to budget, procurement and purchasing, personnel, health and safety, computer management, vehicles, property management, keys, travel, training, PCS moves, payroll, and clerical. Other support includes compliance with requirements defined in various Service, Army, EPA, and Shell agreements and various environmental policy and administrative regulations required by the Service.

OBJECTIVES

1. Provide personnel, contracting, procurement, budget, and other support for its activities at the Refuge.
2. Maintaining an accounting of all funds expended for each task that it conducts.
3. Coordinating budget proposals for submission to the Program Manager.
4. Providing public outreach and management analysis support to the Program Manager.
5. Providing input for the responsibilities described above into the Annual Fish and Wildlife Management Plan, budgets, and reports.

METHODS

Provide personnel, contracting, procurement, budget, and other support for its activities at the Refuge

Personnel--The support staff will assist all Tasks with personnel issues including recruitment, termination, promotion, transfers, accretion, awards, tours of duty, position descriptions, performance plans, appraisals, and payroll. Payroll includes preparation, submission of Time and Attendance reports, monitoring annual, sick, compensatory time, leave without pay, Sunday premium, and any other related issues. The support staff ensures that all necessary documentation and justifications are obtained and maintained for future use and will ensure compliance of all regulations.

Contracting and Procurement--The Administrative staff will assist all Tasks with their purchasing requirements. Acquisitions will be required for all purchases, which include approving signatures and justification. All documentation pertaining to each procurement will be kept to serve as backup documentation. All procured items will be conducted in accordance with the Federal Acquisition Regulations and Circulars and the U. S. Fish and Wildlife Service Administrative Manual. The primary means of procuring items will be with Purchase Orders, Delivery Orders, Contracts, Agreements, IMPAC Visa, and Imprest Funds.

Budgetary--The Administrative support staff assists all Fund Managers with budgetary projection, day-to-day activities, and allocation of nondiscretionary and discretionary funds. Provides various reports showing status of monthly budget obligation and unobligated amounts. A computerized budget tracking system will be used to reconcile to the DASC (Denver Administrative Service Center) Finance Center.

Other Support includes:

Property Management which consists of receiving, processing, and ensuring internal control of all accountable or durable property items. This includes, but is not limited to, marking items, documenting receipts, assigning property numbers when necessary, maintaining a database of property numbers, and obtaining signatures on property receipts when distributing items.

Computer Support and Database Management--Staff assists with database management, trouble shooting computer-related problems, upgrading hardware and software programs, disposal of obsolete equipment, assisting with support, operation and maintenance of the Refuge's file server.

Training and Travel--All training and travel, including justifications will be reviewed and approved prior to attendance. The validity and justifications will be monitored and maintained to ensure compliance with the scope of work for the Refuge. All travel is conducted in accordance with the Federal Travel Regulations and Service Policies.

Clerical Assistance--Clerical assistance is provided to all Tasks, including but not limited to, word processing, copying, typing, filing, and retrieving documents. Retrieving incoming and monitoring outgoing mail to ensure compliance with the various regulations is preformed daily with assistance in shipping. Receptionist duties are required for operator calls on incoming lines as well as assistance to visitors when necessary. All journals, manuals, regulations, and books are maintained in the library. Assistance is given to all employees in work-related Internet searches.

Maintaining an accounting of all funds expended for each task that it conducts

The administrative staff also maintains all supporting documentation pertaining to the expenditure of funds at the Refuge for costs expended by the Service in support of the terms of the Cooperative Agreement. A computerized budget tracking system is used to track each expenditure and to reconcile to the DASC Finance Center in accordance with the MIPR's issue by the Army. All monthly DASC reports will be reconciled and kept by the Service including all supporting documentation such as labor cost reports, time and attendance reports, acquisitions, justifications, purchase orders, invoices, etc.

Coordinating budget proposals for submission to the Program Manager

The Administrative Support Staff will coordinate budget proposal before submission to the Program Manager. Budget responsibilities include projections, justifications, management, accountability, monitoring, and reconciliation of funds.

Providing public outreach and management analysis support to the Program Manager

Project Leader, Refuge Manager, Biological Systems Manager, and support staff will participate in and provide Service direction and input to the RVO and RVPRO efforts, especially serving on the Senior Management Group, Program Integration Team, RMA Council and Committee, and various teams, etc. The goal of this effort is to implement the Record of Decision for the cleanup of the Rocky Mountain Arsenal in a safe, cost-effective, and timely manner to permit the transition to the Rocky Mountain Arsenal National Wildlife Refuge.

Providing input for the responsibilities described above into the Annual Fish and Wildlife Management Plan, budgets, and reports

The Administrative Support staff will ensure that a Service Management Plan and associated detailed budget are developed and provided to the Army for a full review of proposed Service activities at the Refuge. The plan and budget will be prepared in accordance with the Tasks that are stated in the Cooperative Agreement. Both will be submitted to the Army for approval by February 15 of the year prior to the start of the next fiscal year.

The Annual Progress Report which describes the previous fiscal year's efforts and results will be prepared and submitted to the Army along with the final details of the budget expenditures by January 15 or as soon as practicable after the close of that fiscal year.

TASK 6 - REMEDY SUPPORT EFFORTS (SUPPLEMENTAL)

TASK INTRODUCTION

Specific tasks outlined in the cooperative Agreement for Remedy Support Efforts state that the Service shall provide support for RVO remedy-related activities by:

1. Providing engineering support personnel to the RVO to address joint interests with the Service;
2. Providing management analysis support personnel to the RVO to address joint interests and transitioning the Arsenal to a National Wildlife Refuge; and
3. Providing administrative, clerical, and accounting support personnel to the RVO to address joint support interests.

