# Comprehensive Conservation Plan

*Rocky Mountain Arsenal National Wildlife Refuge*

***Colorado***

***December 2016***

***Approved by***

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# Comprehensive Conservation Plan

*Rocky Mountain Arsenal National Wildlife Refuge*

***Colorado***

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# Summary

© Dave Showalter

*Burrowing owls*

> *On this sand farm in Wisconsin, first worn out and then abandoned by our bigger and better society, we try to rebuild, with shovel and axe, what we are losing elsewhere.*
>
> *Aldo Leopold,* A Sand County Almanac

We, the U.S. Fish and Wildlife Service, have completed a comprehensive conservation plan for the management and use of the Rocky Mountain Arsenal National Wildlife Refuge in Colorado. This plan is the result of extensive public input and close collaboration with several cooperating agencies: Adams County, City of Commerce City, City and County of Denver, Colorado Parks and Wildlife, Denver International Airport, Denver Water, Tri-County Health Department, Urban Drainage and Flood Control District, U.S. Army, U.S. Department of Agriculture–Animal and Plant Health Inspection Service, and U.S. Department of Transportation–Federal Highway Administration. Also, several nongovernmental organizations and private citizens contributed comments and input.

The refuge is part of the Rocky Mountain Arsenal National Wildlife Refuge Complex, which also manages the Two Ponds National Wildlife Refuge and the Rocky Flats National Wildlife Refuge, as well as a few small properties located in Larimer and Weld Counties. The refuge complex is a work in progress. Offering unique assets to surrounding communities, these lands promise to become some of the premier urban wildlife refuges in the country. At the heart of the refuge complex is the refuge: 16,000 acres of shortgrass and mixed-grass prairie that is home to bison, bald eagles, migratory songbirds, prairie dogs, the endangered black-footed ferret, and much more—all within the Denver metropolitan area.

This comprehensive conservation plan is the first in the country designed for implementing the National Wildlife Refuge System's new Urban Wildlife Conservation Program. To accomplish this, we analyzed a wide range of options on how best to support up to one million visitors per year without compromising our principal purposes to protect and preserve fish and wildlife and their habitats.

We are fortunate to have inherited infrastructure from the U.S. Army, but we are also constrained by the current condition and layout of these facilities. Some of this infrastructure may be preventing the public from accessing the refuge—a condition incon-

sistent with the purposes of the refuge. Accordingly, we have developed a goal, objectives, and strategies to increase and improve suitable access to the refuge, develop sustainable transportation options, and provide more connections among the units of the refuge complex. This increased access will enable people from all walks of life to visit the refuge. The vision we have developed for the refuge complex calls for the restoration of its historical habitats and the reconnection of people to its natural lands using a network consisting of multimodal trails, a far-reaching light-rail system, and the Denver International Airport.

The refuge is well-positioned to use early investments to create world-class wildlife habitat and a conservation education facility in the heart of a rapidly growing metropolis. So positioned, the refuge represents the ideal intersection of nature and education to transmit the message of conservation, outdoor recreation, and natural resources stewardship to future generations. Toward this end, collaboration is essential to the refuge's future success. We will continue to foster and improve our strong public and private partnerships in the surrounding communities. These partnerships will enable us to act quickly and effectively as we invest in education and outreach efforts to fulfill our potential as a conservation catalyst in neighboring communities, the larger Intermountain West, and the world.

## A New Chapter

The homesteader and wartime eras of the Rocky Mountain Arsenal are important chapters in American history, but how these lands can benefit wildlife and people well into the future is an equally important chapter. Following the massive environmental cleanup that concluded in 2012, the next chapter in the story of the Rocky Mountain Arsenal National Wildlife Refuge will teach us lessons about healing habitats and the resiliency of our natural environment. The refuge offers a destination for millions of people to learn about and connect with the natural environment. Our hope is that these people will love nature and join in the stewardship of our public lands.

In the early 1930s, Aldo Leopold purchased an 80-acre farm in Sauk County, Wisconsin. On this farm, Leopold and his family focused much of their effort on the restoration of the natural environment. Many people believe that Leopold was one of the first to consider restoration as a land management tactic. His essay "The Land Ethic"—published in 1949 and incorporated into later editions of "A Sand County Almanac"—proposed a new relationship between people and nature and set the stage for the modern conservation movement. In December 2013, members of our planning team participated in a Land Ethic Leadership Workshop facilitated by the Aldo Leopold Foundation. Members of the team decided that "The Land Ethic" would be a centerpiece in the development of this comprehensive conservation plan.

Like Leopold's farm, refuge lands were once harmed, and our efforts to transform the refuge will require a landscape approach to land management, linking conservation science, policy, and ethics to ensure the future health of land and water. This transformation will take time, and we must recognize that the refuge is only in its infancy. We will continue restoring a diverse native prairie ecosystem made up of vegetative mosaics of varying composition, height, and density to provide important wildlife habitat. We will restore 4,500 acres to native shortgrass prairie and 8,000 acres to mixed-grass prairie. We will also maintain shrublands as nesting habitat for birds and as forage and shelter for other species. Finally, we will employ the historic landscape left by the prior landowners to maintain the wetlands and reservoirs on the refuge, creating an oasis for wildlife in a highly urbanized environment.

The last master plan for the refuge was completed in 1996; it served us well and guided the refuge through its establishment and the Superfund cleanup process. Almost 20 years have passed since that plan was finalized; this new plan will guide refuge management and conservation for the next 15–20 years.

## Restoration of Native Prairie

Restored prairies, along with a few remnants of prairie that escaped the plow, are mere fragments of native habitat that once existed in the refuge site. Fertile soils created by glacial action were kept treeless and nutrient-rich by periodic fires and the prairie plants themselves (Mlot 1990). However, when prairie grasslands—like those on the land occupied by the refuge—have been converted to agriculture and other human-centric uses, restoration is challenging, and the mechanisms are not always well understood (Camill et al. 2004). To date, more than 10,000 acres of the refuge have been treated and seeded, but the true restoration of these lands will take an unknown amount of time. Our restoration efforts are guided by a habitat restoration plan (FWS 1999a) and a long-term habitat management plan (FWS 2013a). In the short term, we will continue to battle the establishment of invasive plant species. In the long term, we seek to improve the richness of plant species found on the refuge through increased bison grazing and the use of prescribed fire.

Cindy Souders / USFWS

*Prickly poppy*

## Reintroduction of Native Wildlife Species

Over time, many of the terrestrial species originally found on the refuge and surrounding prairie were extirpated. Wild bison were reintroduced to the refuge in 2007 and have been helping us to restore the prairie. Over time we may also reintroduce greater prairie-chicken, plains sharp-tailed grouse, and pronghorn.

Once again we refer to Aldo Leopold, who is credited with first describing the mechanism known as trophic cascade (Leopold 1944, Leopold et al. 1947, Ripple and Beschta 2005). A trophic cascade is an ecological phenomenon triggered by the addition or removal of top predators, the subsequent changes throughout the food chain, and the dramatic changes witnessed in ecosystem structure and nutrient cycling. As part of the development of this comprehensive conservation plan, we had proposed and have carried out the reintroduction of the endangered black-footed ferret to the refuge. This reintroduction will assist with the recovery of this species, and because the ferret is a key predator in the prairie ecosystem, its reintroduction will also assist with the ecological restoration of the refuge.

At the same time, it is important to recognize that, because of the size, urban surroundings, and continuing restoration of the refuge, we must actively manage populations of certain wildlife species. Allowing unregulated population growth of grazing species would jeopardize the long-term sustainability of native prairie and shrublands and contribute to the worsening condition of individual animals, in turn increasing the potential incidence of wildlife diseases.

## Surrogate Species

Recently, the U.S. Fish and Wildlife Service refined its strategic habitat conservation approach to focus conservation design on creating functional landscapes capable of supporting self-sustaining populations of fish and wildlife species (FWS 2012a). This approach is based on the selection of surrogate species, which Caro (2010) defines as "species that are used to represent other species or aspects of the environment." This approach is still under development, but it offers promise for a systematic method of landscape conservation design that could address the absence of key species that are necessary to preserve biodiversity and habitat function.

The use of surrogate species allows us to achieve our conservation mission more strategically by using a smaller number of species to inform our goals and future management of the refuge. For the purposes of this plan, we chose four species (black-tailed prairie dog, lark bunting, Cassin's sparrow, and American bison) as surrogates that are consistent with our goals to focus on threatened and endangered species, declining populations of migratory birds, and the genetic conservation of bison to represent the majority of other species that occur on the refuge. These species and their habitat (shortgrass and mixed-grass prairies with a shrubland component) act as reliable indicators of any impacts on wildlife and their habitats associated with future management. We believe that if we are successful in managing these four species, these habitat types and our other refuge habitats (lacustrine, riparian, wetlands, and woodlands) should react favorably as well.

## Urban Wildlife Conservation Program

Periodically, the Refuge System develops a vision document to assist in guiding its national network of conservation lands. In July 2010, refuge managers from across the nation met in Madison, Wisconsin, to develop our most recent vision, "Conserving the

Future," which is supported by three pillars: wildlife and wildlands, a connected conservation constituency, and leading conservation into the future. The recommendations from this group state that we should strive to engage urban audiences in order to remain relevant to the American people.

With approximately 80 percent of Americans living in cities, we must find ways to connect urban America with our wild places, such as our national wildlife refuges. It is important that we teach each new generation to love the land and that we help children learn to find inspiration in nature even in their urban surroundings. We believe that Americans will have much of their direct contact with nature while in an urban setting and that we, as stewards of our natural heritage, must reach beyond the boundaries of our wildlands to shape the Nation's conservation values, ethics, and priorities.

## Planning Process

Over the past few years we met with the public on several occasions to solicit their input on the content of this plan. Based on public input, a large and diverse group of stakeholders, representing Federal, State, and local governments with important relationships to the refuge, developed this plan.

The primary purposes of this final plan are to:

- Provide a vision to guide the future management of the Rocky Mountain Arsenal National Wildlife Refuge.
- Identify ideas and actions for transforming a wildlife refuge in the middle of a major metropolitan area into one of the Nation's premier national wildlife refuges.
- Describe what will be necessary to balance our goals of providing high-quality experiences for an increasing number of visitors while also protecting the resources that make the refuge significant.

The planning team evaluated four alternatives in the draft plan, ultimately selecting alternative C, the "Urban Refuge Alternative," as the proposed alternative for developing this final plan.

## Colorado's Front Range Refuges

While this plan outlines a vision for the entire refuge complex along Colorado's Front Range (figure 1), its provisions are specific to the Rocky Mountain Arsenal National Wildlife Refuge in Adams County, Colorado. A comprehensive conservation plan for the Rocky Flats National Wildlife Refuge was completed in 2005. The Two Ponds National Wildlife Refuge is currently being managed in accordance with a comprehensive management plan developed in 1997, and we will develop a comprehensive conservation plan for Two Ponds National Wildlife Refuge in the near future.

## Vision for the Refuge Complex

We developed the following vision at the beginning of the planning process. It describes the focus of refuge complex management and portrays a picture of the refuge complex in 15 years.

*As the sun rises, bison thunder across the prairie, red-tailed hawks soar overhead, and the urban bustle begins. Lands once known for their agricultural and industrial uses are being restored on the Nation's premiere urban wildlife refuge, where time moves at nature's pace and wildlife have the right-of-way. Propelled by public and private partnerships, refuge stewards at Rocky Mountain Arsenal, Two Ponds, and Rocky Flats National Wildlife Refuges continue to work to repair and regenerate wildlife habitat. These prairie oases nestled within Colorado's Front Range communities welcome visitors from near and far and foster an appreciation for nature. They will connect people with the land for generations to come.*

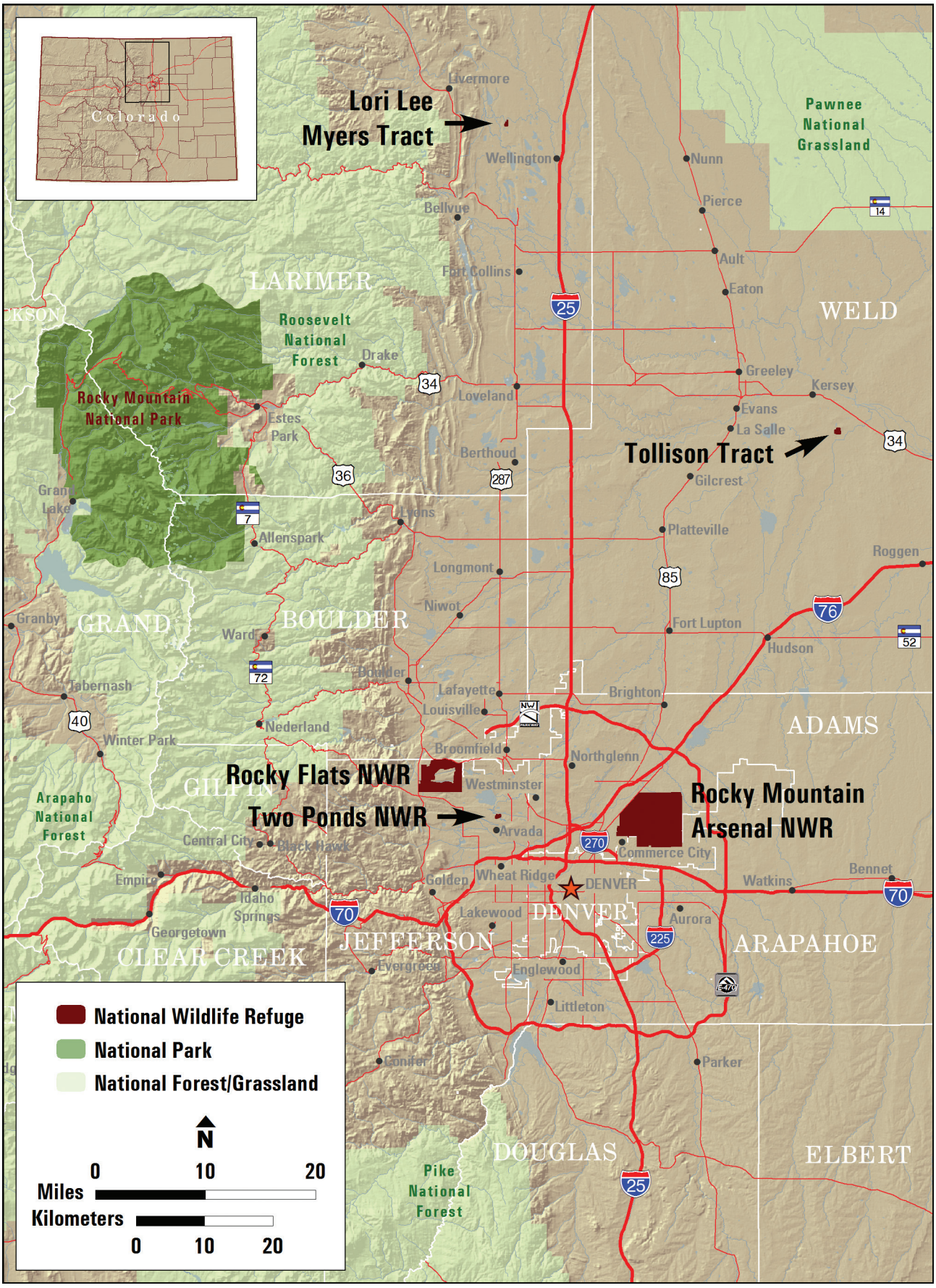



**Figure 1. Rocky Mountain Arsenal National Wildlife Refuge Complex, Colorado.**

## Goals for the Refuge

We developed nine goals for the refuge (table S-1) based on the National Wildlife Refuge System Improvement Act of 1997, the purposes of the refuge, and information developed during planning. The goals focus work toward achieving the vision and purposes of the refuge and outline approaches for managing refuge resources.

## Implementation

All public and agency comments and input were considered throughout the development of this plan and its associated environmental impact statement. This final plan includes the objectives and detailed strategies necessary to implement the selected alternative.

This is a 15–20 year plan, and the actions we propose must be phased in over time. Full implementation will be a slow process. At various stages, we will review this plan and make changes to it. Fish and wildlife conservation remains our primary responsibility.



*Sunrise on the refuge*

If conflicts arise between actions proposed in this plan and our management of fish and wildlife resources, we reserve the ability to forgo actions proposed in this plan and make decisions to restrict access and public use activities.

**Table S-1. Goals for the refuge.**

| *Goal Area* | *Goal* |
|---|---|
| Habitat Management | Use an adaptive management framework to conserve, restore, and enhance the ecological integrity of Front Range prairie communities, including wetlands, grasslands, native shrubs, and trees. |
| Wildlife Management | Balance and preserve wildlife species of concern through active management. |
| Visitor Services | Foster the public's appreciation of natural resources and provide inclusive, accessible, high-quality, wildlife-dependent recreation, education, and interpretation. |
| Communications and Outreach | Through effective communication and innovative technology, engage the public and stakeholders to help them better understand the importance of natural resources, operations, and history at the refuge complex so that they are inspired to take part in and support management and restoration efforts. |
| Partnerships | Seek and foster strong partnerships to support research and management, enhance wildlife-dependent recreation, and promote an appreciation of nature. |
| Cultural Resources | Protect artifacts and interpret the archeological, agricultural, military, and industrial histories of the refuge complex and the story of its restoration in order to connect visitors and the community to the area's past. |
| Research and Science | Use science and promote research to advance the understanding of natural resource functions and management within the refuge complex and beyond. |
| Infrastructure and Operations | Effectively use money, staff, partners, volunteers, and equipment to restore and manage refuge complex habitats, conduct programs, and improve and maintain all necessary infrastructure. |
| Access and Transportation | Support the improvement of suitable access to the refuges, develop sustainable transportation options, and provide more connections within the refuge complex. |

# Abbreviations

| | |
|---|---|
| **°F** | degrees Fahrenheit |
| **Administration Act** | National Wildlife Refuge Administration Act of 1966 |
| **ALR** | Anthropogenic Light Ratio |
| **APHIS** | Animal and Plant Health Inspection Service |
| **BBS** | Breeding Bird Survey |
| **BMP** | best management practices |
| **CCP** | comprehensive conservation plan |
| **CFR** | Code of Federal Regulations |
| **CLIR** | Climate Leadership in Refuges |
| **CPW** | Colorado Parks and Wildlife |
| **DIA** | Denver International Airport |
| **DOI** | Department of the Interior |
| **EIS** | environmental impact statement |
| **EPA** | Environmental Protection Agency |
| **FHWA** | Federal Highway Administration |
| **FONSI** | Finding of No Significant Impact |
| **FTE** | full-time equivalent |
| **FY** | fiscal year |
| **GOCO** | Great Outdoors Colorado |
| **HMP** | habitat management plan |
| **HRP** | habitat restoration plan |
| **IF** | Isolated Find |
| **Improvement Act** | National Wildlife Refuge System Improvement Act of 1997 |
| **IPM** | integrated pest management |
| **LCC** | landscape conservation cooperative |
| **MDA** | Minimum Dynamic Area |
| **NEPA** | National Environmental Policy Act of 1969 |
| **NPL** | National Priority List |
| **NRHP** | National Register for Historic Places |
| **refuge** | Rocky Mountain Arsenal National Wildlife Refuge |
| **refuge complex** | Rocky Mountain Arsenal National Wildlife Refuge Complex |
| **Refuge System** | National Wildlife Refuge System |
| **RTD** | Regional Transportation District |
| **Service** | U.S. Fish and Wildlife Service |

| | |
|---|---|
| **STEM** | science, technology, engineering, and math |
| **TCHD** | Tri-County Health Department |
| **U.S.C.** | United States Code |
| **UDFCD** | Urban Drainage and Flood Control District |
| **USACE** | U.S. Army Corps of Engineers |
| **USDA** | U.S. Department of Agriculture |
| **USGS** | U.S. Geological Survey |

# Chapter 1—Introduction



*Bison*

> *Conservation is a state of harmony between men and land. Despite nearly a century of propaganda, conservation still proceeds at a snail's pace; progress still consists largely of letterhead pieties and conventional oratory. On the back forty we still slip two steps backward for each forward stride.*
>
> *From* The Land Ethic, *by Aldo Leopold, 1949*

We, the U.S. Fish and Wildlife Service (Service), have developed this final comprehensive conservation plan (CCP) for the management of the Rocky Mountain Arsenal National Wildlife Refuge (refuge). The refuge is part of the Rocky Mountain Arsenal National Wildlife Refuge Complex (refuge complex), which also manages the Two Ponds National Wildlife Refuge and the Rocky Flats National Wildlife Refuge, as well as a few small properties located in Larimer and Weld Counties. These units of the refuge complex are located in Adams, Boulder, and Jefferson Counties, along the Front Range region of Colorado (figures 1 and 2). Although all three refuges in the refuge complex are managed by the same staff, Two Ponds National Wildlife Refuge is managed according to a separate comprehensive management plan, and Rocky Flats National Wildlife Refuge is managed as described in a separate CCP. Consequently, these two stations are not included in this CCP.

This CCP was developed in compliance with the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act) and Part 602 (National Wildlife Refuge System Planning) of the "Fish and Wildlife Service Manual" (FWS 2000a) and other Service guidelines. The actions described in the CCP also meet the requirements of the National Environmental Policy Act of 1969 (NEPA; refer to appendix A for brief summary of NEPA regulations).

Wildlife conservation, including habitat conservation, is the Service's first priority for managing national wildlife refuges. Public uses, specifically wildlife-dependent recreational uses, are allowed and encouraged as long as they are compatible with the establishment purposes of each refuge.

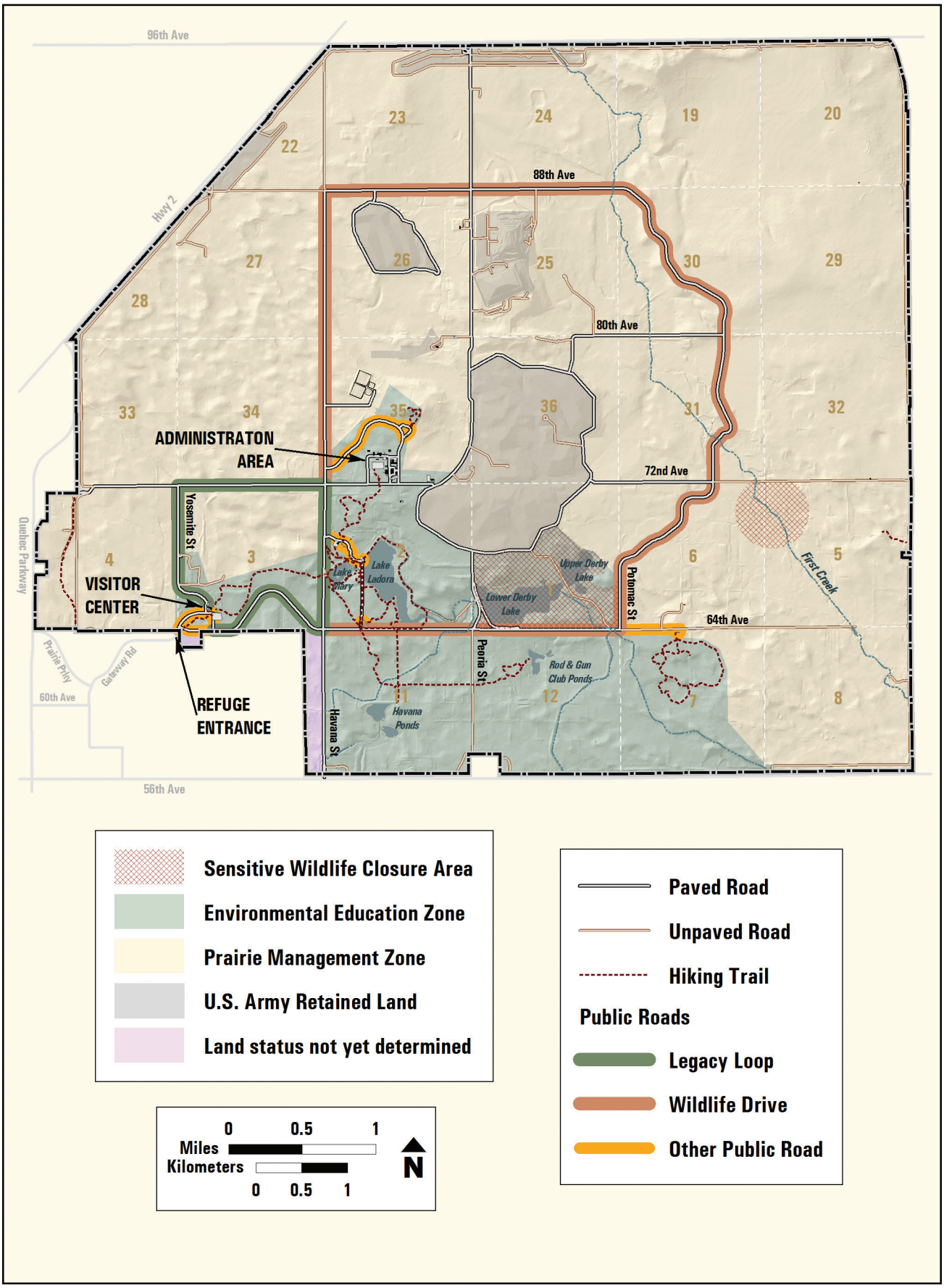



**Figure 2. Rocky Mountain Arsenal National Wildlife Refuge, Colorado.**

This CCP specifies the actions that are necessary to achieve the purposes, vision, and goals of the refuge, and it will guide refuge management activities, programs, and actions for 15 years following approval. This CCP discuses program levels that are sometimes substantially above current budget allocations and, as such, are primarily for strategic planning purposes.

We developed the CCP through extensive public input and collaboration with several Federal, State, and local agencies and neighboring municipalities. The core planning team of representatives from several Service programs and cooperating agencies prepared this CCP (appendix B). The cooperating agencies on the planning team were:

- Adams County
- City of Commerce City
- City and County of Denver
- Colorado Parks and Wildlife (CPW)
- Denver International Airport (DIA)
- Denver Water
- Tri-County Health Department (TCHD)
- Urban Drainage and Flood Control District (UDFCD)
- U.S. Army
- U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS)
- U.S. Department of Transportation, Federal Highway Administration (FHWA)

Public involvement in the planning process is discussed in section 1.6 below and detailed in appendix C.

## 1.1 Purpose and Need for Action

The Improvement Act requires that each unit of the National Wildlife Refuge System (Refuge System) be managed in accordance with a CCP and that each CCP will be revised at least every 15 years. Because the refuge's existing comprehensive management plan was prepared more than 15 years ago, we needed to develop a new CCP. Accordingly, the first purpose of this CCP is to comply with the Improvement Act requirement. The second purpose of this CCP is to describe the role of the refuge in supporting the mission of the Refuge System: to "administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources, and their habitats within the United States for the benefit of present and future generations."

The third purpose of this CCP is to help the refuge fulfill the purposes for which the refuge was established. (For further details, see section 4 of the Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 in appendix D). The fourth purpose of this CCP is to provide long-term guidance for management of refuge programs and activities, ultimately helping us to achieve the following:

- Communicate better with the public and other partners about our efforts to carry out the mission of the Refuge System and meet the purposes of the refuge.
- Provide a clear statement of direction for management of the refuge.
- Ensure that the refuge continues to conserve fish, wildlife, and ecosystems in spite of current challenges such as water shortages and climate change.
- Provide neighbors, visitors, and government officials with an understanding of our management actions on and around the refuge.
- Recruit and collaborate with regional partners to develop strategies for connecting more residents of the Denver metropolitan area with nature.
- Ensure that our management actions are consistent with the mandates of the Improvement Act.
- Ensure that management of the refuge considers other Federal, State, and local government plans.
- Provide a basis for development of budget requests for the operation, maintenance, and capital improvement needs of the refuge.

We are committed to sustaining the Nation's fish and wildlife resources through the combined efforts of governments, businesses, and private citizens.

## Decisions Made

The Regional Director of the Service's Mountain-Prairie Region made the final decision on the management direction for the refuge. The Regional

Director's decision was based on analysis of impacts; our legal responsibilities, including the mission of the Service and the Refuge System; the establishing purposes of the refuge; other legal and policy mandates; the issues facing the refuge; and the vision, goals, and objectives identified in this CCP.

Our final decision was documented in a record of decision for the final environmental impact statement (EIS) that was published in the Federal Register on June 28, 2016 (Federal Register 2016). We will begin implementing this final CCP immediately following publication of the Notice of Availability in the Federal Register.

## 1.2 The U.S. Fish and Wildlife Service and the National Wildlife Refuge System

We are the principal Federal agency responsible for fish, wildlife, and plant conservation in the United States. The Refuge System is one of our major programs.

## The U.S. Fish and Wildlife Service and its Mission

*Our mission is working with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people.*

The Service was established in the Department of the Interior (DOI) in 1940 through the consolidation of bureaus that at the time operated in several Federal departments. The primary precursor agency was the Bureau of Biological Survey in the USDA. Today, we enforce Federal wildlife laws, manage migratory bird populations, restore nationally significant fisheries, conserve and restore vital wildlife habitat, protect and support recovery of endangered species, and help other agencies and governments with conservation efforts. In addition, we administer a Federal aid program that distributes hundreds of millions of dollars to states for fish and wildlife restoration, boating access, hunter education, and related programs.

## Service Activities in Colorado

Our activities in Colorado contribute to the State's economy, ecosystems, and education programs. The following list describes some of our activities:

- We manage 10 units of the Refuge System encompassing a total area of 339,760 acres. This covers nine national wildlife refuges plus other lands managed under the Farm Services Administration and land interests along the Colorado River. These 10 units of the Refuge System are considered as refuges in the Service's "Annual Lands Report" (FWS 2013b). We also manage two fish hatcheries with a total area of 3,208 acres, two coordination areas with a total area of 1,153 acres, and one administrative site (FWS 2013b).
- We provide millions of dollars annually, recovered as excise taxes from the sale of firearms and ammunition, to CPW for sport fish and wildlife restoration and hunter education under the Pittman-Robertson Act of 1937 and the Dingell-Johnson Act of 1950 (FWS 2013c).
- We manage the National Black-Footed Ferret Conservation Center near Fort Collins in Larimer County.
- For more than 20 years, our Partners for Fish and Wildlife Program (Partners program) has helped to restore more than 29,647 wetland acres, 296 linear miles of streams, and 104,910 upland acres in Colorado (FWS 2013d).
- In 2014, we paid Adams County $417,630 under the Refuge Revenue Sharing Act for use in schools, roads, and other county services (FWS 2013e).

## The National Wildlife Refuge System

*The mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources, and their habitats within the United States for the benefit of present and future generations.*

In 1903, President Theodore Roosevelt designated the 5.5-acre Pelican Island in Florida as the Nation's first wildlife refuge to protect nesting colonies of brown pelicans, egrets, and other birds. This was the first time the Federal Government had set aside land specifically for wildlife. This small but significant designation was the beginning of the Refuge System.

Since then, the Refuge System has become the largest collection of lands in the world specifically managed for wildlife, with at least one refuge in every State and in five U.S. territories and Commonwealths, as well as numerous wetland management districts across the nation. These units of the Refuge System vary widely in size, purpose, origin, climate, level of development and use, and degree of Federal ownership (Fischman 2005, FWS 2013f).

Aaron Rinker / USFWS

*Weighing a fawn*

Historically, most refuge-establishing statutes that authorized acquisition of national wildlife refuge lands gave broad authority to the Service for managing lands for wildlife. However, in many cases the establishing authorities lacked specific direction or procedures for uniform management of the acquired and reserved lands. To resolve this, Congress passed two statutes in the 1960s to provide administrative guidance: the Refuge Recreation Act of 1962 and the National Wildlife Refuge Administration Act of 1966 (Administration Act). (Refer to appendix A.) While the Administration Act consolidated the units under our jurisdiction, it still did not meet its goal of giving clear direction for Refuge System management. The Administration Act gave the Secretary of the Interior broad power to decide what secondary uses could occur on refuges and districts, but it did not provide any biological standards or other standards of review outside of the establishing purposes. Furthermore, Congress did not specify a definition for compatible uses or provide any other direction on making such a determination (Tredennick 2000).

In the late 1980s, a decline in migratory bird populations prompted a General Accounting Office study of how refuge and wetland management district management activities negatively affected these populations (General Accounting Office 1989, U.S. House of Representatives 1997). The report concluded that the focus on secondary uses of refuges and wetland management districts diverted the managers' attention and resources away from wildlife management. In the early 1990s, several environmental organizations sought to end recreational and economic uses of Refuge System units because of alleged incompatibility with wildlife conservation, and those organizations challenged the Service through several lawsuits (Tredennick 2000). Eventually, the Service settled the lawsuits by changing or eliminating several existing uses of Refuge System lands. The pressure for new legislation intensified as a direct result of these lawsuits and other concerns, and the ground was laid for passage of a bill that would give us a clear mission and help resolve the problems of the past (U.S. House of Representatives 1997). Finally, on October 9, 1997, Congress passed into law the Improvement Act, which established a clear vision for the Refuge System.

The Improvement Act (and associated regulations) states that each unit of the Refuge System must be managed to:

- "fulfill the mission of the Refuge System, as well as the specific purposes for which that unit of the Refuge System was established";
- consider "wildlife conservation… [as] the singular Refuge System mission" (Final Compatibility Regulations Pursuant to the National Wildlife Refuge System Improvement Act of 1997; FWS 2000b);
- "ensure that the biological integrity, diversity, and environmental health of the Refuge System are maintained";
- fulfill the requirements of preparing "a comprehensive conservation plan… for each unit of the Refuge System within 15 years after the date of enactment of the… Act" and of ensuring opportunities for "public involvement in the preparation and revision of [these] plans";
- recognize that "compatible wildlife-dependent recreation [fishing, hunting, wildlife observation and photography, and environmental education and interpretation] is a legitimate and appropriate general public use of the Refuge System";
- keep the authority of a refuge manager to "make… the compatibility determination" after exercising "sound professional judgment… regarding wildlife conservation and uses of the Refuge System" (Final Compatibility Regulations Pursuant to the National Wildlife Refuge System Improvement Act of 1997; FWS 2000b).

We began following the direction of the new legislation immediately after the passage of the Improvement Act, most directly through initiating preparation of CCPs for all units of the Refuge System. In accordance with the mandates of the Improvement Act, we encourage public involvement in the preparation of all CCPs.

## People and the Refuge System

The Nation's fish and wildlife heritage contributes to the quality of American lives and is an integral part of the country's greatness. Wildlife and wild places have always given people special opportunities to recreate, relax, and appreciate the natural world.

Wildlife-dependent recreation contributes millions of dollars to local economies through birding, fishing, hunting, photography, and other wildlife-related pursuits. Nearly 46.5 million people visited the units of the Refuge System in 2011 (Carver and Caudill 2013), mostly to observe wildlife in their natural habitats. Refuge System visitors enjoy nature trails, auto tours, interpretive programs, and hunting and fishing opportunities. Local communities that surround the refuges and districts receive significant economic benefits. Economists report that Refuge System visitors contribute more than $2.4 billion annually to local economies, 72 percent of which is generated by nonconsumptive activities (Carver and Caudill 2013).

## Urban Wildlife Conservation Program

With approximately 80 percent of Americans living in cities, the Service needs to find a way to connect urban America with our wild places, such as our national wildlife refuges. Such connections are vital for fostering an appreciation for nature in today's generations and for finding ways for the people of our Nation to be inspired by nature in the urban surroundings where they live. We believe that most Americans will have their most direct contact with nature while residing in an urban environment, and this could help shape the Nation's conservation values, ethics, and priorities. For these reasons, our refuge and the Service need to reach out beyond the boundaries of the lands we manage. These are the challenges of the Urban Wildlife Conservation Program.

The Service's vision for the Refuge System—entitled "Conserving the Future"—proposed an Urban Refuge Initiative as Recommendation 13 to increase the Service's relevancy to urban citizens. This recommendation led to the Service's new Urban Wildlife Conservation Program, which has established measures to help define and achieve excellence, create a framework for creating new urban partnerships, and establish a refuge presence in several demographically and geographically varied cities in the United States.

Born from the "Conserving the Future" document, the program focuses the Refuge System to recognize the unique value of refuges near and within major metropolitan areas. In 2014, working with a broad range of Government and nongovernmental organizations, we developed a proposal describing the approach and steps necessary for the Refuge Complex to become one of the premier urban national wildlife refuges in the country. The Service's new "Standards of Excellence for Urban National Wildlife Refuges" (FWS 2014a) has greatly informed and inspired many of the actions proposed in this plan.

## Compatible Refuge Uses

Lands within the Refuge System are different from other Federal lands that have multiple-use purposes. They are closed to the public upon acquisition unless specifically and legally opened. A refuge use is not allowed unless the Service finds the use to be compatible (FWS 2000b). In the case of refuges, we cannot allow a new use, nor can we expand, renew, or extend an existing use unless the Secretary has decided that the use is compatible and is consistent with public safety. A compatible use is one that, in the sound professional judgment of the manager, will not materially interfere with or detract from the fulfillment of the Refuge System mission or the purposes of the Refuge System unit. "Sound professional judgment" is defined as a decision that is consistent with the principles of fish and wildlife management and administration, the available science and resources, and adherence to the law.

Compatibility determinations are typically completed as part of the process for a CCP or stepdown management plan. Compatibility determinations for existing and new uses for the proposed actions in this CCP are provided in appendix E. A compatibility determination is the written documentation that an existing or proposed use of a national wildlife refuge either is or is not compatible with the purposes of the refuge. Following public review, a final determination is made about the compatibility of various uses. Subsequently, the determination is signed and dated by the manager with the concurrence of the assistant regional director for the Refuge System. Once a final compatibility determination is made, it is not subject to administrative appeal.

The Improvement Act states that six priority uses—hunting, fishing, wildlife observation, photography, interpretation, and environmental education—should receive consideration in planning and management over other public uses. All facilities and activities associated with other recreational uses, or where there is an economic benefit associated with a use, such as for livestock grazing or commercial recreation, require compatibility determinations. However, management activities such as prescribed fire or invasive plant control do not require compatibility determinations.

## Biological Integrity, Diversity, and Environmental Health

Central to the Improvement Act is the requirement that the biological integrity, diversity, and environmental health of the Refuge System be maintained for the benefit of present and future generations of Americans. In 2001, we published a policy with guidance on this topic (FWS 2001). This policy directs refuge managers to consider the broad spectrum of fish, wildlife, and habitat resources found on the refuge or district and in associated ecosystems while fulfilling the purposes of the refuge and the Refuge System mission. The policy defines the terms "biological integrity," "diversity," and "environmental health," and it provides direction for secondary economic uses like farming, haying, livestock grazing, beekeeping, firewood collection, and other extractive activities. These are permissible habitat management practices only when prescribed in plans to meet wildlife or habitat management objectives and only when more natural methods, such as fire or grazing by native herbivores, cannot meet the purposes and goals of the Refuge System unit. As stated above, a compatibility determination is required for these uses.

## Rocky Mountain Arsenal National Wildlife Refuge Act of 1992

The Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 transferred management and jurisdiction of the Rocky Mountain Arsenal to DOI for management as a national wildlife refuge and established guidelines for initiating environmental cleanup. The act is reproduced in appendix D.

# 1.3 National and Regional Mandates

Refuge System units are managed to achieve the mission and goals of the Refuge System, along with the designated purposes of the refuges, conservation areas, and wetland management districts as described in establishing legislation, Executive orders, or other establishing documents. Key concepts and guidance for the Refuge System are set forth in the Administration Act and further detailed in Title 50 of the Code of Federal Regulations (CFR) and the "Fish and Wildlife Service Manual."

Brief descriptions of the laws and Executive orders that may affect the development or implementation of this CCP are provided in appendix A. Service policy for the planning process and management of refuges and districts is found in the "Fish and Wildlife Service Manual."

## Strategic Habitat Conservation

Escalating challenges such as threatened and endangered species, land use conversion, invasive species, water scarcity, environmental contaminants, urbanization, and climatic change have led us to move away from our earlier approach to conservation, which emphasized ecosystems, toward a broader vision that emphasizes landscape conservation in partnership with others.

A cooperative effort by the Service and the U.S. Geological Survey (USGS) culminated in a report on strategic habitat conservation by the National Ecological Assessment Team (USGS and FWS 2006). The report outlined a unifying adaptive resource management approach for landscape-scale conservation of the entire range of a priority species or suite of species. This is strategic habitat conservation—a way of thinking and doing business by incorporating biological goals for priority species populations, by making strategic decisions about the work needed, and by constantly reassessing and refining our approach (figure 3).

Since 2006, we have taken significant steps to turn this vision into a reality by defining a framework of 22 geographic areas. Experts from both the Service and USGS developed this framework through an aggregation of bird conservation regions (figure 4). The refuge lies within the Great Plains Geographic Area.

We have used this framework as the basis to establish the first generation of landscape conservation cooperatives (LCCs). These LCCs are conservation–science partnerships between the Service and other Federal agencies, States, tribes, nongovernmental organizations, universities, and others. Designed as fundamental units for planning and science, the LCCs have the capacity to help us carry out the elements of strategic habitat conservation: biological planning, conservation design and delivery, and monitoring and research. Coordinated planning and scientific information will strengthen our strategic response to climate change and other challenges. Because the sheer number of species that we and our partners work with makes designing and conserving landscape-scale habitats impractical on a species-by-species basis, we are now developing a process to collaboratively identify surrogate species, or species that can represent a suite of other species or aspects of the environment such as habitat or water quality. For more information about surrogate or focal species, refer to chapters 3 and 4.

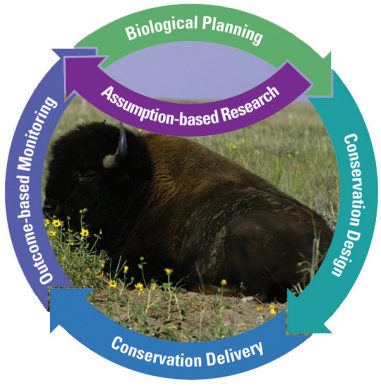



**Figure 3. Strategic habitat conservation.**

## Climate Change

We expect that any change in climate would affect the Nation's fish, wildlife, and plant resources in profound ways. While many species would continue to thrive, some may decline, and some may go extinct. Some species would survive in the wild only through direct and continuous intervention by managers. In 2010, we completed a strategic plan to address climatic change for the next 50 years (FWS 2010a). The strategic plan is built on three key strategies: adaptation, mitigation, and engagement. In addition, the plan acknowledges that no single organization or agency can address climate change without allying itself with others in partnerships across the Nation and around the world. This strategic plan is an integral part of DOI's strategy for addressing climate change as expressed in Secretarial Order 3226 and updated by Order 3289 (DOI 2009). Order 3226 states that "there is a consensus in the international community that global climate change is occurring and that it should be addressed in governmental decision making." Furthermore, we are employing the national fish, wildlife, and plants climate adaptation strategy (National Fish, Wildlife, and Plants Climate Adaptation Partnership 2012), which is a call to action to work with other natural resource professionals and decisionmakers to conserve the Nation's fish, wildlife, plants, and natural systems that could be affected by climate change.

We will use the following guiding principles from the strategic plan in responding to climate change:

- Priority setting—Continually evaluate priorities and approaches, make difficult choices, take calculated risks, and adapt to climate change.

- Partnership—Commit to a new spirit of coordination, collaboration, and interdependence with others.

- Best science—Reflect scientific excellence, professionalism, and integrity in all of our work.
- Landscape conservation—Emphasize the conservation of habitats within sustainable landscapes, applying our strategic habitat conservation framework.
- Technical capacity—Assemble and use state-of-the-art technical capacity to meet the challenge of a possible change in climate.
- Global approach—Be a leader in national and international efforts to meet the challenge of a possible change in climate.

## Conserving the Future

In 1999, we developed a vision for the Refuge System. A report titled "Fulfilling the Promise—The National Wildlife Refuge System" (FWS 1999b) was the culmination of a year-long process by teams of Service employees to evaluate the Refuge System nationwide. It was the focus of the first National Refuge System conference (in 1998), which was attended by the managers of Refuge System units, other Service employees, and representatives from leading conservation organizations. The report contains 42 recommendations bundled with 3 vision statements dealing with wildlife and habitat, people, and leadership. The outcome of that effort continues to influence CCP planning both nationally and locally.

In 2010, we began updating our earlier vision for the Refuge System in a report titled "Conserving the Future—Wildlife Refuges and the Next Generation" to chart a course for the Refuge System's next 10 years (FWS 2011a). The new vision recognizes many new challenges in landscape conservation efforts, including a rapidly changing landscape and a constricted Federal budget. Moreover, less undeveloped land is available, more invasive species are spreading, and it appears that we are experiencing the effects of a possible change in climate. In the face of these and other challenges, we believe that we can most effectively pursue conservation objectives through continued building of partnerships with Federal, State, and local agencies; tribes; nongovernmental organizations; friends groups; and volunteers. As we have done in the past, we continue striving to be a vital part of local communities as we work to conserve wildlife and habitats (FWS 2011a).

We believe that the wildlife management and habitat recovery and conservation actions outlined in this CCP reflect our commitment to the American people to support the Refuge System's landscape conservation efforts and to respond to climate change challenges.

# 1.4 Other National Conservation Efforts

As part of our strategic habitat conservation mission, the refuge collaborates with the planning and conservation work of many regional and national agencies and organizations. Some of these important projects described below.

## Recovery Plans for Threatened and Endangered Species

Where federally listed threatened or endangered species occur within the refuge, we adhere to the management goals and strategies in the recovery plans for those species. The list of threatened and endangered species at the refuge changes as species are listed or delisted or as listed species are discovered. The refuge will follow the recovery and management plans for the black-footed ferret, which is listed as endangered. (Refer to chapter 3.) Other listed species or species of concern that could occur on the refuge are detailed in chapter 3.

## Bird and Landscape Conservation

Over the past few decades, interest in conserving birds and their habitats has been growing. This increased interest has led to the development of partnership-based bird conservation initiatives that have produced international, national, and regional conservation plans. The North American Bird Conservation Initiative Committee, started in 1999, is a coalition of government agencies, private organizations, and bird initiative groups in the United States, Canada, and Mexico working to advance and integrate bird conservation efforts. The primary conservation planning initiatives follow the Partners in Flight North American Landbird Conservation Plan, the North American Waterfowl Management Plan, the U.S. Shorebird Conservation Plan, and the North American Waterbird Conservation Plan. Furthermore, to help apply adaptive management strategies

across large landscapes, the Service is partnering with new and established conservation groups in developing LCCs to address issues for all plant, wildlife, and fish resources that share similar stressors and impacts such as climate change on a landscape-scale level. The refuge's role is in connection with Partners in Flight and the Great Plains LCC is described below.

## Partners in Flight

The Partners in Flight program began in 1990 in response to the declining population levels of many migratory bird species. The program's primary goal is to provide for the long-term health of birdlife in the Western Hemisphere. Partners in Flight's mission is expressed in three related concepts: (1) helping species at risk, (2) keeping common birds common, and (3) voluntary partnerships for birds, habitats and people (Partners in Flight 2012).

For planning purposes, Partners in Flight divides North America into seven groupings of birds by ecological area, avifaunal biome, and 37 Bird Conservation Regions (figure 4). The refuge is in Bird Conservation Region 18–Shortgrass Prairie (North American Bird Conservation Initiative 2013). Region 18 is a topographically complex area that includes the Front Range region of Colorado. Wetlands and riparian corridors along the Front Range support a variety of nesting waterfowl, and the surrounding uplands provide migration habitat for various bird species of management concern.

Focal birds are a subset of the list of the Service's 2009 Birds of Management Concern (FWS 2011b) and are selected on the basis of: (1) high conservation need, (2) characteristics representative of a broader group of species sharing the same or similar conservation needs, (3) a high level of current Service effort, (4) a potential to stimulate partnerships, and (5) a high likelihood that factors affecting the species' status can realistically be addressed.

## Landscape Conservation Cooperatives

Rocky Mountain Arsenal National Wildlife Refuge lies within the Great Plains LCC (figure 5). The Great Plains LCC contains grasslands, playas, saline lakes, prairie rivers, streams and riparian corridors, savannahs, shrublands, and sand dune habitats in parts of Kansas, Nebraska, western Oklahoma and Texas, eastern Colorado and New Mexico, and southeast Wyoming.

The Great Plains LCC has identified an initial list of priority species for shortgrass and mixed-grass prairies, including lesser prairie chicken, burrowing owl, black-tailed prairie dog, American bison, American burying beetle, black-footed ferret, mountain plover, and ferruginous hawk.

## Monarch Butterfly Conservation Initiative

The Service plans to allocate additional funding in the next fiscal years for monarch conservation, building upon our already robust commitment to work with our partners to restore and enhance habitat for monarchs while also supporting several schoolyard habitats and pollinator gardens.

Our Monarch Conservation Strategy identifies key investments in conservation planning, design, delivery, inventory, and monitoring—the primary elements of our strategic conservation approach to our emerging monarch conservation strategy. This comprehensive approach involves habitat restoration and enhancement projects, native seed strategies, and education and outreach programs. Investments align with the strategy's goals, listed below:

- conservation planning and design processes for key geographic areas range-wide
- restoring and enhancing habitat in the eastern population's central flyway for migrating monarchs from border to border, with a focus on first-generation spring breeding habitat and summer breeding areas for monarchs in the high production areas of what is known as the Corn Belt
- developing a range-wide, geospatial approach for conserving the western monarch population while also restoring and enhancing important habitat
- engaging communities, schools, and citizens through a conservation campaign across the country, focusing efforts around a vision for Interstate 35 as the centerpiece of a greater landscape partnership for monarchs and pollinators

Our Monarch Butterfly Conservation Initiative provides a unique and historic opportunity to engage communities, especially young people, in conservation. The Service, working with the National Wildlife Federation and others, is launching an outreach and education campaign with a concerted communications and marketing component to inspire actions for monarch conservation. In support of that effort, we will establish a 21st Century Conservation Service Corps for Monarch Conservation. This project supports the Secretary's goal to provide opportunities for youth to play, learn, serve, and work in America's great outdoors. Interns would be based at national

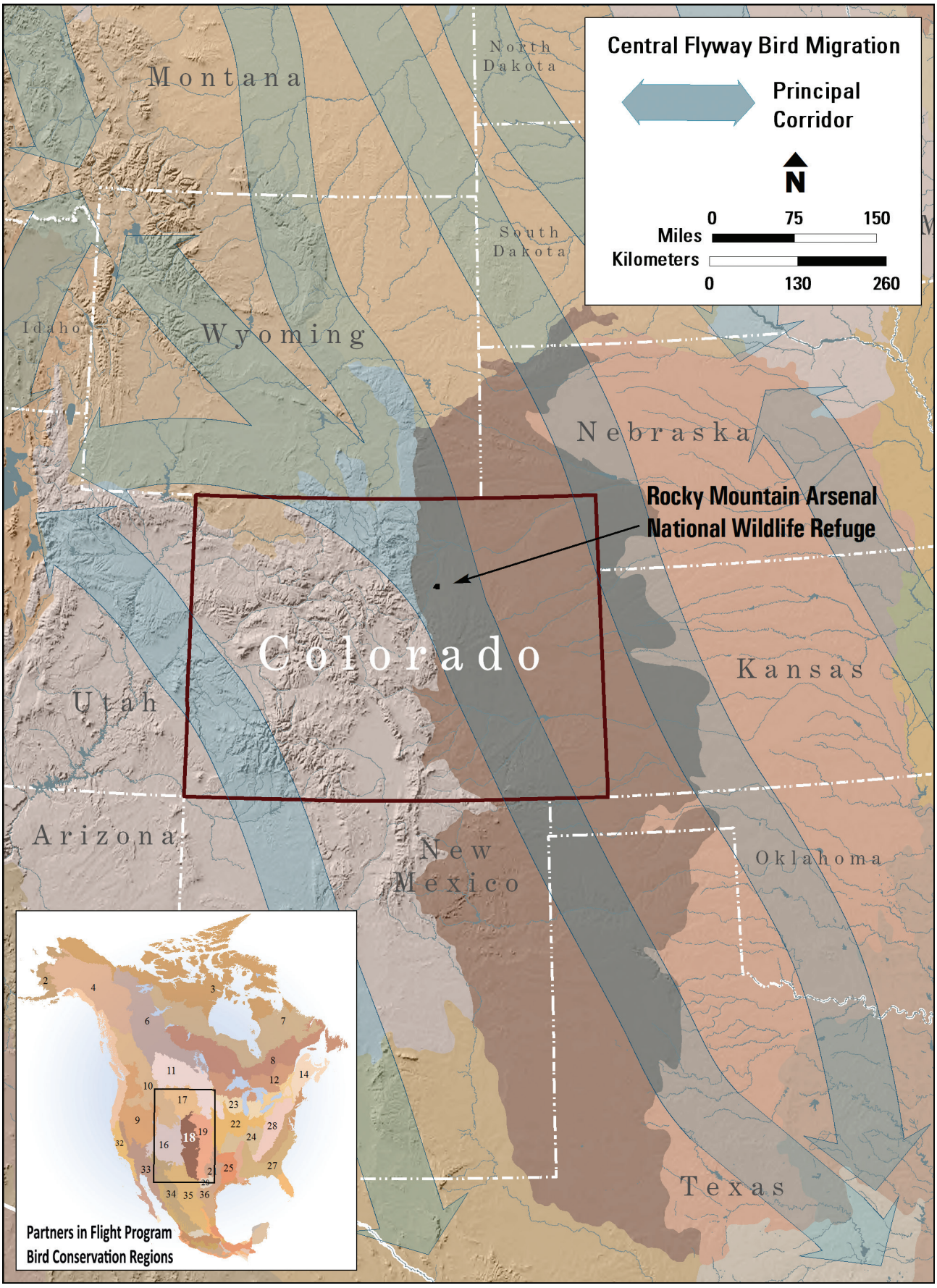



**Figure 4. Principal flyway corridors and North American Bird Conservation Regions.**

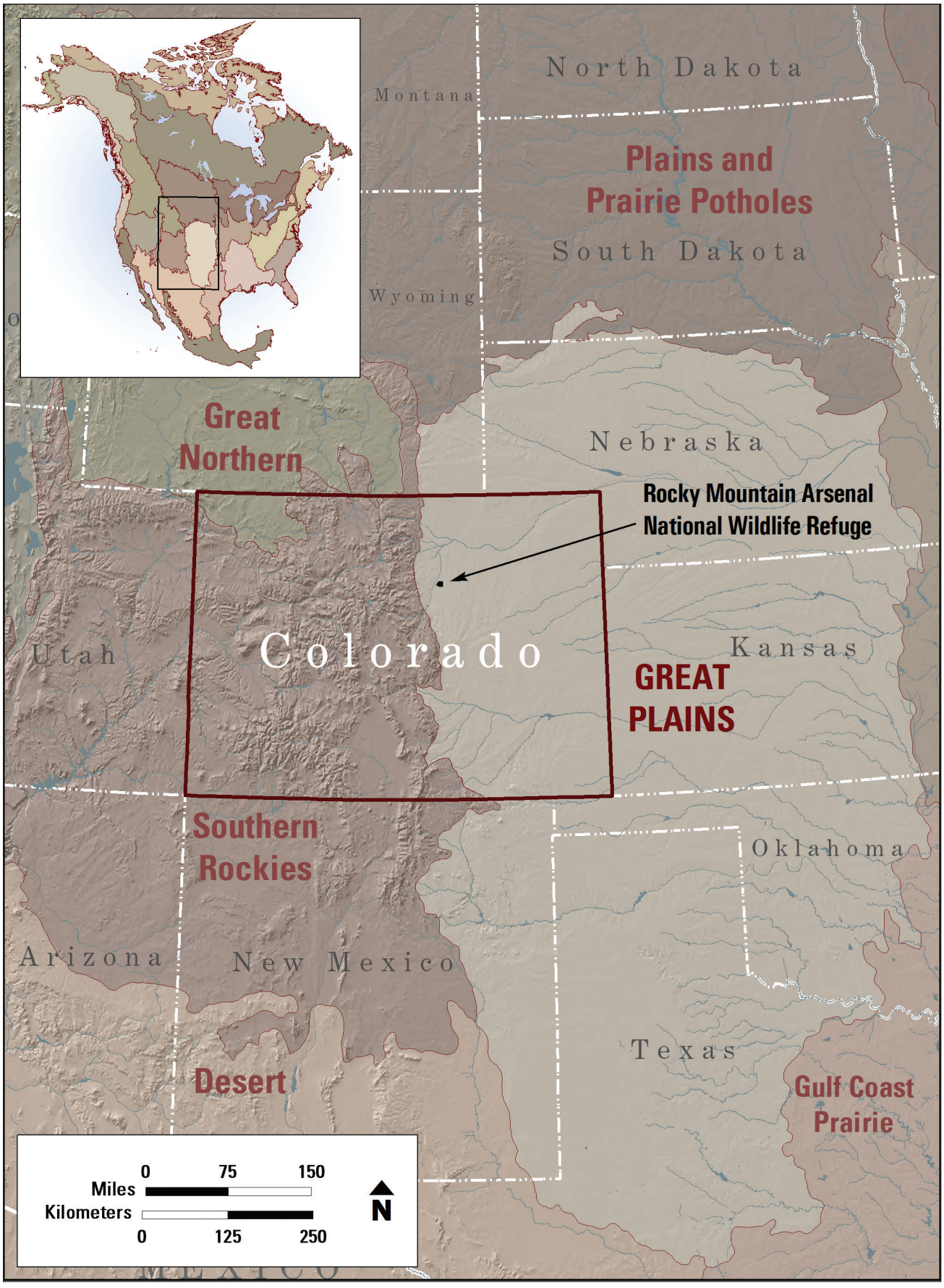



**Figure 5. Landscape Conservation Cooperatives.**

wildlife refuges or other offices. Duties would include developing outreach and environmental education materials, creating schoolyard and community habitats, training volunteers in seed collection and planting, and other outreach-related duties. The Service will place interns in key urban areas for monarchs, mostly in communities along Interstate 35. Proposed locations may include but are not limited to Austin, Texas (Balcones National Wildlife Refuge); Des Moines, Iowa (Neal Smith National Wildlife Refuge); St. Louis and Kansas City, Missouri; Minneapolis, Minnesota (Minnesota Valley National Wildlife Refuge); New York City; Denver, Colorado (Rocky Mountain Arsenal National Wildlife Refuge); and Wichita, Kansas (Great Plains Nature Center).

The refuge will seek partnerships with the Butterfly Pavilion to support monarch butterfly conservation efforts.

## State Comprehensive Fish and Wildlife Conservation Strategy

Over the past several decades, many declines of wildlife populations have been documented across the Nation. To help prevent species from becoming threatened or endangered, Congress created the State Wildlife Grant program in 2001. This program provides States and territories with Federal money to support wildlife conservation.

Under this program, each State develops a Comprehensive Fish and Wildlife Conservation strategy that defines an integrated approach to the stewardship of all wildlife species, with emphasis on species of concern and habitats at risk. The goal is to shift focus from single-species management and highly specific individual efforts to a landscape-oriented, geographically based conservation effort. The Service approves each State's conservation strategy and administers the State Wildlife Grant money.

Colorado's highest priority watersheds include the South Platte Basin, where the refuge is located. Tier 1 species (highest priority) consist of federally listed species, along with 52 species of greatest conservation need, for a total of 107 Tier 1 species. The remaining 103 species of greatest conservation need make up Tier 2. Some of the Tier 1 bird species relevant to the refuge are the bald eagle, Swainson's hawk, burrowing owl, grasshopper sparrow, lark bunting, Cassin's sparrow, and loggerhead shrike (Murray Laubhan, FWS Region 6 Zone biologist; telephone conversation; September 25, 2014).

The planning team for the CCP used Colorado's Comprehensive Fish and Wildlife Conservation Strategy during development of the draft CCP and EIS (CDOW 2006). Implementation of the CCP will support the goals and objectives of the State conservation strategy.

# 1.5 Planning Process

Planning for the refuge's CCP began in spring 2013 with site visits and meetings with refuge staff and invitations to State and Native American tribal representatives, followed with the establishment of a core planning team of Service staff from the refuge and the Mountain-Prairie region in summer 2013. Appendix B lists the planning team members and cooperating agency members for this planning process.

The core team was responsible for the development of a set of management alternatives, the analysis of environmental consequences, and the writing and production of the draft CCP and EIS. With the participation of the entire refuge staff, the core team developed a preliminary vision and set goals for the refuge. The cooperating agencies (refer to section 1.6) are part of the larger planning team, who met throughout the process in a series of collaborative workshops, to develop and review the alternatives and to review drafts of the CCP and EIS.

While developing the CCP, the planning team collected available information about the resources of the refuge and surrounding area. This information, summarized in chapter 3, served as the baseline for analyzing the predicted effects of the alternatives. Table 1 lists many other planning activities that occurred, including creation of a habitat management plan (HMP), a stepdown plan to the CCP that we developed over the last few years and finalized in 2013.

The planning process is based on the Refuge System planning policy, which was issued in 2000 (FWS 2000a). The resulting requirements and guidance for refuge and district plans, including CCPs and stepdown management plans, ensure that planning efforts comply with the Improvement Act. The planning policy sets out the steps of the CCP and environmental analysis process (figure 6).

# 1.6 Public Involvement

Public scoping began in June 2013 with the release of a planning update that described the CCP process and its anticipated schedule (FWS 2013g). On August 7, 2013, we published in the Federal Register

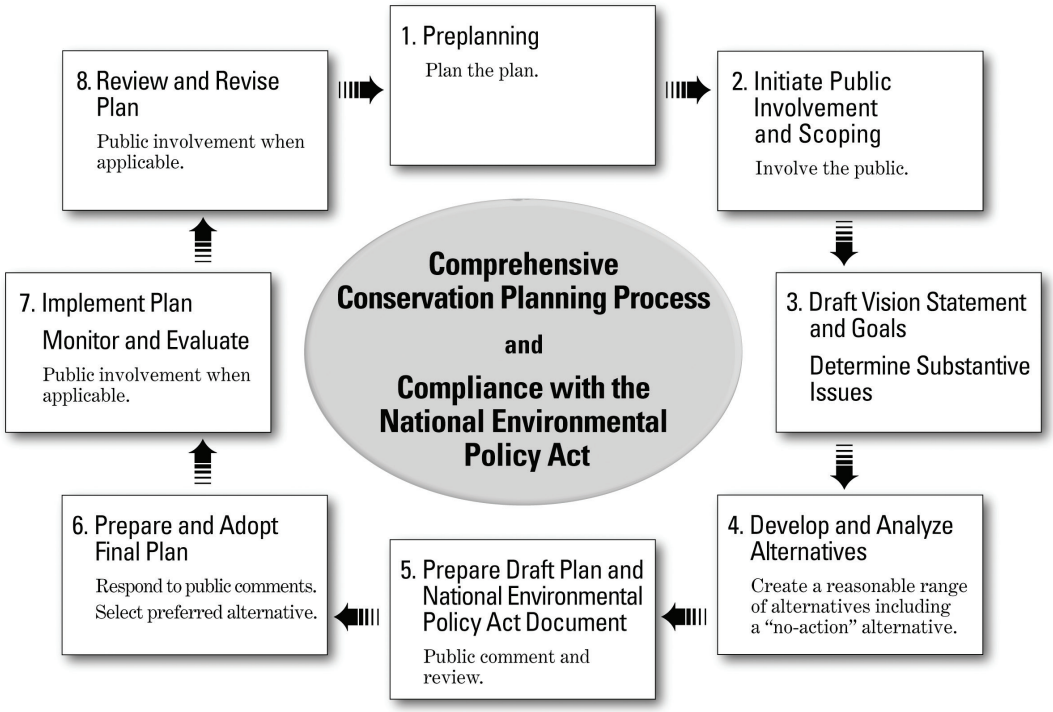



**Figure 6. Comprehensive conservation planning process.**

**Table 1. Planning process summary for the CCP and EIS for Rocky Mountain Arsenal National Wildlife Refuge, Colorado**

| *Date* | *Planning activity* | *Outcome* |
|---|---|---|
| May 6, 2013 | Preplanning meeting and tour of the refuge | Met with refuge staff. Identified refuge purposes and initial list of issues and qualities. Provided overview of the CCP development process. |
| June 13, 2013 | Mailing of Regional Director's invitation letters to numerous Native American tribal leaders and cooperating agencies | Invited several Native American tribal governments as well as cooperating agencies to join us in the process of developing the CCP and EIS for the refuge. |
| June 14, 2013 | Mass mailing of first CCP and EIS planning update | Informed members of the public, cooperating agencies, congressional delegation, and others on our mailing list of our intent to prepare a CCP, of our desire to see them participate, of ways to provide us comments, and of public scoping meetings to be held near the refuge. |
| June 24, 2013 | Onsite meeting and tour of refuge for congressional representatives | Met with local congressional delegation and briefed them on the mission of the refuge, the challenges and issues it faces, and the process to develop the CCP. |
| June 26, 2013 | Kickoff meeting and tour of the refuge | Updated the list of refuge issues and qualities. Identified needed biological information and maps. Developed draft vision and goals. |
| July 25, 2013 | Public scoping meeting at the Reunion Recreation Center | Reached out to and met with the public to present an overview of the planning process, to request public involvement, and to solicit public input. |
| July 30, 2013 | Public scoping meeting at the Central Park Recreation Center | Reached out to and met with the public to present an overview of the planning process, to request public involvement, and to solicit public input. |

**Table 1. Planning process summary for the CCP and EIS for Rocky Mountain Arsenal National Wildlife Refuge, Colorado**

| *Date* | *Planning activity* | *Outcome* |
|---|---|---|
| August 7, 2013 | Publication in Federal Register of Notice of Intent to prepare a CCP and EIS for the refuge | Informed the public of our intention to prepare a CCP and EIS for the refuge, of how to provide us comments, and of the CCP public meetings. |
| August 7, 2013 | Bilingual public scoping meetings at the Commerce City Recreation Center (English and Spanish) | Reached out to and met with the public to present an overview of the planning process, to request public involvement, and to solicit public input. |
| August 15, 2013 | Bilingual public scoping meetings at the Montbello Recreation Center (English and Spanish) | Reached out to and met with the public to present an overview of the planning process, to request public involvement, and to solicit public input. |
| October 29–30, 2013 | Visitor services program assessment workshop | Planning team reviewed existing refuge visitor services program and brainstormed how it could be enhanced and expanded. |
| December 19, 2013 | Meeting on refuge CCP and EIS transportation needs | Planning team leader met with FHWA personnel to identify transportation issues, analysis, and needs and to plan transportation alternatives workshop. |
| January 8–9, 2014 | Purposes, vision, and goals workshop | Planning team reviewed the establishment purposes of the refuge and developed a vision and a set of goal statements for the CCP and EIS. |
| January 28, 2014 | Transportation alternatives workshop | Gained understanding of existing access and circulation conditions and outlined refuge transportation issues to address in the CCP and EIS. |
| February 7, 2014 | CCP and EIS alternatives briefing | Planning team leader briefed FHWA personnel on alternatives development process and analysis needs. |
| February 24–25, 2014 | Range of management alternatives development workshop | Formulated a range of management alternatives, ensured that management alternatives generated by workshop participants satisfy NEPA, and defined requirements for a full range of viable options. |
| March 11, 2014 | CCP and EIS alternatives mapping workshop | Refuge and Regional Office staff met to discuss GIS and mapping needs to show the features of each alternative visually. |
| April 14–16, 2014 | Environmental consequences assessment workshop | Identified affected resources, defined thresholds, and discussed and described impacts of programmatic alternatives. |
| May 16, 2014 | Preliminary proposed action workshop | Reviewed and updated alternatives, reviewed and updated impact summary work to date, reviewed how alternatives meet goals/vision for the refuge, discussed preliminary proposed action and reasoning, and planned for moving CCP and EIS forward. |
| June 11, 2014 | Black-footed ferret consultation conference | Refuge staff conferred with staff from the Ecological Services Colorado Field Office on black-footed ferret reintroduction issues and procedures. |
| June 19, 2014 | CCP and EIS and black-footed ferret reintroduction status briefing to DIA staff | Presented draft alternatives and proposed black-footed ferret reintroduction details and maps to DIA staff, answered their questions, and received input and comments from them. |
| June 26–October 16, 2014 | Drafting of CCP and EIS for internal review | Refuge and Regional Office staffers prepared a preliminary draft CCP and EIS to be reviewed internally by the planning team and Service personnel. |
| July 7, 2014 | CCP and EIS status briefing to the City of Commerce City Council | Presented draft vision, goals, alternatives, and proposed action details and maps to the City of Commerce City Council members, answered their questions, and received input and comments from them. |

**Table 1. Planning process summary for the CCP and EIS for Rocky Mountain Arsenal National Wildlife Refuge, Colorado**

| *Date* | *Planning activity* | *Outcome* |
|---|---|---|
| July 16, 2014 | Design studio meeting with University of Colorado | Planning team leader met with instructor from the landscape architecture program at the University of Colorado–Denver to discuss planning needs. |
| July 17, 2014 | CCP and EIS Status briefing to Rocky Mountain Arsenal committee | Presented draft vision, goals, alternatives, and proposed action details and maps to the Rocky Mountain Arsenal committee members, answered their questions, and received input and comments from them. |
| August 12, 2014 | FWS-FHWA meeting on CCP and EIS long-range transportation needs | Planning team leader met with other Regional Office employees and FHWA staff to discuss the CCP and EIS long-range transportation needs. |
| August 14, 2014 | Refuge and RO Staff CCP and EIS Status Briefing to Denver Parks & Recreation Department | Presented draft vision, goals, alternatives, and proposed action details and maps to the members of the Denver Parks & Recreation directorate, answered their questions, and received input and comments from them. |
| August 22, 2014 | FWS-FHWA meeting on CCP and EIS planning and alternatives | Planning team leaders met with FHWA staff to discuss the status of the CCP and EIS planning effort and the details of the alternatives. |
| August 28, 2014 | Teleconference on socioeconomic analysis needs | Refuge and Regional Office staffers held teleconference with USGS socioeconomic branches to discuss CCP and EIS socioeconomic analysis needs. |
| September 30, 2014 | Refuge project leader and planning team leaders briefing with Colorado and Utah Refuge Supervisor | Refuge project leader and planning team leaders briefed the refuge supervisor on the planning effort status and alternatives details. |
| May–June 2015 | Publishing of Notice of Availability in Federal Register, issuing of press release, distribution of draft CCP and EIS for public review, and holding of public meetings | Refuge staff informed the public about the release of the draft CCP and EIS for public comment and conducted public meetings to solicit public input. |
| July 2015 | Section of the preferred alternative and determination of the environmentally preferable alternative | The planning team reconsidered the proposed action in light of public comments, modified it slightly, and deemed it the refuge's preferred alternative. The Team also reviewed impacts of each alternative and the NEPA 101 criteria for environmentally preferred alternative and designated alternative B as environmentally preferable. |
| August 2015 | Preparation and publication of final EIS | Service personnel prepared and released the final EIS for the refuge. |
| October 2015 | Review of comments received on the final EIS, preparation of record of decision, and reintroduction of black-footed ferrets to the refuge | The planning team reviewed all public and agency comments received after publication of the final EIS and prepared a ROD, which included responses to the comments received. The Service's Region 6 Regional Director signed the ROD. The endangered black-footed ferret was then reintroduced in the refuge. |
| June 2016 | Publishing of Notice of Availability in Federal Register of the record of decision | Refuge staff informed the public about the availability of the ROD of the final EIS. |
| December 2016 | Printing and distribution of final CCP | The Service's Region 6 Regional Director signed the final CCP, which was printed and distributed to the persons on the mailing list and other interested persons. |

a notice of intent to prepare a CCP and EIS. Since then, we conducted four public meetings during the scoping and development of the alternatives; mailed one planning update; posted information on the Web page for the CCP; and coordinated with Federal, State, and local agencies and Native American tribes.

The purpose of the first round of public meetings during the scoping phase was to inform the public about the project and to solicit their ideas and concerns regarding the future management of the refuge. During the alternative public meetings, we described the alternatives to meeting participants, answered their questions, and collected feedback.

Important considerations in the development of this plan—including the vision and goals—are the opinions, perspectives, and values of all interested citizens, agencies, and organized groups. While there are no requirements to base management decisions on public opinion, the Service values and considers input from the public. As detailed in appendix C, the Service has contacted and invited Native American tribes and actively involved Federal and State agencies, local governments, organizations, and private citizens throughout the process.

## Cooperating Agencies

We sent letters of notification about the planning process, including an invitation to join the planning team, to several Federal, State, and local agencies as well as other organizations: the Environmental Protection Agency (EPA), FHWA, U.S. Army, CPW, Colorado Department of Public Health and Environment (CDPHE), TCHD, Adams County, City of Commerce City, City and County of Denver, DIA, UDFCD, USDA-APHIS, and Denver Water. All but the EPA and CDPHE participated as cooperating agencies in the planning process and planning team.

## Native American Tribes

We sent letters of notification about the planning process, including an invitation to join the planning team, to the following tribes: Northern Arapaho, Northern Cheyenne, Southern Ute Indian Tribe, and Ute Mountain Ute tribe.

# 1.7 Significant Issues Addressed

## Habitat and Wildlife Management

We manage a wide variety of habitats on the refuge, including prairie grasslands, wetlands, reservoirs and ponds, and riparian corridors. The nearly 26 square miles of open land encompassed by the refuge provide important feeding, nesting, and wintering habitat for many bird species, including burrowing owl and bald eagle. Many species of mammals use the refuge, including American bison, deer, coyote, red fox, and black-tailed prairie dog. In total, more than 350 species of wildlife can be found in the refuge at different times of the year. Because of previous land management practices and Superfund cleanup activities, many acres of the refuge grassland habitats were severely affected, and we are still in the process of restoring these habitats. The grassland reestablishment task becomes especially challenging when the developing vegetation is subjected to strong grazing pressure, such as that from bison and prairie dogs. Accordingly, it is very important to reduce grazing pressure on recently-restored grasslands until these habitats attain a degree of stability that can sustain more intense grazing. We try to accomplish this by managing the refuge's bison herd grazing areas and by maintaining a healthy prairie dog population.

Many of our wildlife and habitat management issues have already been addressed in our HMP. Consequently, in our EIS we limited our analysis of impacts to new actions, such as increased visitation and reintroduction of native species.

## Water Rights

It is our policy to comply with State laws, regulations, and procedures in obtaining and protecting water rights, both for Service facilities and for trust fish and wildlife resources on lands not owned by the United States, except where State statutes and regulations do not permit Federal purposes to be achieved. Federal reserved water rights will be quantified and asserted when necessary to accomplish the primary purpose of the reservation. Water rights appurtenant to lands proposed for protection, restoration, enhancement, development, or acquisition will be identified and evaluated, and proposed

actions will not proceed until water rights have been acquired. We will cooperate with the States on all matters related to water use and water rights and will seek to resolve conflicts through negotiation, in coordination with the Solicitor's Office, as appropriate. However, if negotiations are unproductive, other courses of action, including litigation, will be pursued (FWS 1993).

Groundwater and water storage rights for the refuge appear to be adequate for current management. Most of our reservoirs have additional storage available. In the future we may seek a change in location of our senior water rights in Upper Derby Lake, or we may petition for additional water rights to the maximum storage available in our reservoirs.

The refuge's water rights and water management are complex subjects requiring an indepth analysis and their own management plan. Accordingly, we developed a more detailed plan (FWS 2014b) that explains how our water will be managed under a variety of circumstances. In summary, we generally obtain water in the following order: (1) use surface stormwater, (2) purchase recycled water, and (3) pump groundwater. This order of priority is most cost-effective, involves the smallest carbon footprint, and limits the amount of groundwater removed from the aquifer. This water management approach requires some minor infrastructure. However, because there would be no changes to our current management, no impact analysis was necessary in the EIS.

In most years, water rights are an issue in the South Platte basin. We will store what we are legally allowed and will divert any incoming water directly back to the basin via our wetlands. During dry years, we may be required to purchase and pump more water to meet our needs. It is also recognized that all natural systems are dynamic. The refuge will see years with high and low water levels, and there will be both positive and negative impacts that result from these fluctuations.

Water rights pertaining to the refuge are summarized in tables 2, 3, and 4.

## Connecting People with Nature

Many of the comments we received during the scoping meetings and by email reiterated an issue that the Service is trying to help address through expanded public opportunities on the units of the Refuge System—connecting people with nature.

Recent studies in the U.S. suggest that a lack of personal connection with nature and decreased engagement in outdoor recreational activities could

**Table 2. Summary of surface water storage rights, Rocky Mountain Arsenal National Wildlife Refuge, Colorado.**

| *Name* | *Priority Date* | *Maximum Storage Right* | *Case Number* |
|---|---|---|---|
| Lake Ladora | March 3, 1919 | 203 af | No. 54658 (12 November 1924) |
| Lake Ladora (enlargement) | May 12, 1942 | 323 af | No. W-9160 (b) -77 (6 August 1996) |
| Upper Derby Lake | May 12, 1942 | 460 af | No. W-9160 (b) -77 (6 August 1996) |
| Lower Derby Lake | October 3, 1893 | 387 af | No. 807 (9 June 1924) |
| Lower Derby Lake (enlargement) | May 12, 1942 | 660 af | No. W-9160 (b) -77 (6 August 1996) |
| Lake Mary | November 24, 1960 | 57 af | No. W-9160 (b) -77 (6 August 1996) |
| Havana Pond | February 28, 1985 | 79 af | No. W-9160 (b) -77 (6 August 1996) |

af = acre-feet

**Table 3. Summary of groundwater rights for Sections 4 and 12 Wells, Rocky Mountain Arsenal National Wildlife Refuge, Colorado.**

| *Name* | *Priority Date* | *Maximum Water Right* | *Case Number* |
|---|---|---|---|
| Section 4 Wells (Wells # 385, 386, 387) | August 6, 1956 | 750 gpm<br>466 af | No. W-9160(a)-77 (16 December 1994)<br>No. W-9161(a)-77 (16 December 1994)<br>No. W-9162(a)-77 (16 December 1994) |
| Section 4 Wells (increase) | March 26, 1999 | 900 gpm<br>700 af | No. 2002CW238 (16 April 2013) |
| Section 12 Well | December 20, 2004 | 900 gpm<br>700 af | No. 2008CW286 (25 November 2014) |

af = acre-feet; gpm = gallons per minute

**Table 4. Summary of groundwater rights for other wells (<50 gpm), Rocky Mountain Arsenal National Wildlife Refuge, Colorado.**

| *Name* | *Priority date* | *Maximum water right* | *Case number* |
|---|---|---|---|
| Ole Rugger Well (Section 20) | May 1, 1965 | 25 gpm<br>Stock | No. W-9150-77 (28 March 1989) |
| Section 8 Well | January 1, 1960 | 10 gpm<br>160 af | No. W-9164-77 (9 October 1981) |
| Section 32 Well | January 1, 1942 | 40 gpm<br>Stock | No. W-9159-77 (13 March 1992) |

af = acre-feet; gpm = gallons per minute

have potential adverse effects on children, adults, and the health of society in general. The Service's "Connecting People with Nature" program seeks to reconnect our Nation's residents with the natural world, especially at the units of the Refuge System.

Our refuge needs to become an example of how our agency and the units of the Refuge System can help address this issue by reconnecting existing and future generations of Americans with the natural world, and instill in them an appreciation for the conservation of our natural resources (see appendix F for information on the Standards of Excellence for Urban National Wildlife Refuges).

## Setting Clear Expectations about the Refuge

Many individuals and members of our staff commented that it is not uncommon for visitors to the refuge, and other units of the Refuge System, to confuse or not know the difference between our agency and the lands we manage and other agencies and their lands, such as the National Park Service, Bureau of Land Management, U.S. Forest Service, and Colorado Parks and Wildlife. Similarly, many visitors are unaware of what activities are allowed in the lands we manage. We realize it is important for us to find better ways to communicate to the public about who the Service is, what our mission and lands are, and how the public can participate in that mission and in the activities offered throughout the lands we manage. To that end, we have developed a Communications and Outreach Goal (see chapter 4) in this CCP through which we propose concrete actions to help us communicate more efficiently and clearly with our visitors and stakeholders.

## Improving and Expanding Public Use Facilities and Programs

Comments that we received during the scoping period show a desire from the public that we expand and improve our visitor services programs and facilities to appeal to a wider audience and non-traditional refuge visitors. Since we expect the number of visitors to the refuge to increase steadily over coming decades (see appendix G), it is important to consider, plan, and implement changes and improvements to our refuge's visitor services programs and facilities to accommodate these anticipated increases and diversification of future visitors. Failing to do so could create logistical complications for our staff, diminish the quality of our visitors' experiences, and cause us to miss opportunities to educate refuge visitors about our refuge, the Refuge System, and environmental conservation in general.

We also received many inquiries and comments regarding expanded fishing opportunities and opening hunting opportunities on the refuge. There is both support for and opposition to the use of hunting as a management tool and a wildlife-dependent recreational activity throughout the country, and at the refuge specifically.

There is also a desire by some groups to invest more and partner with the refuge in environmental education and interpretation to educate visitors about the importance of the refuge and the history of the refuge site.

We also received public comments recommending that we open more refuge areas to wildlife observation and photography and build more blinds and observation facilities throughout the refuge.

There is widespread and increasing public interest in allowing other outdoor recreational opportunities and facilities in the refuge to support bicycling, camping, snowshoeing, cross-country skiing, jogging, hiking, and picnicking. Many of our partners would

like to think beyond the boundaries of each refuge, craft plans at the landscape scale where possible, and use a variety of mechanisms to accomplish our common goals.

## Maintaining a Sense of Retreat

Many comments we received reminded us that the refuge offers a unique "sense of retreat" in the midst of a highly urbanized area. This characteristic is of great value not only for the visitors, but is also essential to the wildlife living in or migrating through the refuge. We have been asked to preserve this refuge attribute—unique in the context of the Denver metropolitan area.

## Interpretation of the Site's History

Many comments stressed the importance of preserving the refuge area's rich pre- and post-European settlement history and requested that we continue protecting and interpreting historical artifacts, structures, and sites within the refuge boundary. In general, there has been outstanding cooperation between Federal agencies, tribes, and the State Historic Preservation Office to preserve and document the refuge site's history.

Museum property representing arsenal activities during World War 2 and the Cold War are currently stored in one of the refuge's buildings. We have been asked to display and interpret these artifacts or to create a World War 2 and Cold War–era museum on the refuge. Although the proper care of these artifacts is the Service's responsibility, and several are displayed in the Visitor Center as part of the interpretation of those eras, a more extensive display is not within the refuge's primary purposes. Nevertheless, our staff needs to determine the best preservation options and future use of these artifacts.

## Improving Access and Transportation

Many comments pointed out the need to provide more and easier access to the refuge now that cleanup activities have concluded. Our alternatives have been developed to address these comments. Refuge neighbors have pointed out that despite their proximity to the refuge boundary, they must travel miles to enter the refuge through the only currently available public access point. Other comments pointed out that adding new refuge access points would offer neighbors and other visitors a more direct connection between refuge trails and other nearby trail systems, such as the Rocky Mountain Greenway Trail Network.

Some commenters asked us to consider allowing the use of bicycles in the refuge to participate in refuge programs and view wildlife and habitats. We have also been asked to consider how our existing and possible future trails may better accommodate pedestrians, bicyclists, and other refuge visitors. The addition of access points, the increased use of bicycles, improved connectivity of trail systems, and the expansion of the public transportation system in the Denver metropolitan area will expand opportunities for many people to visit the refuge without reliance on personal vehicles. Such strategies, taken together, will facilitate increased visitation from the refuge's surrounding communities and beyond.

Other comments asked us to study the possibility of expanding the existing auto tour route and opening some of the staff-only roads to visitors to provide access to areas currently closed to the general public. Presently, the 7.8-mile Wildlife Drive in the central portion of the refuge is open only to the refuge, U.S. Army, or appropriate contractor's staff, and to visitors while being transported in the refuge bus and guided by refuge staff. Allowing refuge visitors to use this drive would provide them with access to refuge habitats and wildlife in the southern portion of the refuge. Many other roads, remnants of the site's diverse uses, are similarly closed to the general public; these are currently used by the refuge, U.S. Army, and appropriate contractors for maintenance and other necessary activities. We have been asked to determine if some of these roadways may be opened to the general public, thereby extending the existing Wildlife Drive.

A few comments pointed out that because some of the site's remnant roads crisscrossing the refuge may no longer be essential for management, maintenance, or general transportation, such roads should be decommissioned and the roadbeds restored to native habitat to improve habitat connectivity. Other commenters pointed out a need for expanded parking facilities where refuge visitors can safely park their vehicles without affecting refuge habitats and other visitors' mobility.

Finally, some commenters have suggested improvements to the refuge signage to help refuge visitors more easily navigate the refuge sites and facilities.

## Reintroducing Native Species

In addition to the American bison—successfully reintroduced to the refuge a few years ago—we are considering bringing back other animal species that historically inhabited the Front Range Region of Colorado. These species include the federally listed black-footed ferret, pronghorn antelope, greater prairie-chicken, and Plains sharp-tailed grouse. We will need to conduct some research and consultation with species experts to determine if the size and current habitat conditions on the refuge are adequate to sustain viable populations of these species.

As part of the overall recovery strategy for black-footed ferret, we are considering reintroducing this highly endangered mammal to the refuge's grasslands habitats. This proposal has generated tremendous interest from the public and nongovernmental organizations throughout the Nation in general as well as from neighboring communities, State and local governments, and a variety of State and Federal agencies throughout the region.

## Improving Outreach to Neighboring Communities

Many people noted that, while visitation to the refuge has increased steadily and dramatically in the past 10 years (see appendix G), many residents in the surrounding communities and the broader Colorado Front Range region are unaware that the refuge exists, is open to the public, and offers programs and outdoor recreational opportunities. They pointed out a need to improve and expand our outreach efforts to these communities.

Ever since the establishment of the refuge, we have endeavored to reach out to partners, stakeholders, and the public using a variety of means and personnel. Based on comments during public scoping, it appears that our efforts have met with mixed results. Many people, especially members of non-traditional and minority groups, are not aware of the refuge or its mission and programs or, perhaps, do not find them appealing.

The Refuge System—the largest system of lands dedicated to wildlife in the world—is tasked with conserving wildlife and the habitats on which they depend, for the enjoyment of future generations. Yet, many refuge visitors and members of the general public do not know of the existence or of the important mission of the Refuge System. Because it is nestled within the Denver metropolitan area and adjacent to DIA, the refuge can be a vital ambassador for the Refuge System, with access to local residents as well as international visitors.

We need to convey to today's young people the importance of the Refuge System and the Service's role in the conservation of wildlife and the habitats on which they depend on a local, national, and international scale. To this end, we must increase the scope and effectiveness of our outreach activities if we are to be successful stewards and leave a fitting natural legacy for future generations.

## Increasing Partnership Opportunities

Some commenters suggested that we assess strategies for increasing our partnerships with neighbors, stakeholders, and others during the planning process. Refuge management offers many opportunities for partners and volunteers to advance the refuge's mission and programs. Both former and existing partnerships have helped us maintain and expand refuge programs, as well as carry out restoration and conservation projects.

The Service in general and our staff in particular appreciate and value the importance of partnerships to achieve the Service's and Refuge System's missions and the refuge's purposes. Accordingly, our planning team will address opportunities for partnerships, with our neighbors, stakeholders, and others in this CCP.

## Make the Refuge More Welcoming

We received many comments regarding the need to modify the refuge boundary fence and vehicular entrance to expand public access to the refuge and create a more welcoming and traditional refuge-like look and atmosphere. Currently, an 8-foot chain-link fence—a remnant of the prior cleanup period of the site—surrounds the entire refuge. This boundary fence has remained to this day even though the Superfund cleanup activities concluded and most of the site became a wildlife refuge. The existing fence conveys and reinforces the messages of "closure" and "forbidden entry" that characterized the site's previous purposes, and which is in direct opposition to the message that the refuge would rather portray to our neighbors, stakeholders, and visitors.

An effective barrier is necessary to promote public safety and curb wildlife diseases. We are attempt-

ing to keep large wildlife species (such as bison and deer) from moving out of the refuge and endangering people and themselves, disrupting automobile and aircraft traffic patterns around the refuge and damaging private property. The fence also helps isolate refuge deer populations from populations outside the refuge that may carry chronic wasting disease. The refuge must find ways to continue managing its habitats and wildlife to ensure public safety, while at the same time creating a more welcoming look and environment for neighbors and visitors.

The Service's Urban Wildlife Refuge Program seeks to engage urban communities as partners in wildlife conservation (see appendix F for information on the Standards of Excellence for Urban National Wildlife Refuges). To accomplish this, the units of the Refuge System near or within urban areas must reach out to and engage the residents of these urban areas. We understand that the current infrastructure of our refuge is not ideal to support the goals of the Service's Urban Wildlife Refuge Program; accordingly, in this CCP we propose some steps to support this important program.

## 1.8 Issues Not Addressed

We considered several issues that were identified by the public during scoping and alternatives development but were not selected for detailed analysis in the CCP and EIS. In accordance with the requirements of NEPA, we have identified and eliminated from detailed analysis the topics or issues that are not significant or are out of the scope of this planning process. These issues and the rationale for not discussing them further in the CCP and EIS are briefly described below.

### Development of Mineral Rights

When the refuge was created, the majority of mineral rights were acquired with the land. In addition, the United States and the State of Colorado entered into an agreement stating that all minerals owned by the State within the boundaries of the refuge are subordinated (November 5, 1942). For those remaining outstanding mineral rights, the draft CCP and EIS did not address the rights of private property owners to exercise their rights to extract any locatable minerals, or oil and gas within or adjacent to, the refuge. Any exploration or other activities supporting the testing, development, or production of gas, oil, and other resources will be analyzed through an additional and separate NEPA process designed to address that issue specifically. While the draft CCP and EIS did not analyze any future mineral development alternative, we are considering how habitat, wildlife, and visitor services should be managed if private mineral development occurs near or adjacent to the refuge.

### Decisions Made in Other Planning Documents

During the past several years our staff has been working with other Service employees from the Division of Biological Resources, the Division of Water Resources, and the Regional Office Fire Management personnel to prepare various plans to assist in the management of the refuge. The plans include an HMP, an integrated pest management plan, a water management plan, a fire management plan, a black-tailed prairie dog management plan, and a station safety plan. Most of these plans were drafted and released for public comment in spring and summer 2013. After analyzing the comments for these plans during the public comment period, we addressed all significant comments received and then finalized these plans. These plans have been under implementation since they were finalized. The draft CCP and EIS did not readdress the decisions made on any of these plans, as they have already undergone their own NEPA analysis and public scrutiny.

#### *Habitat Management Plan*

The HMP provides additional details regarding specific strategies and implementation schedules for meeting the wildlife and habitat goals for the refuge.

#### *Integrated Pest Management Plan*

The integrated pest management plan provides a broad strategy for combating invasive plant species and weed control focusing on early detection and a rapid response program for species with a high potential for spread.

#### *Water Management Plan*

The water management plan is a synthesis of our sources of water and how water is managed on the refuge. The plan includes monitoring protocols to ensure compliance with State of Colorado regulations.

### Fire Management Plan

The fire management plan provides policy direction for wildland fire suppression and prescribed fire activities on all three refuges to promote healthy native habitat for wildlife.

### Black-Tailed Prairie Dog Management Plan

The black-tailed prairie dog management plan provides a transparent decisionmaking process and information on the methods that will be used to control and maintain a healthy and balanced population of prairie dogs on the refuge.

### Station Safety Plan

The station safety plan assesses risks associated with refuge staff and visitors, outlines the procedures for safe operations, and provides information and procedures to be followed in case of an emergency. All of our safety analysis is covered under our station safety plan.

### Habitat Restoration Plan

This restoration plan, developed in 1999, outlines a general strategy for replacing habitat in some portions of the refuge and improving habitat in others. Most of the plan concerns manipulation of vegetation, although management of water and construction of structures are also considered. The plan serves as a stepdown document from the refuge's 1996 comprehensive management plan and as an "umbrella" plan to guide specific habitat restoration projects.

## Superfund Cleanup

Some of the refuge site's historical military and industrial activities resulted in contamination of portions of the lands within and around the refuge boundary. In 1987, the site was studied and declared a Superfund site, initiating a vast and comprehensive cleanup effort. The EPA, the U.S. Army, and Shell have performed numerous environmental studies and complied with appropriate NEPA regulations, including full disclosure, public outreach, and opportunities for public comment. The lands transferred by the U.S. Army and currently being managed by the Service have been cleaned up sufficiently to guarantee human and wildlife safety. From this process, several encumbrances, or "land use restrictions," have been passed along to us (see chapter 2, section 2.1).

Since the site's Superfund designation and its subsequent cleanup activities were subjected to their own NEPA analysis and process, the draft CCP and EIS did not address these issues any further.

## Refuge Revenue-Sharing Payments

Since 1935, we have made revenue-sharing payments for refuge land under our administration to counties under the Refuge Revenue Sharing Act of 1935 (16 United States Code [U.S.C.] 715s), which was subsequently amended. These payments are not the same as other Federal revenue-sharing payments measures such as payments in lieu of taxes, which applies to lands administered by other agencies, including those within the DOI. When there is not enough money to cover the payments, Congress is authorized to appropriate money to make up the deficit; however, payments to a county are reduced when Congress fails to appropriate the money. Understandably, these are issues of concern for many counties in times of declining revenues, but the Service has no control over Congress in making these payments. This issue was outside the scope of the draft CCP and EIS.

## Management of U.S. Army–Retained Sites

The Rocky Mountain Arsenal was established by the U.S. Army during World War 2. With the passage of the Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 (Public Law 102-402), the Secretary of the U.S. Army was directed to transfer jurisdiction over the Arsenal to the Secretary of the Interior. This act created the refuge by transferring most of the former arsenal lands to the Service. However, the U.S. Army retained some lands (approximately 1,000 acres) for the operation and maintenance of landfills and groundwater treatment facilities.

Except for any cumulative effects that result from our proposed actions, the draft CCP and EIS did not address the management of U.S. Army–retained sites within or adjacent to the refuge, as these lands are managed by a different agency and this issue was outside the scope of the analysis.

## Power Transmission Lines

We received many questions about the large overhead power lines at the refuge. In 1947, the U.S. Army granted an easement to the Public Service Company of Colorado, later becoming XCEL Energy Company, to construct and maintain an electric transmission line over and across the refuge. In 1997, the term of this easement was extended by 50 years (ending April 29, 2047). In 2003, a slight adjustment was also made to facilitate the widening of 56th Avenue and allow the power lines to go behind the U.S. Army Reserve Center. Power lines constructed by the refuge will typically be below ground, but any changes to power lines owned by the Public Service Company of Colorado within existing easements are outside the scope of this document.

## Repository Programs

The Service's Office of Law Enforcement manages the National Wildlife Property Repository and the National Eagle Repository, both of which are located within the boundary of the refuge.

These facilities support the Service's law enforcement, migratory bird permit, and educational outreach programs nationwide. Both are funded from criminal fine monies deposited in the Lacey Act Reward Account.

The Property Repository receives, stores, and distributes wildlife property that has been abandoned or forfeited to the government as a result of Service wildlife inspections and wildlife crime investigations. It currently houses approximately 1.5 million individual pieces of wildlife property, including many striking examples of the impact that unlawful wildlife trafficking has on imperiled species such as tigers, rhinos, elephants, bears, and too many more species to succinctly list here. The repository loans wildlife products to public scientific and educational institutions, State agencies, and Service offices for use in conservation education or law enforcement. In 2013, we played a major role in planning and hosting the U.S. Ivory Crush.

The Eagle Repository supplies whole eagles and eagle feathers and parts to enrolled members of federally recognized Native American tribes for religious use under a Service permit program. In 2012 and 2013 the repository conducted formal nationwide government-to-government consultations with tribes and started using the information from those consultations to make improvements to the repository's distribution processes beginning June 1, 2014. Since its transfer to Colorado in 1995, the Eagle Repository has filled more than 42,000 individual orders for Tribal members. Because the repository is not managed by the refuge, it was not addressed in the draft CCP and EIS.

# Chapter 2—The Refuge

Cindy Souders / USFWS

*Rocky Mountain Arsenal National Wildlife Refuge staff*

> *We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect.*
>
> *Aldo Leopold*, A Sand County Almanac

## 2.1 Establishment and Management History

The Rocky Mountain Arsenal National Wildlife Refuge is an urban wildlife refuge just north of Denver, Colorado (figures 1 and 2). The site neighbors several communities that have historically played an active role in the development and management of the land.

The U.S. Army purchased 19,833 acres from Colorado homesteaders in 1942 with the intent to develop a chemical munitions plant to supply American forces during World War 2. The site was selected because of its ideal location: it was far from potential threats to both coasts, easily accessible by rail, and removed from the Denver metropolitan area. The United States developed the Arsenal as a deterrent to counter the German and Japanese production of chemical weaponry, but the U.S. Army never in fact employed chemical weapons during World War 2. Initially, the Arsenal supplied mustard gas, lewisite, and chlorine gas during World War 2. During the Cold War and Korean War, the Arsenal was called into action again, producing white phosphorous, distilled mustard, and incendiary bombs.

In addition to the production of chemical munitions, the Arsenal realized the heightened priority of chemical production byproducts and worked simultaneously to demilitarize older products through the 1960s. During the same period, the U.S. Army continually produced GB-Sarin, a highly dangerous and debilitating nerve agent to deter mounting Soviet threats. Later, rocket fuels and hydrazine were produced to aid the Nation in the space race. Chemical weapon production finally came to a close in the 1970s. In 1972, the United Nations Conference on the Human Environment sparked interest in preventing

the decline of the environment. Outdated practices of deep well pumping (pushing the chemicals deep into the earth) resulted in earthquakes around the Denver area. The need for an efficient and effective method of protecting the public from chemical contamination became apparent.

In 1987, the Rocky Mountain Arsenal was placed on EPA's National Priority List (NPL) because of its status as one of the most contaminated sites in the country (Federal Register 1987). EPA, DOI, Agency for Toxic Substances and Disease Registry, the State of Colorado, and the U.S. Army entered into a Federal Facilities Agreement outlining the responsibilities of each party in the cleanup process. Finally, in 1992, Congress passed the Rocky Mountain Arsenal National Wildlife Refuge Act (appendix D). The Act established the Arsenal as a national wildlife refuge and declared that once cleanup was complete and certified by EPA, management responsibility would lie with the Service.

## Environmental Cleanup

The impact of manufacturing ordnance and pesticides on the site and the subsequent plans that were developed to clean up contaminants are well documented in the 1996 record of decision that initiated the environmental cleanup (Foster Wheeler Environmental Corporation 1996). In summary, disposal practices typical of that era included treating and discharging waste products into evaporation basins. However, by the early 1950s, chemical wastes were leaching through the soil into groundwater and were affecting environmental resources. Subsequent cleanup activities have included construction of borrow areas, caps, covers, landfills, and other remediation structures that disturbed thousands of acres on the present-day refuge. These activities, ongoing since 1988, were concluded in fall 2011. In some cases, the surface topography of an entire section of land was completely recontoured to facilitate cleanup and drainage, whereas in other sections borrow areas had to be excavated to depths ranging from 1 foot to more than 20 feet. As lands were fully remediated, EPA removed them from the NPL so they could be added to the refuge (Federal Register 2003, 2004b, 2006, 2010).

The cleanup effort would result in the loss of considerable wildlife habitat. To mitigate these losses, efforts were initiated to restore much of the future refuge to native plant communities. Restoration of native shortgrass and mixed-grass prairie is a difficult undertaking that was guided by a habitat restoration plan (FWS 1999b). In 2012, we entered into a new agreement to assist the U.S. Army in achieving its goals for restoration and mitigation of habitat losses. This agreement funded restoration of approximately 2,122 acres remaining of the planned mitigation of 10,727 acres at the refuge. This work is still underway; we plan to meet this obligation by 2018.

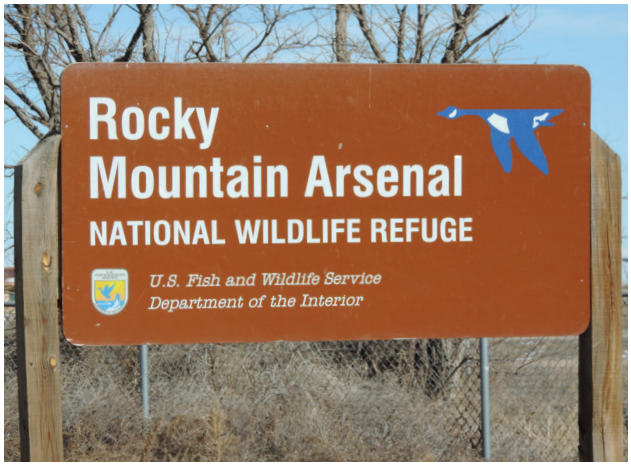
In 2008, the State of Colorado, the U.S. Army, and Shell Oil Company reached a settlement on the natural resource damages associated with the site. This settlement provided approximately $35 million for acquisition, enhancement, and restoration of natural resources in and around the northeast metropolitan area Arsenal site (Colorado Attorney General 2008).

## Refuge Establishment

The refuge was officially established on April 21, 2004, when we accepted 4,930 acres of land in the southern and southeastern areas of the site (Federal Register 2004a). Additional lands were added over the years until the refuge reached its current size. Additional transfers are expected in the future, but the U.S. Army will always retain lands associated with their landfills in the center of the refuge.

Today's refuges are managed by the Service with the intent to fulfill the mission and goals of the Refuge System. The goals of the Refuge System together with the interests of the refuge (as designated by the 1992 Act) afford the refuge an opportunity for new growth and wildlife preservation in this phase of its existence. While the 1992 Act is a guiding foundation for the refuge's direction, the refuge is further managed in accordance with the Migratory Bird Treaty Act of 1918, Refuge Recreation Act of 1962, National Wildlife Refuge System Administration Act of 1966, Title 50 CFR, the "Fish and Wildlife Service Manual," and the Improvement Act.