Funding Sources

100 percent Cleanup - Supplemental

TASK 6 - REMEDY SUPPORT EFFORTS (SUPPLEMENTAL)

TITLE: Engineering support

INTRODUCTION

The Service provides engineering support to the Program Manager for Rocky Mountain Arsenal (Army) as part of the Remediation Venture Office. This support is provided pursuant to the 1997 Cooperative Agreement to address joint interests with the Service. There are two Service engineers who work in an integrated manner with the Remedy Execution Team and the Treatment Systems Team.

The broad scope of support is engineering assistance in support of the Rocky Mountain Arsenal remediation under the Record of Decision. The primary responsibility for these staff provided by the Service to Army is to furnish technical support and project management for Arsenal projects. This support includes more specifically, coordination of remedy execution with the Primary Management Contractor (PMC), preparation of engineering plans for implementation projects, on-going operations, and compliance issues.

The Service plans to continue this mutually beneficial arrangement through FY98 in accordance with the 1997 Cooperative Agreement.

OBJECTIVES

1. The objective of engineering support is to provide technical assistance, project management, contract oversight, and interpretation for planning and design of remedy execution projects to support the execution of the RMA remedy under the ROD.

METHODS

The Service will continue to provide project management, contract and project oversight, technical assistance, data collection and interpretation, remedy execution planning, and regulator oversight coordination through the use of the two full-time staff assigned to work directly with the Army. These staff will review planning documents, reports, and correspondence for all currently assigned and future projects (i.e., Basin A Consolidation and Remediation, Complex and Shell Trenches Slurry Walls, Bedrock Ridge Intercept System, Site-Wide Implementation Plan, CERCLA Wastewater Treatment Facility, and Basin A Neck Treatment Facility).

The Service engineers will serve as members on assigned technical teams, correspond and meet with parties and contractors to anticipate and address comments on contaminant-related issues, provide technical input during status and technical meetings, conduct health and safety audits, and conduct field audits.

TASK 6 - REMEDY SUPPORT EFFORTS (SUPPLEMENTAL)

TITLE: Management Analysis Group

INTRODUCTION

The Service provides management analysis support personnel to the Remediation Venture Office pursuant to the 1997 Cooperative Agreement to address joint interests and issues relating to the transition of the Arsenal to a National Wildlife Refuge.

The primary responsibility of this task is to furnish analytical support for the Remediation Venture Office, Senior Management Group, and with the RVO Program Controls Office. Projects include, but are not limited to, analysis of current or needed policies/procedures and to develop procedures and documentation to provide for the transition from the Rocky Mountain Arsenal to the Rocky Mountain Arsenal National Wildlife Refuge in accordance with the 1992 Refuge Act.

The Service plans to continue this mutually beneficial arrangement through FY 2001 in accordance with the 1997 Cooperative Agreement.

OBJECTIVES

1. Successfully complete and perform tasks as prescribed by the SMG. The objectives will be task specific and a scope of work will be developed and sign off for each specific subtask. Advise and assist the RVO by providing written and/or oral reports which help define the objectives which comply with the mission of the RVO.

METHODS

The Service will continue to provide management analysis support for the review and analysis of existing and/or proposed policies/procedures and regulations to determine relevance and effectiveness; formulate recommendations and reports, and research and collect administrative documentation necessary for the Transition Document. This staff will monitor existing and/or proposed programs to determine tangible or intangible benefits to the government and the RVO.

The management analysis group will provide findings and reports from analysis to guide teams delegated with the implementation of specific projects and further observe the work progress of the various teams. The group will also monitor completed product/policy/procedure to ensure effectiveness and compliance.

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ACRONYMS

ACHP	Advisory Council on Historic Preservation
ATV	All Terrain Vehicle
BAS	Biological Advisory Subcommittee
BBS	Bird Banding Survey
BEMA	Bald Eagle Management Area
BLM	U.S. Bureau of Land Management
BMP	Biomonitoring Program
BRD/USGS	Biological Resource Division/U.S. Geological Survey
CD	Compact Disk
CDC	Centers for Disease Control
CDOW	Colorado Division of Wildlife
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CLEP	Comprehensive Law Enforcement Plan
CMP	Comprehensive Management Plan
CPR	Cardio Pulmonary Resuscitation
CSU	Colorado State University
DASC	Denver Administrative Service Center
DBG	Denver Botanic Gardens
DMS	Degrees, Minutes, Seconds
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act

FFA	Federal Facilities Agreement
FMP	Fire Management Plan
FY	Fiscal Year
GIS	Geographic Information System
GPS	Global Positioning System
HEP	Habitat Evaluation Procedures
HRP	Habitat Restoration Plan
IPM	Integrated Pest Management
IRA	Interim Response Actions
MESC	Mid-Continent Ecological Science Center
MIPR	Military Interdepartmental Purchase Request
MK	Morrison-Knudsen
MOU	Memorandum of Understanding
MSDS	Material Safety Data Sheets
MSL	Mean Sea Level
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPS	U.S. National Park Service
NRHP	National registry of Historic Places
NWR	National Wildlife Refuge
OAS	Office of Aircraft Services
OSD	Optical Sighting Device
OSHA	Occupational Safety & Health Administration
PC	Personal Computer
PL	Public Law
PLGR	Precision Lightweight GPS Receiver

PMC	Primary Management Contractor
PPE	Personal Protective Equipment
PUP	Pesticide Use Proposal
RIMA	Revegetation Information Monitoring & Analysis
RMA	Rocky Mountain Arsenal
ROD	Record of Decision
RVO	Remediation Venture Office
RVPRO	Remediation Venture Public Relations Office
SARA	Superfund Amendments and Reauthorization Act
SHPO	State Historic Preservation Offices
SLR	Single Lens Reflex
SMG	Senior Management Group
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
UTM	Universal Transverse Mercator