We completed our first comprehensive management plan for the refuge in 1996; this plan provided




USFWS

*The refuge was established in 2004.*

guidance through the cleanup period (FWS 1996a). The end of cleanup signaled a major change in management direction for the refuge. In 2013, we released a new HMP and several supporting plans that will guide current and future refuge management (FWS 2013a, 2013h, 2013i).

## Land Use Restrictions

In 1987, pursuant to section 105 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, the Rocky Mountain Arsenal was listed on the National Priorities List (Superfund). A Federal Facility Agreement was developed in 1989 to guide cleanup activities at the Arsenal; Section 44 of this agreement includes several land use restrictions. The 1996 record of decision for the site incorporated many of these land use restrictions (Foster Wheeler Environmental Corporation 1996). In 2003, 2004, 2006, and 2010, EPA completed partial deletions from the NPL of lands that would become the refuge, meaning that the lands have been cleaned up sufficiently to guarantee the health of refuge workers and visitors (Federal Register 2003, 2004b, 2006, 2010). In accordance with Section (2)(2)(b)(2) of the Rocky Mountain Arsenal National Wildlife Refuge Act of 1992, EPA certified that these lands were acceptable for transfer as a national wildlife refuge. Based on the 2004 deletion, the refuge was officially established (Federal Register 2004a).

Land use restrictions found in the 1989 Federal Facility Agreement are as follows:

- Residential development on the Rocky Mountain Arsenal shall be prohibited.
- The use of groundwater located under, or surface water located on, the Rocky Mountain Arsenal as a source of potable water shall be prohibited.
- Consumption of all fish and game taken on the Rocky Mountain Arsenal shall be prohibited, although hunting and fishing on the site for nonconsumptive use may occur if subject to appropriate restrictions.
- Agricultural [sic], including all farming activities such as the raising of livestock, crops, or vegetables, shall be prohibited. Agricultural practices used in Response Action or used for erosion control, however, shall be permitted.
- Wildlife habitat(s) shall be preserved and managed as necessary to protect endangered species of wildlife to the extent required by the Endangered Species Act, 16 U.S.C. §§ 1531 et seq., migratory birds to the extent required by the Migratory Bird Treaty Act, 16 U.S.C. §§ 703 et seq., and bald eagles to the extent required by the Bald Eagle Protection Act, 16 U.S.C. §§ 668 et seq.
- Other than as many [sic] be necessary in connection with a Response Action or as necessary to construct or operate a Response Action Structure, no major alteration shall be permitted in the geophysical characteristics of the Arsenal if such alteration may likely have an adverse effect on the natural drainage of the Rocky Mountain Arsenal for floodplain management, recharge of groundwater, operation and maintenance of Response Action Structures, or protection of wildlife habitat(s).
- The United States shall maintain security at the Rocky Mountain Arsenal adequate to assure the proper construction, operation, and maintenance of Response Action Structures, the proper implementation and monitoring of Response Actions and compliance with the restrictions listed in paragraph 44.2 and the Technical Program Plan. The United States shall take reasonable precautions to assure that only federally authorized access to the Rocky Mountain Arsenal shall occur.

The 1996 record of decision incorporates these restrictions more simply as "The Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 and the Federal Facilities Agreement restrict future land use, and prohibit certain activities such as agriculture, use of on-post groundwater as a drinking source, and consumption of fish and game taken at Rocky Mountain Arsenal NWR." The 1989 Federal Facility Agreement states that "The United States [U.S. Army, EPA, USFWS] shall also evaluate the continuing need for such restrictions or requirements to determine if any restriction or requirements may be removed or modified." We are currently working with these organizations to remove or modify unnecessary land use restrictions on the refuge.

## Hours of Operation

On May 15, 2014, we expanded the hours of operation of the refuge (FWS 2014c). The refuge is now open daily from sunrise to sunset and will be open on most Federal holidays (we are closed on Thanksgiving, Christmas, and New Year's Day). We believe that sunrise to sunset hours are easy to understand, and the change provides better access to visitors when they are not at work. Wildlife can be adversely affected when disturbed overnight; these hours will be strictly enforced.

The refuge's Visitor Center is open Wednesday through Sunday from 9:00 a.m. to 4:00 p.m. and is closed on all Federal holidays. The Visitor Center requires staff to operate, and hours were reduced in 2013 due to significant budget cuts.

# 2.2 Special Values

The following list summarizes many of the unique and special values of the refuge:

- Showcases the transformation of the landscape from heavy industrial development to national wildlife refuge.
- Protects 15,000 acres of diverse habitats–grassland, wetland, riparian, lacustrine, and woodland.
- Supports habitat for breeding neotropical birds in the midst of a highly urbanized area.
- Provides small cottonwood galleries along streams that support a diverse variety of wildlife.
- Provides nesting and winter roosting habitat for bald eagles in the Denver metropolitan area.
- Provides outstanding bird viewing opportunities as a Colorado State Important Bird Area (designated by the National Audubon Society).
- Provides habitat for more than 350 species of wildlife (see appendix H).
- Provides habitat for a herd of American bison as well as for white-tailed and mule deer populations.
- Features a Visitor Center and exhibit hall focusing on prairie wildlife, regional history, and refuge management.
- Provides a self-guided auto tour and miles of nature trails for wildlife observation and photography with distant views of the Rocky Mountains.
- Offers catch-and-release recreational fishing opportunities in the Denver metropolitan area.
- Features the historic Egli House, which is listed in the Colorado State Historic Register and is eligible for listing in the National Register for Historic Places (NRHP).
- Provides environmental education opportunities for area students.
- Serves as a gateway to the Refuge System for local, national, and international visitors because of its proximity to DIA.
- Collaborates and builds partnerships with a large variety of organizations and agencies to enhance the mission of the Refuge System.
- Provides year-round wildlife viewing opportunities of bison, deer, bald eagles, waterfowl, songbirds, and many others.
- Provides research opportunities for a number of wildlife and environmental research organizations.
- Engages more than 80 volunteers who contribute more than 8,000 hours of service annually in support of visitor services, wildlife habitat improvements, trail maintenance, and administrative duties.

# 2.3 Issues Raised during Scoping

Our scoping process for the draft CCP and EIS identified some of the special values listed above along with issues to address and recommendations to consider. Based on this information, as well as guidance from the Improvement Act, NEPA, and our

planning policy, we identified the following issues, which we fully addressed:

- Habitat and wildlife management
- Refuge water rights, water management, and infrastructure
- Connecting people to nature
- Setting clear expectations on what a refuge is and what the refuge can offer
- Improving and expanding visitor services facilities and programs
- Maintaining the sense of retreat of the refuge in the midst of the urban setting
- Interpreting the Arsenal's history
- Improving access and transportation systems to and within the refuge
- Reintroducing black-footed ferrets and other native species
- Improving and increasing breath and types of outreach to neighboring communities
- Increasing partnership opportunities with neighbors and various nongovernmental organizations
- Making the refuge more welcoming and open to the local and international public

Our planning team considered every comment that was received during the public scoping process. These comments were grouped into related topics and subtopics. Significant issues are those that are within our jurisdiction, that suggested different actions or alternatives, and that influenced our decision (see chapter 1, section 1.7). Our planning team used this list of issues to help us develop the four alternatives presented in the draft CCP and EIS, as well as to choose the alternative that formed the proposed action. Furthermore, during our analysis of environmental consequences, we sought to address how the management actions proposed under each of the alternatives would affect these and other issues identified internally. Finally, the issues identified internally and during the public scoping process helped us develop the vision, goals, and objectives to guide the refuge into its next phase (see chapter 4, "Management Direction").

# Chapter 3—Refuge Resources and Description

© Rich Keen

*Hiking on the refuge*

> *The land ethic simply enlarges the boundaries of the community to include soils, waters, plants, and animals, or collectively: the land.*
>
> *This sounds simple: do we not already sing our love for and obligation to the land of the free and the home of the brave? Yes, but just what and whom do we love? Certainly not the soil, which we are sending helter-skelter downriver. Certainly not the waters, which we assume have no function except to turn turbines, float barges, and carry off sewage. Certainly not the plants, of which we exterminate whole communities without batting an eye. Certainly not the animals, of which we have already extirpated many of the largest and most beautiful species. A land ethic of course cannot prevent the alteration, management, and use of these 'resources,' but it does affirm their right to continued existence, and, at least in spots, their continued existence in a natural state.*
>
> *Aldo Leopold*

This chapter describes the characteristics and resources of the Rocky Mountain Arsenal National Wildlife Refuge in the categories listed below:

- Physical Environment
- Biological Environment
- Special Management Areas
- Visitor Services
- Communications and Outreach
- Partnerships
- Human History and Cultural Resources
- Research and Science
- Infrastructure and Operations
- Access and Transportation
- Socioeconomic Environment

## 3.1 Physical Environment

This section describes the physical environment of the refuge. Physical characteristics comprise physiography, water resources, air quality, climate, night sky, and soundscapes.

# Physiography

## Topography

The surface topography on the refuge has been shaped largely by erosional and depositional processes associated with the South Platte River and its tributaries. The land shape varies from almost level to gently rolling, with slopes typically less than 3 percent and terrace escarpments with slopes up to 10 percent. In general, the land surface slopes to the northwest, with elevations ranging from 5,136 feet along the northwest boundary to 5,340 feet at southeastern boundary (figure 7). Rattlesnake Hill and Henderson Hill are prominent high points in the central and northeastern portions of the refuge, respectively (FWS 1996a). As part of the cleanup of the Rocky Mountain Arsenal, two prominent landfills were constructed in the center of the property at 5,302 and 5,314 feet.

## Geology

The refuge lies in the Denver Basin, a north–south fold in the regional geology that extends along the Front Range from Cheyenne, Wyoming, to Colorado Springs, Colorado. Surface geologic deposits consist primarily of unconsolidated river sediments (alluvium) deposited by the South Platte River system and covered partially by windblown (aeolian) sediment. The uppermost bedrock layer is called the Denver Formation. This layer was originally 900 feet thick, but has eroded completely in the nearby South Platte River area, and is 500 feet thick at the southeast corner of the refuge (Morrison-Knudsen Environmental Services Inc. 1989). Wind-deposited material is thickest in the south and southwest sections of the refuge. Most of the alluvial deposits on the refuge are fine-textured, except for remnants of cobble alluvium on Rattlesnake Hill, on Henderson Hill, and in the North Plants Area (James P. Walsh & Associates Inc. 1991).

Soils developed from both wind- and water-deposited material. Soils formed from water-transported material are derived from shales, sandstone, and granite. These soils are generally of clay to loam texture, although cobbly material occurs on hills in the northern portion of the refuge (James P. Walsh & Associates Inc. 1991). Soils developed from wind-deposited material are typically sandy in texture. Throughout the refuge, soils formed under grassland vegetation are typically dark colored with high organic matter content (figure 8).

Bresser soils make up the most common soil series on the refuge. These soils occur on sandy, wind-deposited plains in the southwestern and southern portions of the refuge. Bresser soils are deep and well drained with medium to coarse textures. Weld series soils occur extensively in the northeastern portion of the refuge. These soils are formed from alluvial and wind-deposited material and have fine to medium textures. Ascalon soils are found on old alluvial terraces, escarpments, and aeolian plains in the central and northern areas of the refuge. Satanta soils are similar to Ascalon but are finer textured. The well-drained Nunn soils are found in moderate distribution over the north and east portions of the refuge. The coarse sandy textured Truckton soils are found to a limited extent in the south and west portions of the refuge; they are highly susceptible to wind erosion. Aquic Haplustolls are deep, poorly drained soils occurring primarily along First Creek (James P. Walsh & Associates Inc. 1991).

Refuge soils are subject to wind and water erosion. The Nunn and Satanta soils are the most susceptible to water erosion. Truckton, Bresser, and Ascalon soils have the greatest potential for wind erosion when vegetation is removed. Revegetation potential is moderate for most soils on the refuge, although some soils may have revegetation limitations associated with slope, water holding capacity, or depth.

## Effect of Remediation on Soils

The effects of manufacturing ordnance and pesticides on refuge wildlife and habitats, and the subsequent plans that were developed to clean up contaminants, are well documented in the 1996 record of decision (Foster Wheeler Environmental Corporation 1996). In summary, disposal practices typical of the production era included treating and discharging waste products into evaporation basins. However, by the early 1950s, chemical wastes were leaching through the soil into groundwater and were affecting wildlife. In 1983, EPA listed the site as a Superfund Cleanup site. Subsequent cleanup activities have included construction of borrow areas, caps, covers, landfills, and other remediation structures that disturbed thousands of acres on the present-day refuge. These activities have been ongoing since 1988 and were concluded in the fall of 2011. In some cases (such as Section 36), the surface topography of an entire section was completely recontoured to facilitate cleanup and drainage from the Integrated Cover System, whereas in other sections borrow areas had to be excavated to depths ranging from 1 to more than 20 feet.

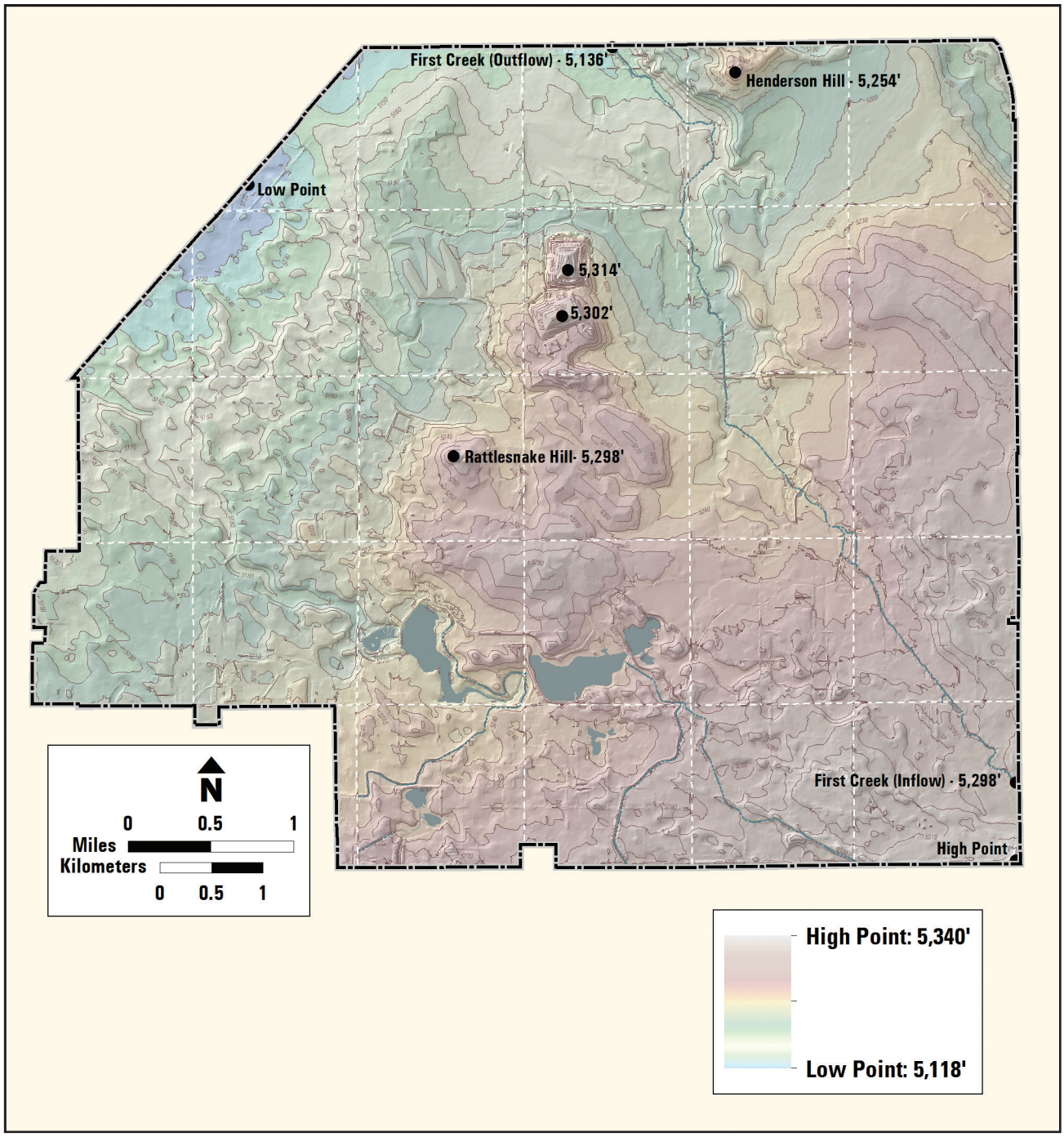



**Figure 7. Topography of Rocky Mountain Arsenal National Wildlife Refuge, Colorado.**

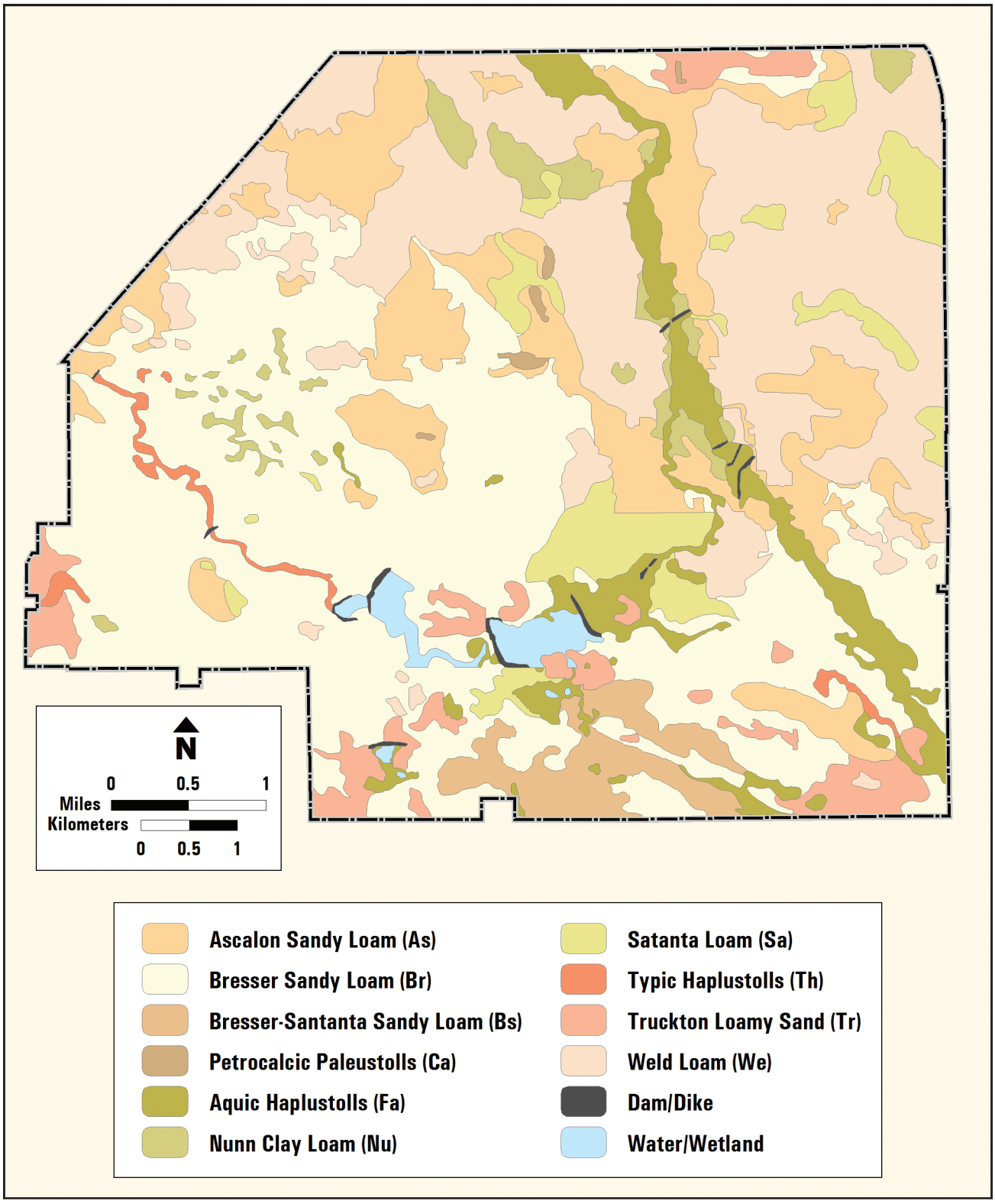



**Figure 8. Soil classes in Rocky Mountain Arsenal National Wildlife Refuge, Colorado.**

## Water Resources

The refuge lies within several drainage basins that are tributary to the South Platte River, less than 2 miles northwest of the refuge. These basins include Irondale Gulch, First Creek, Second Creek, and several small areas that originally drained directly into the South Platte River. As a result of human alterations, some of these latter areas now drain to either Irondale Gulch or First Creek. The Irondale Gulch and First Creek basins cover more than 91 percent of the total refuge area (FWS 1996a).

In the 1870s, homesteaders were well established in the vicinity of the present-day refuge (Hoffecker 2001). Attempts to improve the area for agricultural production were initiated as early as 1883 with the construction of the Sand Creek lateral irrigation canal, which was eventually expanded into an intricate system of irrigation canals, reservoirs, and ponds. Between 1910 and 1920, portions of First Creek were channelized, the Highline Canal system and Ladora ("La Dore") Reservoir were constructed, and the dam forming Derby Lake was built (Hoffecker 2001). During U.S. Army operations and subsequent cleanup, dams and other water management infrastructure were improved.

Water is currently impounded in the refuge's reservoirs: Lake Ladora, Lake Mary, and Upper and Lower Derby Lakes. Water is also stored in the Havana Ponds (figure 9). We allow natural processes to take place on the refuge's 119 acres of wetlands to promote native emergent species and provide opportunistic benefits to wetland-dependent wildlife.

- Lake Mary Dam—Lake Mary was created by a U.S. Army equipment operator and has not been significantly modified since.

- Ladora Dam—In the late 1800s, the "La Dore" reservoir was created by homesteaders. In 1942–1943, the U.S. Army raised the elevation of this dam by 5 feet to increase reservoir capacity. In 1998, the Army completed repairs to the dam and added a new outlet works and spillway.

- Lower Derby Dam—Local farmers constructed a dam around 1900. In the 1940s, the U.S. Army raised the crest of the existing embankment, creating what is now known as Lower Derby Dam. The dam was further rehabilitated in 1990 including the addition of a needed spillway.

- Upper Derby Dam—It is unknown if an earlier dam or other impoundment existed in the current location of Upper Derby Dam, but in 1942–1943 the U.S. Army constructed a dam, several canals, and an outlet that matches what exists today. In 1973, Upper Derby Dam overtopped, breached, and was reconstructed (U.S. Army Corps of Engineers 2014). Currently, the dam is in need of major improvements. Many of these improvements require the removal of some trees. For that reason, prior to transfer, Upper Derby Dam will be breached to allow only a small amount of water to be retained behind the structure (FWS 2013a).

- Havana Ponds Dam—This dam was constructed in 1973 as a part of the enlargement of the old Stapleton airport, and it began holding water in 1974. This dam is operated and maintained by the City and County of Denver.

### Surface Water Quality

Water quality classifications and numeric standards for the refuge's reservoirs are governed by the State of Colorado. In 2009, the Colorado Water Quality Control Commission erred in grouping the refuge's reservoirs into a new segment with other lakes in the Upper South Platte River basin. This change conflicted with prohibitions on the former Superfund site. In 2014, the Commission agreed to a request from the refuge to place its reservoirs into its own segment (Segment 22b–Upper South Platte River).

Both offsite and onsite sources of contamination have adversely affected surface water quality on the refuge (FWS 1996b). USGS has monitored the quality and quantity of incoming streamflow to the refuge since the early 1990s. In most cases, incoming streamflows have failed to meet State standards for water quality (Gordon et al. 2005).

We will attempt to achieve and maintain a water quality standard in all reservoirs (pH = 6.5–9.0 and minimum dissolved oxygen concentration of 5.0 mg/L) (CDPHE 2012) and provide a quality sport fishery for individual reservoirs as defined in our aquatic management stepdown plan (FWS 2006a).

### Urban Drainage and Flood Control

Beginning in at least 1987, the Federal Government recognized that flooding in the Irondale Gulch basin was imminent. At that time, USACE recommended that agreements be developed to allow upstream development while protecting on-post interests and requiring that all new upstream development include sufficient storage for total retention of any increased runoff (Sizemore 1987). Ultimately

the decision was made not to accept any additional water from upstream developments in the City of Denver (Heim 1987).

In 2002, the U.S. Army and UDFCD prepared a drainage study for the Irondale Gulch drainage basin in the southern portion of the refuge. The purpose of the drainage study was to provide preliminary design alternatives for a system to convey periodic stormwater discharge, mitigate the effect of 100-year storm events, and enhance water quality on the refuge (ERO Resources Corporation 2002). In 2003, the U.S. Army signed a Finding of No Significant Impact (FONSI) that would increase trash collection features, enlarge the Uvalda Interceptor, and enhance water storage in the so-called Railroad Embankment. This decision document also proposed enlarging storage capacity in Upper Derby Lake, although this modification has been determined to be infeasible. In 2007, all this information was incorporated into an intergovernmental agreement between UDFCD, the City and County of Denver, and the Federal Government.

Development in the northeast Denver area has continued, and periodic flooding occurs on the refuge. In September 2013, northeast Denver experienced historic flash flooding that caused the Havana Ponds dam to breach and caused millions of dollars in damage to the refuge. A similar event occurred in 1973 when the Upper Derby dam was overtopped and failed.

### Groundwater

The refuge lies within the Denver groundwater basin. Surficial streams and wind-deposited soils contain water, as do several bedrock aquifers. Unconsolidated deposits cover nearly all of the refuge, underlain by the sedimentary Denver Formation. Shallow groundwater flow occurs primarily in the unconsolidated deposits, but also in the weathered outer layer of the Denver Formation. Water levels range from less than 5 feet below ground surface in the area of the reservoirs and First Creek to more than 60 feet on the west side of the refuge. Groundwater level fluctuations are generally less than 2 feet. Groundwater flows are to the north and northwest (FWS 1996a).

Previous human activities and cleanup operations have altered the water table and flow direction locally. These changes include the boundary containment and treatment systems associated with remediation, recharge from surface water impoundments, and subsidence due to well pumping. The shallow aquifer is recharged from precipitation, surface water, and discharges to surface water (principally the South Platte River). It is also recharged from and discharges to the Denver Formation aquifer (FWS 1996a).

The Denver Formation aquifer is separated from the shallow alluvial Row system by relatively impermeable shale or claystone. The Denver Formation, 200–500 feet thick under the refuge, contains water-bearing layers of sandstone and siltstone in poorly defined, irregular, interconnected beds that range in thickness from a few inches to 50 feet. A small amount of recharge occurs from the overly unconfined aquifer and from bedrock outcrops, which occur in only a few locations. Discharge from the Denver Formation occurs by lateral flow into the unconfined aquifer and by leakage to the underlying Arapahoe bedrock aquifer (FWS 1996a).

Surface cleanup of the Rocky Mountain Arsenal was completed in 2011, but the groundwater monitoring and remediation continue. The largest areas of contaminated groundwater—in the north, central, and western parts of the refuge—occur as spatially distinct contaminant plumes. The plumes contain one or more contaminants migrating together through the shallow aquifer. Migration has resulted in the merging of contaminant plumes from individual source areas. At the north and northwest refuge boundaries, contaminated shallow groundwater is being removed, treated, and returned to the flow system downstream. Groundwater intercept-and-treat systems are located at various locations within the refuge (FWS 1996a).

### Platte River Depletions

In 2013, we completed formal consultation on our Federal water use pursuant to Section 7(a)(2) of the Endangered Species Act of 1973, as amended. This consultation was completed as part of the HMP (FWS 2013a) and is tied to the Service's 2006 programmatic biological opinion for the Platte River Recovery Implementation Program. This biological opinion concluded that the refuge's use of up to 1,400 acre-feet of water per year is not likely to jeopardize the continued existence of the whooping crane, interior least tern, and pallid sturgeon, all federally listed as endangered; or the northern Great Plains population of piping plover or western fringed orchid, both federally listed as threatened, in the central and lower Platte River; nor will it destroy designated critical habitat for the whooping crane.

## Air Quality

For air quality planning purposes, the refuge is within the boundary of the Denver metropolitan

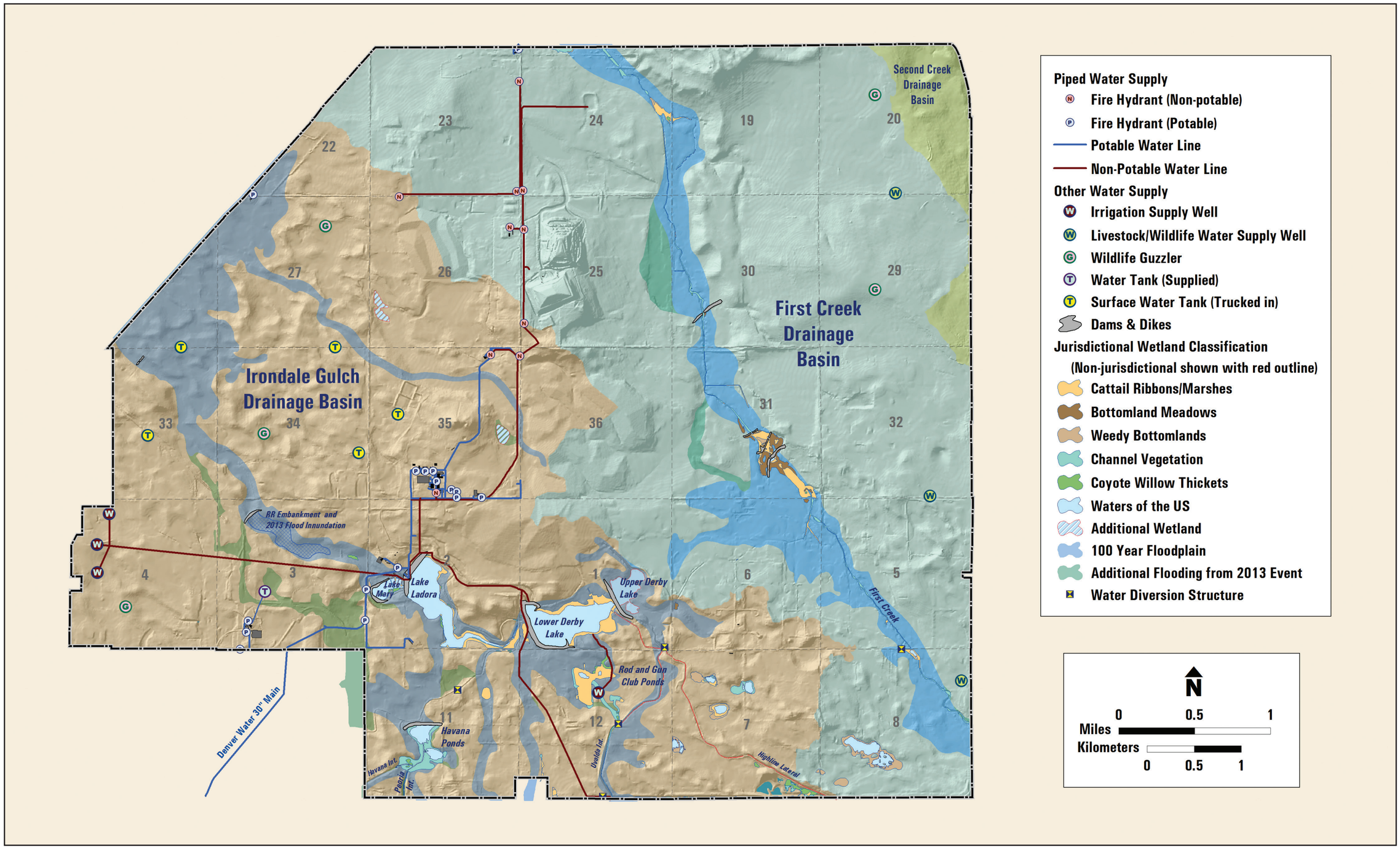



Figure 9. Surface hydrology and water infrastructure on Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

area. For many years, the Denver metropolitan area has experienced carbon monoxide and particulate matter air pollution as well as visibility problems. In July 2012, EPA classified the metropolitan area as a marginal nonattainment area. A nonattainment area is one in which air quality does not meet the ozone standards set forth by the Federal government in 2008. The primary air quality concern in the region is ozone (CDPHE 2014b).

The refuge is in Adams County, Colorado. In 2011, less than 1 percent of days exceeded the required standards for particulate matter and only 3 days exceeded the daily maximum 8-hour standards for average ozone concentrations (CDPHE 2014a). Further, in 2013, there were 256 days when the air quality in the area was considered good or better. The primary air quality concern in Adams County is ozone (EPA 2013).

## Climate

The climate of the refuge is characterized as semiarid with wide variations in seasonal and daily temperatures. January is the coldest month with an average high temperature of 43 °F and an average low of 16 °F. July is the hottest month with an average high temperature of 88 °F and an average low of 59 °F (FWS 1996b).

Colorado's climate is unlike that of any other state—it is characterized by the high elevations and complex topography of the Rocky Mountains, the Colorado plateau and valleys of the West Slope, and the high plains falling off from the Continental Divide toward the east (Ray et al. 2008). The mountains to the west create what is known as a rain shadow—that is, storms forming over the mountains often dissipate before reaching the refuge. Weather on the refuge is dominated by warm-season precipitation, largely a result of localized convective storms. Precipitation varies from 12 to 16 inches annually, with 80 percent occurring from April to September. Average annual precipitation actually increases as one travels eastward from the refuge onto the eastern Colorado plains. May is normally the wettest month, averaging 2.5 inches. Summer precipitation is largely the result of convective thunderstorms, often accompanied by hail. Precipitation from these storms can be quite variable, although 60 percent of the rainfall events occurring from May to August produce less than 0.8 inch per event. In contrast, January is normally the driest month, averaging 0.5 inch (1.2 cm) (FWS 1996b). Winter precipitation (December–February) constitutes a relatively small proportion of the total annual precipitation (Lauenroth and Milchunas 1992).

## Night Sky

One of the most rapidly increasing alterations to the natural environment is the alteration of the ambient light levels in the night environment produced by anthropogenic, or artificial, light. At the turn of the century, it was estimated that two-thirds of the country's population live where they cannot see the Milky Way (Cinzano et al. 2001). While you will never be able to see the Milky Way from the refuge, lands in the northeast portion of the refuge offer twice the visibility of surrounding communities. As the Denver metropolitan area continues to enlarge, this is a value worthy of our protection.

The National Park Service's Natural Sounds and Night Skies Division examined a light pollution model output of the three national wildlife refuges located in the Denver metropolitan area (figure 10). Under the values predicted by this model, stargazing and other nighttime aesthetic values would be substantially compromised and terrain features would be substantially illuminated. The refuge has a predicted mean Anthropogenic Light Ratio (ALR) of 28.0 (minimum = 20.2, maximum = 37.1). An ALR of 0.0 would be a pristine natural area and an ALR of 28.0 would be 2,800 percent brighter than the natural light from the night sky (Moore et al. 2013). This predicted level is where one would also have heightened concern over ecological impacts, though no specific thresholds are presented (Chad Moore, National Park Service, Night Sky Program Manager; email communication; February 25, 2014).

Light pollution is a relatively easy environmental problem to resolve. Solutions are immediate and effective, and they often save money. The following practices are recommended to improve lighting: determine if light is needed, and why; use artificial light only when actually needed; use the right amount of light for the task; direct the light only to the places where needed; eliminate glare; minimize obtrusive lighting (also known as light trespass); minimize direct upward light, a major cause of urban sky glow; turn lights off when not needed; use motion sensors when possible; install dimmers or multi-level lighting; use energy-efficient sources; and minimize energy waste (Alvarez del Castillo and Crawford 2001).

## Soundscapes

Sound plays a vital role in ecological interactions as well as in visitors' experiences on the refuge. A soundscape refers to the totality of the perceived acoustical environment. A soundscape usually refers to human perception, but the term could also apply to

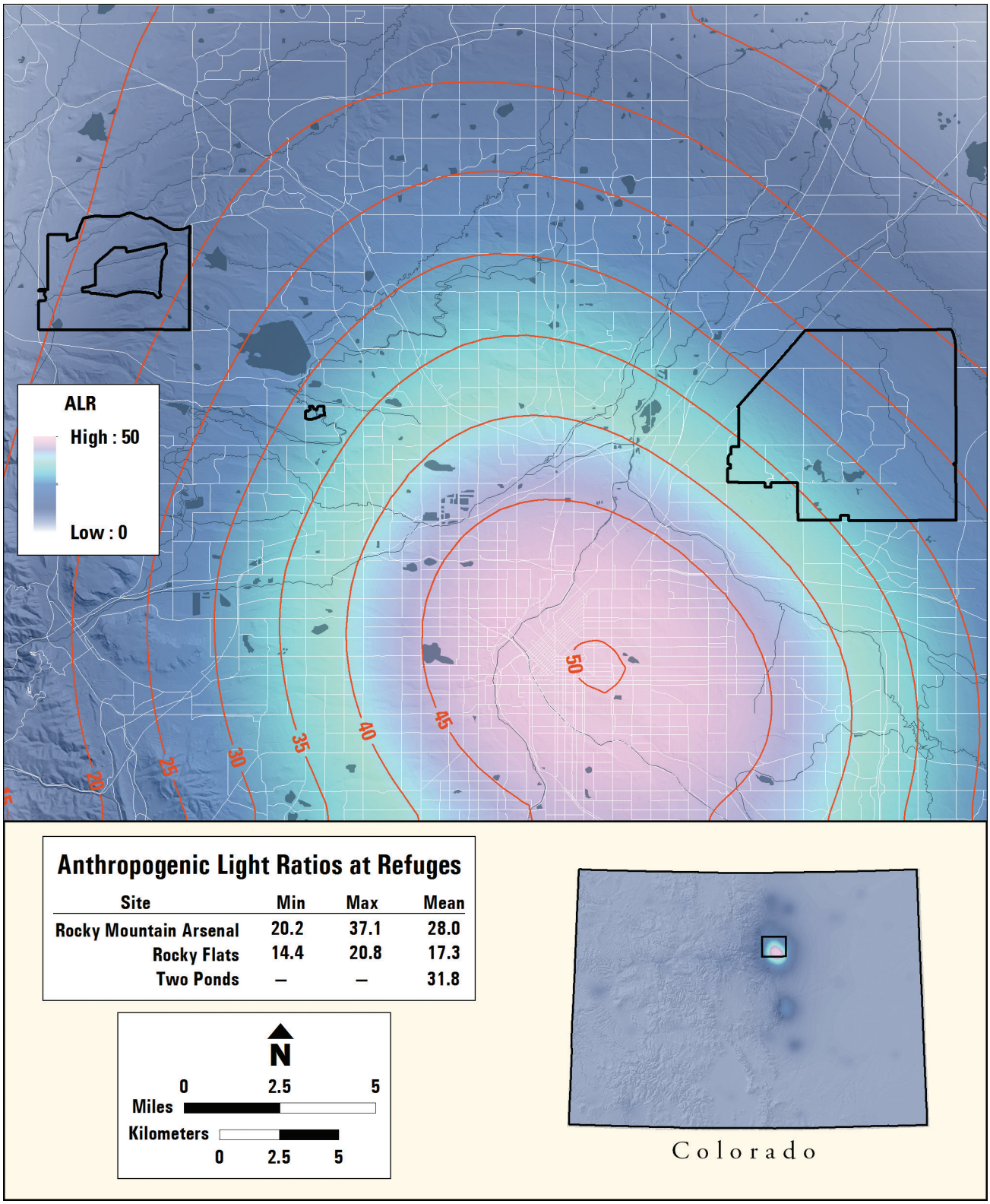



**Figure 10. Anthropogenic light ratio of the night sky in the Rocky Mountain Arsenal National Wildlife Refuge Complex vicinity.**

other species. A listening area is the area in which a sound can be perceived by an organism; the listening area shrinks when background sound levels increase (Turina et al. 2013). The failure to perceive a sound because other sounds are present is called masking. Masking interferes with wildlife communication, reproductive and territorial advertisement, and acoustical location of prey or predators (Barber et al. 2010). The effects of masking are not limited to wildlife. Masking also inhibits human communication and visitor detection of wildlife sounds. In urban settings, masking can prevent people from hearing important sounds like approaching people or vehicles and can interfere with the way visitors experience cultural sounds or interpretive programs (Turina et al. 2013). Seemingly small increases in sound levels can have substantial effects, particularly when quantified in terms of loss of listening area (Barber et al. 2010; Payne and Webb 1971). Each 3 decibel increase in the background sound level reduces a given listening area by half. Therefore, the presence and levels of nonnatural sounds are an important factor influencing future management of the refuge.

The National Park Service's Natural Sounds and Night Skies Division examined a sound level model output of the three national wildlife refuges in the Denver metropolitan area (figure 11). This model shows anticipated existing sound levels, natural ambient sound levels, and impact levels from noise across the three units, for an average summer day. While the existing sound level metric reports current conditions (including anthropogenic and natural sound sources), the natural ambient sound level metric reports what conditions would be without human influence. The impact metric reports the difference between existing and natural to estimate the impact of noise on a given location. Based on predicted values, all three sites demonstrate mean impact levels of concern for protected natural areas near urban centers. Conditions at the refuge would warrant moderate concern, as the listening area is likely reduced by about 91 percent (Emma Lynch, National Park Service, Natural Sounds and Night Skies Division; email communication; February 25, 2014). Despite this concern, the refuge is significantly quieter than surrounding communities, and conditions vary considerably across the site.

Protection of acoustical environments has received growing attention from managers and policy makers as a result of an increased understanding of its role in overall ecosystem health and visitor enjoyment. Soundscape management is becoming more complex and challenging as threats to acoustic resources, both internal and external to park boundaries, increase (National Park Service 2012). Vehicles and aircraft are the largest source of noise on the refuge, but noise is also produced through routine refuge operations.

# 3.2 Biological Environment

## Habitat

Prior to European settlement, most of the area that is now the refuge was shortgrass or mixed-grass prairie, depending on the soil. Post-settlement, much of the land was converted to farming or grazing. Shortly after the U.S. Army took control of the land, the land around the facility was left untouched for several years until the Army planted crested wheatgrass, a nonnative grass species that is perfectly suited to the climate here.

During the cleanup period, thousands of acres of land were disturbed through the remediation process and many more were left in a decadent state. The Service has spent many years, with many more to go, to restore the land to as close to its native condition as possible.

The plant list for the refuge consists of 468 species, including 53 introduced species and 29 noxious weeds (refer to appendix H). Regardless of their origin, these plants represent several dominant habitats on the refuge that are addressed in the HMP (figure 12). Their presence and abundance influence the seed mixes used for prairie restoration and weed control strategies, such as chemical application versus manual removal. No federally listed plant species are known to occur on the refuge at this time.

### *Federally Listed Plant Species*

The Colorado butterfly plant, federally listed as threatened, occurs primarily in southeastern Wyoming, north-central Colorado, and extreme western Nebraska. The Colorado butterfly plant is typically found in wetland habitats along meandering stream channels on the high plains. In undisturbed sites, it grows among native grasses. Its establishment and survival are enhanced when dominant vegetation has been removed by disturbance (FWS 2010b). Two populations have been located near Fort Collins and another population was successfully introduced at the Chambers Preserve in Jefferson County, but surveys of the refuge have not located any populations of this species.

The Ute ladies' -tresses orchid, federally listed as threatened, is found along streams, in wetlands, and in other moist habitats along Colorado's Front Range and plains areas at elevations below 6,500 feet. The refuge contains habitat suitable for the orchid, but surveys of the refuge have not located any populations of this species (FWS 1996a).

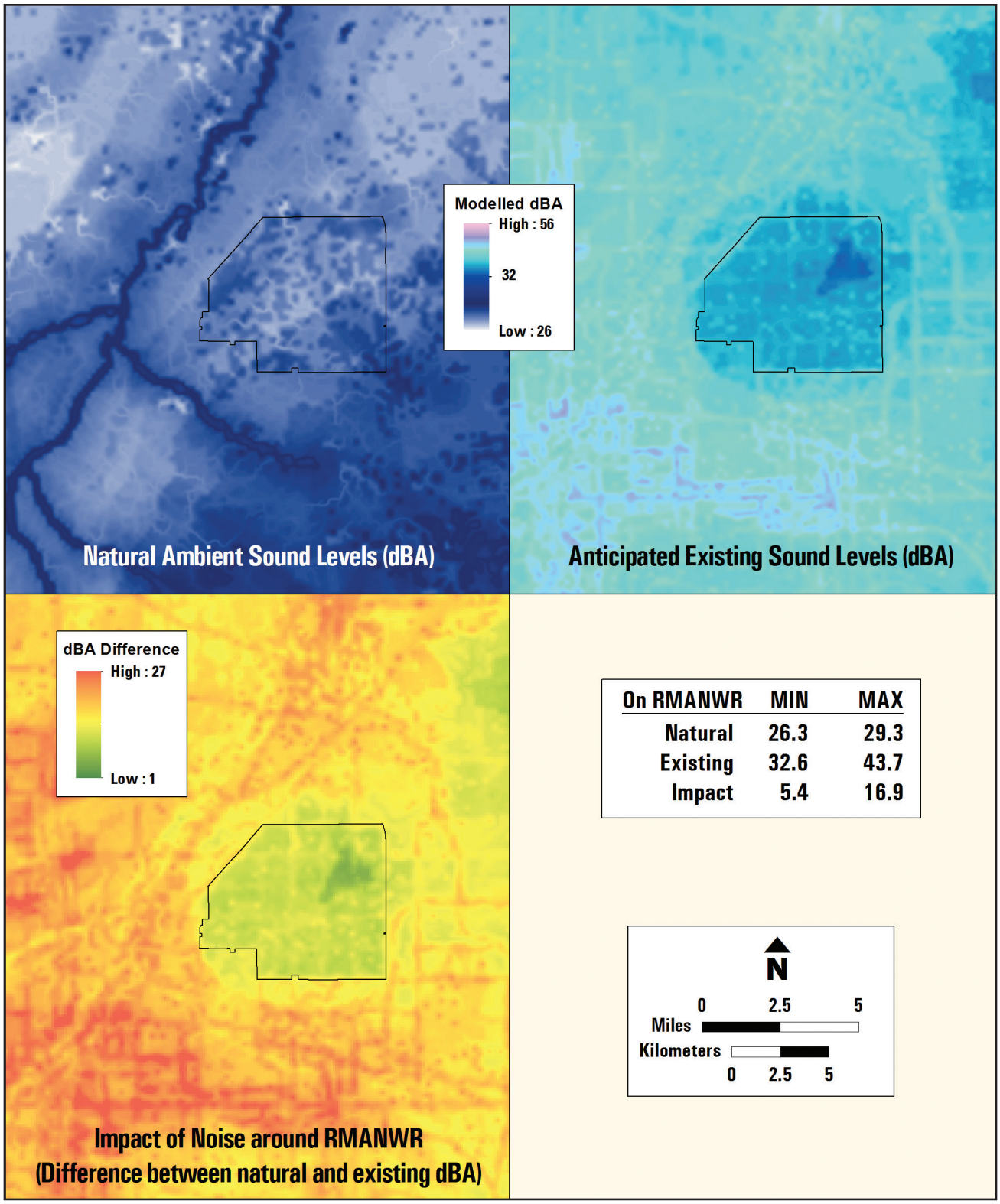



**Figure 11. Comparison of natural and ambient sound levels in the vicinity of Rocky Mountain Arsenal National Wildlife Refuge, Colorado.**

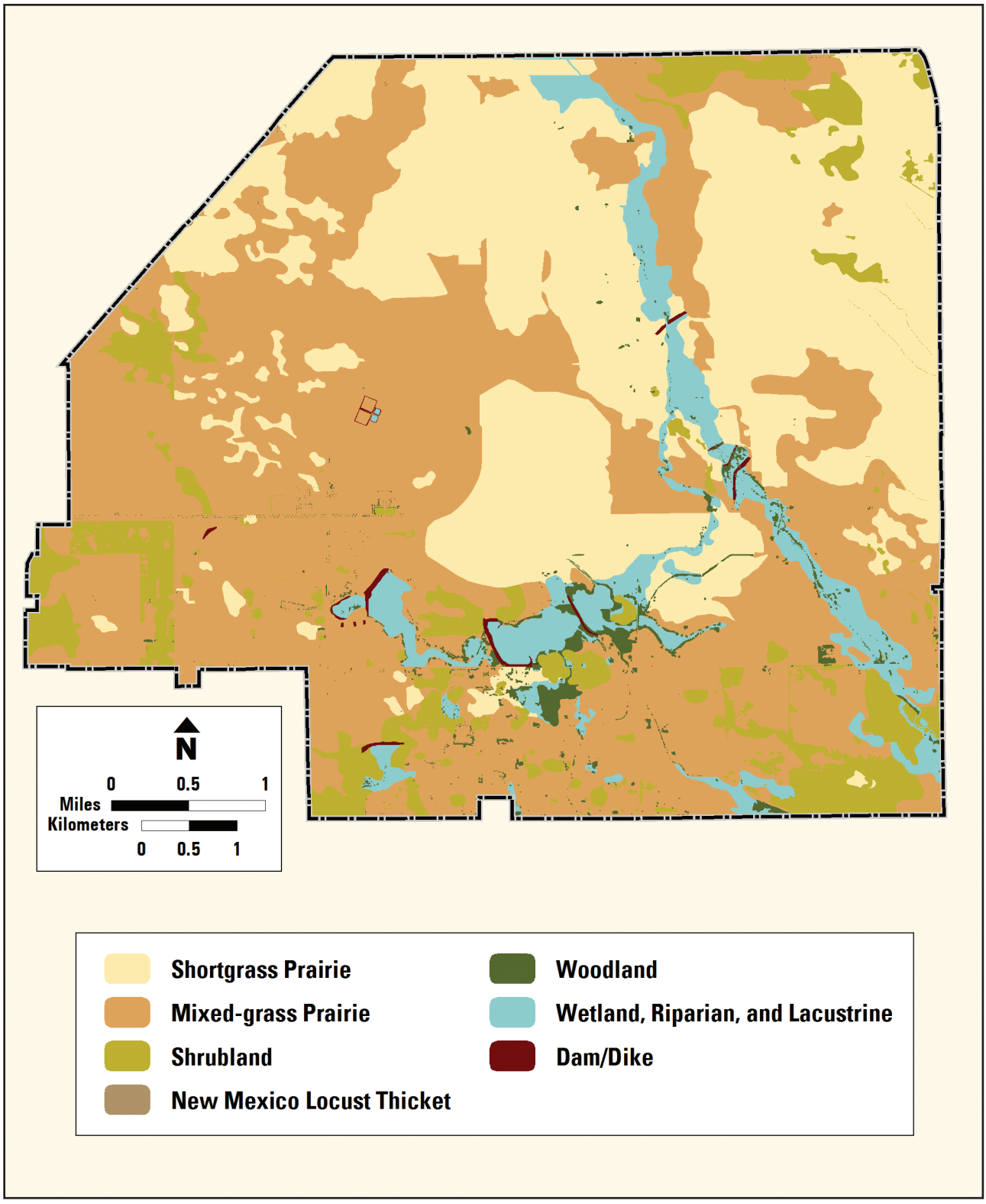



**Figure 12. Habitat types on Rocky Mountain Arsenal National Wildlife Refuge, Colorado.**

## Prairie

Historically, shortgrass prairie with inclusions of mixed-grass prairie and shrubland were the dominant plant communities on refuge lands. However, past activities resulted in the significant degradation of these communities or the conversion of the communities to artificial habitats such as reservoirs, created wetlands, homesteads, buildings, and shelterbelts. Similar losses and conversions have occurred throughout the Great Plains; statewide losses of presettlement shortgrass and mixed-grass prairie range from 29 to 79 percent and from 30 to 75 percent, respectively (Knopf 1994). Future threats to this ecosystem include continued loss to agriculture and other developments, encroachment of nonindigenous species, and loss of genetic diversity (Bachand 2001; Knopf 1994). These prairie ecosystems provide critical habitat for many priority bird species identified by the Service and other conservation entities; accordingly, native prairie was selected as a community of concern. This decision is supported by the Service's Biological Integrity, Diversity, and Environmental Health policy that directs biologists and managers to replicate, to the degree possible, presettlement habitats and ecosystem processes.

The extent of disturbed prairie at the time of refuge establishment was extensive, and the weedy forbs and grasses vegetation type occurred on approximately 10,739 acres (71 percent) of the refuge (FWS 1996a). When restoration is complete, native prairie will comprise approximately 12,680 acres (85 percent) of refuge lands and provide habitat requirements for lark buntings, grasshopper sparrows, burrowing owls, and Swainson's hawks. Prairies containing 5–25 percent live cover of shrubs are found throughout the refuge. Common shrubs include rubber rabbitbrush, sand sagebrush, and four-wing saltbush. In addition, yucca also provides a shrublike function for some grassland birds and is found in both the shortgrass and mixed-grass prairie associations, primarily along ridgelines. These shrublands and associated grasslands provide habitat requirements for Cassin's sparrows.

## Riparian Habitat

Riparian habitats in the western states are known for their value as wildlife movement corridors and migration stopover destinations for birds. The only historic aquatic habitat on the refuge is First Creek, which has experienced some alteration to its hydrology, both historically and with current urban development. Approximately 6 miles of the creek traverse refuge property. However, the most prominent aquatic features on the refuge are artificial: Lake Mary, Lake Ladora, Lower Derby Lake, the Highline Canal, Uvalda ditch, and Havana Ponds. Nevertheless, all these water bodies support a riparian plant community, comprising both herbaceous and woody species. Currently, the herbaceous community is dominated by noxious grass and forb species, including Canada thistle, white top, and smooth brome. Reed canarygrass is also found along the lower portions of First Creek, forming pure stands in some areas. Woody species are dominated by plains cottonwood, peach leaf willow, and coyote willow. Russian olive, a list B noxious weed, was also a very noticeable woody plant dominating the riparian understory until removal of nearly 7,000 trees. The cottonwood-willow gallery provides a primary habitat requirement for both nesting and wintering bald eagles. The HMP objective is to establish 1 mile of gallery forest dominated by cottonwoods by 2027. In addition, the value of riparian areas for foraging big brown bats will be investigated.

## Lacustrine Habitat

Lacustrine, or lake, habitat consists of five artificially created reservoirs and ponds: Lower Derby (73 surface acres), Upper Derby (0 surface acres), Ladora (48 surface acres), Mary (9 surface acres), Havana Ponds (39 surface acres), and Rod and Gun Club Pond (ephemeral). With the exception of Upper Derby, water sources for these lacustrine habitats are varied and include precipitation, flows from drainage interceptors (Uvalda, Peoria, Havana, and Joliet drainage ditches) that channel stormwater discharge, natural groundwater discharge, and pumped water from wells. The plant communities of reservoirs vary depending on the timing and extent of water level fluctuations. The Upper Derby basin, which only receives water periodically, is dominated by noxious weeds. The remaining reservoirs support emergent vegetation, primarily cattails in shallow water along shorelines, and various rooted and floating-leaved aquatic species in deeper portions of the basins that never dry. The HMP strategies for the reservoirs are to stock forage fish when necessary to maintain the sport fishery, conduct annual water quality monitoring, and control cattails as needed.

## Woodlands

Located in the Environmental Education Zone (primarily Sections 11 and 12), the woodland habitat type on the refuge is the result of past land use activities that involved conversion of native prairie to agriculture and the planting of trees around homesteads by settlers. Following transfer of ownership to the U.S. Army, additional trees were planted around new infrastructure, and agricultural lands were abandoned and allowed to revegetate naturally. Dur-

ing this time, additional trees became established as scattered individuals or as small groups in abandoned agricultural fields. Following acquisition by the Service, grasslands have been, or will be, restored to native prairie by seeding appropriate species based on soil type, but in general, trees were not removed. The term woodland is used to characterize interspersion of planted trees and shrub thickets with patches of grassland. The woody component of this habitat type can be classified based on the following species associations: (1) New Mexico locust thickets, (2) American plum and chokecherry thickets, (3) homestead site trees and planted groves, and (4) Russian olive. These created woodland habitats in the midst of restored grasslands are highly valuable for neotropical migrant songbirds as resting and foraging sites. They also provide hunting perches for bald eagles and Swainson's hawks. Deer frequently visit thickets to browse and for shelter.

### Wildland Fire

Prior to European settlement, grazing (primarily by bison, prairie dogs, and insects) and wildfire were the primary ecological disturbances that revitalized the grassland. Ignitions for wildfires were caused by both lightning and Native Americans. Depending on weather and fuel conditions, a wildfire could burn thousands of acres, creating a mosaic of burned, unburned, and grazed areas. Historical fire frequency was probably highly variable but has decreased since settlement (Umbanhowar 1996). Evidence that characterizes fire return intervals suggests about every 5–10 years on the moist portions of mixed-grass prairie and about 25 years on dry portions (Frost 1998, Wright and Bailey 1982).

After settlement by Europeans, wildfires were suppressed. However, agricultural burning by farmers in the area continues to this day. We have been using prescribed burning on the refuge since the late 1990s for managing habitats and reducing fuel loads near the wildland urban interface. Prescribed fire is currently used in all habitat types found within the refuge.

## Wildlife

Approximately 350 species of wildlife have been documented on the refuge (refer to appendix H). Wildlife species on the refuge have adapted to the many changes in their enclosed, fenced habitat surrounded by increased urbanization. As the fence and cattle guards were added to the perimeter landscape, some large mammals, mainly deer, could no longer enter or exit the refuge. Other wildlife, accustomed to the presence of buildings from farmhouses to factories, had to adjust to the absence of artificial structures and adapt to expanses of bare soil followed by reseeded natural vegetation. It has been difficult to track all the changes in species diversity and abundance. Some wildlife groups have been well documented on this site, while others have not been adequately inventoried.

### Threatened and Endangered Species, Resources of Concern, and Surrogate Species

The discovery of the formerly endangered bald eagle using First Creek within the Arsenal boundaries in 1986 was a determining factor in the establishment of this area as a national wildlife refuge. Like many wintering raptors, migrating bald eagles were attracted to the abundant food sources on the Arsenal site—particularly small mammals, and specifically the non-hibernating black-tailed prairie dog. The bald eagle was delisted in 2007 but still resides on the refuge both as a breeder and winter visitor and is identified in the HMP as a resource of concern. The nesting and roosting habitat remain protected from human disturbance during use by eagles.

The black-footed ferret, federally listed as endangered, is also directly linked to the prairie dog, both as a food source and for living space. Although black-footed ferrets were never documented as inhabiting the specific area of the refuge, they are an important component of the shortgrass prairie, and the refuge is within their historic range.

The Mexican spotted owl, federally listed as threatened, is considered a habitat specialist. These owls occur in both forested and rocky canyon habitats. Forests used for roosting and nesting often contain mature or old-growth stands with complex structure. In parts of their range, Mexican spotted owls occupy a variety of steep, rocky canyon habitats (FWS 2012b). In Colorado, spotted owls can be found in the foothills south of Denver and west of Colorado Springs (FWS 2012b). There are no owls on the refuge, nor is there suitable habitat for owls on the refuge.

The Preble's meadow jumping mouse, federally listed as threatened, occurs in riparian areas along Colorado's Front Range. Neither the mouse nor its habitat currently exists on the refuge.

To conceptualize an adaptive management plan for the refuge, we analyzed what wildlife species could benefit from the habitat we were creating and considered their local, regional, and national priorities to the Service. A thorough explanation for our choices and eliminations can be found in the HMP. The list of priority species, or resources of concern, comprised six bird and two mammal species that nest

**Table 5. Habitat needs for resources of concern and associated species, Rocky Mountain Arsenal National Wildlife Refuge, 2013.**

| *Resource of concern* | *Associated species* | *Desired vegetation structure* |
|---|---|---|
| Bald eagle | Osprey | Riparian gallery cottonwoods |
| Swainson's hawk | Red-tailed hawk, ferruginous hawk, golden eagle, American kestrel, western and eastern kingbirds, loggerhead shrike | Isolated trees or small groups of trees in open perennial grasslands |
| Burrowing owl | Black-tailed prairie dog | Perennial grasslands with prairie dog towns |
| Cassin's sparrow* | Loggerhead shrike, lark bunting, western meadowlark, grasshopper sparrow, Swainson's hawk, short-eared owl, vesper sparrow | Perennial grassland and some shrubs |
| Lark bunting* | Swainson's hawk, western meadowlark, long-billed curlew, short-eared owl, horned lark, ferruginous hawk | Perennial grassland |
| Grasshopper sparrow | Upland sandpiper, vesper sparrow, western meadowlark | Perennial grassland |
| Black-tailed prairie dog* | Burrowing owl, prairie rattlesnake, mountain plover, American bison, black-footed ferret | Perennial grassland |
| American bison* | Black-tailed prairie dog, burrowing owl, ferruginous hawk | Perennial grassland |

* These surrogate species are mentioned in this document. At this time, the big brown bat has not been included as a resource of concern for the purposes of the CCP. The refuge might play an important role for this species; however, additional research is needed to determine if the species' fidelity to the site continues post-cleanup.

or breed within the refuge. For this CCP, we adopted four of these as surrogate species to represent the most abundant habitat, the prairie. The priority species and their associated habitats are listed in table 5.

In addition, the presence of the following taxa is significant to the understanding of other habitat uses on the refuge and choices for placement of roads, trails, and infrastructure.

## Fishes

Of the 14 fish species in refuge water bodies, 12 are native transplant introductions and 2 are exotic. The three main water bodies are artificial and have been managed to support a catch-and-release recreational fishery. Objectives in the HMP specify that balanced populations of largemouth bass and bluegill should be maintained in Lake Mary. The objective for Lake Ladora adds northern pike to those species. Lower Derby Lake is to be managed as a stocking source and for wildlife use. Three native fishes—channel catfish, fathead minnow, and green sunfish—also share the reservoirs with two nonnative rough fish species—common and grass carps. One more native fish, brook stickleback, and the introduced mosquitofish occupy First Creek and Parkfield Ponds.

## Reptiles and Amphibians

Reptiles and amphibians, collectively known as herptiles, total 24 documented species on the refuge, but surveys have not been conducted recently. The 1994 species list included one salamander, three toads, three frogs, five turtles, three lizards, two skinks, and seven snakes. The determinations of occupied habitat and occurrences were based on existing literature for Adams County, Colorado (Hammerson 1986), and a local catch-and-release survey conducted in various habitats prior to the onset of cleanup on the Arsenal. During cleanup, not only were massive amounts of soil and vegetation removed or rearranged, but water sources fluctuated annually due to weather events and the deliberate manipulation of water for irrigation, dust control, flood prevention, and recreational use. Although these detrimental activities have been reduced and habitat has been created, the herptile species list did not increase based on a roadside survey done in 2005. For instance, although the northern leopard frog has not been found on the refuge, it is disappearing from locations in many western states because of threats such as habitat loss, disease, nonnative species, pollution, and climate change. There are no specific objectives for herpetofauna in the HMP, although the reservoirs are recognized as breeding and wintering habitat for some amphibians (FWS 2013a:59). In addition, control of bullfrogs to improve the sport fishery may be indicated in future aquatic management plans.

### Birds

Unlike the residential and stable nature of the fish, herptile, and mammal communities, the bird species that use the refuge are highly mobile and variable. Therefore, although the number of bird species that have used the refuge is presently 282, this could change in the future. To illustrate the point, two species, the dickcissel and bobolink, were sighted on the refuge in spring 2014 for the first time, both in recently restored grassland habitats. Furthermore, upland game birds that were previously stocked for hunting, including ring-necked pheasant, northern bobwhite, chukar, and wild turkey, were removed from the list. Although waterfowl, shorebirds, and warblers have a high representation of species that occur on the refuge, the majority of these groups use the habitats for stopover points on migration to and from their breeding grounds or are rarely counted on surveys. Conversely, a high percentage of raptors and sparrows have been documented as breeding or overwintering on the refuge.

### Mammals

The present refuge mammal list comprises 37 species that are representative of the typical fauna of Adams County, Colorado. Recent additions include the bobcat and American beaver. One mammal that has been taken off the original list is the porcupine. Population estimates of some refuge mammals have been well documented by various censuses and surveys, from the heavily viewed deer and bison to the seldom-seen badgers and nocturnal bats. In the past, animal health and abundance were important tools for tracking exposure to contaminants manufactured here. Presently and in the future, the emphasis will be on monitoring the restored prairie habitat to sustain the prominent consumers of grassland vegetation, namely bison, white-tailed deer, mule deer, and prairie dogs (refer to "Appendix H—Forage Allocation Methodology for Use at RMANWR" in the HMP). We must also analyze another grazer, the pronghorn, if it is considered for reintroduction.

## 3.3 Visitor Services

Visitors to the refuge can enjoy a variety of compatible, wildlife-dependent recreational activities: fishing, wildlife observation, photography, environmental education, and interpretation. The refuge Visitor Center is open Wednesday through Sunday from 9 a.m. to 4 p.m. and is closed on all Federal holidays. The refuge is open to visitors from sunrise to sunset every day and is closed on Thanksgiving, Christmas, and New Year's Day. Information kiosks outside the Visitor Center, on the Legacy Loop, and at the Contact Station provide brochures and maps of the refuge for visitors.

## Hunting

Currently the refuge does not have a hunting program. The Federal Facilities Agreement currently prohibits the take of any wildlife on refuge property for consumptive purposes. We are studying ways to remove this restriction as we have proposed hunting of deer and doves in the refuge. However, until this restriction is removed, a hunting program will not be established.

We have determined that mourning dove, white-winged dove, Eurasian collared-dove, mule deer, and white-tailed deer may be hunted on the refuge. We have also determined that we will open the refuge to host a site for CPW's hunter education programs, especially for youth hunters, with potential outreach to local schools.

### Doves

Two of the three dove species (mourning and white-winged) present on the refuge are migratory birds. The Eurasian collared-dove is a nonnative, invasive species that is not afforded protection under the Migratory Bird Treaty Act and is hunted year-round in Colorado. The refuge will only allow hunting of any dove species during the Colorado mourning dove season.

### Deer

Both mule deer and white-tail deer are currently present on the refuge. The deer herds on the refuge are isolated from other populations by the 8-foot chain-link fence constructed around the property in 1990. The deer herds, for practical purposes, should be considered closed populations with no immigration or emigration.

Deer hunting is a popular activity throughout Colorado, but because of the refuge's juxtaposition to a large urban area and lack of public lands, most deer hunting in the immediate area surrounding the refuge takes place on private lands.

# Fishing

Public fishing is offered as a recreational, fee-based program ($3.00 per day) from mid-April through mid-October. Three fishing piers and a floating boardwalk are located at Lake Mary, and a floating boardwalk is located on the east end of Lake Ladora.

Lake Mary, Lake Ladora, and Lower Derby Lake are stocked annually with fry-sized fish to provide a food source for larger fish. These stockings are intended to maintain a healthy fishery in support of recreational sportfishing. Species stocked include bluegill, channel catfish, and fathead minnow. Fish stockings are coordinated and permitted through CPW.

## Events

The refuge hosts several annual fishing events. We host the Annual Fishing Frenzy—in partnership with the City of Commerce City and Bass Pro Shops—to educate and provide fishing opportunities to youth. It offers fishing instruction and classes in knot tying, fish identification, and casting techniques. The average estimated attendance for this one-day event is 900 visitors. We also host Refuge Day in October, attended by more than 500 visitors engaging in wildlife-focused activities to celebrate National Wildlife Refuge Week.

The refuge also hosts weekly therapeutic fishing programs throughout the fishing season on Lake Mary. The refuge's volunteer staff provides hands-on instruction and assistance to anglers. This highly successful program targets special needs groups (Craig Hospital, Children's Hospital, Colorado State Veterans Nursing Home, and Greely Center for Independence).

## Rules and Regulations

Current regulations allow fishing on the refuge from April 15 through October 15 annually. Fishing is allowed only on Lake Mary and Lake Ladora. Wading is allowed in Lake Ladora after Memorial Day. Only artificial bait is allowed for fishing on the refuge and all fish hooks must be barbless. Only catch-and-release fishing is allowed. All persons wishing to fish on the refuge must have a valid State fishing license, a fishing fee receipt, and a signed permit/fishing regulations (free). Because of human safety and wildlife disturbance concerns, we currently do not allow the use of boats or other vessels (such as float tubes) on the refuge.

## Reservoirs

Lake Mary is the smallest of the refuge's reservoirs at 8.4 acres with a maximum depth of 12.4 feet. It is an excellent resource for beginning anglers. Amenities include a floating boardwalk and fishing pier. Facilities are also accessible, providing equal



*Lake Mary is the smallest of the refuge's reservoirs at 8.4 acres.*

opportunity for all to participate in and benefit from fishing programs and activities on the refuge. Fish species in Lake Mary include largemouth bass, channel catfish, white and black crappie, bluegill, grass carp, and yellow perch.

Lake Ladora, at 54.9 acres with a maximum depth of 17.6 feet, is open to bank fishing. Wading with calf, hip, or chest waders is allowed after Memorial Day. Fish species include northern pike, largemouth bass, and bluegill.

Lower Derby Lake measures approximately 72.7 acres with a maximum depth of 11.5 feet. This reservoir is currently closed to fishing. Fish species include largemouth bass, bluegill, and channel catfish.

## Wildlife Observation and Photography

The refuge is open to wildlife observation, but some areas are closed to protect sensitive wildlife. A viewing blind on the edge of Rod and Gun Club Pond is sheltered by cottonwood trees to offer views of wildlife and wetland habitat.

The refuge is open to photography, and an accessible (portable) blind is located at Havana Ponds. We issue a limited number of special use permits annually for commercial photography for a fee of $50 per person per day. We evaluated this use and have determined the appropriate numbers of permits, as well as suitable roads for vehicle access to ensure that vehicle traffic on some roads and trails does not pose safety issues for visitors using them.

## Environmental Education and Interpretation

Environmental education is intended to teach visitors the history and importance of conservation. Through this process, we can encourage others' awareness, knowledge, attitudes, skills, motivation, and commitment to conserve our wildlife and natural resources. Environmental education uses onsite and offsite as well as distance learning materials and activities to explain the Refuge System's mission.

The refuge has dedicated curricula for offsite and onsite students, focusing on introducing first through fifth grade students to native wildlife. Students come from Adams County, Montbello, Denver, Commerce City, and area homeschools. We are in the process of developing Rhythms of the Refuge materials to provide refuge-specific activities that will address all grade levels. In addition, we regularly participate in the Aurora Youth Water Festival, with a focus on the value of water resources and habitat for wildlife.

Interpretation is the means by which we can encourage positive visitor attitudes about natural resources and refuges. We provide opportunities for visitors to create their own connections with resources to promote an understanding of the relationship between individuals, resources, and the impacts of human activities. For many visitors, taking part in interpretive programs may be their primary contact with the refuge and their initial contact with conservation and wildlife. Well-designed interpretive programs can also be effective resource management tools. Refuge staff and volunteers conduct a variety of interpretive programs on the refuge through bus tours, hiking tours, and nature programs. Wildlife viewing tours are conducted year-round and are designed for all ages.

### *Visitor Center*

The refuge's 12,500 square-foot Visitor Center, completed in 2011, includes an exhibit hall that features prairie wildlife, history, and refuge management. The discovery room offers drop-in activities (such as tactiles, crafts, and interactive displays). A 73-seat amphitheater has audiovisual capabilities for refuge interpretive programs. The Visitor Center also houses the Nature's Nest Books and Gifts store operated by Friends of Front Range Wildlife Refuges. An accessible amphitheater that seats 150 is adjacent to the Visitor Center, and a fenced pollinator garden is behind it.

Since the reintroduction of the endangered black-footed ferret to the refuge, we developed and opened to the public an outdoor black-footed ferret exhibit. This exhibit is located immediately outside of the Visitor Center and hosts a pair of live black-footed ferrets overlooking a prairie dog colony.

### *Contact Station*

This 5,000-square-foot facility can accommodate 60 students. This facility has learning stations, tactiles, and wildlife dioramas that can be used for environmental education. Teachers, scout groups, and other youth or homeschool groups can reserve this facility for environmental education with a refundable deposit. More than 20,000 students and teachers use this facility for self-guided programs each year.

### *Kiosks*

The refuge has a total of four informational kiosks. Three kiosks—at the Visitor Center, Legacy

Loop, and the Contact Station—provide maps and information about facilities, programs, and regulations. Interpretive panels are located at the Visitor Center, Contact Station, and Lake Mary kiosks.

## Recreation Fee Program

We manage a recreation fee program consisting of fishing fees ($3.00 per day for visitors over 16) and the sale of Federal Recreation Lands Passes. The program's annual revenues of $11,000–$13,000 are used to make improvements to visitor facilities.

## Staff

Our visitor services staff consists of a permanent fulltime visitor services manager, an Environmental Education Specialist, a Supervisory Park Ranger, and three seasonal Park Rangers. Other refuge staff, seasonal employees, and volunteers assist in staffing the Visitor Center. Two fellowship positions assisted us in visitor services in 2014.

Our volunteer program is important to our success. Over 60 volunteers contributed more than 8,000 hours in 2013. These volunteers support our visitor services program; maintain facilities and trails; and assist with wildlife surveys, habitat restoration, and administrative duties. We work with Groundwork Denver and Mile High Youth Corps for improvements to facilities, trails, and habitat.

# 3.4 Communications and Outreach

With the help of our refuge volunteers, we currently reach out to traditional refuge visitors and our neighboring communities through our participation in community outreach events such as Refuge Day, Bass Pro Fishing Classic, Colorado Get Outdoors Day, Aurora Youth Water Festival, Barr Lake Birding Festival, and other such events.

In addition to special events and local career development programs, we carry out our visitor services programs onsite to promote the importance of the Service's new Urban Wildlife Conservation Program.

We manage the refuge's Web site and social media platforms to reach a broad spectrum of visitors. We distribute, both by email and in printed format at the Visitor Center, the quarterly Wild News publication, which contains a list of refuge tours and nature and interpretation programs. We distribute a general brochure and a rack card, and we are in the process of developing brochures for trails and auto tour routes.

## Media

The refuge has a Web site (http://www.fws.gov/refuge/rocky_mountain_arsenal) and social media sites (Facebook and Flickr) that provide current information about refuge resources, programs, and activities. Wild News is a quarterly publication that lists interpretive tours and programs, is sent to a 5,000-person mailing list, and is available in hard copy at the Visitor Center, information kiosks, and local community centers. Refuge staff is routinely interviewed by local area media. National Geographic photojournalists have recently completed projects on bison and burrowing owls.

Cindy Souders / USFWS

*The Honker Scavenger Hunt is a popular guide to help youth explore the refuge.*

## Brochures

Refuge information is available in the general brochure, rack card, trail map, fishing information (English and Spanish), and bird list. The Honker Scavenger Hunt is a popular guide to help youth explore the refuge. Brochures are provided to DIA, the Denver Convention and Visitor Bureau, REI, community recreation centers, and libraries. We are developing an interpretive brochure for our auto tour routes.

## Special Events

We partner with the City of Commerce City to host an annual Fishing Frenzy in April with an estimated 900 participants each year. Refuge Day is an annual event in October to celebrate the Refuge System with a variety of activities and an estimated 400 participants each year.

# 3.5 Partnerships

We partner with various organizations (such as the Rocky Mountain Greenway Trail Network and Sand Creek Greenway Partnerships) and municipalities to expand and interconnect the various regional trails to form a trail network connecting the refuge with Two Ponds National Wildlife Refuge and Rocky Flats National Wildlife Refuge. Our existing partnership with the Friends of Front Range Wildlife Refuges supports some of our refuge programs and assists us in operating the Nature's Nest Books and Gifts store in the Visitor Center. We maintain a partnership with the City of Commerce City and with Bass Pro Shops to carry out the annual Fishing Frenzy event on the refuge. We are currently working with the City and County of Denver and Rocky Mountain Bird Observatory to enact the Urban Bird Treaty in the Denver metropolitan area. We would continue to implement the Urban Refuge Partnership with Environmental Learning for Kids at their property in Montbello. We would continue to develop our partnerships with the Denver Botanical Garden and Butterfly Pavilion for monarch and pollinator programs and outreach. We would continue to work with Mile High Youth Corps and Groundwork Denver for habitat restoration projects. We maintain a partnership, through our Regional Office of Diversity and Civil Rights, with Arrupe High School, which allows one student to work with us one day per week at the Visitor Center.

Cindy Souders / USFWS

*We rely on partnerships to carry out the annual Fishing Frenzy event on the refuge.*

# 3.6 Human History and Cultural Resources

The site of the refuge has a rich history of human occupation. Native Americans used the site for thousands of years. The area changed drastically with farming, military weapons production, commercial pesticide production, environmental restoration, and eventually habitat restoration and refuge development. Each period made its own impacts on the landscape, some more than others.

## Human History

The following is a very brief summary of the prehistory of the Rocky Mountain Arsenal National Wildlife Refuge. Sections of this summary are condensed versions of the background research undertaken as part of the archaeological investigations conducted in preparation for the cleanup of the Arsenal lands and eventual transfer to the Service (Gilmore et al. 1997) and for the proposed Northwest Parkway west of Denver (Painter et al. 2005). Additional detailed information is available in those publications and in the numerous sources cited as a part of that research.

### *Prehistory*

Current archaeological evidence indicates that the earliest humans migrated to the region near the

close of the last Ice Age approximately 14,000 years ago. The sites and artifacts left by these early peoples are divided into five general stages:

- Paleoindian: 12,000 B.C.–5,700 B.C.
- Archaic: 5,700 B.C.–A.D. 150
- Late Prehistoric: A.D. 150–A.D. 1540
- Protohistoric: A.D. 1540–A.D. 1750
- Early Historic: A.D. 1750–A.D. 1850

The Paleoindian stage is the earliest evidence of human occupation in Colorado. The traditional view of the Paleoindian pattern emphasizes a nomadic culture tied to the migration of large game, most notably extinct Pleistocene megafauna, including mammoths and the massive antique bison. Recent studies, however, indicate that Paleoindians also exploited smaller game, fish, and waterfowl, although to a much lesser extent (Kuehn 1998, Walker 1982, Wheat 1979, Wilmsen and Roberts 1978). Perhaps the most readily recognized stone tools in the Americas are associated with the Paleoindian stage—specifically the large, lanceolate, projectile points that are often fluted (i.e., long longitudinal flake scars extending from the base of the point along its centerline) and consistently well crafted. Paleoindian lithic assemblages are predominantly flaked stone tools believed to have been used primarily for hide and meat processing. Because population densities were low during the Paleoindian stage, sites (particularly camp sites) dating to this period are found less frequently than those of the subsequent stages.

The Archaic stage is marked by increasingly diverse food choices, an extensive feature assemblage including fire hearths and storage areas, and a variety of stone tool and projectile point styles. The beginning of the Archaic stage coincides roughly with the onset of the Altithermal climatic episode (approximately 7,000 B.C.–4,000 B.C.): a prolonged period of general warming and drying in western North America (Frison 1991). The change in weather patterns and environments resulted in the replacement of many Pleistocene animals with generally modern species. Collected wild plant foods made up a significant portion of the human diet during the Archaic stage, and small mammals, reptiles, and even insects were utilized as well. Ground stone implements used to process plant material such as nuts, seeds, berries, and fruits became common. Stone boiling pits, storage cists, and architectural features such as basin houses are also associated with the Archaic stage and are likely the result of increasing population density and a general shift toward more long-term settlements (Frison 1991, Metcalf and Black 1991, Shields 1998). Archaic projectile points are generally large and often are not as well crafted as points of the preceding Paleoindian stage.

The introduction of the bow and arrow and the use of pottery mark the onset of the Late Prehistoric stage, while the latter years include the earliest contacts of the native population with Europeans. Throughout the region this was a time of important changes in food choices, artifact types, and population distribution. This time period coincides with the introduction of the bow and arrow and the associated small triangular projectile point. A range of habitation sites with structures has been recorded in eastern Colorado, but there is no evidence of permanently settled villages. Ceramics are varied but in general consist of cord-marked jars. Bone artifacts are common and include awls, fleshers, wrenches, and beads. Ground stone is abundant and varied, including not only manos and metates but also shaft abraders.

## Early History

The Protohistoric stage encompasses the span of time between the earliest European influences on the Native Americans and the onset of regular, direct contacts between Native Americans and persons of European descent. The A.D. 1540 date for the beginning of this stage corresponds with Coronado's first expedition to the southern plains of North America and, although the early Spanish explorers did not reach the refuge region, the expedition nevertheless represents the beginning of potential influences. Anglo incursions into the central and western high plains are known to have taken place infrequently during the latter half of the eighteenth century. External pressures in addition to the introduction of the horse and other material goods led to accelerated changes in the traditional cultures. A nomadic, equestrian lifestyle emphasizing bison hunting, generally with firearms, became pervasive among tribes occupying eastern Colorado. The circular arrangements of rock often associated with Protohistoric sites are thought to be primarily the remnants of tipi structures—rock weights used to secure the structure coverings.

Much more information is available for the post–A.D. 1725 periods. Most notably, historically identifiable tribes established a presence in the region. Historical records indicate that this particular span of time is characterized by successive incursions and retreats by various tribes. By 1725, incursions by Comanche and their Ute allies had forced the Apache to withdraw from Colorado. The short-lived Ute/Comanche alliance that successfully pushed the Apache south disintegrated by the late 1740s (Anderson 1989:34). The Comanche subsequently controlled southeastern Colorado until they were pushed south by the Kiowa and Kiowa Apache in the late 1780s (Jones et al. 1998). A later alliance among the Comanche, Kiowa, and Kiowa Apache was, in turn, chal-

lenged by Cheyenne and Arapaho entering the region in the first quarter of the nineteenth century. During this rather turbulent period of history, however, trade networks between Native American and Anglo groups became well established despite ongoing hostilities.

Although people of European descent had been in the area sporadically for several decades, in 1806 the U.S. Government funded the first major expedition to investigate central and southern portions of the newly acquired Louisiana Purchase. Led by Lt. Zebulon Pike, the expedition explored both the Arkansas River and South Platte River basins and, along the eastern slope of the Rocky Mountains, came as far north as the Colorado Springs area before heading west. After Pike's foray, the next significant expedition to the Front Range area occurred in 1820. Commanded by Major Stephen H. Long of the U.S. Army, the exploration had a decidedly scientific emphasis and traveled west along the South Platte River to the foothills before heading south. The first accounts of the Denver area and the foothills to the west were provided by the Long expedition. It is interesting to note that neither man ever set foot on the peaks that were later named after them.

The 1820s and 1830s were also characterized by a flourishing fur trade. Notable mountain men such as Andrew Sublette and Louis Vasquez exploited the abundant animal resources along the Front Range. Vasquez and a band of trappers are reported to have camped at the confluence of the South Platte River and Clear Creek (known originally as the Vasquez River or Vasquez Fork), and from there followed Clear Creek to its source in the mountains. The booming fur trade led to the establishment of a series of trading posts bordering the eastern flanks of the Rocky Mountains from southeastern Colorado to southeastern Wyoming. By the early 1840s a growing scarcity of beaver and changes in European fashion led to a significant decrease in the fur trade.

Throughout much of the 1850s, the Colorado Piedmont and adjacent foothills remained devoid of permanent settlements. The discovery of gold quickly changed this situation. Gold was reportedly first found along the Front Range creeks sporadically during the late 1840s and early 1850s (Mehls 1984:33), particularly by miners on their way to the gold fields of California. However, the 1858 discovery of gold near the confluence of the South Platte River and Cherry Creek provided the initial impetus for large-scale mining in the region (Ubbelohde et al. 1995:56–57).

During the initial gold rush years northeast Colorado above the fortieth parallel (Baseline Road in Boulder, Colorado) was part of the Nebraska Territory, and the portion below the fortieth parallel (which includes the Rocky Mountain Arsenal) was part of the Kansas Territory. Colorado was proclaimed an official territory by the U.S. Congress after Kansas entered the Union in 1861 and became the 38th State in 1876.

Homesteading on what is now the refuge began in 1871. Due to the semiarid conditions, early homesteaders probably ranched more than they farmed. This situation changed when the Highline Canal and associated Sand Creek Lateral were constructed in the late 1870s. Although neither irrigation system provided reliable sources of water, homesteading in the region continued to increase. At its greatest density of occupation in the early 1940s, the site had 474 individual property owners, 241 homes, and 2 schools (Clark 1997). Only one home still exists, built in 1912 by Gottlieb and Rose Egli (Peil 2002, Wright and Wright 2014). The home is being restored as a representation of the early agricultural days of the area.

## Recent History

### Rocky Mountain Arsenal: Chemical Weapons and Industry (1942–1983)

Following the bombing of Pearl Harbor on December 7, 1941, the United States found itself searching for ways to produce state-of-the-art chemical weapons. While the U.S. did not want to use them, leaders believed that a formidable stockpile of chemical weapons would probably deter Germany and Japan from using them (Hoffecker 2001), a strategy that appeared to work very well.

The U.S. Army needed to find the best place to build such a facility. The Rocky Mountain Arsenal location exhibited several favorable attributes: it was close to major existing railroad lines, had adequate water and electric power, was adjacent to a major metropolitan area that could provide large numbers of skilled laborers, and was too far inland to be bombed (Hoffecker 2001). In June 1942, almost 20,000 acres were condemned, all inhabitants were forced to evacuate their homes, and new facilities began to be constructed. Although this action was devastating to many families, no noticeable complaints were heard. People were willing to make serious sacrifices for the war effort.

The factories (later named South Plants) were constructed and staffed so quickly that the first batch of the blistering chemical known as mustard was produced on New Year's Day 1943 (Hoffecker 2001). Other chemical weapons produced at the Arsenal included lewisite (also a blistering agent) and chlorine. The reluctance of Germany and Japan to use chemical weapons against the U.S. and its closest allies quickly led to a reduced demand for production at the Arsenal. By late 1943, the factories largely

produced incendiary weapons rather than poisonous chemicals. At first, magnesium bombs were made, but critical material shortages for those weapons led to napalm production instead. Fire bombs were used most notably on Hamburg and Schweinfurt, Germany, as well as on Tokyo and other Japanese cities—always with devastating results.

Other notable aspects of this period were the large numbers of women working in the factories, freeing up men to fight. This situation provided an excellent opportunity for women to demonstrate that they could essentially do what men could do. The importance of women working in war materiel factories was embodied in posters of the iconic female worker, Rosie the Riveter. Approximately 70 percent of the Rocky Mountain Arsenal workers in World War 2 were women (Remediation Venture Office 1999).

The Arsenal became home to approximately 100 German and Italian prisoners-of-war. Rose Hill School in the southwestern portion of the Arsenal became the camp's administration building. Prisoners-of-war were put to work on a variety of tasks, most notably working in the employees' cafeteria.

The Arsenal was put in standby status following World War 2. However, South Plants was reactivated for incendiary production less than 2 months after the beginning of the Korean War in 1950 (Hoffecker 2001).

Construction of a new factory complex (North Plants) began in January 1951. While described as an "incendiary oil plant," the facility's secret mission was to produce German Brown nerve agent, also known as Sarin (Hoffecker 2001). The Cold War was in full swing, and the Russians were known to have captured an entire Sarin plant in Germany and reassembled it in the Soviet Union. This organophosphorus compound could kill a person by only contacting a single drop on the skin. The agent was being produced at North Plants by the summer of 1953, and like other poisonous chemical weapons previously produced at the Arsenal, served only as a deterrent.

Several chemical facilities on the Arsenal site became available following World War 2 and were leased to Julius Hyman and Co. for the production of insecticides. Shell Chemical Co. acquired this company and significantly expanded commercial operations, eventually constructing 150 new buildings in the South Plants area (Remediation Venture Office 1999). Shell produced numerous types of pesticides until 1982 (Wright and Wright 2014).

## Environmental Cleanup (1983–2011)

Pollution—from spills, improper disposal, and even disposal practices thought safe at the time—became a serious problem. Buildings, soil, and groundwater all became contaminated, especially in the central core of the Arsenal. Contamination in groundwater and soil was spread through both infiltration and wind erosion, causing widespread issues. Fortunately, a large buffer area around the exterior of the factories kept most windblown contaminants onsite and slowed the movement of groundwater onto other properties.

In 1988, after considerable litigation, the U.S. Army and Shell signed a consent decree that set the way for a comprehensive cleanup. Remedial investigations were initiated in 1983 under the Comprehensive Environmental Response, Compensation, and Liability Act. The section of land (36) between North Plants and South Plants was described by the Arsenal commander as the "most contaminated square mile in the nation." This statement was later exaggerated to "the most contaminated tract of real estate on the Planet Earth." Later that year, the Rocky Mountain Arsenal was nominated for the National Priorities List under Superfund (Hoffecker 2001).

Numerous actions—known as interim response actions—were conducted during the mid- to late 1980s to prevent further contamination while a formal cleanup plan was developed and approved by regulatory agencies. In 1996, the record of decision was signed and intensive cleanup was initiated. The last of the ground projects (structures, soil, and containerized liquids) was completed in 2011. Groundwa-

Cindy Souders / USFWS

*Large numbers of bald eagles were discovered on the eastern side of Rocky Mountain Arsenal in 1986.*

ter cleanup will continue for decades to come (Wright and Wright 2014).

### Refuge Development (1992–Present)

Large numbers of bald eagles were discovered on the eastern side of Rocky Mountain Arsenal in December 1986 during a biological survey (Ron Beane, ERO Resources, senior wildlife biologist; email communication). Service biologists were brought to the Arsenal because the bald eagle was listed as endangered at the time, and the communal wintering roost along First Creek in Section 5 met the criteria for critical habitat for this species. Service biologists then discovered impressive numbers of wildlife species and began efforts to convert the site into a national wildlife refuge. The Rocky Mountain Arsenal National Wildlife Refuge Act was signed into law in 1992, with language stating that it would be managed as if it were a refuge until officially becoming a refuge when declared clean. Jurisdiction of portions of the land was handed over to the Service starting in 2004. While the U.S. Army maintains jurisdiction of approximately 1,000 acres of mostly caps, covers, and groundwater remediation sites, the refuge controls about 15,000 acres (Hoffecker 2001, Wright and Wright 2014)—a very large tract of public land in a very urban area.

Terry Wright / USFWS

*The Egli House*

## Cultural Resources

### Known Cultural Resources

The 1994 and 1995 cultural resource survey of 11,725 acres of Arsenal lands identified a total of 235 cultural resources. Forty-two of these resources had been previously identified during earlier surveys. Of the 235 resources, 121 are sites or structures and 114 are isolated artifacts: small groupings of artifacts called Isolated Finds (IFs). The 121 sites or structures consist of 84 historic resources, 23 prehistoric sites, and 14 multi-component sites with both prehistoric and historic remains. The prehistoric sites are all classified as campsites or lithic scatters (stone tools and fragments of stone from tool manufacture). The vast majority of the historic sites are the remains of farmsteads or homesites that dated from 1871 to 1941 and were demolished when the army acquired the land in the early 1940s. Several trash scatters were also recorded, as were laterals and reservoirs associated with the Highline Canal.

The 114 IFs consist of 87 that are historic, 26 that are prehistoric, 1 one that is multi-component. The majority of the historic IFs are locations with the very limited remains of farmsteads and homesites or trash scatters with no research potential. Prehistoric IFs included isolated lithics, small groupings of lithics, or scatters of fire-altered rocks.

In addition to these cultural resources, seven resources representing the World War 2 and Cold War activities have been extensively recorded (appropriate recordation is legally sound mitigation) and subsequently demolished. Four Districts (South Plant, North Plant, Logistics Complex, and the Munitions Storage Complex); the Post Headquarters; the Fire Station Headquarters; and the Burlington Northern Railroad tracks were determined to be eligible for inclusion in the NRHP (Remediation Venture Office 1999).

Four of the remaining sites are determined eligible for inclusion in the NRHP: two prehistoric sites, the Sand Creek lateral to the Highline Canal, and the pioneer home and garage that Gottlieb and Rose Egli built in the early 1900s (Wright and Wright 2014). Subsurface testing at the two prehistoric sites revealed intact deposits with significant research potential. The Sand Creek Lateral is a part of the much larger Highline Canal system that was instrumental in the settlement of the region. The Egli home, which was listed in the Colorado State Register of Historic Places in 2002, dates to the early years of the twentieth century and is the only remaining example of pre-war historic settlement of the refuge. The Service and the Friends of the Front Range Wildlife Refuges are renovating portions of the home to protect it from weather and wildlife.

### Artifact Collections

Wright and Wright (2014) produced table 6, which not only demonstrates a timeline for the events in the area, but also identifies the artifacts we have accessioned (that is, acquired or added) into our extensive collection. Their paper on the collection, “A Vision for the Future of the Past,” follows the theme of John

Hoffecker's (2001) book, "Twenty-Seven Square Miles." Using the book as a model, Wright and Wright divided the historical timeline of the Arsenal into six distinct periods: Prehistoric; Explorers, Trappers, and Railroads; Homesteaders and Early Colorado Agriculture; World War 2; The Cold War; and Cleanup and Refuge Transition. They made the following observations:

- The Rocky Mountain Arsenal's unique success story seems to be a well-kept—or at best, misunderstood and/or underrepresented—secret. Even many of the employees are unaware of what it means, what it looks like, to have spent 14 years and $2 billion on remediation and what happened before and after that; what 474 homesteads sprinkled across the (then) 25 square-mile landscape and the farm life of settlers looked like in the pre-World War 2 era; the significant role the Arsenal played in World War 2 and the Cold War: some of the many events that shaped the Arsenal into the thriving wildlife refuge it is today that hosts over 330 animal species and over 300 native plant species and boasts thousands of visitors per year. That is our heritage and our history. It is also the history of this country.

- This story—the full story and the details that make it interesting—should be told. The variety of historically significant cultural resources that have survived over the years are the original props: the most tangible pieces of the past. They speak volumes to and paint pictures for those who see and touch them. Environmental education opportunities abound. In addition to the public benefit, any items that could be potentially displayed in Service buildings would be seen and appreciated by employees passing through. It would be a unique keepsake for RMANWR employees as a way to have a visible reminder of its past, and a tribute to those whose efforts came before them.

## 3.7 Research and Science

We are currently engaged in several research and monitoring programs, and some of our management projects assist in research, monitoring, and inventory programs. We know that this work is and will continue to be helpful in making sound management decisions. For example, our burrowing owl trapping and banding activities add to other research underway on the migratory pathways of this species throughout western North America. Other monitoring and inventory activities and programs that we conduct annually on the refuge are listed below:

- Bald eagle winter roost and nest counts (cooperative effort with the Rocky Mountain Bird Observatory) to monitor overall riparian health at the refuge as well as individual bald eagle reproductive production

- Monitoring of raptor nests (such as Swainson's hawk and burrowing owl)

- Electrofishing and gillnetting in refuge reservoirs to assess fish populations

- Fall deer census and bison roundup

- Monitoring of vegetation and native and invasive species (especially on restored habitat sites)

- Annual mourning dove banding

- Support of the Great Backyard Bird Count in February

- Christmas Bird Count in January

- Spring and fall bird counts in May and September

- Annual monitoring of black-tailed prairie dog locations and densities

While we do not actively undertake specific climate change research at this time, we work with U.S. Army personnel to collect meteorological data that may be useful in the future for identifying trends in climate change at the refuge. Currently we are not conducting any type of social science, social media, or emerging technologies research. Occasionally we allow social science research that might benefit our management of the refuge.

## 3.8 Infrastructure and Operations

Our visitor facilities include a Visitor Center, a Contact Station, four information kiosks, two amphitheaters (one behind the Visitor Center and one at

**Table 6. Items accessioned into existing collection itemized by historical period, Rocky Mountain Arsenal National Wildlife Refuge, Colorado.**

| *Period* | *Historical timelines and events** | *Collection artifacts* |
|---|---|---|
| Prehistoric: 12,000 B.P. to A.D. 1350 | Native American campsites along First Creek (two prehistoric sites eligible for listing in the NRHP)<br>(Interpretation of this period not available in Visitor Center) | 157 Accessions: points, scrapers, mano stones, pottery shards, grinding stone and metate, bison bones, stone flakes, and one stone spear point estimated 7,000 years old. |
| Explorers, Trappers, and Railroads: 1700s–late 1800s | (Historical events in refuge vicinity)<br>*1820:* Major Stephen Long expedition, 1820, near Brighton, CO.<br>*1860:* Wagon trails cross RMA to reach Denver and gold fields.<br>*1869:* Denver Pacific Railroad reaches to within about one-half mile of the RMA's northwest corner.<br>*1870:* Kansas Pacific RR comes within 2 miles south of RMA.<br>*1881:* Chicago, Burlington and Quincy RR line is built adjacent to RMA's northwest edge, defining diagonal boundary.<br>*1886:* East Colorado RR (narrow gauge) is operational, running roughly along present day 56th street.<br>(Interpretation of this period not available in Visitor Center) | 0 Accessions. No artifacts in collection representing this period. |
| Homesteaders and Early Colorado Agriculture: 1870–1942 | *1871:* The first homesteader was Fred Steinhauer, 160-acre homestead in Section 4. Some 474 homesteads eventually occupy land that is to become Rocky Mountain Arsenal. | 102 Accessions: mostly bottles and jars; also coins, children's toys, license plates, coins, two rifles, one shotgun. Also includes oral and video histories from homesteaders. |
| World War 2: 1941–1945 | *1941 (December 7):* Japanese attack Pearl Harbor. December 7th Avenue—present-day 7th Avenue—is named in remembrance of the Pearl Harbor Attack, first road built into Arsenal.<br>1942: (May 2) U.S. War Board announces 19,882 acres purchased outside Denver will be the future location of a chemical weapons production facility. In June, the first fully operational building is completed a full year ahead of schedule.<br>*1942 (summer):* All homesteaders are forced to vacate their properties.<br>*1942–1945:* Mustard, lewisite, chlorine, M74s, M47s, and phosgene-containing shells are manufactured. About 70 percent of Arsenal employees are women (Rosie the Riveter and We Can Do It poster).<br>*1943 (January 5):* Building 111 is dedicated by a formal ceremony and flag-raising by Brigadier General Loucks. Workers commended.<br>*1943:* South Plants manufacturing facility becomes operational, producing mustard gas, napalm and incendiary bombs (M47s, M69s, M20s), and "Willie-Peter" (white phosphorous) artillery rounds.<br>1943 (October): B17 Superfortresses using 1,300 M47 incendiary bombs destroy the Focke-Wulf aircraft assembly plant at Marienburg, East Prussia. M47s were also used for the air raid to the roller bearing plant in Schweinfurt, Germany, as well as the bombing of the Ploesti oil refineries in Rumania.<br>1943: From November 6, 1943 to April 1946, U.S. Army operates a prisoner-of-war camp, with as many as 300 prisoners (in Section 3, near present-day Visitor Center). Old Rose Hill School converted into an administration complex for the POW camp.<br>*1944:* Marge Brandow and Pete Fox (sisters) begin work at the Arsenal Incendiary Oil Bomb factory (oral history collection). | Accessions: helmets, bottles, 20mm round, tags for Chemical Warfare Service, signs, Chemical Service insignia, flags.<br><br>We Can Do It poster at Visitor Center.<br><br>Partial bomb fin at Visitor Center.<br><br>One foundation of guard tower still present. One 10- by 10-ft WWII guard tower foundation on the north edge of Lake Ladora that guarded part of the South Plants perimeter.<br><br>Chalk writing in Section 6 bunker.<br><br>Oral histories in collection. |

**Table 6. Items accessioned into existing collection itemized by historical period, Rocky Mountain Arsenal National Wildlife Refuge, Colorado.**

| *Period* | *Historical timelines and events** | *Collection artifacts* |
|---|---|---|
| | *1945 (March):* Large-scale air raid by B-29 bombers over Tokyo, using M69 incendiary bombs. The air raid and subsequent firestorm is believed to have killed an estimated 40,000 civilians and destroyed 16 square miles of the city. Raid is regarded as a key turning point in the air war over Japan.<br>*1945 (June):* Nora Ruiz killed in pyrotechnic assembly line; five other women burned, some seriously.<br>*1945 (August):* World War 2 ends. More than 100,000 tons of incendiary bombs are dropped on Japan, destroying 158 square miles of urban industrial areas and leaving 8.4 million people homeless. U.S. military estimates 40 percent of every Japanese city hit by incendiary bombs is destroyed. | |
| Cold War: 1946–1982 | *1945–1950:* Demilitarization of mustard gas shells begins.<br>*1946:* Arsenal is placed on standby status.<br>1947: Portions of the facility are leased to private industry, including Shell Chemical Company and Julius Hyman and Company, which uses the facility to manufacture agricultural pesticides.<br>*1947–1949:* Demilitarization of 155mm shells, 75mm shells, ANM76 bombs, M78 bombs, M79 bombs.<br>*1950–1952:* Arsenal reactivated for Korean War. Manufactures M74 (M20A1 Cluster) bombs, M31 clusters, E101 clusters, E101R1 clusters, M15 hand grenades, white phosphorous cups, M23 fire bomb igniters, renovated M19 clusters.<br>1951: Construction starts on the North Plants complex.<br>1952: Shell Chemical Co. acquires Julius Hyman and Co, which had been producing agricultural chemicals. Shell continues to manufacture agricultural chemicals until 1982.<br>*1953:* In summer, nerve gas production begins at North Plants Sarin (GB) complex. From 1953 to 1957, the Arsenal produces approximately 500,000 gallons of (GB) nerve agent Sarin, and was the free world's primary stockpile of that chemical agent.<br>1956: Basin F is constructed, initiation of contamination cleanup efforts.<br>1957: U.S. Army places the Arsenal on standby status and stops producing munitions.<br>1959: Hydrazine blending and storage facility is constructed to make rocket fuel for U.S. Air Force, producing until 1982.<br>*1960s:* Biological warfare program starts; collection of wheat rust spores from farmed fields Sections 23–26 for planned release in U.S.S.R. to cripple wheat crop. "Button bombs" and napalm are produced during the Vietnam war.<br>1961: U.S. Army begins construction of a deep injection well; over the next 4 years 365 million gallons of waste are pumped 12,000 feet underground.<br>*1964–1973:* Biological warfare activities—storage, planting, and destruction of wheat rust spores.<br>1965: Earthquakes hit Denver area, stopping deep well injection the following year (1966).<br>1967: Arsenal concentrates on production of rocket fuel for NASA.<br>1968: President Johnson orders the destruction of excess and obsolete chemical weapons. Arsenal is chosen to demilitarize the U.S. Army's Sarin (GB) and mustard chemical agent supplies: Project Eagle (Phase I) for mustard; Project Eagle (Phase II) for Sarin. Demilitarization of M34 clusters (Sarin), Weteye bombs (Sarin), and Honest John warheads M190 and M139 bomblets (Sarin). | Accessions: approximately 200<br>Includes: nerve gas manufacturing control panels; robotic arm for de-mil of M34 cluster bombs; munitions scale; X-ray machine; warning signs of all kinds; rubber protective suits; weight scale; wooden cart, wooden dolly, bombproof telephone and clocks; deep injection poster; GB emergency poisoning kit; policeman badges; fire department items; large purple mixer stick, some munitions, many forging tools.<br><br>Also includes oral and video histories of employees who worked here during this time, not available in VC.<br><br>Chiller gauges—item now in Butler Building |

**Table 6. Items accessioned into existing collection itemized by historical period, Rocky Mountain Arsenal National Wildlife Refuge, Colorado.**

| *Period* | *Historical timelines and events** | *Collection artifacts* |
|---|---|---|
| | 1969: Demonstrations against RMA occur for chemical contamination. Denver Post urges U.S. Army to close Arsenal.<br>1970: North Plants manufacturing facility goes on standby status until closure in 1982. During this time it dismantles and disposes of U.S. Army ordnance. President Nixon promises destruction of all stockpiled chemical weapons.<br>1971: Incineration of mustard gas begins and destruction of Sarin (Project Eagle). Arsenal's primary mission shifts from national defense and space exploration to destroying munition stockpiles and chemical warfare agents.<br>*1973:* M34 Cluster bombs filled with nerve gas are demilitarized. Stockpile of all biological agents destroyed.<br>*1974–1975:* Reports of pollutants in wells near Arsenal.<br>*1976:* Remaining stocks of phosgene gas are sold to private industry, removed from site. Destruction of Honest John warheads and nerve agent bomblets.<br>1979: U.S. Army constructs its first groundwater treatment system to treat contaminated groundwater onsite.<br>1982: All chemical manufacturing and demilitarization at the Arsenal ceases. | Cluster bomblets in collection, one at Visitor Center. |
| Cleanup and Refuge Transition 1984–2011 | *1983:* Cleanup investigations begin under the Comprehensive Environmental Response, Compensation, and Liability Act.<br>*1984:* Section 36 is described as "the most contaminated square mile in the world" and RMA is nominated to EPA's National Priorities List under Superfund law.<br>1986: Roosting bald eagles found on RMA.<br>1987: U.S. Army and Shell implement construction of groundwater treatment plants, cleaning up Basin F, dismantling rocket fuel blending facility, and asbestos removal. RMA is put on EPA's National Priorities List (Superfund).<br>1989: Congressional members Pat Schroeder and Wayne Allard propose legislation to accelerate Arsenal cleanup and conversion to a national wildlife refuge.<br>1992: 1992 Refuge Act, the founding legislation of Rocky Mountain Arsenal National Wildlife Refuge, passed by Congress.<br>1995: The Record of Decision (ROD) directing cleanup is agreed upon by multiple Federal and State agencies.<br>1997: U.S. Army and Shell undertake 21 specific cleanup projects outlined in the ROD.<br>1998: Demolition of the U.S. Army's former manufacturing plants begins, eventually involving more than 300 structures and the recycling of 10,000 tons of steel.<br>2003: Last of the Arsenal's chemical weapons manufacturing facilities and equipment are destroyed.<br>2004: EPA certifies 5,000 acres for removal from the Superfund list; those acres are transferred to the Service, officially establishing the Rocky Mountain Arsenal National Wildlife Refuge.<br>*2011:* The last and final stages of ground projects associated with cleanup are completed. | Accessions: 2<br>Map poster, picture, oral histories of Pat Schroeder and others. |

* Italicized dates reflect timeline items currently not represented on panels at the Visitor Center.

*Source:* Wright and Wright (2014)

Lake Mary), a fee station (iron ranger), and a wildlife viewing blind.

The refuge has entrance signs at the main gate and the Havana gate, as well as guide and directional signs throughout the refuge. We have installed and maintain interpretive signs at three of the information kiosks, the Contact Station, and Lake Mary.

There are five major dams on the refuge. Upper Derby, Lower Derby, Ladora, and Lake Mary dams are currently owned and operated by the U.S. Army. Havana Ponds dam is owned and operated by the City of Denver and UDFCD. We are not planning to accept transfer of the U.S. Army dams until the necessary repairs on Lower Derby, Ladora, and Lake Mary dams have been completed. Upper Derby would be partially breached prior to transfer and would no longer be considered a dam. Because of the damages resulting from floods in 2013, Havana Ponds is currently impaired but is undergoing repairs.

The entire refuge is surrounded by 8-foot chain-link fence to preclude deer movement across the refuge boundary and to contain the refuge bison herd within the boundary. Several miles of fencing within the refuge support the refuge's habitat and wildlife management activities.

The refuge is open from sunrise to sunset. Visitors are generally not allowed in the refuge during hours of darkness.

We manage the refuge in adherence to the Service's climate change policy, taking all the necessary measures to increase energy efficiency and reduce the carbon footprint of our operations.

Every year we have around 80 volunteers who actively support refuge operations by staffing the front desk of the Visitor Center, conducting interpretive tours and programs, performing light maintenance of trails and facilities, assisting with biological surveys, and staffing special events. Together with our volunteers we maintain a fenced pollinator garden behind the Visitor Center.

Cindy Souders / USFWS

*Our visitor facilities include a Visitor Center.*

# 3.9 Access and Transportation

## Roads

Currently there are 7.8 miles of roads open to the public: 7.2 miles of asphalt roads and 0.6 mile of gravel roads. Roads open to the public consist of the entrance road, Legacy Loop, a portion of the Wildlife Drive, and several small access roads to points of interest such as fishing reservoirs. All existing public roads are open to two-way vehicular traffic. There are 43.5 miles of administrative roads—asphalt, gravel, and two-tracks—used to access sites throughout the refuge; these are closed to the public. Roads are maintained by refuge and U.S. Army staff on an as-needed basis.

## Trails

Currently there are 27.1 miles of trails in and surrounding the refuge that are open to the public. Approximately two-thirds of this trail system is the refuge Perimeter Trail. Within the refuge, approximately 10 miles of nature trails are open to hiking and snowshoeing (Legacy, Discovery, Havana Ponds, and Prairie Trails). These trails are surfaced with crushed gravel fines material. Bicycle access is only allowed on the entrance road from the main gate to the Visitor Center.

## Access

Public access to the refuge is currently limited to the main entrance, known as the Prairie Gateway, at 6550 Gateway Road north of the Dick's Sporting Goods Event Complex. Visitors typically access the refuge from Quebec Street and 64th Avenue. Prairie Parkway heads southeast approximately 0.6 mile to a left turn onto Gateway Road. The main refuge entrance is 0.8 mile farther on Gateway Road. Visitors may have difficulty finding the entrance because of the multiple turns and less than optimal directional signs. Furthermore, Commerce City's Prairie Gateway Open Space Trail follows both Prairie Parkway and Gateway Road, contributing to the confusion: visitors sometimes believe they are at the refuge when in fact they have not yet reached the entrance. Finally, the current refuge entrance gate—a sliding chain link gate—is uninviting, and visitors

occasionally leave, believing that it is not the entrance.

For administrative purposes, three additional regular vehicle access points are on the north, west and south sides of the refuge. Several other locked swing gates can be used for emergencies.

## Way-Finding within the Refuge

Way-finding within the refuge consists of brown signs that direct visitors along our auto tour routes and to points of interest such as fishing reservoirs and trailheads. For their safety, visitors are reminded to stay in their vehicles while in the bison pasture. However, signage across the refuge has been inconsistent because of the change in management from the U.S. Army to the Service. Consequently, a comprehensive signage plan is needed. Visitors can, however, obtain a refuge map at the Visitor Center, the Wildlife Drive kiosk, or the Contact Station kiosk.

# 3.10 Socioeconomic Environment

## Social and Economic Context

Tables 7 and 8 provide key demographic data for understanding the refuge vicinity's communities. The refuge is situated in a diverse area in the Colorado Front Range region. A variety of socioeconomic and cultural barriers may impede residents from participating in outdoor recreation. Community characteristics provide a context for understanding potential barriers to visiting and engaging with the refuge. Accordingly, understanding the present characteristics of surrounding communities can help refuge staff determine how best to serve local residents, while exploring trends in community characteristics can assist with planning into the future (USGS 2014a).

**Table 7. Comparison of U.S. Census data to the results of the Rocky Mountain Arsenal National Wildlife Refuge visitor survey.**

| | *U.S. Census —Aurora* | *U.S. Census— Commerce City* | *U.S. Census —Denver* | *2012 visitor survey* |
|---|---|---|---|---|
| Population | 339,030 | 48,421 | 634,265 | N/A |
| Median Income | $51,048 | $60,963 | $49,091 | $75,000–$99,999 |
| College or higher | 26.6% | 20.1% | 42.2% | 48% |
| Race | | | | |
| Native American | 1.0% | 1.5% | 1.4% | 5% |
| Asian | 4.9%% | 2.2% | 3.4% | 3% |
| Black or African American | 15.7% | 3.1% | 10.2% | 3% |
| Hispanic | 28.7% | 46.8% | 31.8% | 7% |
| Native Hawaiian or Pacific Islander | 0.3% | 0.1% | 0.1% | 1% |
| White | 61.1% | 69.1% | 68.9% | 95% |

**Table 8. Enrollment and demographics of public school districts surrounding the Rocky Mountain Arsenal National Wildlife Refuge, 2013.**

| | *Aurora public schools* | *Adams 14* | *School District 27J* | *Denver public schools* |
|---|---|---|---|---|
| Enrollment | 37,389 | 7,321 | 16,193 | 81,870 |
| Native American | 0.7% | < 1% | 0.7% | 0.8% |
| Asian | 4.6% | < 1% | 2.8% | 3.3% |
| Black or African American | 17.9% | 2% | 1.9% | 14.5% |
| Hispanic | 54.7% | 83% | 45.0% | 58.0% |
| White | 17.8% | 13% | 47.3% | 20.3% |
| Other | 4.4% | < 2% | 2.1% | 2.9% |
| Free/Reduced Lunch | 71% | 72.5% | 37.7% | 68% |

## Population

In 2012, the total population of the eight-county local area near the refuge was more than 3.1 million people, or roughly 60 percent of Colorado's total population. However, these eight counties contain a combined area of less than 10 percent of the State's total area (10,200 square miles compared to the State's 103,600 square miles), giving the local area a disproportionately dense population compared to the State overall. In fact, each of the eight counties is more densely populated than the State as a whole. In 2012, Denver County had the largest resident population (619,000) and was also the most densely populated (more than 4,000 people per square mile) of the eight counties. Broomfield County had the smallest population (57,000), but being smallest of the eight counties (153 square miles), it was also the second most densely populated (1,700 thousand persons per square mile). Weld County was the least densely populated county (65 persons per square mile), but it is by far the largest of the eight counties (nearly 4,000 square miles) (USGS 2014b).

Since 1990, population has increased steadily in all eight counties near the refuge, in many instances outpacing the growth rate of the State as a whole. From 2000 to 2010, Adams, Broomfield, Larimer, and Weld Counties all grew at a rate faster than that of the State. The projected growth rates for 2010–2020 for Broomfield, Denver, Larimer, and Weld Counties similarly outstrip that for the State (USGS 2014a).

## Race and Ethnicity

The growing population of the eight local area counties has become more diverse over time. Minority populations in all counties have steadily increased over the last few decades. Denver, Adams, Arapahoe, and Weld Counties have the highest percentages of minority residents. In the case of Denver and Adams Counties, minorities constitute almost half the population and, with the exception of Larimer County, minorities make up 20 percent or more of the population in each county. Both Hispanic/Latino and non-white populations have increased in all counties since 1980. Adams, Denver, and Weld Counties have the highest percentages of Hispanic/Latino residents, while Denver, Arapahoe, and Adams have the highest percentages of non-white residents. There are a variety of racial groups within the non-white population; racial and ethnic groups are rarely homogenous and there may be more diversity within a group than between groups (USGS 2014a).

A diversity index (that is, a statistical calculation of the probability that two individuals selected at random from a given census tract are from different racial or ethnic groups) shows how diversity varies from neighborhood to neighborhood. The neighborhoods closest to the refuge include some of the most diverse neighborhoods in the Denver metropolitan area. Census tracts nearest the refuge have lower percentages of white residents and higher percentages of Hispanic/Latino residents than tracts farther away (USGS 2014a).

## Age

Overall, the population around the refuge is aging. The percentage of households with children has decreased over time in all counties. However, the decline in some counties, such as Broomfield, Adams, and Weld, has been minimal since 1990. At the same time, the percentage of the population over the age of 65 has increased in most counties except in Denver and Weld, where it has decreased or remained stable (USGS 2014a). The median age of residents in each of the eight counties ranged from 32.6 in Adams County to 40.6 in Jefferson County (USGS 2014b).

The neighborhoods around the refuge tend to have more households with children under the age of 18 than neighborhoods farther away. The percentages of older residents in the census tracts near the refuge mirror the county averages, with fewer than 15 percent of people aged 65 and over (USGS 2014a).

## Education

The percentage of residents with at least some college education in the region has risen over time to more than 50 percent in all counties by 2010. Conversely, in 2010, in some counties, such as Adams, Denver, and Weld, 15 percent or more of the residents had less than a high school degree. Additionally, in 2010 in all counties, except Boulder, a fifth to a quarter of residents had a high school degree or less (USGS 2014a).

While the overall level of education for the region has increased over time, a closer look at the census tracts around the refuge reveals neighborhoods with high percentages of residents age 25 and above without high school degrees. In several census tracts to the west and southwest of the refuge, 41 percent or more of the residents age 25 and above do not have high school degrees (USGS 2014a).

## Income, Employment, and Poverty

Median incomes (adjusted to 2010 dollars) have generally risen over time in the region, despite a drop in 2010 in all counties except Weld. The gap between the lowest and highest income has widened slightly. In 1980, the highest and lowest median incomes for any individual county were $22,594 apart; in 2010, the highest and lowest median incomes were $28,090 apart. The percentage of people living below the poverty level remained relatively steady over time in the region until 2010, when it increased in all counties. Larimer, Boulder, and Arapahoe Counties saw the biggest increases (4 percent or more) from 2000 to 2010 in the percentage of people living below the poverty level. The decrease in median incomes and increase in percentage of people living below the poverty level from 2000 to 2010 most likely reflects the effects of the recession of 2007–2009 (USGS 2014a).

Though the percentage of residents living below the poverty level is relatively low at the county level, most of the census tracts near the refuge exceed the percentage of impoverished residents in their counties by a substantial amount. In many of the neighborhoods on the west and south sides of the refuge, one-fifth to two-fifths of the residents are living below the poverty level (USGS 2014a).

Comparing the 2013 average unemployment rates between the eight counties further reveals some differences in relative economic health. Across the eight-county region, average 2013 unemployment ranged from a low of 5.2 percent in Boulder County to a high of 7.5 percent in Adams County. The unemployment rate for six of the eight counties is comparatively similar (within one percentage point) to the State's average unemployment rate of 6.8 percent in 2013. Deviating from this trend are Boulder and Larimer Counties, each with unemployment rates at or below 5.4 percent. This suggests a relatively healthier economic situation for employees in those two counties compared to both the State's average and to the other six counties in the eight-county local area (USGS 2014b).

The eight-county area boasted more than 1.5 million full-time jobs in 2012. Accounting for more than one in every five jobs, education, health care, and social assistance was the largest industry category within the eight counties. The region is also a hub for professional and scientific industries, accounting for 14.6 percent of total employment. Additionally, combined employment in all travel and tourism sectors—retail trade, transportation, arts, entertainment and recreation, and accommodation and food—constituted more than 25 percent of total employment in the eight-county region. Construction and manufacturing also have a large combined presence, with nearly 15 percent of total employment falling into one of these sectors (USGS 2014b).

## Access to Transportation

The majority of households in the region have access to two or more vehicles, but the percentage of households with access to one or no vehicle has increased slightly in all counties except Larimer and Broomfield. In some counties, such as Denver, Arapahoe, and Boulder, a quarter or more of the households have access to only one or no vehicle. Despite a lack of access to vehicles for these households, in each county only a small percentage of working residents aged 16 and over use public transportation to get to work (USGS 2014a).

The neighborhoods around the refuge tend to have access to fewer vehicles than the county-wide levels. In several census tracts west and south of the refuge, from two-fifths to three-fifths of residents have access to one or no vehicle. Despite a relatively widespread lack of access to vehicles, 10 percent or fewer of workers aged 16 and over in neighborhoods near the refuge use public transportation to get to work (USGS 2014a).

## Recreation and Tourism

Outdoor recreation is an important component of Colorado's economy, contributing more than $34.5 billion in total economic output and supporting 313 thousand jobs statewide in 2013. With more than 24

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*Refuge Day*

million acres of federally managed lands, Colorado hosts a diverse range of outdoor recreational opportunities. In 2013, 90 percent of Colorado residents participated in some form of outdoor recreation. The three most reported popular outdoor recreational activities in Colorado are walking, hiking/backpacking, and picnicking (USGS 2014b).

Fishing, hunting, and wildlife-viewing are also popular recreational activities within Colorado, with approximately 2.3 million residents and nonresidents participating in wildlife-related activities in the State during 2011. Approximately 70 percent of people who participated in wildlife-related activities in Colorado reported engaging in wildlife viewing, while 40 percent engaged in either hunting or fishing. In 2011, residents and nonresidents spent a total of 6.9 million days watching wildlife away from home, with residents accounting for 69 percent of wildlife watching days. Colorado residents accounted for 71 percent of the 2.2 million hunting days in 2011, and accounted for 89 percent of the 8.4 million fishing days. Spending associated with all wildlife recreation in Colorado totaled $2.98 billion in 2011; of this amount nearly 42 percent were trip-related expenditures, 52 percent was spent on equipment, and the remaining 6 percent was spent on other related items (USGS 2014b).

# Chapter 4—Management Direction

Cindy Souders / USFWS

*A Service employee controls weeds with a chemical treatment.*

*Our job is to sharpen our tools and make them cut the right way…*

*Aldo Leopold, The River of the Mother of God and Other Essays*

This chapter describes the management direction for the Rocky Mountain Arsenal National Wildlife Refuge. The vision and goals we have developed for the refuge are included below, along with strategies we intend to follow to meet these objectives. Many of the actions included in this plan have been inspired by the Service's "Standards of Excellence for Urban National Wildlife Refuges" (FWS 2014a; also see appendix F).

*Vision for the Rocky Mountain Arsenal National Wildlife Refuge*

*As the sun rises, bison thunder across the prairie, red-tailed hawks soar overhead, and the urban bustle begins. Lands once known for their agricultural and industrial uses are being restored on the Nation's premiere urban wildlife refuge, where time moves at nature's pace and wildlife have the right-of-way. Propelled by public and private partnerships, refuge stewards at Rocky Mountain Arsenal, Two Ponds, and Rocky Flats National Wildlife Refuges continue to work to repair and regenerate wildlife habitat. These prairie oases nestled within Colorado's Front Range communities welcome visitors from near and far and foster an appreciation for nature. They will connect people with the land for generations to come.*

## 4.1 Management Focus

Our focus and planning approach for the refuge is consistent with the visions and principles promoted in the Improvement Act; the Service's Biological

Integrity, Diversity, and Environmental Health policy; and "Conserving the Future." This includes conserving native communities and species of concern and developing "quantifiable objectives" that "integrate the conservation needs of the larger landscape (including the communities they support)."

Our staff will continue to comply with all applicable laws, regulations, and policies for management activities that could affect refuge resources such as soil, water, air, threatened and endangered species, and archaeological and historical sites. A list of key legislation and policies is presented in appendix A.

We will endeavor to increase the visibility of the refuge within the Denver metropolitan area and thus welcome many more nontraditional visitors to the refuge. Through an expanded visitor services program, an abundance of instructional programming, and widespread outreach, we will strive to connect more people with nature and wildlife. We will make the refuge more accessible to outlying communities with the opening of additional access points and the development of an enhanced transportation system (figure 13). We will work with nontraditional users' trusted avenues of communication to increase outreach success. We will expand our conservation education in surrounding communities and schools, develop youth-specific outreach, and employ social marketing to broaden our agency's reach. We will continue implementing the habitat restoration and management objectives set in the refuge's HMP, as well as the prairie dog management plan and other approved plans to provide for a wide variety of resident and migratory species. We will reintroduce the endangered black-footed ferret and attempt to reintroduce the greater prairie-chicken and sharp-tailed grouse to the refuge.

The elements listed below and the sections that follow describe practices and policies that guide refuge management as well as actions that have been approved in other plans and are currently in force.

## 4.2 Overview of Goals and Objectives

Under each goal in this chapter, we describe the objectives and strategies that will serve as the steps needed to achieve the refuge vision. While a goal is a broad statement, an objective is a concise statement that indicates what is to be achieved, the extent of the achievement, who is responsible, and when and where the objective should be achieved—all to address the goal. The strategies are the actions needed to achieve each objective. Unless otherwise stated, the refuge staff will carry out the actions in the objectives and strategies. The rationale for each objective provides context such as background information, assumptions, and technical details. The plan has objectives for the following goals:

- 4.3, Habitat Management
- 4.4, Wildlife Management
- 4.5, Visitor Services
- 4.6, Communications and Outreach
- 4.7, Partnerships
- 4.8, Cultural Resources
- 4.9, Research and Science
- 4.10, Infrastructure and Operations
- 4.11, Access and Transportation

## 4.3 Habitat Management

***Goal: Use an adaptive management framework to conserve, restore, and enhance the ecological integrity of Front Range prairie communities, including wetlands, grasslands, native shrubs, and trees.***

We will continue to use an adaptive management framework to conserve, restore, and enhance the ecological integrity of the Front Range prairie communities, including the wetlands, trees, and native shrubs within those communities. We will use prescribed fire, mowing, grazing, and integrated pest management (IPM) to restore and then maintain refuge habitats.

We will continue to manage for habitat diversity in fire-maintained ecosystems using management tools like prescribed fire, as described in the fire management plan (FWS 2013i).

We will manage invasive species through the use of approved biological controls, physical controls,

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*Western meadowlark*

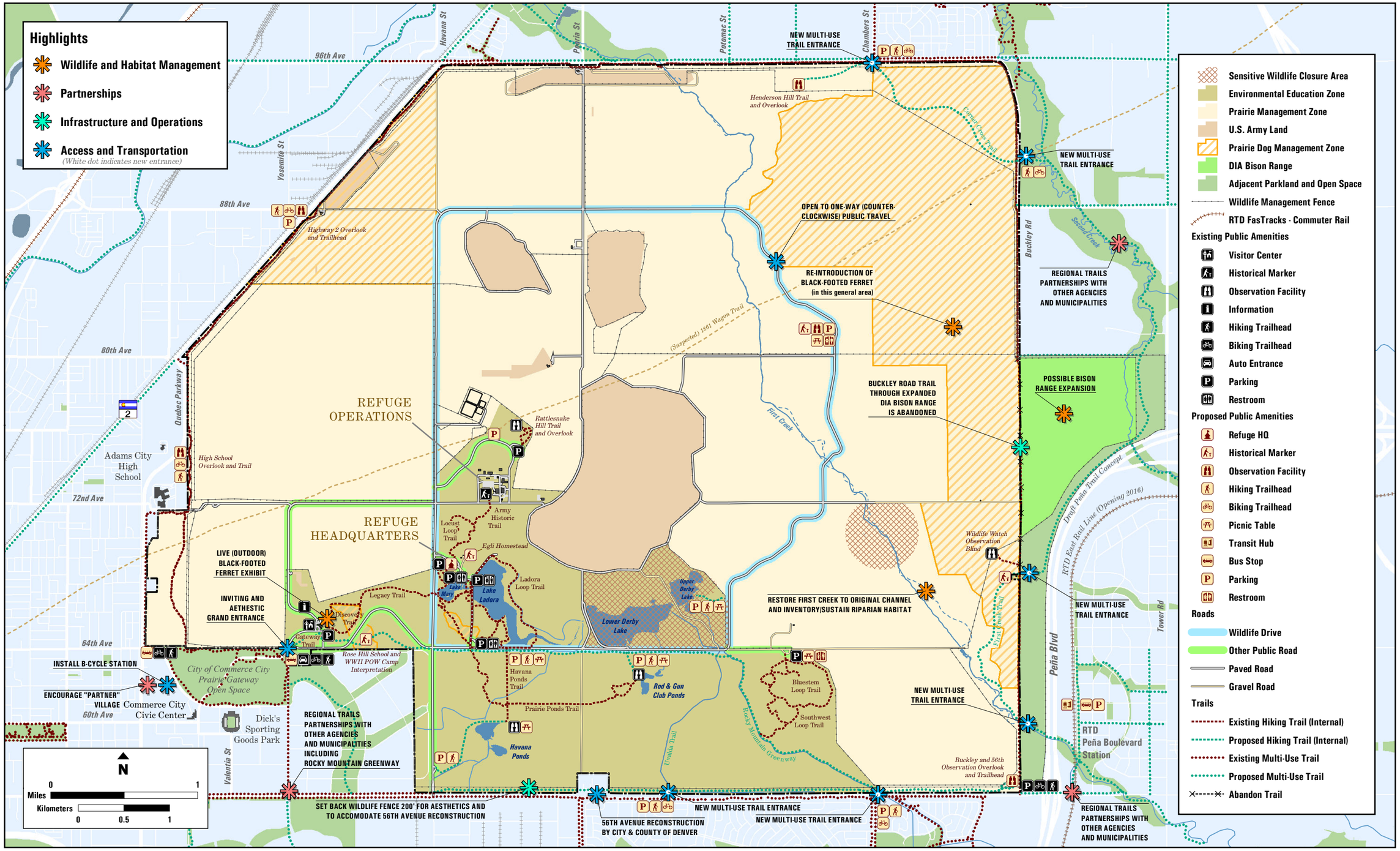


**Figure 13. Principal features of Rocky Mountain Arsenal National Wildlife Refuge under the comprehensive conservation plan.**

chemical controls, and appropriate cultural controls for the prevention, early detection, monitoring, and control (or eradication) of invasive plant species and other pests on the refuge (FWS 2014d).

We will manage herbivore populations, such as bison and prairie dogs, to ensure the long-term sustainability of restored prairie and shrubland, contribute to the Service's bison metapopulation goals, and provide suitable habitat for species of concern.

When appropriate and feasible, we will pursue a variety of strategies aimed at protecting various wildlife habitats (such as fee-title acquisition, leases, and co-management of private lands).

## Climate Change

The potential effects of climate change on fish and wildlife that currently inhabit the refuge are broad, and many of the stressors occur beyond the refuge's boundaries. Under our circumstances, increasing the size of the refuge is not an option. Accordingly, our principal strategy for mitigating the effects of climate change is to maintain the resilience of shortgrass and mixed-grass habitats on the refuge through the use of fire and grazing. More information on climate change as it relates to the refuge and habitat management is presented below.

Scientific evidence indicates that the global climate is changing. Most scientists agree that this change will result in a fluctuations in the abundance and distribution of wildlife and their habitats. In response to a rapid warming trend, some species may be able to adapt, some may struggle, and others may disappear forever. The Service's dedication to the conservation of wildlife and their habitats includes reducing, to the extent possible, the impacts that climate change may have on the Nation's natural heritage (FWS 2013j).

The direction and magnitude of ecosystem change in response to climate change will depend on the type and intensity of the disturbance (Backlund et al. 2008). Ecological changes in the phenology and distribution of plants and animals are occurring in all well-studied terrestrial systems. These observed changes appear to be consistent with modeled predictions and have been linked to local or regional climate change (Parmesan 2006). Ecosystem structure and function in the central Great Plains are closely associated with regional climatic gradient, precipitation being the most important climatic variable (Burke et al. 1991).

The potential effects of even small changes in climate could be significant on the refuge in light of the area's history of severe soil disturbance and the abundance of invasive species. Because many native plants and animals that currently inhabit the refuge are near the limits of their current known ranges, small changes in climate may provide a competitive advantage to invasive and nonnative species already established on refuge lands. For example, species that were once limited by elevation or drought tolerances may be able to inhabit new areas (Backlund et al. 2008).

Given these concerns, restoring and maintaining native plant communities is and will continue to be a primary focus of management on the refuge. Native communities tend to be more resilient than nonnative communities and consequently represent the best approach for addressing potential long-term climate change (FWS 2013j). In addition, native plant communities provide suitable habitat for wildlife—the Service's primary mission.

### Climate Change in Colorado

Colorado's climate is unlike that of any other state—it is characterized by the high elevations and complex topography of the Rocky Mountains, the Colorado Plateau and valleys of the West Slope, and the high plains falling off from the Continental Divide toward the east (Ray et al. 2008). West of the mountains the battle among subtropical, Pacific, and polar continental air masses determines which years are warmer or colder than average. The climate of the plains is comparatively uniform from place to place, with characteristic features of low relative humidity, abundant sunshine, infrequent rains and snow, moderate to high wind movement, and a large daily and seasonal range in temperature (Pielke Sr. et al. 2003). Weather on the refuge is dominated by warm-season precipitation, largely a result of localized convective storms.

In Colorado, statewide temperatures have increased about 2 degrees Fahrenheit (°F) over 30 years. Regionally, the north-central part of the State has been warming fastest (a +2.5 °F change in the annual average over the past 50 years). In the last 50 years, minimum temperatures, when compared to maximum temperatures, show greater overall warming (Ray et al. 2008).

In all parts of Colorado, no consistent long-term trends in annual precipitation have been detected in the time periods analyzed (Ray et al. 2008). A widespread and significant increase in the proportion of precipitation falling as rain rather than snow and a reduction in snow water equivalent have been observed elsewhere in the West between 1949 and 2004. In Colorado, however, these changes have been less pronounced (Knowles et al. 2006). Warming may have increased the severity of droughts (Andreadis and Lettenmaier 2006) and their impacts (Breshears et al. 2005).

Focusing on Colorado, the multi-model average projects an annual mean warming of about 4 °F [+2.5 to +5.5 °F] by 2050 in Colorado as part of a continent-wide pattern of warming. The projections show summers warming more (+5 °F [+3 to +7 °F]) than winters (+3 °F [+2 to +5 °F]). Temperature increases are greatest in the summer. Most projections suggest that typical summer temperatures will equal or exceed the extreme warm summers of the last half of the twentieth century. The projected temperature changes are somewhat less for winter, and the year-to-year variations are larger. While extreme warm winter months would increase in these projections, most years—even by 2050—will not be extreme by present standards. Mid-twenty-first century summer temperatures on Colorado's eastern plains are projected to shift westward and upslope, bringing into the Front Range temperature regimes that today occur near the Kansas border (Ray et al. 2008). Individual model projections do not agree whether annual mean precipitation will increase or decrease in Colorado by 2050. Projections show a precipitous decline in lower-elevation (below 8,200 feet) snowpack across the West by the mid-twenty-first century. The multi-model average shows little change in annual mean precipitation by 2050, although a seasonal shift in precipitation does emerge (Ray et al. 2008). Individual model projections do not agree on whether annual mean precipitation will increase or decrease in Colorado by 2050. Projections show a precipitous decline in lower elevation (below 8,200 feet) snowpack across the West by the mid-twenty-first century. The multi-model average shows little change in annual mean precipitation by 2050, although a seasonal shift in precipitation does emerge (Ray et al. 2008).

The State believes that the most serious anticipated impacts of climate change include increasing frequency and severity of forest insect infestations and wildfires (both of which are believed to be occurring already), and changes in the hydrologic cycle that will affect fish and other aquatic organisms. Climate is a key determinant of the spatial distribution and characteristics of ecosystems and species. In both aquatic and terrestrial environments, we should expect northward and upward shifts in the distribution of animal and plant species and ecosystems in response to warming temperatures. Similarly, it is anticipated that warming would shift the phenology (the timing of life-cycle events such as flowering and hibernation) of both plants and animals, independent of changes in range. The most climate-vulnerable ecosystems in Colorado may be shortgrass prairie, fire-dependent forests, and aquatic ecosystems (Averyt et al. 2011).

## Climate Change Strategies for Surrogate Species in Colorado

### *Black-Tailed Prairie Dogs*

Black-tailed prairie dogs and their habitat serve as surrogates for many species on the refuge. They also constitute an important food source for many predators. Factors other than predation—such as climatic changes, shifts in the availability of edible plants, and outbreaks of disease—also affect the size of prairie dog populations. Longer growing seasons, higher temperatures, changes in fire regime, and increased variability in weather will affect prairie dog food sources, increase competition, and increase the risk of plague outbreaks (Davis et al. 2004, Stenseth et al. 2008).

Changes in habitat that result from prairie dog activity could either accelerate or mitigate the consequences of climate change. Accelerated effects could involve the loss of grasslands through increased desertification, while mitigating effects could be manifested as reductions in the spread of exotic species, impediments to shrub encroachment, and maintenance of species diversity (Fahnestock et al. 2003, Larson et al. 2001, Weltzin and McPherson 1997). Our HMP (FWS 2013a) and black-tailed prairie dog management plan (FWS 2013h) recommend that, to continue addressing potential effects of climate change, care be taken to retain both large and small and isolated and interconnected prairie dog colonies (Friggens 2011).

### *Bison*

Bison are extremely well adapted to a wide range of environmental conditions. Climate change will affect relationships between C3 (forbs, woody plants, legumes) and C4 (grasses, sedges) plants in North American grasslands (Fischer et al. 2008). Similarly, temperature changes may have greater influence than the amount of precipitation on native prairie forb species (Adler and HilleRisLambers 2008). Impacts on prairie plant species will be particularly difficult to predict, as will be the effect on our bison herd. Bison herbivory is a key ingredient to our habitat restoration objectives, but grazing intensity will need to be monitored and managed to minimize degradation. Of particular concern in the context of the refuge's bison herd is the relationship between climate change and emerging infectious diseases in wildlife. The pressures of human encroachment and shrinking wildlife habitat tend to increase wildlife densities and the emergence of disease (Daszak et al. 2000). The refuge's bison herd is contained and managed, but remains vulnerable to emerging disease threats.

## Climate Change Policies

In 2001, the Secretary of the DOI issued Secretarial Order 3226 (DOI 2001) requiring Federal agencies under its direction that have land management responsibilities to consider potential climate change effects as part of long-range planning endeavors. Recently, this order was replaced by Secretarial Order 3289 (DOI 2009). It left intact many of the planning requirements of Secretarial Order 3226, reiterating the need to analyze climate change effects, but made organizational changes to enable the bureaus and agencies to fulfill the planning requirements. In 2009, President Obama signed Executive Order 13514 requiring Federal agencies to establish an integrated strategy toward sustainability in the Federal Government and to make reduction of greenhouse gas emissions a priority for Federal agencies. In 2010, the Service completed its strategic plan for managing climate change (FWS 2010a). As part of implementing the Refuge System's "Conserving the Future" document, all this information was synthesized into a document to assist planners and managers in fulfilling these mandates and incorporating climate change considerations into planning documents (FWS 2014e).

## Climate Change Objective 1

Throughout the life of this plan, carry out at least five management actions that improve resiliency of shortgrass and mixed-grass habitats and their associated wildlife to adapt to the effects of climate change.

### Strategies

- Protect relic and native-dominated grassland communities found on the refuge.
- Minimize fragmentation of refuge grasslands from land use changes and roads.
- Continue restoration of refuge grasslands wherever possible through reintroduction of native species, eradication or control of invasive species, and restoration of native disturbance regimes:
  - Maintain and restore natural fire regimes to the refuge through the use of prescribed burning.
  - Use a rest-rotation system of bison grazing.
  - Prevent and slow the proliferation of invasive species.
  - Study and explore how drought-tolerant species can be integrated into grassland without dramatically changing local native genotypes.
- Increase connectivity of existing refuge grasslands.
- Provide "buffer areas" wherever possible within and adjacent to the refuge.
- Collaborate with climate science experts to reduce uncertainty of climate change effects on the refuge.

### Rationale

Resilience is defined by the capacity of a system to absorb disturbance, undergo change, and still retain essentially the same function, structure, and feedbacks—in other words, retain the same identity (Walker and Salt 2012). The structure and function of the world's grasslands makes them one of the most vulnerable to global climate change of any terrestrial ecosystem (IPCC 2001, Sala et al. 2000). The condition of vegetation and soils will prove critical to grassland resilience to climate change. Healthy, vig-

| Ecological Principles and Guidelines for Managing the Use of Land (Dale et al. 2000) |
|---|
| Examine impacts of local decisions in a regional context. |
| Plan for long-term change and unexpected events. |
| Preserve rare landscape elements and associated species. |
| Avoid land uses that deplete natural resources. |
| Retain large contiguous or connected areas that contain critical habitat. |
| Minimize the introduction and spread of nonnative species. |
| Avoid or compensate for the effects of development on ecological processes. |
| Implement land-use and management practices that are compatible with the natural potential of the area. |

orous stands of native vegetation are likely to be more resilient to climate change. However, uncertainty will exist about which grassland types may be most impacted by climate change (Gelbard 2003). The importance of the refuge as a large, relatively intact grassland ecosystem cannot be understated as a landscape-level adaptation measure to climate change.

The Service's climate change strategy establishes the basic framework for working with others as part of the larger conservation community to help ensure the sustainability of fish, wildlife, plants, and habitats in the face of accelerating climate change. We accomplish this by using three key strategies: adaptation, mitigation, and engagement (FWS 2010a).

Relic grasslands found on the refuge are important (see Remnant Prairie Objective, below), because these sites act as models for restoration and can be used for comparison of human and climate change effects on the environment. Relic vegetative communities on the refuge are isolated and surrounded by altered habitats, making them most vulnerable to climatic shifts (Halpin 1997). The negative effects of habitat fragmentation on wildlife are well known, but the percentage of native plant species also increases with distance from roads (Gelbard and Harrison 2003). A loss of plant diversity may occur from climate change due to an absence of suitable intermediate habitats between populations that are adapted to specific environmental conditions and the land that will have those conditions under future climate regimes (Loss et al. 2012). "Buffer areas" around the refuge and increased habitat connectivity to the refuge protect paths for colonization by new species, and ecotypes of existing species, that are adapted to future climatic conditions. Lastly, the long-term health of refuge grasslands depends on management of the various ecological processes such as herbivory and fire (Fuhlendorf et al. 2009, Ricketts et al. 1999) and eradication or control of invasive species (Mack 1989) (see Prairie Dog Management Zone Objective).

## Climate Change Objective 2

Through a phased-in approach, strive to meet Federal goals on sustainability by making refuge facilities carbon-neutral, efficiently using domestic water, and implementing other actions that will minimize the footprint of refuge activities on future generations.

### Strategies

- Promote sustainable practices such as energy efficiency, alternative energy use, water conservation, "green" purchasing and facility management, minimal-to-zero waste, and environmental management. Specifically:
  - Continue to use and expand recycling and the use of composting.
  - Begin to utilize the Climate Leadership in Refuges (CLIR) Tool data as a means to track and report progress towards the refuge's sustainability goals.
  - Through the use of recycled water, eliminate the use of 90 percent of the potable water being used for non-potable purposes.
  - Develop plans to increase the use of renewable energy options to provide 100 percent of the electricity needed for refuge facilities (for example, solar garden).
  - Continue to develop plans to further reduce potable use of domestic water.
  - Ensure staff, volunteers, and partners are able to talk about the refuge's sustainability projects.
- Use high performance, net zero, sustainable building design for the construction, operation, and maintenance of new refuge facilities.
- Eliminate acquisition, use, and generation of toxic and hazardous chemicals and materials.
- Reduce greenhouse gases directly associated with the refuge and its contractors, concessionaires, and visitors. Specifically:
  - Periodically review and maintain the refuge's fleet management plan.
  - Strive for zero discharge of emissions or pollutants by maintaining all air conditioners and refrigerators.
  - Identify any remaining significant sources of carbon emissions on the refuge and develop plans to reduce their impacts on the environment.
  - Complete necessary visitation and use studies to propose reductions in the number of miles driven on the refuge by visitors.

- Conduct or participate in at least three educational programs where community members gain knowledge and skill in implementing sustainable practices.

- Engage with community partners using a holistic approach to promote the health and well-being of people and the sustainability of natural resources.

### Rationale

In 2009, President Obama signed Executive Order 13514, which required Federal agencies to establish an integrated strategy toward sustainability in the Federal Government and to make reduction of greenhouse gas emissions a priority for Federal agencies. As a part of the Refuge System's current vision for engaging urban communities with conservation, the refuge should "model sustainability." As a leader in conservation and trustee of our Nation's natural resources, we have the responsibility to set the standard for sustainable use of resources and energy conservation (FWS 2014a). The CLIR Tool will be used to estimate, track, and plan actions to reduce greenhouse gas emissions as well as share progress with visitors, partners, and the public.[1]

## Prairie

We will continue to pursue the goals specified in the 1999 habitat restoration plan (HRP) and the HMP for restoring native prairie to develop diverse plant community mosaics that differ in composition, height, and density. These activities will promote successful long-term establishment and maintenance of seeded restoration sites, as well as existing native prairies and shrublands, to provide habitat for species of concern. We will continue to work with DIA and adjacent cities to co-manage specific parcels of wildlife habitat (such as the bison viewing area) and to acquire and protect inholdings and lands next to the existing refuge boundary.

### *Shortgrass Prairie Objective*

By 2028, restore 4,500 acres to shortgrass prairie patches that are greater than 250 acres and consist of 60–90 percent cover of native grasses; 0–20 percent cover of native shrubs, native mixed-grass species, or forbs; and less than 20 percent cover of bare ground for lark bunting nesting habitat and associated species.

### *Mixed-Grass Prairie with Shrubs Objective*

By 2028, establish 8,000 acres of mixed-grass prairie in parcels greater than 120 acres that are characterized by 60–90 percent cover of native grasses, 0–15 percent cover of native shrubs, and less than 20 percent cover of bare ground to provide nesting habitat for Cassin's and grasshopper sparrow and associated species.

### Strategies

- Develop and follow a restoration prioritization schedule and methodology.

- Reseed habitat to native species following recommendations in the HMP.

- Follow HMP recommendations for best timing and best seedbed preparation techniques.

- Irrigate reseeded zones to help reestablish native vegetation.

- Control invasive plant species using chemical, biological, mechanical, and fire control agents.

- Remove prairie dogs (applicable to prairie outside designated zones and as necessary to restore grasslands within designated zones).

- Monitor vegetation composition of restoration sites.

- Utilize bison herbivory and prescribed fires to maintain vigor of shortgrass prairie habitat.

- Monitor breeding grassland birds.

- Monitor prairie dog density.

- Annually map occupied prairie dog areas and burrowing owl nest sites.

- Develop suitable IPM techniques to control noxious weeds.

- Reintroduce and maintain a suitable population of black-footed ferrets on the refuge.

[1] The Climate Leadership in Refuges (CLIR) Tool can be found at: https://fishnet.fws.doi.net/regions/9/bmo/Sustainability/SitePages/InsideFWS/clirPopulatedList.aspx?mobile=0

### Rationale

Due to extensive soil disturbance and contamination from past activities, native prairie on the refuge was limited at the time of refuge establishment. Remnant native areas are often dominated by sand dropseed and western wheatgrass on more finely-textured soils and needle-and-thread grass, often in association with rubber rabbitbrush and yucca, on hills and ridge tops. There also are small inclusions of cobble soil that support a unique combination of native species, including Fendler's three-awn and yellow violet. In addition, sand sagebrush occurs as a remnant shrub community in areas of loamy sand soils. Unfortunately, many of these native grasslands are being degraded by invasive and noxious weeds (appendix H) and will require active management.

The extent of disturbed prairie at the time of refuge establishment was extensive and the weedy forbs and grasses vegetation type occurred on approximately 10,739 acres (65 percent) of the refuge (FWS 1996a). Morrison-Knudsen (1989) estimated the distribution of specific sub-types of this vegetation on refuge lands as follows: 16 percent weedy forbs, 20 percent cheatgrass and weedy forbs, 10 percent cheatgrass and perennial grass, and 19 percent crested wheatgrass. The majority of this area has been or is targeted for restoration to native prairie. To improve restoration success, the Service, in consultation with ecologists from Colorado State University and URS Corporation, developed seed mixes of grasses and forbs that are specific to soil types on the refuge (figure 14). In general, these mixes conform to plants characteristic of the shortgrass and mixed-grass prairie associations. When restoration is complete, native prairie will compose approximately 12,680 acres (79 percent) of refuge lands.

Restoration and management of native prairie is a primary goal of the refuge in the coming years. Although much restoration work has already been accomplished, there are still many acres yet to be seeded, and recently restored prairie will require active management to maintain vegetation composition and structure suitable for wildlife resources of concern. Given that much work remains to be accomplished, restoration and management activities must be prioritized to efficiently and effectively achieve the long-term goals of the refuge.

One of the most critical factors affecting the success of native prairie restoration efforts on refuge lands is the ability to simultaneously create a suitable seedbed for native species while controlling the extensive weed seedbank, particularly prior to seeding and during the establishment phase. General guidelines for accomplishing these tasks have been developed based on published information and modified as the refuge staff gains site-specific experience in the implementation of techniques. However, given the diversity of noxious species in the seedbank, a multi-faceted IPM approach to weed control offers the greatest versatility in combating weed problems.

Based on past results at the refuge, restoration of sites dominated by weeds to native prairie that meet the criteria specified in the HRP requires 5–7 years. During the first few years, management is intensive and strategies are designed to promote germination and survival of native species. Following this period, additional management is required to ensure that native species composition is maintained and structural conditions (for example, height and density) necessary to support resources of concern are available.

## *Remnant Prairie Objective*

For the life of the plan, prevent further degradation of all remnant prairie parcels and by 2030, restore 75 percent of remnant prairies that degraded since 1992 such that these sites can meet restoration success criteria.

### Strategies

- Use the HMP (FWS 2013a) to identify locations of remnant prairie sites.
- Visit and inventory all sites.
- Evaluate the level of degradation factors at each site using GIS, site history information, etc.
- Evaluate the causes of degradation at each site using site history information, expert review, etc.
- List and map sites that mostly need maintenance.
- List and map sites that require some restoration.
- Prioritize projects based on the (1) highest need for halting further degradation, (2) probability of success, (3) estimated cost, (4) uniqueness, and (5) rarity.
- Evaluate whether any of the sites could be managed by other entities such as a volunteer, school, or partner group.
- Establish the definition of success.
- Determine the methods to evaluate success.

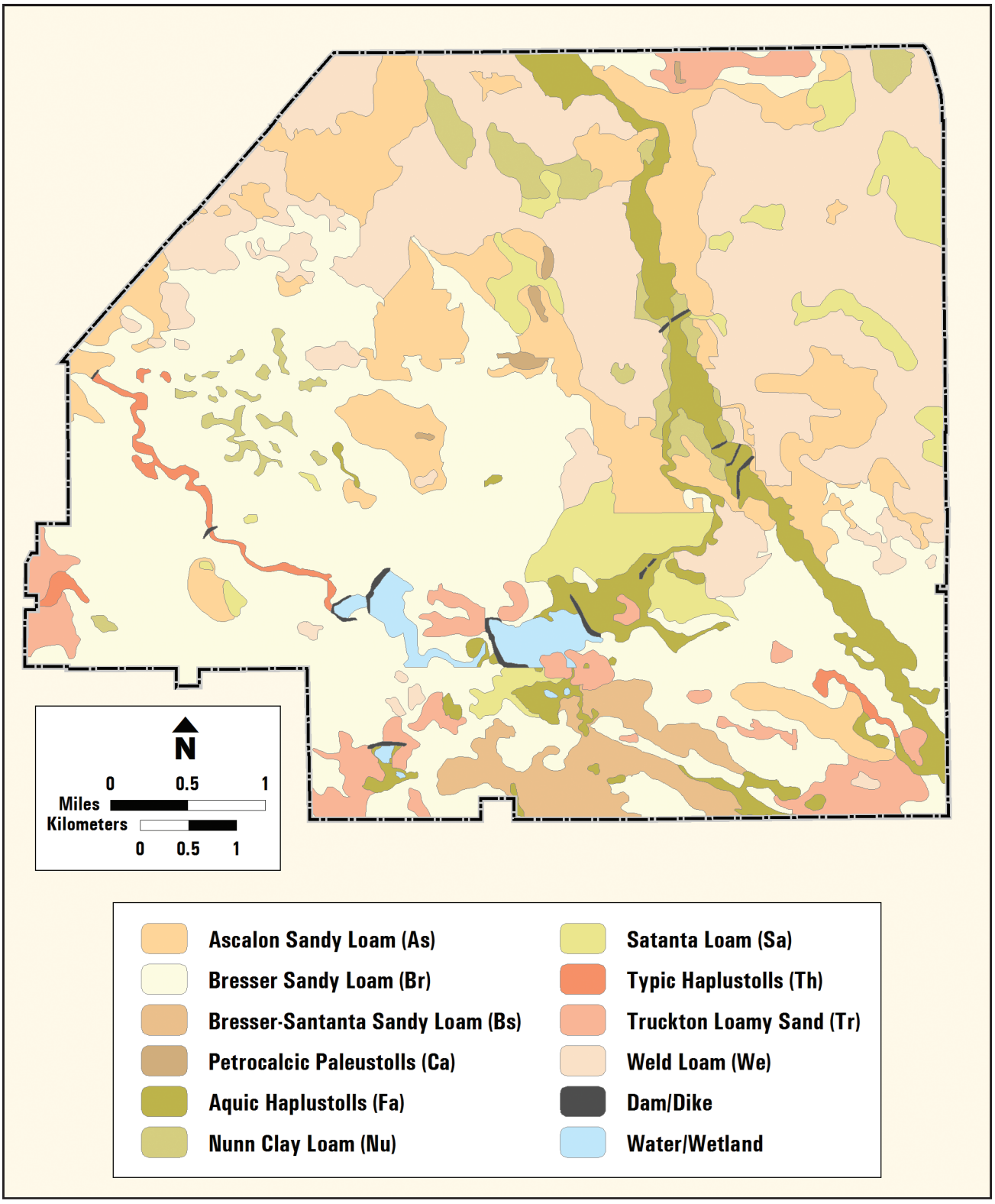


**Figure 14. Soil classes in Rocky Mountain Arsenal National Wildlife Refuge, Colorado.**

- Develop a plan for all of these sites combined. Include all potential tools for removing stressors, such as:
  - remove prairie dogs if they will significantly destroy the site,
  - protect from or manage disturbance from other grazers such as bison, if needed,
  - protect from prescribed burning unless specifically needed for the site, and
  - employee weed control carefully, using the following where appropriate: mowing, hand pulling, prescribed burning, applying appropriate chemicals and/or applying biocontrol agents.
- Evaluate whether any of the weed control methods (for example, hand pulling) could be conducted by other entities.
- Determine whether seed collection and seeding are appropriate for each site.
- For those sites that require seeding, determine the best methods to seed while causing the least disturbance.
- Evaluate whether seed collection and/or seeding could be conducted by outside entities.
- Develop and conduct a monitoring protocol for determining success and trends in each site.
- Repeat the appropriate steps above when needed.

### Rationale

Native prairie was significantly reduced prior to establishment of the refuge (FWS 2013a). Most destruction of prairie was due to extensive soil disturbance caused by farming before the U.S. Army acquired the property (FWS 1996a). However, isolated pockets of native habitat were further degraded during the manufacturing of chemicals, environmental remediation, and even habitat restoration. In addition to direct soil disturbance by the above activities, weed infestations and highly dense populations of prairie dogs continue to degrade these sites.

The Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 requires us to "conserve and enhance populations of fish, wildlife, and plants within the refuge… " and "conserve and enhance the land and water of the refuge in a manner that will conserve and enhance the natural diversity of fish, wildlife, plants, and their habitats." Preserving what native prairie is left and restoring what has been destroyed since 1992 meets the requirements of the act. Fortunately, most of these sites should be reparable by 2030 such that they function on their own, as long as major stressors are managed. Preservation and restoration would preserve their unique characteristics and rarity (FWS 1996a) and allow future biologists and visitors alike to take a look into the past to better understand these sites' potential composition and functionality.

Cindy Souders / USFWS

*Toad*

As discussed above under Climate Change Objective 1, resilience is defined by the capacity of a system to absorb disturbance, undergo change, and still retain essentially the same function, structure, and feedbacks—the same identity (Walker and Salt 2012). The structure and function of the world's grasslands make them one of the most vulnerable to global climate change of any terrestrial ecosystem (IPCC 2001, Sala et al. 2000). The condition of vegetation and soils will prove critical to grassland resilience to climate change. Healthy, vigorous stands of native vegetation are likely to be more resilient to climate change. However, uncertainty will exist about which grassland types may be most impacted by climate change (Gelbard 2003). The importance of the refuge as a large, relatively intact grassland ecosystem cannot be understated as a landscape-level adaptation measure to climate change.

The Service's climate change strategy establishes the basic framework for working with others to help ensure the sustainability of fish, wildlife, plants, and habitats in the face of accelerating climate change. We use three key strategies: adaptation, mitigation, and engagement (FWS 2010a).

Relic grasslands found on the refuge are important, because these sites act as models for restoration and can be used for comparison of human and climate change effects on the environment. Relic vegetative

communities on the refuge are isolated and surrounded by altered habitats, making them most vulnerable to climatic shifts (Halpin 1997). The negative effects of habitat fragmentation on wildlife are well known, but the percentage of native plant species also increases with distance from roads (Gelbard and Harrison 2003). A loss of plant diversity may occur from climate change due to an absence of suitable intermediate habitats between populations that are adapted to specific environmental conditions and the land that will have those conditions under future climate regimes (Loss et al. 2012). "Buffer areas" around the refuge and increased habitat connectivity to the refuge protect paths for colonization by new species, and ecotypes of existing species, that are adapted to future climatic conditions. Lastly, the long-term health of refuge grasslands depends on management of the various ecological processes such as herbivory and fire (Fuhlendorf et al. 2009, Ricketts et al. 1999) and eradication or control of invasive species (Mack 1989).

## Prairie Dog Management Zone Objective

By 2028, restore 1,500 acres of designated prairie dog management zones to a vegetative community tolerant of their disturbance activities consisting of 40–60 percent cover of native grasses, 20–30 percent cover of forbs, and less than 20 percent cover of bare ground to provide habitat for wildlife species associated with this habitat.

### Strategies

- Develop and implement a rating system to evaluate current vegetation conditions within designated prairie dog zones that will determine the length of preparation time needed prior to permanent native seeding.
- Use weed control methods prior to seeding to remove nonnative vegetation that will compete with newly emerging seedlings.
- Develop seed mixes consisting of plant species preferred by prairie dogs and species tolerant to clipping, grazing, and drought once established.
- Establish cover crops prior to permanent native seeding in sites where irrigation is not used.
- Irrigate select restoration sites to significantly increase the restoration success rate while decreasing the time to establish a self-maintaining (that is, tolerant to clipping, grazing, and drought) native vegetation stand.
- Manage prairie dog population density in restoration sites using appropriate methods discussed in the "Black-Tailed Prairie Dog Management Plan" during the native vegetation establishment period (3–5 years) to prevent clipping of new seedlings.
- Restrict bison grazing during the establishment period.
- Use a fabric barrier and/or cover crops to isolate restoration sites within the prairie dog zones to prevent competition from migrating prairie dogs.
- Measure restoration success using the standard vegetation monitoring protocol (see the HMP) previously established to assess progress in meeting success criteria (FWS 1999b).
- Continually assess established native vegetation condition to determine if prairie dog density is increasing to levels whereby the native vegetation cannot rebound from clipping.
- Manage prairie dog population density on successfully restored sites within the prairie dog management zones to prevent overclipping, which would lead to the loss of established native vegetation.

### Rationale

The current habitat conditions in prairie dog towns at the refuge reflect the long-term consequences that occur when ecosystem processes are significantly altered or destroyed. The majority of these areas currently occupied by prairie dogs are in poor habitat condition, containing large populations of invasive, exotic species as defined by the Federal Noxious Weed Act of 1974. Allowing these areas to remain in their current degraded condition would conflict with the statutory purposes of the refuge and the Service's Biological Integrity, Diversity, and Environmental Health policy; additionally, it would violate the mandates of the Federal Noxious Weed Act. Conversely, prairie dogs, which are considered a resource of concern, survive and may seem to thrive in these weedy areas. However, prairie dogs have been described as selective opportunists (Clippinger 1989), and the existing vegetation is not required to support the species and likely is not preferred. For

example, native species such as western wheatgrass, blue grama, and buffalograss have been reported as the most common species consumed by black-tailed prairie dogs (Clippinger 1989), yet in most colonies at the refuge these species are absent or only infrequently present.

Plant communities within designated prairie dog zones will be restored to native vegetation systematically. Species selected for seeding will include a combination of the following: (1) native grass and forb species that prairie dogs prefer to graze that provide the appropriate dietary needs, (2) native grass (for example, purple three-awn) and forb (Rocky Mountain beeplant, fetid marigold) species that may be avoided by prairie dogs (Clippinger 1989) and will help maintain suitable vegetative cover to prevent site erosion and compete with exotic species, and (3) species (for example, plains prickly pear) that will provide refugia for highly desirable species and protect them from being completely eliminated from the site. Based on these criteria, specific species to be seeded will include buffalograss, blue grama, bottlebrush squirreltail, purple three-awn, scarlet globemallow, western wheatgrass, western wallflower, Rocky Mountain beeplant, fetid marigold, fringed sage, hairy golden aster, stemless evening primrose, and blazing star, among others. Grasses, sedges, and forbs compose up to 60 percent of prairie dog diets (Clippinger 1989), and species such as western wheatgrass, blue grama, buffalograss, and sand dropseed are preferred in spring and summer. Forbs are consumed throughout the year, but consumption increases during fall with plains prickly pear and scarlet globemallow composing nearly 60 percent and 20–24 percent of the winter diet, respectively (Clippinger 1989). Refer to table E-6 on page 130 of the HMP for an adapted seed mix.

Klatt and Hein (1978) found perennial grasses composed 68.5 percent cover on an active prairie dog town in shortgrass prairie, and Clippinger (1989) suggests the optimal percentage of herbaceous cover be at least 15 percent to facilitate continuous habitation by prairie dogs. Although many studies have documented up to 60 percent bare ground at prime burrowing owl nesting sites, data on the refuge indicate the species frequently nests in prairie dog colonies with less than 20 percent bare ground. Further, the refuge staff does not think a native community consisting of more than 20 percent bare ground can be sustained due to the potential for germination of invasive species from the seed bank. Therefore, a target of 40–60 percent native grass cover, 20 percent forb cover, and a maximum of 20 percent bare ground is assumed to be reasonable for sustaining native vegetation and supporting prairie dogs and burrowing owls.

## Shrubland

Shrubland will be maintained and restored where appropriate to provide suitable nesting habitat for Cassin's sparrow as well as forage and shelter for associated small mammals and deer.



*Western kingbird*

## Shrubland Habitat Objective

By 2023 develop a baseline inventory of shrubland plant community composition and structure. By 2031 use this inventory as the basis to identify and eliminate 90 percent of invasive plant species present in shrublands, and improve other aspects of plant composition and structure as necessary to support Cassin's sparrow and associated species.

### Strategies

- Restore the habitat's natural disturbance regimes.
- Conduct baseline inventory to determine current species composition and structure.
- Monitor long-term vegetation composition and structure following compliance with HRP requirements for establishment.
- Monitor treatment effects of fire and herbicides on vegetation composition and structure.

### Rationale

Shrublands are defined as areas greater than 5 acres that support at least 25 percent live cover of shrubs (Chuck Loesch; personal communication; 2004). Primary species include rubber rabbitbrush, four-wing saltbush, and sand sagebrush. Yucca, although classified as a sub-shrub, was considered part of the shrubland habitat type at the refuge. Winterfat, another sub-shrub, is also found on the refuge, but it only occurs in small areas of Sections 19 and 35 (Rattlesnake Hill).

The current composition and structure of shrublands is uncertain, and an inventory is necessary prior to implementing management actions. The Service will initiate a baseline inventory by reviewing existing vegetation maps. Shrub areas will be ground-truthed. Shrubland boundaries and acreages will be determined using geospatial technologies.

Seeded areas that are possibly shrublands will be evaluated by estimating shrub density with the following method. Ten locations for 50-meter transects will be selected randomly in shrub areas. Shrubs will then be counted in the 1-meter area on each side of the 50-meter transects, yielding a shrub density sample of the number of shrubs per 100 square meters. After 10 samples, an average number of shrubs per 100 square meters will be calculated, and a sample adequacy calculation will be made. If an adequate number of samples (90 percent confidence level) has not been acquired, the process will be repeated with five more random shrub density samples. A maximum number of 20 samples will be taken to estimate shrub density in the area. A density of one or more shrubs per 45 square feet (on a per-acre basis) will determine if the area is defined as a shrubland.

In addition, seeded areas that are possibly shrublands will be evaluated using the same methods as grassland monitoring. Baseline data will be collected the year prior to revegetation work to establish a baseline and during the growing season of the third, fifth, and every fifth year thereafter until the site achieves the HRP criteria. These data will be used to assess the composition, density, and diversity of seeded sites over time to determine range trend and condition.

Initially, success of restoration efforts will be based on meeting mitigation requirements established in the HRP (FWS 1999b). These requirements primarily are based on plant composition and the amount of live and bare ground cover. Although important, these attributes do not consider all composition and structural components (for example, grass and forb cover, plant height, patch size) that the scientific literature suggests are necessary to support grassland birds identified as resources of concern in the HMP.

During the breeding season, Cassin's sparrow—one of our surrogate species—inhabits shortgrass prairie with scattered shrubs (including sand sagebrush, yucca, and rabbitbrush) that are used for song perches and nest cover. During the breeding season, sparrows will accept shrub densities as long as grass cover exists (Beidleman 2000). They avoid pure grassland and pure shrubland habitats (Sauer et al. 2003). Greatest densities in Bird Conservation Region 18 were in areas with more than 10 percent shrub cover (n=665) and 41–50 percent grass cover that was more than 5.9 in height (n=228) (Sparks et al. 2005). In eastern Colorado, the species occurred in Breeding Bird Atlas blocks that were comprised of shortgrass prairie (50 percent) and sand sage shrublands (25 percent) (Melcher 1998). Nests are built on the ground at the base of a shrub, yucca, cactus, or clump of grass, or less than 1 foot above the ground in a shrub or cactus (Bent 1968). Conservation Reserve Program fields in Texas had an average density of 0.7 nest per acre. Field types varied, but all were dominated by blue grama (Berthelsen and Smith 1995). Preliminary estimates of breeding density from a study in Sueco, Mexico and Tinaja Verde, Mexico were 0.16 pair per acre and 0.14 pair per acre, respectively (Ruth 2000).

In Colorado, Cassin's sparrows are found in sandy rabbitbrush grasslands in Logan County and along the South Platte River. Common grasses in this area include purple three-awn and needlegrass (Faanes 1979 from Dunning Jr. et al. 1999). Andrews and Righter (1992), Rising (1996), and Ruth (2000) state

Cassin's sparrows in Colorado are found primarily in rabbitbrush and sand sage grasslands. At the refuge, Cassin's sparrows were most abundant in plots dominated by yucca (Preston 1994).

# Wetlands

We will continue to manage wetlands to promote native emergent species, provide opportunistic benefits to wetland-dependent wildlife, and maintain spawning grounds for forage fish. We will treat cattails when 80 percent or more of shorelines are covered with them within 30 feet of the shoreline.

## *Wetland Habitat Objective*

Throughout the life of this plan, manage wetland plant communities to promote native emergent species and provide opportunistic benefits to wetland-dependent wildlife.

### Strategies

- Eliminate exotic species and control expansion of robust emergent species.
- Treat cattails when 80 percent or more of shorelines are covered within 30 feet of shoreline.
- Do not manage water levels in wetlands; wildlife use of wetlands will depend on unmanaged timing and duration of flooding.

### Rationale

The majority of the 119 wetland acres on the refuge was created with only Wetlands 2 and 4 being enhanced on natural basins. Wetlands were constructed for various purposes such as stormwater retention, wildlife, and public viewing or as a result of topographic alteration that occurred from cleanup activities (figure 15).

Primary wetland habitats include Bald Eagle Shallow in Section 5; Wetlands 3, 4, 5 and Parkfield Ponds in Section 7; Wetland 1 in Section 8; Rod and Gun Club in Section 12; Lorri's Ponds in Section 26; and Mackey Pond in Section 35. Although most wetland construction was done in natural wetland basins, Wetland 5 in Section 7 was an inter-dune basin constructed in sandy soils and does not hold water very long. In addition, although water sources for wetlands were included in the original design plans, changes in management and infrastructure over time have significantly reduced or eliminated the ability to manage hydroperiods in many wetlands. For example, the wetlands in Sections 7 and 8 no longer can be flooded due to the decommissioning of the Highline Canal.

Plant community composition is varied, but dominant species in many wetlands include cattail, cottonwood saplings, and noxious weeds.

## *Lacustrine Habitat Objective*

By 2022 achieve and maintain a water quality standard in all lakes (pH = 6.5–9.03, maximum water temperature of 86 °F, and minimum dissolved oxygen concentration of 3.0 milligrams per liter [mg/L]) (CDPHE 2012) and provide a quality sport fishery (see HMP for specific quality metrics).

### Strategies

- Stock forage fish when necessary to maintain a quality sport fishery on refuge lakes by annually monitoring fish populations and conducting annual water quality monitoring.
- Conduct cattail control as needed and to the extent practicable, based on available resources.

### Rationale

Lacustrine habitat consists of five artificially created lakes and ponds: Lower Derby Lake (73 surface acres), Upper Derby Lake (0 surface acres), Lake Ladora (48 surface acres), Lake Mary (9 surface acres), and Havana Ponds (39 surface acres). Derby Lake and Lake Ladora were constructed between 1910 and 1919 for cropland irrigation and domestic water purposes. The U.S. Army constructed Lake Mary and installed a dam to subdivide Derby Lake into Upper and Lower Derby Lakes. At that time, the primary use of water was industrial, although the stocking of fish was initiated in 1960 as a recreational fishery for employees. Upper Derby Lake has not functioned as a lake for many years and only receives water following major storm events; accordingly, a plan has been developed to breach the dam. Havana Ponds was constructed in 1979 to assist with urban flood control and drainage after the extension of Stapleton airport runways.

With the exception of Upper Derby Lake, water sources for these lacustrine habitats are varied and include precipitation, flows from drainage interceptors (Uvalda, Peoria, Havana, and Joliet) that channel storm water discharge, natural groundwater discharge, and pumped water from wells. Surface water also can be transferred between some lakes by gravity flow.

Water and bottom substrates of lakes were regularly monitored as part of cleanup activities, and all

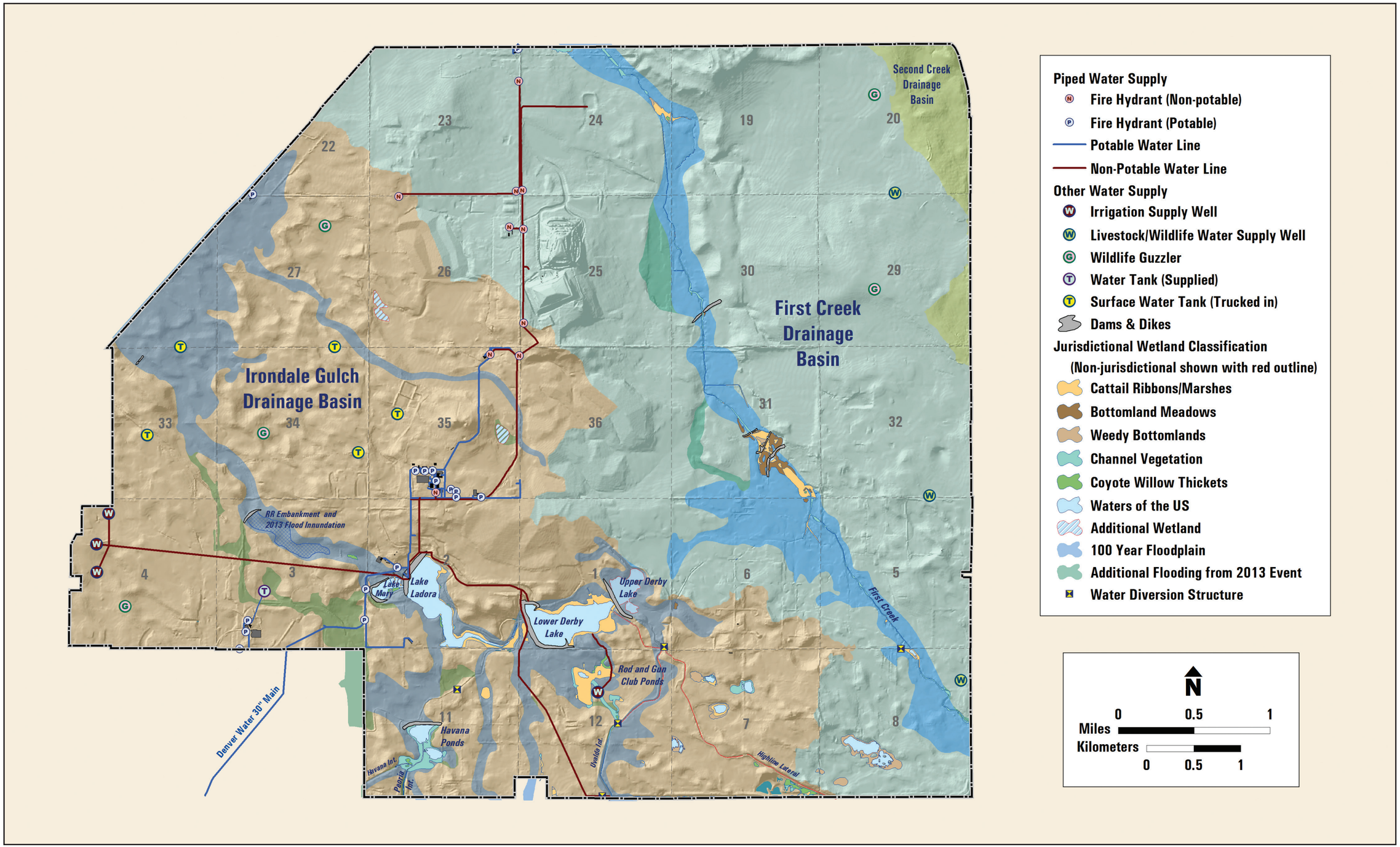


**Figure 15. Surface hydrology and water infrastructure on Rocky Mountain Arsenal National Wildlife Refuge, Colorado.**

contaminants were below State of Colorado and EPA thresholds for human health and the environment. However, suspended sediment in Lake Mary has recently increased due to erosion of constructed peninsulas and islands, and Havana Ponds receives inputs of sediment from stormwater received from the Joliet and Havana Interceptors.

In 2012, the Havana Ponds dam was reconstructed. Recently, a master planning effort began for the Urban Drainage District that would include construction of a new retention pond immediately upstream of where the Uvalda and Joliet interceptors merge. This pond would limit inputs of sediments and debris into Havana Ponds, but it likely would not reduce inputs of dissolved solids (Tom Jackson; personal communication; 2011).

The plant communities of lakes vary depending on the timing and extent of water level fluctuations. The Upper Derby basin, which only receives water periodically, is dominated by noxious weeds. The remaining lakes support emergent vegetation, primarily cattail, in shallow water along shorelines and various rooted and floating-leaved aquatic species in deeper portions of the basins that never dry. The lakes serve multiple purposes, including providing irrigation water (Lower Derby Lake) for restoration of native prairie, public fishing opportunities, and habitat for wetland-dependent wildlife.

Related to the final cleanup of the refuge, Section 9.1 of the Record of Decision for the On-Post Operable Unit (Foster Wheeler Environmental Corporation 1996) states that "water levels in Lake Ladora, Lake Mary, and Lower Derby Lake will be maintained to support aquatic ecosystems." To further assist with defining this requirement, the U.S. Army, Shell Chemical Company, EPA, and CDPHE agreed to the following (FWS et al. 2006):

- Sufficient quantity and quality of water in Lake Ladora and Lake Mary will be maintained to support a warm-water recreational fishery. The lakes will be managed to provide an ecosystem that sustains populations of green sunfish, bluegill sunfish, largemouth bass, and other native or desirable naturalized game and forage fish species, as determined by the Service.

- Sufficient water quality and quantity in Lower Derby Lake will be maintained to support a minimum of 50,000 use-days by migratory waterfowl during October–April, annually. While the primary ecological function of Lower Derby Lake, for the duration of the surface remedy, is to provide waterfowl habitat, the Service may also conduct fishery management activities.

Maintenance of the following minimum lake levels will ensure that adequate water quantity is available to support the desired aquatic ecosystem. Lower Derby Lake (full pool = 454 acre feet) may be reduced 85 percent to approximately 68 acre feet. The minimum elevation of the pool is 5,237 feet above mean sea level. Lake Ladora (full pool = 415 acre feet) may be reduced 27 percent to approximately 300 acre feet. The minimum elevation of the pool is 5,217 feet above mean sea level. Lake Mary (full pool 66 acre feet) may be reduced 10 percent to approximately 60 acre feet. The minimum elevation of the pool is 5,202.5 feet above mean sea level.

Lake Ladora, Lake Mary, and Lower Derby Lake are monitored annually to track population trends, fish health, and management actions. Based on the data collected—including calculated proportional stock density, fish health, and fish weight—fish are stocked in the lakes with the goal of providing ample forage fish, a balanced fish population, and a quality sportfishing experience. Annual monitoring occurs in June after all fish have completed their spawning activities and have returned to their normal habitat and niches within the lake. Regular locations have been established in each lake for various sampling gears so trends can be monitored. Gill nets, Fyke nets, and minnow traps are used at these set locations over a 2–4 day sampling period. Electrofishing activities occur over 2–3 nights at regular established transects in each lake. Fish are then stocked based on the collected data in mid- to late summer. Assistance for this monitoring comes from the Service's Fish and Wildlife Conservation Office for net and trap surveys and CPW for electrofishing surveys to track population trends and management actions needed.

Most of the time, lake water quality is within the Colorado guidelines for Class 1 and Class 2 parameters for warm-water biota. A range of conditions can cause short-term deviations outside the standards; these include temperature, vegetation growth, lake water levels, drought conditions, and water supply. These short-term deviations do not have long-lasting effects on the fishery and can be tolerated by the fishery, but they need to be monitored as to not become a chronic issue that can have devastating effects. Water quality sampling can be performed while net sampling, using a Secchi disk and a portable probe to measure dissolved oxygen, pH, and temperature. Water temperature, dissolved oxygen, pH, and Secchi depths will be measured in June at set locations in each lake. Additional periodic sampling every 3–5 years of invertebrate taxa presence, lake nutrients in the water column (phosphorus and nitrogen) and chlorine can give a good indication of water quality based on the presence or lack of presence of sensitive invertebrate taxa and algae. This is highly recommended but not a requirement.

# Riparian Areas

We will continue to work to sustain and inventory riparian corridors and to refrain from managing the refuge hydrology so as to maintain surface flows unaltered. We will inventory this habitat.

## *Riparian Habitat Objective 1*

By 2027, provide a gallery of forest at least 1 mile in length that has a canopy closure of 20–50 percent and is dominated (more than 75 percent) by cottonwoods a minimum of 60 feet in height to provide habitat for bald eagles.

## *Riparian Habitat Objective 2*

Throughout the life of the CCP, maintain a mosaic of wetland and riparian habitat within the grassland matrix of the refuge to provide foraging habitat for bat populations, and research relationships between vegetation type and height, insect production, and echolocation activity. By 2030 use the findings of this research to define a measurable habitat objective for bats.

### Strategies

- Conduct a baseline inventory of the condition of cottonwoods.
- Implement cottonwood planting along First Creek and thereafter in areas based upon condition.
- Minimize unnatural erosion occurring along First Creek.

### Rationale

Plant communities in riparian zones include both herbaceous and woody species. Currently, the herbaceous community is dominated primarily by noxious grass and forb species, including Canada thistle, white top, and smooth brome. Reed canarygrass is also found along the lower portions of First Creek, forming pure stands in some areas. Woody species are dominated by plains cottonwood, peach leaf willow, and coyote willow. The age of most cottonwood stands varies from 35 years (Section 12) to more than 70 years (First Creek, Upper Derby Lake) and most likely established following significant flood events in 1973, 1965, and 1933 that created bare, moist substrates. The future of riparian communities is uncertain at this time. Cottonwood is considered "old growth" at 80 years of age (Kindscher and Holah 1998); some existing stands on the refuge likely will degrade during the life of this CCP. In addition, cottonwoods along the Highline Canal may be in jeopardy because the canal has been decommissioned and water no longer flows to Upper or Lower Derby Lakes. Mortality may occur if the water table drops during a severe, prolonged drought because survival depends on proximity to the water table (Jonathan Friedman, USGS; personal communication; 2002; Joseph Capesius, USGS; personal communication; 2003). Some cottonwood regeneration is occurring, particularly along the margins of seasonal wetlands in Sections 5, 7, and 8, but survival is limited to small areas. Regeneration also may be more likely along First Creek because base flow is expected to substantially increase in future years (Tom Jackson, FWS; personal communication; 2007). However, the extent of natural regeneration likely will not replace current stands during the next 50 years.

The current cottonwood galleries adjacent to First Creek likely established following the 1933 flood event and are more than 75 years old. These trees, which currently are used by nesting and roosting bald eagles, will likely begin to die within 20–25 years, and new cottonwoods are not surviving to replace these trees. This is likely due to a combination of factors, including (1) channelization of the creek in the 1940s and 1950s that produced steep cutbanks and (2) construction of upstream stormwater retention basins to minimize large water inflows. Collectively, these alterations have eliminated flood events that are necessary to create the bare mineral substrate necessary for germination of cottonwood seedlings. Although urbanization surrounding the refuge is expected to increase flows in First Creek, most of the increased runoff created during significant rain events will be trapped and caught upstream. Consequently, the increased flow will probably result only in a temporary rise of the groundwater table near streams like First Creek for short periods (Joseph Capesius, USGS; personal communication; 2003) rather than the larger peak stream flows or "pulses" necessary to create the scouring conditions at the proper time for natural cottonwood regeneration. Therefore, maintaining a suitable mile-long gallery of old-growth cottonwood forest to perpetuate bald eagle nesting along First Creek will require systematic planting of replacement cottonwoods. Under favorable conditions, young plains cottonwood trees can grow 6–12 feet in height per year (Burns and Honkala 1990) and it is possible that trees would attain a height and girth necessary for use by nesting and roosting bald eagles in 20–25 years.

In a systematic survey of the refuge, at least five species of bats were observed on the refuge, though 86 percent of captures were big brown bats (Everette et al. 2001); these trapping results are consistent with a repeat survey in 2004 which found that, of 291 captures, 242 were big brown bats, and 196 of these were

adult females (N. Ronan unpublished data). This, plus the atypically high commuting distance that radio tagged bats flew from day roosts in the Denver metropolitan Area to the refuge to feed, suggests that the refuge is a regionally significant foraging resource for lactating females of that species. Interestingly, because of its history, the refuge also hosts big brown bats with organochloride pesticide and other contaminant loads up to an order of magnitude higher than non-contaminated sampling sites (O'Shea et al. 2001), though later sampling shows an apparent decline in these contaminant loads (N. Ronan unpublished data). The fitness consequences of these contaminants, and their relative levels following ongoing remediation, are unknown.

Research at the refuge found that the presence of water and tree edge features were significantly associated with echolocation activity, with activity more than five times higher along edges than in open prairie. The same study found a disproportionately high ratio of adult female and juvenile big brown and hoary bats, suggesting the importance of the refuge to recruitment in local bat populations (Everette et al. 2001). Unfortunately, data on the vegetation type area and arrangement necessary to support lactating females and young of the year are not extant; data would need to be gathered specifically at the refuge because of the vastly different caloric expenditures of these high-distance nightly foragers relative to more typical colonies that fly 1–2 kilometers per night from day roosts to foraging sites.

## Woodland–Savannah

### *Woodland–Savannah Habitat Objective*

By 2031 restore native species composition and maintain the current spatial distribution (figure 16) and structure of savannah to provide nesting sites and foraging areas for Swainson's hawks and migratory habitat for other neotropical migratory species.

#### Strategies

- Remap units by habitat goals, monitoring, and management; match to existing objectives using habitat types found in the HMP.
- Remove Russian olives and dead and downed debris.
- Investigate strategies to minimize damage from future locust borer outbreaks in New Mexico locust thickets.
- Prevent over-browsing of native shrubs (for example, *Prunus* spp.) by deer.
- Establish additional plum and chokecherry thickets in suitable locations.
- Annually monitor Swainson's hawk nest trees and ensure adequate nesting sites are available.

#### Rationale

Located in the Environmental Education Zone, primarily in Sections 11 and 12, the savannah habitat type on the refuge is the result of past land-use activities that involved conversion of native prairie to agriculture and the planting of trees around homesteads by settlers. Following transfer of land ownership to the U.S. Army, additional trees were planted around new infrastructure and agricultural lands were abandoned and allowed to revegetate naturally. During this time, additional trees became established as scattered individuals or as small groups of trees in abandoned agricultural fields. Following acquisition by the Service, grasslands have been—or will be—restored to native prairie by seeding appropriate species based on soil type, but in general trees were not removed. The term "woodland" is used to characterize interspersion of planted trees and shrub thickets with patches of grassland. The woody component of this habitat type can be classified based on the following species associations: New Mexico locust thickets, American plum and chokecherry thickets, homestead site trees and planted groves, and Russian olive.

Russian olive is to be eradicated, contained, or suppressed. Replacement of Russian olive with native trees such as cottonwoods helps suppress reestablishment. In addition, mortality and branch loss from cottonwoods, Siberian elms, and white poplars due to strong winds, heavy snow, and disease results in the accumulation of fuels that, if ignited, may generate sufficient heat to kill living trees. Removal of this decadent woody vegetation will help protect habitat for Swainson's hawk, bald eagle, and neotropical migrants by reducing the probability of a catastrophic fire.

# 4.4 Wildlife Management

***Goal: Balance and preserve wildlife species of concern through active management.***

The principal purpose of a national wildlife refuge is to conserve fish and wildlife and their habitats. We

are entrusted by the American people with conserving and protecting these resources; this commitment involves prioritizing certain trust resources on our refuges. Trust resources—wildlife and habitat for the conservation of which the Service has statutory responsibility—typically refers to federally listed as threatened or endangered species, migratory birds, certain marine mammals and fish, and wetlands. The Service issued draft policy (FWS 2013l) focusing our attention on the following conservation priorities:

- recovery of threatened and endangered species
- implementing the North American Waterfowl Management Plan
- conserving migratory birds of conservation concern

As detailed in the refuge HMP (FWS 2013a), restoration and maintenance of habitat are central to accomplishing our mission. The presence and health of wildlife populations are key indicators in measuring the success of these efforts.

To fulfill our purpose and focus on conservation priorities, we will maintain healthy wildlife communities in harmony with the refuge's historic cultural landscape—which includes New Mexico locust thickets, old farmstead windbreaks, and other planted trees—as well as with cottonwood galleries, created wetlands and lakes, and restored grasslands.

We will restore habitat for species of concern (such as grassland-dependent birds, burrowing owls, bald eagles, neotropical migratory birds, bats, and black-footed ferrets) and resident species using tools such as prescribed fire. We will continue to provide nesting sites for burrowing owls along with long-term, quality nesting and roosting habitat for bald eagles. The habitat the refuge provides in the Environmental Education Zone for neotropical migratory bird species is very important, as neotropical migratory birds continue to lose suitable stop-over areas to urbanization throughout the Denver metropolitan area. We are implementing the recommendations found in the HMP addendum to restore and maintain mosaic of wetland and riparian habitats to provide foraging habitat in support of big brown bat populations. We used to install and maintain artificial bat roosts, also known as bat boxes, but we have discontinued them over the past few years.

## Grassland Birds

The Audubon Society recently announced that of the 588 North American bird species studied, more than half (314 species) are considered "climate endangered or climate threatened" due to loss of habitat (Nijhuis 2014). Similarly, the State of Birds report on climate change (U.S. North American Bird Conservation Initiative 2010) asserts that climate change is expected to exacerbate declines in birds that already

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*We will restore habitat for species of concern (such as grassland-dependent birds, burrowing owls, bald eagles, neotropical migratory birds, bats, and black-footed ferrets) and resident species using tools such as prescribed fire.*

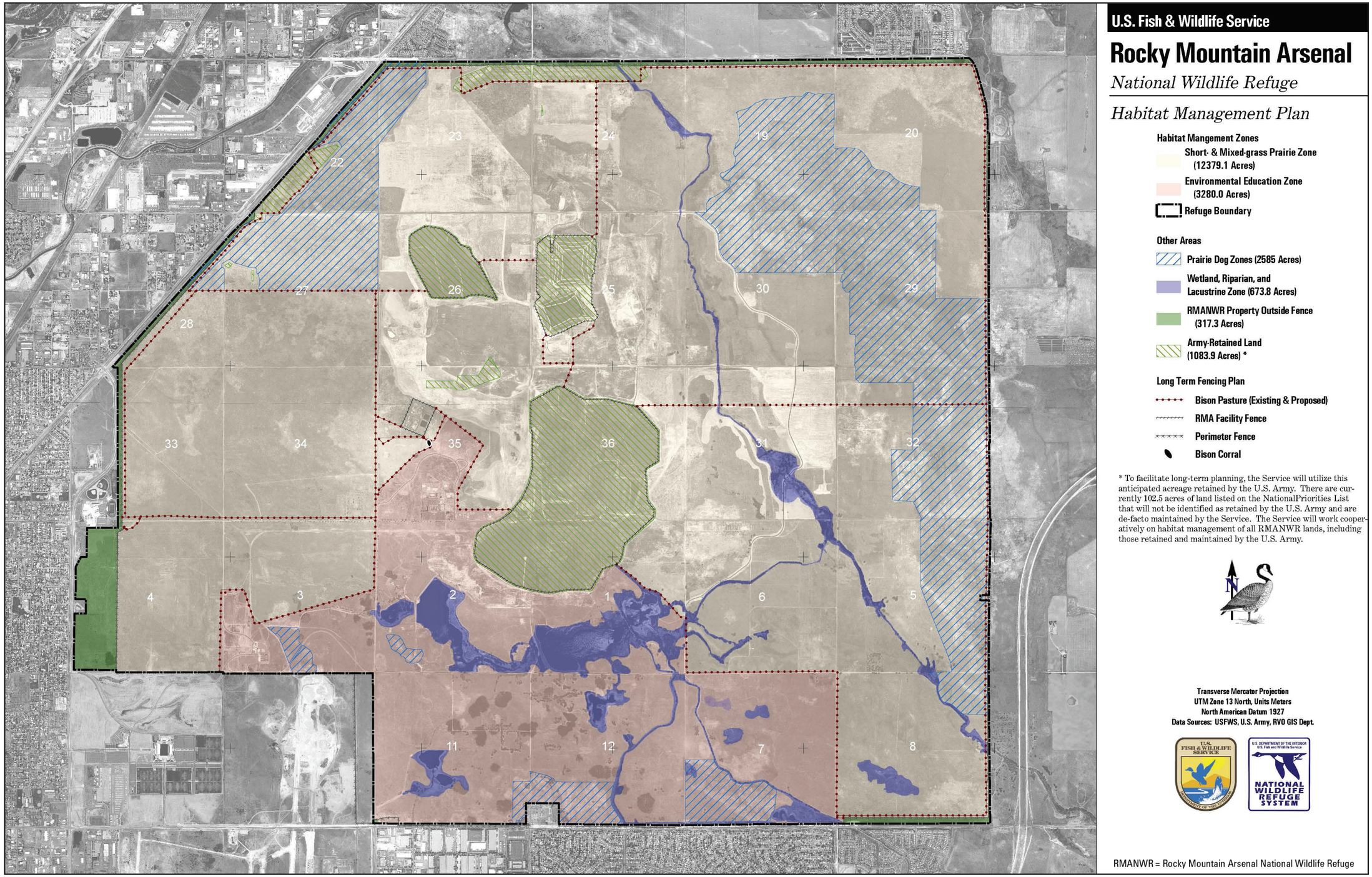


**Figure 16. Location of habitat management zones in Rocky Mountain Arsenal National Wildlife Refuge, Colorado (FWS 2013a).**

suffer declining populations. The lark bunting and Cassin's sparrow are representative of other grassland birds using the refuge and are identified in this report with a medium score for climate vulnerability. Even subtle climate changes are causing northward distributional shifts in both species, and Cassin's sparrow is moving northward at more than half a degree of latitude per decade (about 5 kilometers per year) (Peterson and Baltosser 2003).

Juvenile survival can also have dramatic effects on population dynamics (Robinson et al. 2004). Severe drought has been shown to have multiple impacts on grassland birds (George et al. 1992). Drought reduces post-fledgling survival of lark buntings in northeast Colorado through starvation and increased predation (Yackel Adams et al. 2006). The refuge's habitat restoration program is still in its early stages, but implementation of vegetative monitoring specified in our HMP (FWS 2013a) as well as new monitoring programs designed for our focal bird species may help illuminate climate change effects on the refuge.

## Grassland Bird Objective

Over the life of the plan, ensure that the running 10-year average occupancy of seven commonly encountered grassland bird species (burrowing owl, horned lark, Cassin's sparrow, vesper sparrow, lark bunting, grasshopper sparrow, and western meadowlark) is greater than or equal to baseline values from the refuge Breeding Bird Survey (BBS) conducted from 1994 to 2015. These seven species represent three grassland bird guilds defined as follows: (1) a bare ground to short vegetation structure guild characterized by heavy grazing (burrowing owl and horned lark); (2) a short to tall vegetation structure guild characterized by light to moderate grazing (lark bunting, grasshopper sparrow, and western meadowlark); and (3) a short to tall vegetation structure with shrub component guild characterized by light to moderate grazing (Cassin's sparrow, vesper sparrow).

### Strategies

- Continue the annual BBS survey in early June to determine occupancy and relative abundance of breeding bird species on the refuge. Analyze BBS data and complete grassland bird reports every 2–3 years.

- Expand knowledge of refuge use by grassland birds, including as a breeding area and migration stopover. Explore options for surveying grassland birds during spring and fall migration.

- Incorporate data on occupancy and relative abundance of grassland birds in the annual habitat management decisionmaking process.

- Evaluate the reliability of the seven selected grassland bird species to represent the larger grassland bird community and overall "grassland health."

### Rationale

The Service's draft technical guidance (FWS 2014f) of selecting species for landscape-scale conservation begins with establishing the goal for using surrogate species (see the following section, "Surrogate Species"). While our original goal was to select one or two bird species to act as surrogates for the larger grassland bird community, our analysis of BBS data from 1994 to 2015 revealed that there were very few significant positive correlations in counts or occupancy among species. Accordingly, we concluded that selecting one or two surrogate species would not adequately represent the larger grassland bird community.

While a single species can be enormously important for documenting change and informing current and future habitat management actions (Caro 2010), we must be aware of the limitations of a single-species approach acting as a proxy for other species (Landres et al. 1988). For a single species to be used, the correct species must be selected, there must be sufficient understanding of the key ecological processes of the species, and the individuals must be able to be accurately measured (Lindenmayer and Likens 2011). Periodically, it is possible to correlate the effectiveness of an indicator species to represent trends and patterns for other associated species (Favreau et al. 2006). Caro (2010) describes "ecological-disturbance indicator species" where species are used to understand how specific land-use changes affect plants and animals. We used this approach to divide our seven grassland bird species into three guilds, each representing a different state along the vegetation disturbance gradient (from most disturbed to least disturbed).

We elected to take a multi-species approach because we found little support in our existing data for any single species to be able to adequately represent the grassland bird community as a whole. Baseline data analysis from the refuge BBS can be found in "Grassland Avian Species Trends at Rocky Mountain Arsenal National Wildlife Refuge: 1994–2015" (Hetrick et al., 2016 in prep). We selected occupancy (the proportion of occupied survey stations) as the indicator in the objective instead of abundance because the BBS survey methodology yields an estimate of relative abundance rather than true abun-

dance. Specifically, the BBS survey methodology does not take imperfect detection probability in account. The presence of each species in areas of suitable habitat across the refuge was considered adequate for the purposes of defining success in a desired future state.

During the life of this plan, many habitat restoration projects will be ongoing, whereas others will reach the success criteria established for particular habitat communities. Because of the paucity of avian grassland species utilizing refuge prairies during the breeding season, exploring other long-term datasets such as spring, fall, and Christmas bird counts may explain the value of the refuge prairie to migrating and overwintering birds as well.

## Surrogate Species

*Surrogate species are defined as "species that are used to represent other species or aspects of the environment." (Caro 2010)*

Surrogate species are defined as "species that are used to represent other species or aspects of the environment." (Caro 2010). However, more than 350 wildlife species have been documented on the refuge. With such a broad suite of species, habitat conditions (such as food and cover) that provide the needs of all these species individually cannot be managed consistently and reliably (FWS 2013a). Consequently, in 2006 the Service endorsed strategic habitat conservation as its new adaptive management business model. Strategic habitat conservation recognizes that future conservation of fish and wildlife species must utilize new tools that function at broader scales, embracing landscape-level approaches. The key to this model is the designation of priority species as a guide for conservation design (National Ecological Assessment Team 2006). Selecting priority species is a valuable tool to assist in the development of conservation efforts.

The Service has further refined its strategic habitat conservation approach to focus conservation design on creating functional landscapes capable of supporting self-sustaining populations of fish and wildlife species (FWS 2012a). This approach is based on the selection of surrogate species, which Caro (2010) defined as "species that are used to represent other species or aspects of the environment." This guidance is still under development, but it shows promise for a systematic approach to landscape-level conservation design that would address the essential limiting factors of certain species. In other words, focusing on a surrogate species will help us identify and nurture habitat conditions necessary to preserve other sensitive species that would benefit from the same habitat conditions, thereby supporting biodiversity overall.

For the purposes of this CCP, we will use a limited number of species to inform our goals, objectives, and future management of the refuge. We have chosen four species as surrogates—lark bunting, Cassin's sparrow, black-tailed prairie dog, and American bison—that are consistent with our focus on threatened and endangered species, declining populations of migratory birds, and the genetic conservation of bison. We believe these four species represent the majority of our habitats (shortgrass and mixed-prairie with a shrubland component) and will serve as good indicators for the application of adaptive management. If we successfully manage for these species, their ecosystems should respond favorably as well.

While the refuge supports other important habitat types (lacustrine, riparian, wetlands, and woodlands), their roles on the refuge do not directly relate to national or regional biological goals, and so surrogate species have not been selected for these habitat types.

### Lark Bunting

The lark bunting is the selected surrogate for the mosaic of shortgrass and mixed-grass prairie. The lark bunting is associated with Swainson's hawk, western meadowlark, mountain plover, long-billed curlew, short-eared owl, horned lark, and ferruginous hawk. We plan to restore up to 4,500 acres of native shortgrass prairie, providing suitable nesting habitat for the lark bunting and associated species.

### Cassin's Sparrow

The Cassin's sparrow is the selected surrogate for mixed-grass prairie and shrubland (which includes sand sagebrush, yucca, and rabbitbrush). The Cassin's sparrow is associated with loggerhead shrike, western meadowlark, grasshopper sparrow, Swainson's hawk, short-eared owl, and vesper sparrow. We plan to restore and establish up to 8,000 acres of mixed-grass prairie, providing suitable nesting habitat for the Cassin's sparrow and associated species.

### Black-Tailed Prairie Dog

The black-tailed prairie dog is the selected surrogate for a native vegetation community that not only supports prairie dogs, but also associated species such as burrowing owl, black-footed ferret, prairie rattlesnake, American bison, and many other species

that reside on the refuge. We plan to manage a minimum of 2,585 acres (17 percent) of the refuge for prairie dogs.

## American Bison

The American bison is the selected surrogate for shortgrass prairie and will be the primary habitat maintenance tool. The bison is associated with prairie dog, burrowing owl, and ferruginous hawk. A second goal of the refuge bison herd will be to serve as a genetic reservoir to lessen the chance of inbreeding depression and reduce the risks of disease and genetic drift. As of July 2014, our herd numbered 80 animals, exceeding the carrying capacity for current pastures. An additional pasture unit was developed in 2014 and, as more infrastructure is constructed, approximately 12,165 acres will eventually be available for bison grazing.

## Surrogate Wildlife Species Objective 1

Throughout the life of this plan, manage bison populations to contribute to the Refuge System bison conservation program and in support of DOI's Bison Conservation Initiative, at or below the ecological carrying capacity for the refuge.

### Strategies

- Further refine and update (as necessary) the refuge's forage allocation methodology to inform bison carrying capacity.
- Within 5 years, integrate the refuge's forage allocation methodology and grazing systems where habitat will be grazed at an intensity that contributes to achieving the patch size, species composition, and structural conditions that will contribute to supporting grassland birds.
- Coordinate with DOI, the Intertribal Bison Cooperative, Native American tribes, and other partners to donate, transfer, or sell excess bison to maintain an appropriate herd size of overwintering bison.
- Contribute to the overall size of the Refuge System's bison metapopulation to decrease loss of diversity through genetic drift while achieving objectives for other species within the management area (see "Genetic Conservation Strategies" box in next column).
- With the assistance of the Service's Wildlife Health Office, support healthy bison populations, as measured through the wildlife health surveillance program (see "Bison Herd Health Strategies" box on the following page).
- Periodically evaluate the reliability of the refuge's bison to represent trends and patterns for associated species.

| Bison Genetic Conservation Strategies (2016) |
|---|
| Contribute to the overall size of the Refuge System bison metapopulation to decrease loss of diversity through genetic drift while achieving objectives for other species within the management area. Management as a metapopulation will further contribute to Refuge System bison genetic diversity conservation (Dratch and Gogan 2010, Gates et al. 2010, Hedrick 2009). |
| Maximize conservation of genetic diversity to the extent possible through use of scientifically supported strategies associated with population management activities. Recent studies suggest that conservation of 70 percent of gene diversity over 500 years is achievable for most herds within the Refuge System metapopulation (Giglio et al. in press). |
| Minimize cattle gene introgression as a priority secondary to diversity conservation. Such conservative methods will likely result in slow, but eventual reduction of cattle gene introgression with little or no impact on diversity conservation objectives (E. Latch; personal communication; March 2, 2015). |
| Allow as many of the forces of natural selection as possible to operate across the largest population and geographic scale, allowing evolutionary processes and adaptation to function to the extent possible (Dratch and Gogan 2010, Gates et al. 2010). |
| Manage habitat and herd distribution for a healthy bison population, as measured through the wildlife health surveillance program, allowing natural disease processes to function to the extent possible without affecting genetic diversity conservation. |
| Fecal parasite counts are evaluated relative to population density and distribution from samples collected in the field during the summer. If necessary, habitat management is implemented, such as the use of prescribed fire, to improve animal distribution. Treatment with anthelmintic (antiparasitic) drugs is only considered after habitat management options have failed and if average parasite burden become excessive, or if deaths are identified as a result of verminous pneumonia or gastrointestinal parasitism. |

### Rationale

Prior to settlement, the site of the refuge was a short and mixed-grass prairie. One of the major ecological drivers of this ecosystem was random, nomadic grazing by large herds of native ungulates

| Bison Herd Health Strategies (2016) |
|---|
| Maintain bison populations at or below ecological carrying capacity. This threshold is designed to minimize parasitism, maximize habitat condition, and encourage distribution of animals across the management area. Measures of success are based on the wildlife health assessments, as well as by habitat condition evaluations. |
| Morbidity and mortality surveillance activities include general herd health checks, including observation of at least 50 percent of each herd, performed during routine refuge management activities (five at least monthly when road conditions allow), along with conducting necropsies on all mortalities found in at least good postmortem condition. |
| Repeat health assessments for clinically ill animals, using remote temporary marking techniques to identify individuals, as appropriate. Through consultation with the Wildlife Health Office, humanely euthanize moribund animals and conduct postmortem exams of all euthanized animals and of found carcasses in suitable postmortem condition. |
| During the annual population management roundup, bison that are handled for genetic sampling or for surplus are sampled for several diseases, including bovine virus diarrhea, bovine respiratory syncytial virus, parainfluenza, infectious bovine rhinotracheitis, and Johne's disease. Sampling for these diseases is designed to detect disease that occurs in at least 7 percent of the herd with 90 percent confidence each year. Additional tests may occasionally include brucellosis, tuberculosis, *Mycoplasma bovis*, and a disease caused by *Pasteurellaceae* organisms. Tests may vary slightly each year due to changes in the disease landscape both regionally and nationally. A small number of additional adult animals may be handled for specific disease sampling, based on clinical presentation, body condition, or past disease test results. |
| Fecal parasite counts are evaluated relative to population density and distribution from samples collected in the field (three times) during the summer. If necessary, habitat management is implemented, such as the use of prescribed fire (details on prescribed fire frequency are provided in the refuge's fire management plan), to improve animal distribution. Anthelmintic (antiparasitic) treatment is only considered after habitat management options have failed and if average parasite burden become excessive (generally 200 eggs per gram or 100 larvae per gram of feces), or if mortalities are identified as a result of verminous pneumonia or gastrointestinal parasitism. |

(FWS 2013a). Grazing pressure from these large herds could most likely be categorized as short-duration–high intensity because bison are not as selective as other ungulates in their choice of forage, have a greater preference for warm-season grasses, and are able to make greater use of the total available herbage in any given area (Peden et al. 1974). Extensively grazed areas, and those areas disturbed by prairie dogs, were initially re-colonized by native forbs that were utilized by pronghorn. As native grasses replaced early successional forbs and cool-season grasses, bison were attracted back to these areas because the grasses were high in nitrogen, highly palatable, and easily digestible. This "niche separation" created a relatively large, nomadic ungulate population in the shortgrass steppe (Lauenroth and Milchunas 1992).

The American plains bison, also known as buffalo, was selected as a "resource of management concern" in the refuge's HMP (FWS 2013a). An estimated 30 million bison inhabited North America until nearly extirpated through overhunting. Through the establishment of public preserves and privately owned herds, bison numbered about 75,000 in 1983 (Meagher 1986), about 150,000 in 1999 (Knapp et al. 1999), and currently number closer to 1 million. The refuge is currently one of seven Service sites that contributes to the DOI's Bison Conservation Initiative (U.S. Department of the Interior 2008). In 2007, the Service developed a policy to manage bison as one metapopulation (as opposed to many smaller groups) to help prevent loss of genetic material and maintain populations at natural densities and levels of variation at the landscape scale (Roffe and Jones 2007). Therefore, one purpose of our refuge bison herd is to serve as a genetic reservoir to lessen the chance of inbreeding depression and reduce the risks of disease and genetic drift.

Since 2007, the Rocky Mountain Arsenal National Wildlife Refuge bison herd has been part of the Refuge System's bison conservation and management program, which supports the goals of the DOI Bison Conservation Initiative. DOI bison herds, including those in the Refuge System, are an invaluable resource for bison conservation, with high levels of genetic diversity and low levels of cattle gene introgression (Dratch and Gogan 2010, Halbert 2003, Halbert et al. 2004). While genetic diversity of all Refuge System herds was determined to be above the threshold at which inbreeding effects become apparent (Halbert and Derr 2008, Halbert et al. 2004), careful management of these herds is essential to ensure long-term species conservation (Hedrick 2009, Gates et al. 2010). Geneticists recommend maintaining an even sex ratio, minimizing variation in population size, maximizing effective population size, and maximizing generation time to mitigate the effects of genetic drift (Dratch and Gogan 2010, Gross and Wang 2005).

Although most refuges are unable to maintain population numbers high enough to independently conserve bison (Gross and Wang 2005, Hedrick 2009), management of all bison refuges together as a metapopulation allows even very small bison herds to contribute to long-term conservation of bison. Maintaining the Refuge System bison genetic foundation across several locations reduces the risk of total loss of genetic resources at a single location from a natural event or other disaster, and movements of animals with diverse genetics across diverse landscapes also results in a broad range of natural selection forces acting on the largest population genetic foundation possible. A metapopulation approach is also consistent with the Improvement Act by managing bison refuges as a system within the Refuge System's bison conservation and management program. Details of this program, including participating refuges, are available in "DOI Bison Report: Looking Forward" (DOI 2014).

In addition to contributing to the Service metapopulation goals, bison at the refuge will be used to manage the composition and structure of native prairie to benefit other resources of concern. The Great Plains prairie ecosystem evolved under the grazing pressure of bison and, in combination with climate, influenced the composition and distribution of native flora and fauna. Bison crop vegetation closer than domestic livestock and create patchier mosaics of heterogeneous vegetation that provide diverse habitats desired by some grassland birds (Askins et al. 2007, Vickery and Herkert 1995). Knopf (1996) noted how an increase in grazing intensities resulted in an increase of species characteristic of the shortgrass. In addition, herbivory decreases competition for available soil nutrients by individual plants (Truett et al. 2001) and increases the nitrogen content and digestibility of plants used as forage.

Traditional grazing schemes employ the concept of uniform utilization. However, this method is incompatible with restoration of biological diversity as it provides limited structural diversity (Truett et al. 2001). Therefore, a rest-rotation system of bison grazing will be used on the refuge because Fuhlendorf and Engle (2001) determined slow rotations of herbivory and long rest periods (lasting more than one growing season) yield greater structural heterogeneity of vegetation compared to rapid rotational grazing systems. An adaptive grazing system must be developed that will determine the location and frequency of bison herbivory incorporating age of the restoration sites and structural conditions of the vegetation. Habitats will be grazed at an intensity that helps achieve the patch size, species composition, and structural conditions that will contribute to supporting grassland birds identified as resources of concern (Coffin and Lauenroth 1988, Fuhlendorf and Engle 2001). The grazing system will also be adjusted annually to account for herd dynamics (for example, time of rut, time of calving, and social groups) to facilitate herd movement and avoid disruptions that may cause a cessation in breeding, fetal abortions, or other behavioral anomalies (Miller 2002).

The refuge's HMP calls for a forage allocation methodology to inform management decisions to attain sustainable populations of bison, white-tailed deer, mule deer, and prairie dogs on refuge lands. The forage allocation model developed for Theodore Roosevelt National Park (National Park Service 2010) was used as a "blueprint" for the refuge's model. To estimate the number of bison that potentially could be supported on the refuge, the model calculates annual carrying capacity based on estimates of average annual plant (forage) productivity, daily bison forage consumption rates, and bison forage utilization rates from published literature.

The refuge staff monitors the size and health of its bison herds by conducting annual "round-ups," where animals are herded so that each animal can be individually handled for identification and testing purposes. Round-ups typically occur in the late fall or early winter and are scheduled to avoid conflicts with other Service bison round-ups. During round-ups, all animals are placed in corrals. For the safety of refuge staff and bison, extremely uncooperative animals may be excluded from a particular round-up.

Although some level of diseases and parasites are considered to be part of a normally functioning ecosystem, the risks from emerging infectious diseases such as *Mycoplasma bovis*, combined with the risks of well-known introduced livestock diseases such as brucellosis, tuberculosis, and Johne's disease, require strong health surveillance and monitoring protocols to effectively conserve small populations of bison. Additionally, management as a metapopulation across the Refuge System requires adherence to a variety of interstate transport regulations that frequently change from year to year in response to changes in the animal health landscape within each state, and consistent data collection over time provides high confidence in the disease status of each herd.

The Wildlife Health Office oversees wildlife health management for the Refuge System, including disease surveillance and response. Consistent with the paradigm shift to managing bison as wildlife, veterinary intervention and associated animal handling has been significantly reduced in recent years. This includes allowing for natural behaviors, such as mate competition, that may result in wounds and injuries. The Wildlife Health Office will be consulted regarding decisions and protocols for humane euthanasia on a case-by-case basis. Vaccination and disease-specific treatments are no longer routinely applied, although mitigation for the exacerbation of

an existing disease condition due to handling or other management activities is considered if a large portion of the herd is affected and if little to no additional stress to the animal is expected.

Disease response is considered on a case-by-case basis, depending on the disease(s) involved, severity of the outbreak, transmission cycles that may involve vectors and/or area livestock, and risk to the genetic resource. Response using habitat management is considered first, including encouraging distribution to reduce density. Use of veterinary treatments is generally reserved unless the bison genetic resource is at risk.

Bison are nomadic, migratory animals. However, the refuge's bison herd is confined to a relatively small management area. Confinement to small areas, dense animal aggregation, and repetitive use of select forage can all enhance spread of transmissible diseases and parasites.

Currently the size of the bison herd is actively managed, and herd size may change with new information derived from research, changes in the size of the management area(s), and parasite burdens, as well as vegetative and wildlife response to grazing benefits.

## *Surrogate Wildlife Species Objective 2*

Throughout the life of this CCP, maintain prairie dogs in designated zones at densities of 6–10 animals per acre to promote long-term sustainability of native vegetation and provide sufficient prey and burrow sites for resources of concern.

### Strategies

- Manage black-tailed prairie dog populations in accordance with existing plans (FWS 2013h).
- Periodically review and adjust the size and boundaries of Prairie Dog Management Zones as needed to support black-tailed prairie dogs and associated species.
- In coordination with the Black-footed Ferret Conservation Subcommittee, implement plague management strategies within Prairie Dog Management Zones.
- Periodically evaluate the reliability of black-tailed prairie dogs to represent trends and patterns for associated species.

### Rationale

The black-tailed prairie dog occupies an estimated 2 percent of its former pre-settlement range (FWS 2002). Black-tailed prairie dogs do not migrate, although colonies expand and contract temporally and individuals disperse to other colonies. Over the past 25 years, black-tailed prairie dog populations have fluctuated dramatically. At their highest, prairie dogs were active on 4,573 acres of the refuge in 1988. At their lowest, prairie dogs were only active on 22 acres of the refuge in 1996 (FWS 2013h). The black-tailed prairie dog acts as our surrogate for a native vegetative community tolerant of prairie dogs. The prairie dog can be associated with burrowing owl, black-footed ferret, prairie rattlesnake, the American bison, and many other species that reside on the refuge (Kotliar et al. 1999, Miller et al. 2000).

The Service has developed a separate plan (FWS 2013h) to manage prairie dog populations at the refuge. This adaptive management plan supports the habitat goals and objectives outlined in the refuge's HMP. The primary method selected to achieve the balance of active habitat restoration within a landscape that includes prairie dogs is to establish and maintain permanently designated prairie dog zones of 2,585 acres at appropriate population densities where habitat is not significantly degraded. The 2,585 acres represents approximately 16 percent of the total refuge area and is consistent with historical accounts (FWS 2013a). The HMP provides specific details on how these densities are determined, but black-tailed prairie dog density varies depending on the season, area, and climate, but it typically ranges from 2 to 18 per acre with an average of 10 per acre (Gober 2004). A minimum of 6 per acre is desired (Clippinger 1989), with a maximum of 10 per acre (FWS 2013a). From 1991 to 1996, prairie dog densities ranged from 4 per acre to more than 45 per acre (Seery 1998), and current densities are measured at 19 per acre (FWS 2015a).

Black-tailed prairie dogs at the refuge are preyed upon by a variety of species including coyotes, bald eagles, and several other raptor species. However, despite the presence of natural predators, prairie dogs have exhibited steady—and oftentimes increasing—population rates (FWS 2013h). The addition of another natural predator, the black-footed ferret, is not seen as a detriment to the future survival of prairie dogs at the refuge. Instead, it can be viewed not only as an opportunity to aid in the recovery efforts of an endangered species but also as a chance to reintroduce a component of the grassland ecosystem and to learn more about this endangered predator.

The refuge currently "dusts" its prairie dog management zones as protection from sylvatic plague. This is accomplished by applying appropriate insecticides to kill fleas, the intermediate host for the plague bacterium. Plague is an acute infectious zoonotic disease caused by the highly virulent bacterium *Yersinia pestis*. Infections in humans most often result from the bites of fleas that feed on infected

rodents, although person-to-person transmission can occur if the bacteria are inhaled (Abbott and Rocke 2012). Contraction of plague by humans, while not necessarily imminent, is still regarded as a feasible concern. The Centers for Disease Control (2012) reports humans can also be infected by handling contaminated animals or through exposure to persons or animals with plague pneumonia and cough. Although human plague in the United States is rare (an average of only 5–15 cases are reported each year), States in the western portion of the country have reported establishment of plague in local rodent and flea populations, thereby creating source areas for infection and outbreak. There have been periodic outbreaks of sylvatic plague on the refuge, most recently in 2001–2002. To provide for a more long-term solution to plague management, the refuge will work with partners to implement a sylvatic plague vaccine program for prairie dogs. This will provide increased resiliency for plague events, while also reducing the amount of labor needed to carry out plague management activities. As this program develops, the refuge will adapt to provide the most cost-effective and viable solution to this disease.

# Federally Listed Wildlife Species

## *Black-Footed Ferret*

We reintroduced and regularly survey for the population status of the federally listed black-footed ferrets in the refuge. We will investigate opportunities for the public to participate in black-footed ferret spotlighting surveys.

## *Federally Listed Wildlife Species Objective*

In support of national recovery goals, and to bring back an important missing element of the prairies, reintroduce and maintain a self-sustaining population of 23–36 black-footed ferret families (1 female, 0.5 male, and 3.3 kits) in the refuge by 2031.

### Strategies

- Over the course of at least 3 years, reintroduce ferrets to prairie dog management zones.
- Monitor ferret populations and overall survival and reproduction twice each year in coordination with the National Black-Footed Ferret Conservation Center staff. Share all data, information, and lessons learned with the greater biology community to improve ferret recovery.
- Conduct plague management—through vaccination, dusting with deltamethrin (an insecticide), or other means—and surveillance on an annual or as-needed basis to reduce potential impacts on prairie dog colonies.
- When populations become stable, work in coordination with the National Black-Footed Ferret Conservation Center to provide wild-born ferrets from the refuge to other reintroduction sites.
- Conduct reoccurring monitoring of prairie dog colonies to obtain information regarding population densities and areas of occupancy.
- Manage black-tailed prairie dog colonies through the use of prairie dog management zones. This will help the refuge meet population goals for prairie dogs and ferrets, while also meeting habitat restoration goals.
- Manage predators by removing unnatural vertical structures that could provide perches for raptors.
- Provide education through media releases, displays at the refuge, and other future opportunities.
- Foster formal (through memoranda of agreement, for example) and informal partnerships with neighbors and conservation organizations to promote the awareness of black-footed ferrets at the refuge and nationwide.

### Rationale

As one of the most endangered mammals in North America, the Service has an obligation to reintroduce the ferret to suitable habitats under its management. Furthermore, ferret recovery is a priority of the Service's Mountain-Prairie Region in fiscal year (FY) 2014 (FWS 2013l). The refuge can contribute to the downlisting of the ferret from endangered to threatened under the Endangered Species Act (FWS 2013k) by helping the Service meet the following:

- Establish free-ranging black-footed ferrets totaling at least 1,500 breeding adults, in 10 or more populations, in at least 6 of 12

States within the historical range of the species, with no fewer than 30 breeding adults in any population.

- Maintain these population objectives for at least 3 years prior to downlisting.

- Maintain approximately 247,000 acres of prairie dog–occupied habitat at reintroduction sites by planning and implementing actions to manage plague and conserve prairie dog populations.

Both the HMP (FWS 2013a) and the black-tailed prairie dog management plan (FWS 2013h) were drafted specifically to manage vegetation and prey in a way that is consistent with the reintroduction of black-footed ferrets. Black-tailed prairie dogs at the refuge are preyed upon by a variety of species including coyotes, bald eagles, and several other raptor species. However, as noted above under Surrogate Wildlife Species Objective 2, despite the presence of natural predators, prairie dogs have exhibited steady—and oftentimes increasing—population rates. The addition of another natural predator, the black-footed ferret, is not seen as a detriment to the future survival of prairie dogs at the refuge. Instead, it can help recovery efforts of an endangered species, reintroduce a component of the grassland ecosystem, and help us learn more about this endangered predator. While reintroduction of black-footed ferrets cannot be used as a tool for restoration, the addition of a natural predation process is viewed as a desirable method for managing appropriate prairie dog populations and densities on the refuge.

The refuge currently manages 2,995 acres as prairie dog management zones (FWS 2016a). In 2015, prairie dog populations averaged 19.74 prairie dogs per acre and could support up to 42 ferret families (FWS 2015a). However, in these management zones the refuge is striving to maintain prairie dogs at densities of 6–10 animals per acre to promote long-term sustainability of native vegetation and provide sufficient prey and burrow sites for resources of concern (FWS 2013a). Therefore, an ideal ferret population range will be between 23 and 36 ferret families (1 female, 0.5 male, and 3.3 kits) at a population density of 6–10 prairie dogs per acre within the management zones.

When it comes to creating a self-sustaining population, it should be noted that reintroduction of an endangered species raised in captivity has a high risk of failure. This is due to persistent environmental factors that result in population declines, the effects of inbreeding in small populations, and various other behavioral and physiological consequences of their captive up-bringing (Grenier et al. 2007). Monitoring of both ferret and black-tailed prairie dog population trends will allow the refuge to adaptively adjust management techniques to increase population survival.

The refuge is also uniquely positioned to potentially become a supply site for other ferret reintroduction efforts. Because refuge prairie dog populations will become increasingly disconnected from other prairie dog colonies due to urban expansion, the need to transplant excess ferrets to other sites may be warranted. This would be advantageous, as currently most ferrets that are reintroduced into the wild are from captive-reared populations, which have been hypothesized to be a potentially limiting factor to ferret recovery. In addition, it has been shown that maintaining source populations below carrying capacity can actually improve overall survival in the source population (Biggins et al. 2011).

## Federally Listed Plant Species Objective

By 2031, improve riparian habitat conditions by removing invasive species and improving hydrological conditions along First Creek to facilitate the potential reintroduction of Ute ladies'-tresses orchid and Colorado butterfly plant.

### Strategies

- Locate riparian corridors along First Creek that could serve as a reintroduction site for these listed plants.

- Manage potential reintroduction sites according to practices outlined in the HMP (FWS 2013a) to reduce competition with invasive species and the need for broad scale herbicide applications.

- Conduct a baseline assessment of the hydrology and herbivory conditions along First Creek.

### Rationale

The Colorado butterfly plant is a threatened plant species that occurs primarily in southeastern Wyoming, north-central Colorado, and extreme western Nebraska. The Colorado butterfly plant is typically found in wetland habitats along the meandering stream channels on the high plains. In undisturbed sites, it grows among native grasses. Its establishment and survival is enhanced when dominant vegetation has been removed by disturbance (FWS 2010b). Two populations have been located near Fort Collins, and another population was successfully introduced at the Chambers Preserve in Jefferson

County, but surveys of the refuge have not located any populations of this species.

The Ute ladies'-tresses orchid is a threatened plant species found along streams, in wetlands, and in other moist habitats along Colorado's Front Range and plains areas in elevations below 6,500 feet. The refuge contains habitat suitable for the orchid, but surveys of the refuge have not located any populations of this species (FWS 1996a).

The non-selective use of broadleaf herbicides on agricultural lands is a moderate threat to the plants and their habitats (FWS 2014d). Use of broadleaf herbicides for the control of Canada thistle and leafy spurge are common in agricultural areas of Colorado and Wyoming. Although competition from these invasive species may have negative impacts on the Colorado butterfly plant, observations indicate that the butterfly plant is highly susceptible to commonly used herbicides (FWS 2010b).

Negative impacts from competition by aggressive, nonnative weed species is the most frequently cited potential threat to Ute ladies'-tresses, affecting 32 extant populations (62 percent) and an estimated 84 percent of all plants (Fertig et al. 2005). Herbivory by native wildlife (particularly voles) has been cited as a threat at two populations, with an estimated 11 percent of all plants (Fertig et al. 2005).

Modification of wetland habitats through development, flood control, de-watering, and other changes to hydrology was identified as a significant threat when Ute ladies'-tresses was listed as threatened. Eleven extant populations (21 percent) containing an estimated 52 percent of all orchid plants are considered threatened by further changes in hydrology.

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*Mule deer, confined within the refuge by a perimeter fence, heavily utilize the southern half of the refuge.*

# Other Native Wildlife Species

## *Other Native Wildlife Species Objective*

Within the life of the CCP, opportunistically continue assessing the possibility of and pursue reintroducing up to five native fauna—such as prairie grouse, swift fox, or horned lizard—considered a component of the prairie and likely to thrive in a site the size of the refuge.

### Strategies

- Undertake research to generate a list of species that could be reintroduced.
- Work with other divisions of the Service (for example, Ecological Services) and our partners (for example, CPW and LCCs) to stay informed on species status and reintroduction efforts.
- Continue restoring, maintaining, and increasing resiliency of refuge habitats.
- Work with LCCs to gain landscape-level situational awareness to prioritize species reintroduction in the refuge.
- Continue ecological function restoration, including removal of problematic nonnative species such as bull frog, European starling, Norwegian rat, and feral cats and dogs, if appropriate, for native species conservation.
- Develop a wildlife disease contingency plan that would protect existing native species as well as potential reintroduced species from disease transmission on the refuge.
- Create interpretive materials and programs to educate the public.
- Use citizen science to monitor success.

### Rationale

The purpose of restoring the structure of vertebrate communities is to reestablish the ecological drivers that originally influenced the habitat mosaic (Samson et al. 2004). The present-day refuge is part of the Great Plains prairie ecosystem, which is characterized as consisting mostly of temperate grasslands that evolved with the ecological drivers of drought at the broad scale and grazing and fire at the landscape and local scales (Fuhlendorf and Engle 2001). Prior to settlement, the area that is now the refuge was mostly shortgrass with some mixed-grass prairie (or steppe) that likely included xeric shrubs such as sand sagebrush and rubber rabbitbrush and succulents like yucca and prickly-pear cactus. This ecosystem, with all its values and productive assets, is part of the Great Plains LCC, a multi-agency group that includes the Service and which focuses on conserving plant, fish and wildlife in the mid- and shortgrass prairie. This group's Web site states that "[t]emperate grasslands represent one of the most altered ecological systems on Earth with their biodiversity and ecological processes threatened by habitat loss and degradation" (Great Plains Landscape Conservation Cooperative 2011).

The refuge site is a prime example of acute local landscape modification—that is, the establishment of the Arsenal—and progressive global alterations such as urbanization and climate change. Without a doubt, the natural community structure, biodiversity, and abundance of indigenous wildlife and plants on the refuge site was affected first by European settlement and then by more intensive use that resulted in extensive contamination by the U.S. Army.

The smallest area that can sustain an ecological system with all its native biodiversity and ecological drivers has been termed Minimum Dynamic Area (Pickett and Thompson 1978) or MDA. The first goal of our HMP (FWS 2013a) is to "[r]estore a diverse, native prairie comprised of vegetative mosaics that differ in composition, height, and density to accomplish remediation as specified in the HRP (FWS 1999b) and provide habitat for resources of concern." We will continue to carry out this habitat management objective during the life of the CCP and expect that the grassland habitat and associated patches will represent an MDA that can add to the long-term persistence of the Great Plains biome. The reintroduction of native species—both flora and fauna—is feasible and warranted. However, it is inconceivable that all species associated with the Great Plains grassland will be compatible or sustainable within the refuge boundary due to the species requirements (territory size, competition with existing occupants) or environmental constraints (fences, public safety). For instance, feasibility studies for pronghorn antelope and plains sharp-tailed grouse were drafted in 2010 and 2005, respectively, but have not occurred. In addition, natural rather than captive sources of declining species may be lacking, and we will rely on State organizations as guides to availability of resident species to relocate.

Besides helping to fulfill our imperative to support wildlife conservation, re-establishing this ecosystem to functionality will provide local, immediate value to the visitors who will appreciate this refuge as an example of good land stewardship. Furthermore, involving the public with monitoring projects and presenting enticing educational programs will gain much needed support for this complicated restoration. Such efforts are discussed in the following section as well as under "Citizen Science Projects" in section 4.9.

## 4.5 Visitor Services

***Goal: Foster the public's appreciation of natural resources and provide inclusive, accessible, high-quality, wildlife-dependent recreation, education, and interpretation.***

The refuge does not have an entrance fee, nor will an entrance fee be considered in this CCP. However, under the Federal Lands Recreation Enhancement Act, the refuge may charge reasonable fees for some of its programs. Fees are used to support programs and help pay for facility maintenance, brochures, passes, and fee envelopes. The refuge currently charges the following fees:

- Recreational Fee:
  - Daily Fishing—$3 per day for persons 16 years and older
  - Annual Fishing—$50 per year for persons 16 years and older
- Non-Recreational Fees:
  - Facility Fee—$50 per day plus any additional staff time for use of refuge facilities (such as commercial summer camp and fee-based programs)
- Commercial Photography—$100 dollars per day

In the future, we may also offer our facilities to outside organizations for wildlife-dependent presentations, training, and other functions. Fees for hunt-

related programs would be developed as part of a future hunt management plan.

We sell Migratory Bird Hunting and Conservation Stamps (Federal Duck Stamp) and continue to issue Federal Lands Recreation Passes in the refuge. The cost of both Federal Duck Stamps and the various Federal Lands Recreation Passes are determined nationally.

When visiting the refuge, the public is required to park in designated parking areas and must abide by all other refuge-specific regulations.

# Hunting

## Hunter Education Objective

By 2021, the refuge will provide appropriate facilities to our partners to assist them in providing hunter education opportunities to the public in a natural setting within the Denver metropolitan area.

### Strategies

- As needed, the refuge will provide classroom facilities to support CPW's hunter education course.
- When refuge hunting programs become available, synchronize the programs with on-refuge hunter education courses.
- Do not limit hunter education opportunities to the hunter education course required by CPW to obtain a hunting license. Expand courses as needed to include education programs of interest to Colorado hunters, such as building outdoor survival skills, increasing hunter success, and understanding how hunting is a necessary tool for wildlife management.
- As needed, partner with CPW and other appropriate partners to design an appropriate, safe, and secure archery range on the refuge.
- Develop an archery range and offer instructional archery classes.

### Rationale

Both hunting and environmental education are considered priority public uses for national wildlife refuges (see "Compatible Refuge Uses" under section 1.2). The Hunter Education Program is also a priority for the Service's Wildlife and Sport Fish Restoration Program, which is funded by taxes on archery equipment and handguns, pistols, and revolvers (FWS 2016b).

Current Colorado law requires that anyone born on or after January 1, 1949, who wishes to obtain a Colorado hunting license must complete an approved hunter education course. This course is intended to teach hunters to hunt safely, responsibly, and legally. Topics covered include wildlife management, wildlife identification, ethics, laws and regulations, and firearms safety. Bowhunter education, a course that covers bow skills and using tree stands, is not a required course in Colorado (CPW 2016). Opportunities for the public to attend the hunter education course are limited along the Front Range, and opportunities are even more limited for those wishing to take the bowhunter course (CPW 2016).

The refuge currently has locations available for both the classroom and field components of the hunter education course. In meetings with CPW, the refuge has been identified as a unique location within the Denver metropolitan area to offer this course, because students can obtain the required coursework in a natural setting. As opportunities arise, other courses may be offered that would not be required for obtaining a license.

In future years, the refuge will offer public hunting opportunities for hunters holding a Colorado hunting license. It is hoped that hunter education course held at the refuge will bring those participants back to the refuge for a future hunt.

There are currently very few outdoor archery ranges in the Denver metropolitan area. In cooperation with CPW and other partnering organizations, the refuge will construct an outdoor archery range in the Environmental Education Zone (the southern area of the refuge). Such a range would be designed to maximize participant and public safety, located in an area that would not conflict with other public-use activities, and secured to prevent unauthorized use.

## Deer Hunt Objective

When necessary for population management, refuge staff will provide a public, limited, archery-only deer hunting program for youth and disabled persons within the approved hunting areas.

### Strategies

- In partnership with CPW, develop a hunt management plan. This plan will describe the goals and detailed information needed to support a high-quality archery hunting program for youth and disabled hunters.

- Work with the EPA, CDPHE, and TCHD to modify the current land use control that affects hunting on the refuge.
- Consistent with refuge HMP, maintain a long-term deer population of 325–550 animals.
- As necessary, coordinate with adjacent landowners, municipalities, and local law enforcement agencies on planning and executing a hunt program.
- As necessary, provide a portable blind to improve the enjoyment of the program for disabled hunters.
- Where practicable, use refuge volunteers and other volunteer organizations to support the deer hunting program.

### Rationale

The refuge's HMP (FWS 2013a) states that deer populations will be managed at or below the carrying capacity for the refuge to maintain a healthy deer herd and minimize adverse effects on vegetation and habitat that support other species. Long-term deer population goals would range between 325 and 550 animals. The deer population is monitored through a periodic census. As of October 2012, the combined population of both white-tailed and mule deer was estimated at 368 animals.

Hunting is considered a priority public use for national wildlife refuges (see "Compatible Refuge Uses" under section 1.2). In addition, refuge regulations allow for hunting as a method for surplus wildlife population control (50 CFR Section 31.2(e)) and requires that the privilege of hunting may be extended to the general public (50 CFR Section 31.15). The Service has established further policy on hunting on national wildlife refuges (605 FW 2) that strongly encourages hunting and requires coordination with State fish and wildlife management agencies. As determined by a hunt management plan, refuge-specific regulations will be developed in the future. Service policy mandates, to the extent practicable, that refuge-specific regulation be consistent with State fish and wildlife laws, regulations, and management plans.

A thorough hunt management plan is a critical to the success of any hunting program. This plan will include all the detailed information necessary and will ensure hunt programs are designed to achieve program goals while minimizing conflicts with other visitor services programs. Public safety is a priority for the refuge, and hunting will only occur in areas closed to the general public. All hunters will be required to obtain a Colorado hunting license and take a hunter education course. A refuge-specific hunting permit will also be required; this permit will provide information on regulations and areas available for hunting. A 1,000-foot safety buffer will be established (figure 17) to minimize potential impacts or conflicts with activities outside the refuge. In addition, a 500-foot safety buffer will be established around all public-use roads. There are numerous organizations that aim to support archery hunting programs for youth and disabled individuals.

## Dove Hunt Objective

When appropriate, provide an annual public, limited dove hunting program for youth and disabled persons within the approved hunting areas boundary to help control Eurasian collared-dove populations and to foster an appreciation for ethical hunting.

### Strategies

- In partnership with CPW, develop a hunt management plan. This plan will describe the goals and detailed information needed to support a high-quality upland bird hunt program for youth and disabled hunters.
- To reduce indirect risks from lead to refuge wildlife, require non-toxic shot for upland bird hunting.
- As required, work with the EPA, CDPHE, and TCHD to modify the current land use control that affects hunting on the refuge.
- As necessary, coordinate with adjacent landowners, municipalities, and local law enforcement agencies on planning and executing a hunt program.
- As necessary, provide a portable blind to improve the enjoyment of the program for disabled hunters.
- Where practicable, utilize refuge volunteers and other volunteer organizations to support the dove hunting program.

### Rationale

The mourning dove is one of the most abundant bird species in urban and rural areas of North America and is common on the refuge. Mourning dove abundance in the central United States, which includes Colorado, has declined over the past 48 years, but there has not been a significant decrease or increase of mourning doves in recent years. In

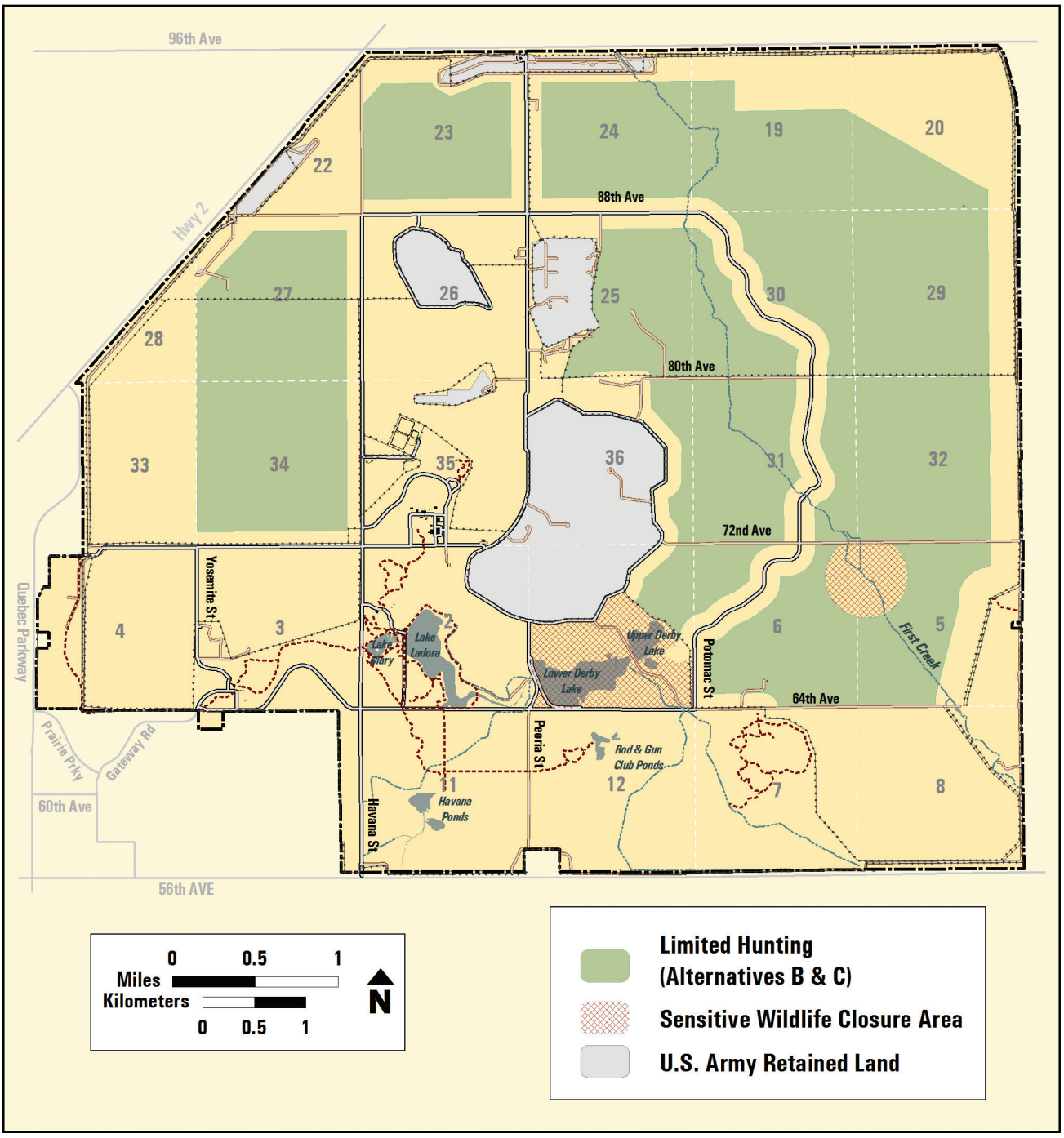


**Figure 17. Proposed limited hunting areas on Rocky Mountain Arsenal National Wildlife Refuge, Colorado.**

Colorado specifically, fewer mourning doves have been seen and heard, accordingly to a recent 2-year study (Seamans et al. 2013).

Mourning doves are the continent's most popular game bird, and each year hunters shoot 10–20 million birds. The regulation of hunting seasons and quotas by the Service and its partners is successful, and hunting does not appear to have negative effects on overall populations of this species (Raftovich et al. 2015). However, widespread and repeated deaths occur when these doves are exposed to high densities of spent lead shot in areas where hunting and shooting is concentrated (Kendall et al. 1996).

The North American invasion of the Eurasian collared-dove, or collared-dove, most likely originated from a stock that escaped from captivity in the Bahamas in 1974 and subsequently established a wild population (Smith 1987). The first collared-dove spotted by ornithologists in Colorado was in Rocky Ford in 1996 (Truan and Percival 1996). In the latest Audubon Christmas Bird Count, there were close to 19,000 in the State. They have now populated all 64 counties in Colorado (Lofholm 2016), and collared-doves are frequently sited on the refuge. Habitat preferences of this species tend to follow human-altered landscapes such as roads and agricultural areas and may also be influenced by general geographical features and climatic factors such as temperature and precipitation (Fujisaki et al. 2010).

The rapid expansion of collared-doves in North America has raised concerns about its effect on ecologically similar species, particularly mourning doves. Exotic species may compete with native species for resources and increase the potential of disease transmittal if they occupy similar niches. Little attention has been paid to the impacts of collared-dove invasions on native species, but potentially negative interactions have been reported (Poling and Hayslette 2006, Romagosa and Labisky 2000). Collared-doves have been infected with *Trichomonas gallinae* in Europe and Florida and have been reported to carry pathogenic strains of *T. gallinae* that may create the possibility for epizootics in mourning doves (Romagosa and Labisky 2000). Further, the collared-dove has been shown to be an excellent reservoir for Newcastle disease, which can cause high mortality rates in agricultural and wild bird species (Terregino et al. 2003). When practicable, refuge personnel currently remove collared-doves, and further removal through hunting is considered beneficial to native species.

As noted above, hunting is considered a priority public use for national wildlife refuges (see "Compatible Refuge Uses" under section 1.2). In addition, refuge regulations allow for hunting as a method for surplus wildlife population control (50 CFR Section 31.2(e)) and requires that the privilege of hunting may be extended to the general public (50 CFR Section 31.15). The Service has established further policy on hunting on national wildlife refuges (605 FW 2) that strongly encourages hunting and requires coordination with State fish and wildlife management agencies. As determined by a hunt management plan, refuge-specific regulations will be developed in the future. Service policy mandates, to the extent practicable, that refuge-specific regulation be consistent with State fish and wildlife laws, regulations, and management plans.

Poisoning from the ingestion of lead shotgun pellets has long been considered a mortality factor in waterfowl populations (Bellrose 1959). It is also clear that many non-waterfowl species are at risk from lead shot and bullet fragments (Fisher et al. 2006). Secondary lead poisoning in raptors is well-documented (Benson et al. 1974, Jacobson et al. 1977, Redig 1979, Redig et al. 1980), and ingestion of lead has also increased mortality and reduced hatchability of mourning doves (Buerger et al. 1986). For these reasons, non-toxic shot will be required for upland bird hunting on the refuge.

A thorough hunt management plan is critical to the success of any hunting program. This plan will include all the detailed information necessary and will ensure hunt programs are designed to achieve the program goals while minimizing conflicts with other visitor services programs. Public safety is a priority for the refuge, and hunting will only occur in areas closed to the general public. All hunters will be required to obtain a Colorado hunting license and take a hunter education course. A refuge-specific hunting permit will also be required; this permit will provide information on regulations and areas available for hunting. A 1,000-foot safety buffer will be established to minimize potential impacts or conflicts with activities outside the refuge. In addition, a 500-foot safety buffer will be established around all public-use roads. There are numerous organizations that aim to support upland bird hunting programs for youth and disabled individuals.

## Fishing

To enhance existing fishing opportunities, we will offer an annual fishing pass. We will initiate introductory fishing classes or educational opportunities and increase instructional fishing programs in partnership with Environmental Learning for Kids and others. We will consider spring instructional programming, hosting fishing clinics to prepare people for the summer season, and organizing additional fishing derbies.

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*Fishing will be allowed on the refuge.*

We will improve access by offering shoreline fishing opportunities—an improvement over the current access that is only available from docks. We will improve Lake Mary as a developmental reservoir with more facilities, a high catch rate, and more user-friendly access.

All persons engaging in fishing activities on the refuge are required to possess a valid State-issued fishing license and to carry a refuge fishing permit. Fishing is and will continue to be allowed only in designated fishing areas as posted and shown on maps.

## Recreational Fishing Program Objective

For the duration of the plan, stock sufficient forage fish to maintain a balanced fish population and support a quality sport fishery for anglers and other outdoor enthusiasts.

### Strategies

- Achieve and maintain appropriate water quality standards for aquatic life in refuge lakes.
- Consistent with the HMP and aquatic step-down management plan, provide balanced populations of sportfish in Lake Mary and Lake Ladora.
- Periodically review refuge-specific fishing regulations.
- Continue coordination and training with volunteer groups and other organizations that participate in the fishing program.

## Adaptive and Educational Fishing Program Objective

Throughout the life of the CCP, the refuge will continue supporting the volunteer groups that provide adaptive fishing programs for hospital patients, military veterans, school-aged children, and others to promote conservation ethic, appreciation of sport fisheries, and urban residents' interaction with nature.

### Strategies

- Continue coordination and training with the volunteer group and other organizations that participate.
- Hold a fishing volunteer meeting annually to determine the needs of the program, including equipment and bait needs.
- Maintain accurate scheduling of events.

### Rationale

The refuge's lakes were created as part of the irrigation infrastructure to support agriculture. When the U.S. Army took ownership of the land, the lakes were stocked with various species of fish to provide recreational opportunities for personnel stationed at the Arsenal. The lakes do provide important ancillary benefits to resident and non-resident wildlife; however, refuge staff determined that managing the lakes primarily as a fishery would best meet our refuge purposes (FWS 2013a).

Lake Mary and Lake Ladora will be used to support a catch-and-release public fishing program that extends from mid-April through mid-October (50 CFR Section 32.25). The program is supported by the collection of daily user fees from participating anglers, which are used to offset the costs of maintenance and fish stocking. The fishery program is utilized extensively by children and individuals with physical and emotional disabilities.

Water quality is essential to the refuge's sport fishery. Water quality sampling is conducted on all lakes. In addition, understanding type and composition of our sport fish populations is important to determining our management actions. A complete stocking record and various annual surveys are conducted to determine population size, age structure, and health of the fishery in Lake Mary and Lake Ladora. In 2006, this information was used to develop an aquatic management plan (FWS 2006a) that included both water quality and fisheries goals that are adopted in the HMP. Both water quality and annual fish surveys have continued to the present day.

The refuge coordinates with both CPW and the Service's Fish and Wildlife Coordination Office on the dynamics of our sport fishery. For example, our most recent surveys indicate a healthy fishery in Lake Mary, but Lake Ladora continues to have too many large predators and too few forage fish (FWS 2006a, 2016c). Beginning in 2015, the refuge authorized removal of all yellow perch and any undernourished pike from our lakes (FWS 2015b) and increased stocking of larger bluegill.

# Wildlife Observation and Photography

We will develop more wildlife observation and photography facilities; these will include a new viewing area, four viewing overlooks, and new trails with accessibility for all new facilities. We will increase access by expanding the Wildlife Drive.

We will develop partnerships to lead more instructional programming and guided tours. We will develop more interpretive panels and brochures to enhance self-guided visitor opportunities. Improved and simplified signs, along with expanded law enforcement, will be used to manage public use and reduce impacts on habitat.

## *Wildlife Observation and Photography Objective*

Throughout the life of the plan, improve wildlife viewing and photography opportunities in all primary habitats represented on the refuge to increase visitor awareness and enjoyment. Visitors of all ages will have an opportunity to observe and photograph wildlife.

### Strategies

In general:

- Continue seasonal closures to protect sensitive wildlife areas and reduce disturbance to wildlife.
- Expand law enforcement presence in order to better manage visitors and reduce impacts.

For access:

- Offer year-round opportunities and improve information and way-finding signs on the Wildlife Drive, nature trails, and information kiosks.
- Open the north loop of the Wildlife Drive to increase wildlife observation and photography opportunities by October 2016.
- Continue to improve and increase accessible opportunities for wildlife observation and photography whenever feasible.
- Continue self-guided opportunities on the Wildlife Drive, along nature trails, and from viewing facilities. Continue staff- and volunteer-led nature programs and tours to provide visitors with a spectrum of experiences from awareness to engagement.

For facilities:

- Develop more wildlife observation and photography facilities, including a new viewing area at Lower Derby Lake, four viewing overlooks, and new trails.
- Develop interpretive panels for Rattlesnake Hill, Wildlife Watch, and information kiosks.
- Develop a raised wildlife viewing platform along Highline Canal.
- Explore the feasibility of developing more photography blinds.

For media:

- Develop an interpretive brochure for the Wildlife Drive with numbered stops.
- Integrate wildlife viewing ethics into brochures, interpretive panels, and social media.
- Develop wildlife web-cams on the refuge where feasible, like a ferret exhibit web-cam, eagle nest web-cam, and trail web-cams.
- Develop a refuge mobile app that will help visitors explore the refuge; the app could assist with wildlife identification, provide photography tips, or identify photography locations.
- Continue to regularly update the refuge Web site and Facebook page to highlight interesting wildlife.

Cindy Souders / USFWS

*Opportunities for wildlife photography abound on the refuge.*

- Continue to highlight the availability of new species on the eBird kiosk to engage visitors onsite and offsite.
- Develop rotations of staff photos to highlight wildlife sightings.
- Develop staff profiles include with refuge Facebook posts, which will provide a "behind the scenes" perspective on managing habitat for wildlife.

For programs:

- Continue the annual amateur photography contest to promote wildlife photography as a way of connecting visitors with the refuge.
- To ensure a quality experience, continue to issue a limited number of special use permits for commercial photography. Evaluate each permit request on a case-by-case basis. Review numbers of issued permits each year, tallying number per day and number per season.
- Explore the feasibility of partner-led and or concessionaire-led photography workshops which could be fee-based and added to the Recreation Fee Program.
- Continue to offer nature programs focusing on refuge wildlife and habitats.
- Continue to provide backpacks for check-out to encourage visitors to explore the refuge through activities and identification guides. Provide backpacks in both English and Spanish versions.

### Rationale

Opportunities to participate in wildlife observation and photography in the Denver metropolitan area are limited due to urban development and limited open space. Many areas lack the diversity and abundance of wildlife that the refuge offers. The refuge offers a unique environment to visitors by limiting non-wildlife-dependent activities that disturb wildlife such as biking, jogging, and dog walking. The refuge draws photographers ranging in skill-level from amateur to professional. Digital photography, improved camera optics, mobile phones, and social media have broadened the reach and interest of visitors to explore their environment through photography. The refuge is identified as a Colorado State important bird area and continues to draw a wide variety of bird enthusiasts from local, national, and international locations. Bison, bald eagles, burrowing owls, and mule and white-tailed deer are key wildlife species that visitors enjoy photographing. Our black-footed ferret exhibit offers unique wildlife observation and photography opportunities of this endangered North American species.

## Environmental Education and Interpretation

We will explore nontraditional ways to educate visitors about environmental topics. We will develop partnerships with other organizations and concessionaires to provide environmental education programs and summer camps. We will use current and emerging technology to extend educational "reach" and to connect with a broader audience.

A new Environmental Education Center will be constructed to provide quality experiences. We will deliver more conservation education programs to neighboring communities by partnering with other organizations, such as parks, libraries, recreation centers, and schools. We will expand interpretive

programs for adult education as a potential venue for increasing stewardship and volunteerism. We will integrate more art into the refuge programming by developing a Refuge Artist Program. We will work with partners to create refuge-inspired nature murals that would help raise the visibility of the refuge in local communities.

## Onsite and Offsite Environmental Education Objective

By 2021 develop a targeted, curriculum-specific, and experiential onsite Environmental Education Program to offer during the school year. Through formal, curriculum-based environmental education tied to State education standards, we will advance public awareness, understanding, appreciation, and knowledge of key fish, wildlife, plants, and their habitats. We may support environmental education through the use of facilities, equipment, educational materials, and teacher workshops that are safe and conducive to learning.

### Strategies

In general:

- Determine how to efficiently and most effectively schedule environmental education programming given limited staffing. For example, participants could begin with a staff-led activity in the morning, followed by lunch and a self-guided experience in the afternoon—a hike, scavenger hunt, or discovery activity.

- Optimally use staff to concentrate on target audiences and areas including underserved communities surrounding the refuge.

- Stress the quality of programs over the quantity of participants and strive to work with key stakeholders at all levels in the design, delivery, and evaluation of our programs. Review program evaluation forms (given to teachers) and additional evaluation materials to assess effectiveness of each program.

- Annually participate in at least one career day or fair at area schools and universities to acquaint students with Service career possibilities.

- Develop environmental education opportunities that will complement and emphasize current refuge management practices and landscape-level ecological issues that affect the refuge including updates for science, technology, engineering, and math (STEM) curriculum modifications.

Cindy Souders / USFWS

*The refuge's Visitor Center houses several exhibits.*

- As significant new management practices are implemented, explore their possibilities for complementary environmental education programming.

For partners:

- Identify local teachers who are interested in using the refuge as a classroom, and ask them for input and guidance for developing the refuge's teacher-led environmental education program, using State standards and local school curriculums as resources. Seek State approval of offered curriculum.

- As programs are developed, provide up-to-date information on environmental education opportunities on the refuge Web site. Include information on how schools can apply to be a Refuge Partner School. In 2020 and biannually afterwards, host teacher workshops to promote refuge teacher-led programs as part of in-service training. Workshops could be focused on Project WILD, Wild Aquatic, and Learning Tree curriculums. Determine if continuing education credits could be available for these workshops.

- In 2021, begin researching funding and school interest in the Service's Schoolyard Habitat Program.

- Beginning in 2018, coordinate with the National Eagle Repository to provide onsite programs such as career awareness and law enforcement to interested area colleges and high schools.

- Beginning in 2018 coordinate with U.S. Army staff to provide educational programs on the environmental clean-up of Rocky Mountain Arsenal for area colleges and high schools.

- Continue working with Friends of the Front Range Wildlife Refuges to secure funding for bus transportation for students.

For programs:

- Review Common Core State standards and environmental education programming in the Denver metropolitan region and determine how best to focus the refuge's environmental education program. Identify topics to feature and grade levels to target.

- Set a lower limit of 15 students and upper limit of 60 students to best use refuge staff and resources.

- Research and review existing regional nature programming and the State core curriculum to determine where the refuge best fits in the curriculum. Continue to refine programs in this area and assign resources where they can have the greatest impact.

- Refine sequential environmental education programs that build on previous years' experiences at the refuge such as Adventures on the Prairie and Home on the Range. Encourage repeat visits.

- Review existing, successful environmental education curriculums to assess strengths that can be included in our refuge curriculum. Review Minnesota Valley National Wildlife Refuge's Refuge Partner School Program, Tualatin River National Wildlife Refuge's Rhythms of the Refuge, the Service's Wild About Black-Footed Ferrets, Project WET, and Project WILD.

- In early 2017, focus on program development for students in grades 2–5. Meet with interested teachers and volunteers to assist in this development.

- Using State standards and existing curriculums, begin developing a refuge-specific curriculum. Develop and implement a three-tiered approach to working with schools. Ensure curriculum meets the needs of targeted audiences discussed in Urban Standards of Excellence (appendix F).

  - Tier 1 will be designated as partnership schools implementing a STEM curriculum. These schools or classes should come to the refuge more than once during the school year for hands-on activities, building upon what they have learned in the classroom.

  - Tier 2 will be schools where teachers have been trained on the refuge curriculum. These teachers will lead refuge field trips on their own, though staff-led scheduled field trips will also occur. Refuge staff and volunteers should work closely with these teachers to ensure needs are met, and when classes arrive for field trips, staff and volunteers should conduct a "meet and greet."

  - Tier 3 will be schools that come to the refuge for completely self-guided field trips. Refuge staff and volunteers, if available, will conduct a "meet and greet." Staff and volunteers could develop activity kits, loaner trunks, or other tools for classroom or field use by teachers. We would also establish a system to loan these materials to local schools.

- By 2022 investigate the possibility of creating a refuge-specific distance learning program to expand the reach of refuge conservation messages.

- Continue to provide offsite classroom visits when feasible.

- Potentially develop materials like fact sheets, loaner trunks, lesson plans, guides, and other tools teachers can use in their classrooms or in the field to convey global and refuge-specific conservation messages. Establish a system to loan these materials to local educators.

### Rationale

Environmental education is identified as one of the priority public uses of the Refuge System. Environmental education activities promote appreciation and knowledge of natural resources, foster a conservation ethic, and aid in understanding the important role people have in the environment. Ultimately the highest goal of environmental education is to develop an aware and involved citizenry that takes an active role in conservation efforts. Refuges in particular provide an environment for fulfilling that goal; as stated in the "Conserving our Future through Environmental Education" (FWS 2014g) document:

> One value of environmental education programs on national wildlife refuges is that they can be locally relevant and place-based, but also address national issues. Place-based learning can use all aspects of the environment/community on and surrounding a refuge, thus serving as the integrating context for learning, making programs more relevant to target audiences.

As an urban national wildlife refuge, the refuge is uniquely positioned in the Denver metropolitan area to provide environmental education to a diverse urban population. Offsite programs help to reach communities and individuals who may not have experience with outdoor activities, nature, or wildlife.

Refuge staff will continue to focus efforts in environmental education programming where they will have the most impact, thus targeting specific topics and age groups. We will reach out to urban schools in the Denver metropolitan area and provide STEM activities. Program emphasis will be on connecting kids to the resource and nature and turning them on to what nature has to offer. The tone of programs will be positive, exciting, and fun.

We will seek partnerships with national organizations and State programs that target students in grades 3–8. Research supports that refuge-based programs are most effective with this specific age group, and such targeting enables our agency to focus limited education staff and resources on key audiences.

We intend to work with the Friends Group to help ensure that Title 1 schools receive the benefit of repeat visits, including opportunities for students in grades 6–12 to participate in STEM activities and for students in grades 2–5 to benefit from staff- and teacher-led programming. Repeat programming for the schools will be emphasized, as students benefit from repeat visits. We will evaluate opportunities to collaborate with local schools and students, emphasizing recurring programs and building strong partnerships.

By providing sequential lessons where new knowledge builds on past experiences, the refuge staff helps connect urban people with nature via stepping stones of engagement. Structured teacher-led and staff-led activities provide learning opportunities and safe environments conducive to learning. These opportunities help to maintain and minimize real threats to safety and welcome and engage individuals from all demographic groups.

Working under the assumption that the Visitor Center remains open Wednesday–Sunday, offering teacher loaner materials will allow for offsite programming on days when the Visitor Center is in use or closed. Also the assumption is that visitor services staff will devote one quarter of their time to supporting offsite programs and three quarters of their time to onsite educational programming.

## *Regional Environmental Education and Interpretation Collaboration and Partnership Objective*

Throughout the life of the CCP, regularly collaborate with other Denver metropolitan area environmental education and interpretive providers to understand the different niches, to cross-promote one another's programs, and to share resources.

### Strategies

- Annually explore partnerships with local, private, and national conservation organizations to provide environmental educational programming—an example includes CPW and its Students in Outdoor Learning Environments and Outdoor Understanding for Teachers programs.
- Organize regular meet-ups and exchanges to ensure we all know who is offering what.
- Share lessons learned and best practices.
- Continue to develop and expand partnerships with current partner schools such as Adams 14 Middle School and Adams High School in Commerce City and KIPP Elementary in Montbello.
- When requests are received for environmental education programming that is not aligned with the refuge's, refer the inquiring parties to other nature program providers rather than accommodating these requests.

- Continue to explore partnerships with YMCA groups, the Boy and Girl Scouts of America, and the Boys and Girls Club to begin using the refuge as a venue for summer camps.

### Rationale

Working with local partners connects the refuge to surrounding communities, allowing them to know and relate to these communities. Moreover, regional collaborations and partnerships help the refuge to provide equitable access.

Many opportunities exist for the Service to work together with partners to both enhance the environmental education program at the refuge and to provide coordination and assistance to other local programs.

Refuge staff will be available and will seek out ways to collaborate in environmental education efforts throughout the northeast Denver area. Such collaboration is already underway with the Northeast Metro Coalition formed around the Great Outdoors Colorado (GOCO) Inspire grant program. Schools currently work closely with refuge staff and partners to provide educational opportunities in neighboring communities. Other partners including CPW's Students in Outdoor Learning Environments and Friends of the Front Range Wildlife Refuges provide some transportation funding to local area schools to participate in onsite environmental education programming. Finally, CPW provides opportunities for teachers to explore refuge curriculum in their annual teacher workshops.

Knowing what educational opportunities are offered by partners will allow refuge staff to stay focused on priority schools and activities and to refer people with specific interests to other locations and organizations rather than adapting their programs to fit so many different requests.

## Independently Led Environmental Education and Interpretation Programming Objective

Beginning in year 2021 in conjunction with the opening of the new Environmental Education Center, promote the refuge as a venue and resource for independently led or partner-led year-round environmental education and interpretive programming.

### Strategies

- Continue to explore partnerships with the YMCA, Boy and Girl Scouts of America, and other local partners or concessionaires to begin using the refuge as a venue for summer camps. Make the Environmental Education Center available to partners and educational institutions during weekends and in the summer when it is not being used by visitor services staff for environmental education programming.

- Develop online programs, activity sheets, and learning guides that can be downloaded and used by teachers, parents, and others.

- Host annual teacher workshops to orient local teachers to the resource and encourage them to lead their own activities at the refuge.

- Encourage partners, concessionaires, and educators to advertise and promote their programs to a diversity of markets including nontraditional audiences.

### Rationale

Through partnerships, we will create alternatives to staff-led environmental education in order to increase capacity, allowing visitor services staff to focus on targeted, curriculum-based environmental education programs. We will support seasonal programming to reach more diverse audiences and engage with community partners to build connections with schools. Providing opportunities for independently led programs allows us to function as a community asset, contributing resources toward improving the quality of community life, thereby strengthening the urban community as a whole.

## Interpretation Objective 1

Within 1–5 years of finalizing the CCP, improve or develop new interpretive media and activities targeting traditional and nontraditional refuge visitors to facilitate self-led interpretive experiences.

### Strategies

- Evaluate existing and develop new interpretive panels or signs along trails, viewing areas and overlooks, the Wildlife Drive, and other visitor facilities.

- Evaluate and create additional maps, brochures, and pamphlets about the refuge; these may include a wildlife checklist, refuge brochure, trail guide, and a Wildlife Drive brochure with numbered stops. Make these materials available at the Visitor Center and on the refuge Web site.

- Maintain Visitor Center interpretive exhibits and replace exhibits as needed to keep them current and well-maintained.

- Enhance, as needed, the refuge family activity backpacks, which are full of self-guided activities (available in English and Spanish) and loaned out at the Visitor Center.

- Develop a refuge mobile app that will facilitate self-guided exploration and learning at the refuge (English and Spanish).

- Create refuge-specific, self-guided nature badge opportunities for Girl and Boy Scouts. Make available on the refuge Web site.

- Develop a junior ranger program for children that consists of a series of self-led activities that lead to a refuge-specific junior ranger badge.

- Develop partnerships with other organizations or concessionaires to provide youth summer camps.

- Evaluate and use current and emerging technology to extend interpretive "reach" and connect with a broader audience.

- Update refuge video to include black-footed ferret information.

### Rationale

In urban areas with little open space, opportunities to participate in wildlife and habitat interpretation activities are somewhat limited. The refuge offers an expansive 15,000 acres 10 miles north of downtown Denver. The number of visitors to the refuge is rapidly growing, and we expect a significant increase in visitation with the expansion of the Wildlife Drive auto tour route in late 2016. Many visitors come in small groups, with their families, or alone. Self-guided interpretive experiences are essential for connecting with a high volume of visitors and providing a high-quality experience. By providing additional self-led interpretive experiences, visitors will be able to select activities and levels of participation that are comfortable and compatible with their interests to connect with the resource and the Refuge System.

## *Interpretation Objective 2*

Continue to provide a variety of high-quality interpretation programs to refuge visitors and work to tailor instructional programming to new and nontraditional audiences to help new visitors feel comfortable, welcome, and interested in the refuge and the Refuge System.

### Strategies

- Each year, identify and/or modify instructional programming to target one new or nontraditional audience.

- Continue to produce the refuge's bimonthly Wild News newsletter, which lists free refuge interpretive program opportunities, refuge news, and general updates. Continue to distribute the newsletter by e-mail (current e-mail list is 4,000 people) and post it on the refuge Web site.

- Work with partners to expand the reach of refuge interpretive program opportunities to residents of the Denver metropolitan area.

- Annually evaluate interpretive programming for trends, interest, volume, and frequency.

- Communicate with partners and the GOCO Youth Advisory Council to determine niche programming for new and non-traditional audience programming ideas.

- Develop or modify "how-to" instructional programming to provide introductory guided activities focused on how to explore and use the refuge.

- Work with partners/seasonal refuge staff to offer Spanish language wildlife viewing tours whenever feasible.

- Offer National Association for Interpretation Certified Interpretive Guide training to interpretive guide volunteers and new permanent visitor services staff.

- Continue to oversee and review the development of all interpretive programming.

### Rationale

The refuge is located in a rapidly growing urban area with decreasing open space and places for people to connect with the natural world. The refuge is situated 10 miles from downtown Denver and DIA and is easily accessed using a major freeway. By continuing to offer a variety of free, guided interpretive programming, the refuge is in a unique position to

annually educate thousands of local, national, and international visitors about the resource and the Refuge System.

Communications with partnering agencies and the GOCO Youth Advisory Council shows that new and nontraditional users may still be confused or unsure about the refuge and the opportunities that exist here due to its former use as a military and munitions manufacturing site. Offering introductory and "how-to" programming will help break down those barriers and enable visitors to branch into additional activities, including self-led activities, once they feel comfortable and knowledgeable about the site.

## Interpretation Objective 3

Within 5–10 years of finalizing the CCP, evaluate transitioning high-demand interpretive programs to fee-based commercial or partner operators to allow for more frequent programming.

### Strategies

- Conduct a needs assessment to evaluate high-demand interpretive programming.
- Through a compatibility and fee study, determine the appropriate cost for programming and the feasibility of a concessionaire or commercial operator to lead these programs (for example, photography, fishing, or birding trips).

### Rationale

Visitation and demand for specific interpretive programs continues to rise. Due to staffing limitations and time-constraints associated with conducting specialty interpretive programming, it may be more efficient for commercial operators (rather than staff or volunteers) to lead specific programs. Staff would oversee the concessionaire or commercial operator and assist with preparing and reviewing scripts and activity guides. Switching high-demand programming to commercial-led interpretation may also increase opportunities for visitors to participate in these programs.

## Volunteer and Stewardship Programming Objective

Throughout the life of the CCP, continue to recruit and retain a group of volunteers to support various refuge programs, operations, and events. Provide tangible opportunities for urban people in the Denver metropolitan area to experience and actively participate in the work of conservation.

### Strategies

- Continue to recruit qualified volunteers for a wide variety of duties including operating Nature's Nest gift store, assisting with recreation programs, gardening, maintaining trails and facilities, assisting with biological work, restoring habitat, providing Visitor Center information, and leading tours.
- Continue to offer a monthly volunteer activity to support conservation, interpretation and education, and habitat restoration.
- Continue the Planting for Pollinators program, including supporting activities and topics such as planting native plants, seed collecting, invasive species management, and fire mitigation.
- Continue to advertise volunteer opportunities on the refuge's Web site and on the Volunteer.gov national recruitment Web site.
- Continue to offer volunteer appreciation events to formally recognize volunteer contributions.
- Through partnerships, hire a stewardship and youth coordinator to work with local entities such as Groundwork Denver and Mile High Youth Corps to complete restoration projects on the refuge.
- Work with partners like Groundwork Denver and ELK to access youth, recruit participants in stewardship programming and volunteer opportunities, and make connections with nontraditional visitors and underserved populations.

USFWS

*Secretary of the Interior with members of the Mile High Youth Corps*

- Continue to work with partners such as Butterfly Pavilion to offer citizen science opportunities such as butterfly monitoring.

- Continue to support Friends of the Front Range Wildlife Refuges on grant applications as opportunities arise.

### Rationale

Volunteer programs and regular stewardship activities are another means of connecting urban people with the opportunity to connect with and care for nature. The volunteer program at the refuge is actively growing, and by volunteering, people can learn more about wildlife conservation and management that is unique to the Denver metropolitan area.

## *Other Recreational Uses Objective*

Within 3 years of CCP approval, develop ways to accommodate various nontraditional but compatible recreation uses in a way that is safe for the public, preserves the natural setting of the site, conserves important wildlife habitats, promotes conservation ethics, and provides outdoor recreational opportunities.

### Strategies

- Encourage use of the Visitor Center and other facilities like the amphitheater when it promotes wildlife education and conservation; this can include activities that support community wellness where there is a connection to wildlife education and conservation.

- Charge fees as appropriate for any activity that requires a reservation or issuance of a special use permit.

- Prioritize refuge-sponsored activities for the use of facilities.

- Authorize night-time activities when appropriate safety and staffing issues are fully addressed.

- Establish and support several areas for picnicking by placing small "first come–first serve" areas near the environmental education areas.

- Plan and construct appropriate "nature play" and adventure activity areas near trailheads.

- Do not permit any activity that conflicts with existing refuge regulations (50 CFR Part 27); examples of existing regulations affecting other recreation uses include the following:

  - Possession or use of alcohol on the refuge is prohibited (50 CFR Section 27.81).

  - Any activity that requires disturbing, injuring, or collecting any plant or animal on the refuge is prohibited (50 CFR Section 27.51).

  - Field trials are prohibited on the refuge (50 CFR Section 27.91).

  - Operation of remote-controlled devices on the refuge is prohibited (50 CFR Section 27.31).

- Inform the public of allowed and prohibited uses on the refuge; communicate this information through, for example, brochures, maps, the refuge Web site, panels, and social media.

- Permit other recreational uses on the Perimeter Trail and Rocky Mountain Greenway in order to make the refuge more welcoming and inviting to urban and nontraditional visitors and to encourage more widespread wildlife observation and appreciation of the refuge's resources.

- Construct the Rocky Mountain Greenway Trail through the refuge; this will include signed crossings where the trail crosses roadways.

- Develop a clear system for signing trails and informing visitors about permitted and prohibited uses.

- Install bicycle racks throughout the refuge at trailheads and facilities.

- Work with B-cycle to set up a bike sharing station on the perimeter of the refuge at trailheads, which could help facilitate connections with Regional Transportation District (RTD) rail and bus lines.

- Make improvements to allow bikes to travel separate from motorized vehicles; this includes all of the Perimeter Trail and the Rocky Mountain Greenway trail through

the refuge and several spurs to key locations.

- Do not permit races and/or other competitive events on the refuge; it is not appropriate to train or hold sporting events on a national wildlife refuge.

- Adopt these three best management practices (BMPs): (a) the refuge will not permit races; (b) running and bicycling will not be allowed in bison management areas; (c) trails will be designed to discourage high-speed bicycling.

#### Rationale

The Administration Act, as amended, provides direction to the refuge manager on what types of uses may be considered appropriate and compatible. The act also prescribes several priority wildlife-dependent recreational activities. Simply, the refuge cannot be everything to everyone, and our emphasis must remain on maintaining lands for fish and wildlife conservation. The decisionmaking process when evaluating recreational uses will focus on how a particular activity will impact wildlife and their habitats and how an activity may impact other users of the refuge. Decisions on new recreational uses will be made following determinations on the appropriateness and compatibility of the request.

### Events Objective

Over the life of the CCP, continue to annually host one large public event and two or three mini-events in conjunction with conservation holidays to connect visitors with nature and develop an understanding and appreciation for the Refuge System.

#### Strategies

- Host a large annual event (400+ visitors) for Refuge Day, celebrating National Wildlife Refuge Week at the Visitor Center to include conservation partners, wildlife activity booths, guest speakers, and guided and self-guided activities; mini-events will typically include celebrating International Migratory Bird Day, Endangered Species Day, and a partner-led kids fishing derby.

- Structure mini-events to include guided hikes and informal talks and programs; mini-events should target audiences of all ages and be family-focused.

#### Rationale

Annual, free events are a great way to connect with new, traditional, and nontraditional users as well as visitors of all ages. It is an opportunity to highlight conservation holidays, wildlife, and the Refuge System through a variety of wildlife activity booths, partnerships, outdoor nature experiences, and guided and self-guided experiences. With projected staffing levels and volunteer support, sustaining one large event and two or three mini-events is feasible for the life of the CCP.

### Visitor Services Facilities Objective

By 2018 and for the rest of the plan, improve, develop, and expand visitor facilities to provide a wide variety of experiences for visitors to foster meaningful connections to nature.

#### Strategies

- Enhance the refuge main gate area to create a more attractive and welcoming entrance by developing a wood frame gateway above the entrance road; other improvements will include an entrance sign and information kiosk to provide orientation and after-hours information.

- Provide way-finding signs at former gate entrances so visitors can easily locate the main entrance.

- Develop more wildlife observation and photography facilities, including viewing areas, platforms, blinds, viewing overlooks, and new trails; make improvements to Rattlesnake Hill and Wildlife Watch.

- Modify the outdoor amphitheater at Lake Mary to serve as an outdoor classroom and interpretive facility and for general visitor use.

- Incorporate Nature Play features into boundary trailheads, at Lake Mary, and at the Visitor Center.

- Develop a shade structure for the Visitor Center amphitheater to make it more user-friendly for environmental education and interpretive programming and the visitor experience. Also develop shade structures at trailheads throughout the refuge and add benches with shade along identified trails.

- Create opportunities for tweens and teens to take limited risks outdoors using natural elements to challenge themselves and one another while connecting with nature.

- Develop a life-size eagle nest near the Visitor Center and explore partnerships to develop additional nests offsite in community parks or trail systems.

- Enhance areas around the Contact Station to provide a more inviting and attractive appearance.

#### Rationale

The refuge continues to see urban residential development around its boundaries. The current boundary trail system, future Greenway Trail, and future pedestrian access points to the refuge will make it easier for neighboring communities to enjoy the refuge. Dispersing natural play features at the fringe of and inside the refuge will encourage exploration by families and older children. It will add a new dimension to exploring the refuge and will offer an added degree of fun to the refuge experience.

Focus groups with teens have shown that this age range is looking for a safe and fun place to spend time with friends. Offering a gathering space with natural elements and posing limited risk opportunities is a gateway to attracting a younger audience that will in turn connect with and develop an appreciation of the resource, and the refuge will be seen as a community asset.

Wildlife observation and photography is one of the most popular activities at the refuge. Additional facilities are needed to disperse visitors throughout the refuge as well as offer new experiences to connect with the resource. Making improvements to areas such as amphitheaters, Rattlesnake Hill, and the former Wildlife Watch will provide additional opportunities.

## 4.6 Communications and Outreach

***Goal: Through effective communication and innovative technology, engage the public and stakeholders to help them better understand the importance of natural resources, operations, and history at the refuge complex so that they are inspired to take part in and support management and restoration efforts.***

### Audiences

In addition to our traditional audiences, we will also target nontraditional refuge visitors and residents of outlying communities. We will strive to improve our understanding of urban demographics of the Denver metropolitan area to enhance and sharpen our outreach efforts. To this end, we will develop a communications plan for the refuge built on a consistent message for outreach and media.

In support of our efforts to reach nontraditional and underserved audiences, to develop messages and approaches to target specific minority groups, and to develop outreach specifically tailored to engage youth, we will forge partnerships with groups like Exportiva, Univision, and Community Enterprise.

### Emphasis of Outreach Message

We will boost the visibility of the refuge and explain the Service's and Refuge System's missions, emphasizing the distinction between a city park and a wildlife refuge. We will emphasize that we invite our neighbors, as well as traditional and nontraditional visitors, to visit the refuge.

We will emphasize how the refuge benefits and serves the community by:

- encouraging better health and school performance by getting kids out in nature;

- improving air and water quality;

- benefitting future generations through the protection and appreciation of natural resources; and

- offering new entry points, expanded hours of operation, and more convenient access.

### Tools and Approaches

We will significantly increase communication and disseminate more information through existing outlets and media—like social media, Web sites, and newsletters—while also developing new communication outlets to more effectively reach area residents. We will package refuge experiences into half- or full-day activities that would appeal to the local community, and we will create a monthly Refuge Saturday where organized tours leave from somewhere in the community, tour the refuge, and then return home.

We will use the latest technology to reach and connect with broad audiences, and we will build a promotional campaign branding the refuge as a premiere urban refuge with a myriad of opportunities to connect people to nature.

## Conservation Communication Objective

Over the life of the plan, the refuge will serve as a gathering place and clearinghouse for information and resources about natural resource conservation and the Refuge System to be shared among community organizations, agencies, educators, elected officials, businesses, and other stakeholders.

### Strategies

- Establish the refuge staff and the Service as leaders in teaching about conservation.
- Use the refuge to tell the national story of public land conservation and restoration.
- Work with local and national media outlets to provide more widespread coverage of the Refuge System and habitat conservation.
- Use social media more effectively and more regularly to share conservation information and refuge complex stories.

### Rationale

Increasing the relevance of natural systems for the well-being of people will build increased awareness of and support for conservation. The refuge can be a catalyst for building natural resource conservation awareness and a conservation community among urban dwellers due to its strategic location within the Denver metropolitan area. The refuge is also accessible to countless local and regional jurisdictions, schools, agencies, nonprofit organizations, and commercial organizations. Location and access offers tremendous opportunities to partner with various entities to communicate and reach multiple audiences.

As an urban refuge, the refuge and its activities are extremely visible to the public. It is critical to communicate the refuge's role in wildlife conservation and habitat protection to maintain a positive public view of the refuge. The refuge can serve as an example of wildlife habitat restoration and sound land management techniques, as well as high-quality nature-based recreation and education. The refuge's visibility will increase by improving public relations through outreach and partner activities. A variety of local media outlets would be used to convey this message and generate interest and visitation, including internet, radio, newsprint, and television media. Maintaining connections with these media outlets allows the refuge to connect with diverse audiences that otherwise may not be reached.

## Reaching Nontraditional Audiences Objective

Within the first year after CCP approval and throughout the life of the plan, the refuge staff and its partners will increase awareness of the refuge with more widespread outreach and targeted communications.

### Strategies

In general:

- Enhance refuge presence in the community by participating in cultural holidays and local community events in order to become part of the community and create awareness of the refuge.
- Share how the conservation of natural resources is relevant to urban communicates in a way that:
  - builds support for conservation of the refuge and natural spaces,
  - promotes dialogue and partnerships to further identify connections between the value of natural world and the well-being of people, and
  - increases environmental literacy of citizens.
- Provide surrounding urban residents and communities tangible opportunities to experience nature and actively participate in the work of conservation; doing so will provide comfort for those unfamiliar with or lacking experience in nature and welcome families and children to the refuge.
- Integrate cross-cultural events and occasions—for example, Cinco de Mayo or Day of the Dead.
- Add an information officer to the refuge staff; this staff member can build media partnerships, work with the Regional Office's external affairs team to collect media contacts, and develop outreach tools.

For partnerships:

- Conduct outreach to partners, inform them about the refuge, and encourage them to advertise it; encourage more cross-promotion and reciprocate for our partners.

- Continue working with partners on expanding and refining outreach to nontraditional audiences. For example, continue advertising in Groundwork Denver's Hispanic newsletter and working with this organization to increase Latino/Hispanic participation in programs and volunteering. Also maintain collaborations with the Northeast Metro Coalition that is working to understand what youth in the area want. Similarly, Mile High Youth Corps, SCA, Vista, Scouts, and ELK are partners that could help with outreach and recruiting nontraditional audiences to visit and participate in programming at the refuge.

- Work with concessionaires and partners to develop programming specifically targeted to nontraditional audiences; specifically, request help from partners to tap into communities' trusted sources of communications.

- Work with partners to address transportation issues—for example, many nontraditional audiences do not have cars.

- Develop partnerships with media that have access to and are trusted by nontraditional audiences; for example, a recent article in Colorado Parent was an effective, targeted piece of media.

- Continue participating in conservation career education programming—for example, Impact Denver career talks or the Adams County 9 to 5 program.

### Rationale

The population of the Unites States is ethnically and socially diverse, with 80 percent of people living in urban or suburban areas. The Denver metropolitan area is ranked within the top 20 most populous urban areas in the United States, with a population that continues to increase. Denver's population is a microcosm of the demographic changes happening in the country, with ethnic groups representing about one-third of the population that is rapidly growing. It is critical for the refuge to play a role in regional conservation across this diversity of interest parties and stakeholders.

Outreach is needed for these new and growing audiences in order to build interest in the refuge, bring visitors to the refuge, and build support for refuge programs and fish and wildlife conservation. People in the Denver metropolitan area may not know the refuge exists, what a wildlife refuge is, what it offers, or that it is open to all. Staff members commonly hear "I didn't know we could come out here, thought it was closed." The refuge must overcome misconceptions about the site being closed and unsafe. Efforts have begun with the GOCO Inspire grant and the Northeast Metro Coalition that is serving urban and underserved populations. Outreach programs are expanded to youth and families that may not otherwise have opportunities to engage in activities on national wildlife refuges.

Many opportunities exist to work together with partners to develop outreach programs. Strong partnerships will be essential for the refuge and the Service to achieve the vision and goals of the Urban Wildlife Conservation Program. Cooperative efforts with key partners will greatly further habitat protection and restoration, education and interpretation, and outreach for the refuge and all communities within the Denver metropolitan area. Together with our partners, we will work to build a presence that is inclusive of, and welcoming to, the diverse individuals living in and visiting the Denver metropolitan area.

## *Safe and Welcoming Destination Objective*

Over the life of the CCP, we will make physical site improvements and increase the amount of communications and outreach in order to ensure visitors feel safe, welcomed, and belonging in the refuge.

### Strategies

In general:

- Diversify the refuge's workforce to make it more representative of the surrounding communities.

- Update uniforms of the refuge staff who regularly interact with the public; choose something a bit more casual, like logo shirts.

- Offer and promote a variety of experiences that will appeal to a diversity of visitors including nontraditional visitors and underserved populations.

- Ensure adequate onsite law enforcement presence; law enforcement should be visible and approachable.

For communications:

- Offer "Welcome to the Refuge" programming; the program should target nontraditional visitors and provide an overview of what the refuge and the Service are and what the refuge has to offer.

- Address perceived barriers about the refuge's safety and accessibility by communicating a "you are welcome here" message through outreach, signs, and other media.

- Convey "safety" messages cross culturally.

- Communicate more effectively about rules and regulations. Where possible use icons and adjust language on signs to more positive messaging and minimize "no's." Post the regulations at entrances to ensure they are enforceable.

- Develop a refuge mobile app that will facilitate self-guided exploration and learning at the refuge.

- Explain why the refuge needs gates, cattle guards, and fences. Explain that these facilities are necessary for wildlife protection while acknowledging that, historically, they were to keep people out.

- Consider the following themes and messages in future communications in order to inspire appreciation for the Refuge System, increase awareness of habitat and wildlife conservation, and build support for the refuge complex:

  - Highlight uniqueness of a national wildlife refuge—let alone three of them—in the Denver metropolitan area.

  - Note how special it is that the government has set aside 15,000 acres for wildlife and wildlife-dependent recreation in the Denver metropolitan area.

For partnerships:

- Recruit partners to help spread the word about the refuge being open and welcoming.

- Work with partners to create refuge-inspired nature murals to raise the visibility of the refuge in local communities.

- If partners are conducting a survey, consider inserting questions that could measure efforts to make the refuge feel more welcoming and safe and to make more visitors feel like they belong.

For site improvements:

- Install secondary entrance signs in order to increase the visibility of the refuge at 96th Street, 56th Street, and Quebec Street and the northern Buckley Road gate.

### Rationale

The area surrounding the refuge is becoming increasingly developed, and the population is expanding. The refuge opened to the public in 2006 and is still relatively unknown to many area residents and businesses. Outreach is needed for these new and growing audiences, in order to build interest in the refuge, bring visitors to the refuge, and build support for refuge programs and fish and wildlife conservation.

## 4.7 Partnerships

***Goal: Seek and foster strong partnerships to support research and management, enhance wildlife-dependent recreation, and promote an appreciation of nature.***

We will focus on more partnerships throughout the Denver area—and especially in surrounding communities and local government agencies—to assist with outreach and to connect more area residents with refuge resources and programs. Encouraging community partners to use the refuge as a resource for educational and interpretive programming as well as for health and wellness activities would nourish their relationships both with their constituents and with us.

We will leverage partnerships to build physical linkages between the outlying communities, regional trails, and the refuge. By focusing on partnerships that will reach nontraditional visitors and supporting more instructional programming, we hope to connect a broader cross section of our community to their natural surroundings.

We will increase the use of citizen science and the collaboration between the refuge and local schools to work on habitat restoration.

We will expand partnerships to include RTD, Denver Regional Council of Governments, and commercial partners.

Collaboration with our partner agencies or organizations will continue under established agreements. Cooperation and collaboration with Federal, State, tribal, and local governments; nongovernmental organizations; and adjacent private landowners will continue. We seek to maintain and grow six types of partnerships:

1. Concessionaire partnerships to expand visitor uses and allow staff to focus more environmental education

2. Resource conservation partnerships to improve habitat protection and research

3. Visitor service programming partnerships to improve a variety of visitors uses (for example, tours, fishing, and hunting)

4. Transportation partnerships designed to improve convenient access to the refuge

5. Agency partners key to operations like police, fire, neighboring municipalities, and the Colorado Department of Transportation

6. Urban conservation partners that will collaborate to connect more people with nature and raise awareness of conservation issues and opportunities

Section 3.6 describes existing and potential partnerships.

## Transitioning to Commercially Led Programming Objective

Within 5–10 years of finalizing the CCP, research the feasibility of implementing a concessionaire to run visitor service programming as well as food service. Within 15 years, award a concession contract to expand appropriate and compatible wildlife-dependent recreational opportunities complex-wide.

### Strategies

- Conduct a needs assessment evaluating high-demand interpretive programming.

- Conduct a market analysis to determine the feasibility of awarding a contract for the development and operation of visitor services programs and activities across the refuge complex.

- Through a compatibility and fee study, determine the appropriate cost for programming and the feasibility of a concessionaire or commercial operator to lead these programs (for example, photography, fishing, or birding trips).

### Rationale

Visitation and demand for specific interpretive programs continues to rise. Due to staffing limitations and time-constraints associated with conducting specialty interpretive programming, it may be more efficient for commercial operators (rather than staff or volunteers) to lead specific programs. Staff would oversee the concessionaire or commercial operator and assist with preparing and reviewing scripts and activity guides. Switching high-demand programming to commercial-led interpretation may also increase opportunities for visitors to participate in these programs.

## Improving Visitor Services through Partnerships Objective

Throughout the life of the plan, solicit existing and new partners to run habitat and wildlife-oriented visitor services programs at the refuge.

### Strategies

- Partner with CPW and other appropriate partners to design an appropriate, safe, and secure archery range and run archery and ethical hunter programs.

- Maintain fishing partnerships.

- Maintain partnership with ELK and recruit additional partners to bring their groups to the refuge and use the Environmental Education Center and other visitor services for programs that they lead independently.

- Recruit partners who can integrate art into programs—for example, wildlife photography, plant illustration walks, and nature journaling.

- Recruit partners who can offer historic and cultural resource-based programs, such as History Colorado.

- Engage other potential partners that could run habitat or wildlife-oriented programs, activities, and tours, such as Denver Botanical Gardens, Community Colleges, Denver Zoo, and Butterfly Pavilion.

### Rationale

With more partner involvement, the refuge can increase the number of program offerings. More partners will allow the refuge to offer more specialized programming and a wider variety of programming. It will be important, however, that partners can run programs on the refuge independently and would not require support and excessive oversight from staff. Staff will review content and curriculum and sign off on all partner-led activities, but partners will be expected to run programs independently. Also, the Service will benefit from these partners promoting their programming to their constituents. This will greatly increase the breadth of outreach.

## Habitat and Wildlife Partnerships Objective

Throughout the life of the CCP, continue to work with partners on habitat, wildlife, research, science, and management. Seek out partners to support the refuge staff in implementing the habitat and wildlife goals and objectives and their prairie restoration priorities.

### Strategies

- Continue working with existing partners, such as Colorado State University, USGS, CPW, Butterfly Pavilion, ELK, and Groundwork Denver, while also cultivating new conservation-oriented partnerships.

- Continue equipment-sharing with CPW and other partnerships with the State.

- In addition to recruiting partners to help the Service realize its habitat goals, the Service will lend its technical expertise to other partners and assist them with their land management and habitat conservation projects.

- Work with partners on recovery efforts for ferrets and other wildlife species.

### Rationale

Prairie restoration is a key niche of this refuge, so partnerships that help us attain habitat restoration are a priority for our staff. For example, partnerships that assist us with native seed collection, shortgrass prairie restoration, endangered species recovery, and other refuge management activities are keys to our success. The refuge is also valuable as a seed bank and a key resource for CPW and others working on regional conservation projects. Therefore, the refuge staff is prepared to serve as a technical advisor to regional partners engaged with prairie restoration projects.

## Transportation and Access Partnership Objective

Throughout the life of the CCP, improve access to the refuge through transportation-based partnerships.

### Strategies

- Work with RTD to explore the possibility of bus stops near or at trailheads.

- Also work with RTD to determine where "Safe Routes to School" might intersect with refuge access points. Additionally, work with RTD to ensure the new Pena light rail stop provides orientation to the nearby refuge.

- Work with the Adams County, City of Commerce City, and City and County of Denver to improve trails, trail heads, and community access to the refuge.

- Work with partners to secure funding for and facilitate transportation to and from schools.

- Work with groups such as B-cycle, People for Bikes, and Bike Denver to set up a bike sharing system.

- Partner with the Rocky Mountain Greenway and local communities to promote the trailheads on the refuge's perimeter and to encourage hiking and biking to and through the refuge.

### Rationale

We want to make the refuge more accessible, and transportation is a major barrier to access for Denver area residents who depend on public transportation and youth whose families do not have the time or means to drive them to the refuge.

## Egli Farmstead

*Undated photo of Egli family members in front of their home.*

Shortly after the arrival of the railroad to Colorado, homesteading and other forms of new settlement began on and around the refuge. Settlement patterns changed over time as land was subdivided. Many of the arriving residents were recent immigrants from overseas. By the late 1930s, several hundred families were living within the boundaries of what would eventually become the refuge (Hoffecker 2001).

Gottleib Egli was born in Switzerland. He and his family came to Colorado after 1910 and acquired a relatively large plot of several hundred acres. They built a home and farmed corn, alfalfa, wheat, barley, and millet, and they raised pigs and cattle. With the creation of the Rocky Mountain Arsenal, the Federal Government acquired the land through condemnation, and all the families on the property were forced to abandon their homes. By all accounts, most did so without protest, but the pain of the experience was never forgotten (Hoffecker 2001).

The Egli house and garage, near the refuge's Contact Station, are the only surviving pre–World War 2 structures on the refuge. The house and garage are now listed in the Colorado State Register of Historic Properties, and these structures were determined as potentially eligible for listing in the National Historic Register of Historic Places as representative of 20th century agriculture in northeast Colorado.

A structural assessment of the buildings was completed in 2004, but little preservation has been carried out since (Preservation Partnership 2004). In 2014, the Friends of Front Range Wildlife Refuges replaced the roof and gutters and repaired the chimney and windows on the second floor.

Our management of this historical site has satisfied the requirements of the National Historic Preservation Act, and, as our budget and priorities allow, we will strive to complete a full restoration of the exterior of the Egli farmstead. We will attempt to install additional interpretive panels outside the house to explain the significance of the farmstead and past homesteading on the refuge.

### *Urban Wildlife Conservation Program Partnerships Objective*

Over the life of the CCP, work with local partners to support and implement the urban refuge conservation program and to increase the community's understanding and appreciation of the refuge's significance to natural resource conservation and its contribution to the Refuge System, and to garner additional support for refuge programs by increasing the visibility of the refuge, refuge visitation, and participation in the refuge.

#### Strategies

- Continue to seek out and develop new partnerships and to build more community connections.
- Develop a guide to sustainable land management and prairie conservation employed by the refuge, and share with interested partners such as urban drainage, municipalities developers, individuals, and community organizations.
- Provide technical assistance or subject matter experts to local communities for both wildlife and habitat restoration and management and nature-based recreation and education. These partnerships may address the following: backyard habitats, school yard habitats, pollinator pathways, and noxious weeds.

#### Rationale

The Urban Refuge Conservation Program requires partnerships beyond programming and conservation. This includes all the offsite grants and programs. As an urban refuge, the refuge as well as its activities are extremely visible to the public. It is critical to communicate the refuge's role in wildlife conservation and habitat protection to maintain a positive view of the refuge. The refuge can serve as an example of wildlife habitat restoration and sound land management techniques, as well as high-quality nature-based recreation and education. The refuge's visibility will increase by improving public relations through outreach and partner activities.

# 4.8 Cultural Resources

***Goal: Protect artifacts and interpret the archeological, agricultural, military, and industrial histories of the refuge complex and the story of its restoration in order to connect visitors and the community to the area's past.***

Under Section 106 of the National Historic Preservation Act, we will continue to conduct cultural resource reviews for projects that involve ground-disturbing activities or that could affect buildings or structures more than 50 years old. Most of the refuge was intensively surveyed for cultural resources in 1994 and 1995, and the results of those surveys form an excellent basis for these reviews (Clark 1997).

We will avoid disturbing significant cultural resources unless such disturbance is necessitated by unusual circumstances. In addition, we will continue to conduct law enforcement patrols to monitor sensitive sites. We will continue to consult with the Colorado State Historic Preservation Office, Native American tribes, local governments, and members of the general public on matters pertaining to cultural resources. We will continue to adhere to other cultural resource laws; however, research opportunities would be minimal.

Artifacts currently stored at the refuge—both prehistoric and historic items—will be cared for and inventoried. We are exploring and will possibly implement deaccession of some artifacts.

Significant historic buildings, structures, and sites will be preserved and interpreted using signage and bus tours. The Egli House and other historic sites—including the observation bunker, the old Officer's Club, the guard tower foundation, the weapons storage bunker, homestead sites, a wagon road, historical tree plantings, and farming equipment—will continue to be protected.

Additionally we will:

- enter into partnerships with the Native American community to interpret the prehistoric landscape;
- strive to complete full restoration of the exterior of the Egli farmstead, enhancing the public's experience;
- provide more guided interpretation (without signs) of cultural resources suited for outdoor storage, such as farm equipment and some World War 2 and Cold War machines.

## *Cultural Resources Objective 1*

Throughout the life of the CCP, monitor and protect cultural resources for the enjoyment of future generations.

### Strategies

- Meet storage compliance requirements for artifacts by partnering with U.S. Army to utilize Building 112 as a future permanent storage center for our artifacts, including the Cold War artifacts currently being stored in the Butler Building. If Building 112 is not feasible for a future location, another source should be located to properly store the North Plant Nerve Gas Manufacturing Control Panels or other archeologically significant North Plant items currently being stored at the refuge.
- Protect the Egli garage, listed on the State of Colorado's register of historic places, from further deterioration; currently, the foundation has serious cracks and the roof is in an advanced state of decay.
- Protect the historic September 1945 chalk writing located on the cement wall of the World War 2 Munitions Storage Bunker in Section 6. Consider some sort of protective covering to prevent damage from insects, water, mold, or damage from the possibility of accidental human contact.
- Fabricate metal protection caps for the three Cold War vaults located in Section 19 in accordance with the refuge's Confined Space Plan.
- Maintain a complete and current inventory list of all cultural resources collection artifacts, with both a hard copy and a computer copy for backup. (This strategy includes paper site records and photographs as well.)
- Update the "Scope of Collections" appendix in the integrated cultural resources plan for the refuge to revise accession and de-accession procedures for artifacts, documentation of the cultural resources collection inventory, and the use and vision of the refuge cultural resources collection. (This will also serve as a user guide for refuge employees for managing the cultural resources collection.)

- Make certain that all items are tagged appropriately with correct accession numbers and that these tags stay with the artifacts regardless of location.

- Periodically inspect historic properties on the refuge with the Region 6 Archeologist to ensure the integrity of those items remains intact—for example, the Cold War vaults in Section 19, the World War 2 Bunker in Section 6, and pre-history sites 5AM185 (Section 19) and 5AM718 (Section 20).

## *Cultural Resources Objective 2*

Over the next 10 years, expand education and interpretation for cultural resources through programs and materials that highlight the prehistoric, agricultural, and military heritage of the refuge.

### Strategies (For All Cultural Resource Objectives)

- At a minimum, finish the exterior restoration of the Egli House as well as the restoration of the garage so that they can be open to public viewing as a prime example of early 20th century Colorado agriculture. (Both the Egli House and garage are listed on the State Register of Historic Places.) Architectural restoration "phases" are currently being developed with History of Colorado as a future path forward to attain these goals; once restoration is completed, develop partnerships that will allow the restored house to function as a "living history museum" after restoration.

- Look for opportunities to display artifacts in Service buildings or along the auto tour route and possibly appropriate trails.

- Develop a refuge cultural resources collection brochure that is specific to the history of the site; this brochure can be designed to include a self-guided tour of things and past facilities that can be seen from the auto tour route.

- Create and display kiosks along the auto tour route and hiking trails that identify, using before and after views of the landscape and historical details, former military and cleanup activities and how they look after native prairie restoration (for example, the flash bunker in Section 30, the munitions storage bunker in Section 6, the location of the prisoner-of-war camp, the Cold War vaults in Section 19, the historic Sand Creek lateral, the North and South Plant areas, Henderson Hill, Rattlesnake Hill, and native American occupation along First Creek). Develop a partnership with History of Colorado in order to attain funding for these kiosks.

- Develop a mobile phone app that would help interpret the refuge's cultural resources and integrate cultural resources into the refuge's digital interpretation tools such as the Web site and social media.

- Incorporate specific cultural resource tours for the public as part of the overall interpretation of the refuge. Past experience with tours has indicated that there is significant interest in this regard, particularly when the public is shown areas where large chemical manufacturing facilities used to exist.

### Rationale (For All Cultural Resource Objectives)

The requirements and standards for proper curation and management of the cultural resources collection at the can be found in 36 CFR Sections 79.5–79.10 (National Parks Service). Some of the highlights of this law relating to cultural resources collection storage and protection are:

1. Storing artifacts in a suitable facility meeting local electrical, fire, building, and health and safety codes, with operational fire alarm and fire suppression systems.

2. Maintaining complete and accurate records of the collection.

3. Handling and storing artifacts that protect them from breakage or other damage, and "possible deterioration from adverse temperature and relative humidity, visible light, ultraviolet radiation, dust, soot, gases, mold, fungus, insects, rodents, and general neglect."

4. Protecting all cultural resources collection artifacts (including paper records) from theft.

5. Ensuring that cultural resources collection artifacts are curated by a professional archeologist.

The cultural resources collection represents a tangible record of history starting from approximately

12,000 years ago to the present (Terry Wright, . USFWS; personal communication; 2013). The cultural resources collection can and is being used to help fulfill Purpose 5 of the Refuge Act of 1992, which states "To provide opportunities for compatible environmental and land use education."

The refuge cultural resources collection, which includes not only the stored and displayed artifacts but onsite features as well, offers a valuable interpretive resource for the public. Most of what the Arsenal was historically is not visible anymore. Without an interpreted past, the success of the transition of the Arsenal to a successful wildlife refuge is greatly diminished.

## 4.9 Research and Science

***Goal: Use science and promote research to advance the understanding of natural resource functions and management within the refuge complex and beyond.***

### Research

We are currently engaged in several research and monitoring programs; these will continue. Some projects support both research and monitoring and inventory programs. All this work is helpful for making management decisions.

Trapping and banding burrowing owls contributes to research on the migratory pathways of burrowing owls in western North America. Other research opportunities arise, often unexpectedly and involving short-term levels of effort.

In addition to ongoing activities and priorities, we will evaluate prairie dog densities, especially as they relate to the black-footed ferret reintroduction. We will emphasize the use of public participation and social media as means of acquiring and collating data to support refuge management.

### Monitoring and Inventory Programs

We will continue to conduct the following annual monitoring and inventory programs:

- Trap and band burrowing owls as a monitoring project (as well as for research) that may help evaluate trends in the migratory pathways of burrowing owls in western North America.
- Conduct bald eagle winter roost surveys and nest counts in cooperation with the Rocky Mountain Bird Observatory to help monitor overall riparian health of the refuge and bald eagle reproductive success at the refuge.

Aaron Rinker / USFWS

*Service staff perform a deer health check.*

- Monitor raptor nests (such as those of Swainson's hawks and burrowing owls) in accordance with objectives in the HMP.
- Assess fish populations through electrofishing and gillnetting in accordance with objectives in the HMP to maintain a quality sport fishery.
- Conduct a deer census each fall to assess populations for inclusion into the refuge forage allocation plan.
- Conduct a bison roundup each fall to assess overall individual health and to evaluate populations for inclusion into the refuge forage allocation plan.
- Monitor native and invasive vegetation—especially at habitat restoration sites—to determine future management actions that may be necessary.
- Band 200 mourning doves to support national efforts to monitor migratory birds.
- Support Citizen Science projects in connection with the Great Backyard Bird Count in February.
- Conduct a Christmas Bird Count in January to support national efforts to monitor migratory birds.
- Conduct spring and fall bird counts in May and September to support national efforts to monitor migratory birds.
- Develop an inventory and monitoring plan.
- Recommence water quality monitoring and data gathering.
- Adopt the findings of the water management plan.
- Reestablish yearly monitoring of cultural resources sites.
- Monitor reintroduced species for success.
- Introduce the use of hand-held devices (such as tablets) to facilitate improvements in data and information collection and monitoring.

In addition to ongoing programs, we will delegate some of the monitoring and data-gathering activities to volunteers and partners, taking advantage of the increased accessibility and visitation at the refuge, and develop citizen science projects to support monitoring of the ferret population as well as bald eagle nesting and roosting. We will enhance monitoring of visitation commensurate with the increased access points, trails, and road system. In addition, neighbor satisfaction surveys will be established.

## Citizen Science Projects

We will continue to support citizen science projects, especially the Christmas Bird Count in January, the Great Backyard Bird Count each February, and spring and fall bird counts in May and September. We will create additional citizen science opportunities, such as tracking phenological characteristics and the monitoring efforts mentioned above. In addition, we will investigate opportunities for the public to participate in black-footed ferret spotlighting surveys.

We will increase the extent of existing bird counts as other opportunities arise and implement the Big Sit Bird Count—an annual, international, noncompetitive birding event hosted by Bird Watcher's Digest. It involves bird watchers tallying as many bird species as they see and hear from a limited site (17 feet in diameter) where they remain for 24 hours.

We do not conduct research on climate change. However, refuge and U.S. Army personnel do collect meteorological data that may be useful in the future for establishing trends in climate change at the refuge.

## Social Science, Social Media, and Emerging Technologies

We do not currently conduct research in social science, social media, or emerging technologies. However, we do occasionally permit social science research that benefits refuge management.

We will consider the installation and use of remote cameras to monitor and provide Web-based public viewing of refuge fauna for species like bald eagles and black-footed ferrets. In addition, we will broaden the use of existing and emerging technologies and social media to aid in wildlife management and tracking while also engaging visitors in conservation activities. For example, we will likely use Facebook, Twitter, or a future social media application to report sightings of birds banded on refuge lands.

## General Research Objective

For the life of the CCP, conduct or support studies that benefit refuge management to the extent practicable, and identify and pursue all other necessary research that assists in fulfillment of this CCP's goals and objectives.

### Strategies for Internal Research

- As part of the annual work plan, develop and maintain a list or table of known research needs that may be conducted internally. Include both ongoing and potential studies.
- Develop and use the findings in an inventory and monitoring plan to determine additional data needs and how to obtain success in meeting management objectives.
- Determine which of the studies on the list or table can be conducted by refuge staff and which studies can be conducted by other internal groups like volunteers.
- Develop and use a citizen science program where appropriate data collection is needed—for example, the Christmas Bird Count, Great Backyard Bird Count, spring and fall bird counts, the Big Sit Bird Count, tracking of phonological changes, and monitoring of ferrets and bald eagle nesting and roosting.
- Re-establish intern, student, and career pathway opportunities.
- Make use of electronic techniques and other modern technologies as appropriate for data gathering and analysis.
- Follow all requirements of the DOI's science policy and ensure that all other researchers also follow the policy.

### Strategies for External Research (Originating from Universities or Similar Entities)

- Develop and maintain a list or table of known research needs that may be conducted by external entities.
- Develop research partnerships with institutions of higher education—for example, Colorado State University.
- Develop partnerships with CPW, private organizations, and other interested parties to support ongoing and future research and monitoring.
- Allow research entities to submit proposals regardless of whether they are based on our internal list, external list, or one originating from the researchers.
- Require research applicants to submit a proposal that outlines:
  - the objectives of the study,
  - the justification for the study,
  - a detailed study methodology and schedule, and
  - potential impacts on refuge wildlife and habitat (including long- and short-term disturbance, injury, and mortality).
- Also require the proposals to include:
  - a description of mitigation measures the researchers would take to reduce disturbances or impacts,
  - personnel required and their qualifications and experience,
  - status of necessary permits,
  - costs to the refuge's budget,
  - refuge staff time requested, and
  - product delivery schedules such as reports or publications.
- Assign appropriate refuge staff and others to review research proposals and issue special use permits if approved. For further information and requirements see the compatibility determination for research in appendix E.
- Give priority to studies that contribute to the enhancement, protection, preservation, and management of native plants, fish, wildlife populations, and habitat on the refuge; more specifically, evaluate approval criteria based on the following:

- Research that would contribute to specific refuge management issues would be given higher priority than other requests.
- Research that would include the needs of both the refuge and high priority partners, like state fish and wildlife agencies, in Region 6 would be given higher priority than most other requests.
- Research that would conflict with other ongoing research, monitoring, or management programs would not be approved.
- Research projects that can be conducted off-refuge would be less likely to be approved.
- Research that causes undue disturbance to wildlife or habitat, or is intrusive, would likely not be approved; the degree and type of disturbance would be carefully weighed when evaluating a research request.
- Evaluation of the research proposal would determine the level of effort that has been made to reduce disturbance through study design, including adjusting location, timing, number of permittees, study methods, and number of study sites.
- Evaluation of the research proposal would determine if staffing or logistics makes it impossible for the refuge to monitor researcher activity in sensitive areas such as near active raptor nests.
- Specific timeliness, including the length of the project and product delivery dates, would be considered and agreed upon before approval; all projects would be reviewed annually.

- Ensure that researchers follow all requirements of the DOI science policy.

**Rationale**

The Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 requires us to "provide opportunities for compatible scientific research." Research is needed to fulfill many of the other purposes of the legislation regarding wildlife, habitat, and visitor services.

The refuge is a very complex site. It has numerous types of wildlife habitat, more than 300 species of wildlife, more than 300 species of plants, and a diverse mix of human uses. Most of the refuge has been impacted by farming, manufacturing of chemicals, environmental remediation, and even habitat restoration. Sites are in various stages of revegetation. In addition, the refuge is located in an urban area. All of this diversity in land use has resulted in the need for various types of research and monitoring to evaluate what the conditions are, how they are changing, and how they can be improved. Some of these studies can be conducted by staff members and volunteers, others by outside sources. There will never be an end to the need for additional information if decisionmakers are to manage the site effectively and efficiently. Appropriate research will tell us what we should do where, regardless of whether we are managing wildlife, habitats, or people. Therefore, we need to produce dynamic lists of research needs in each of these categories that would provide the information needed to make appropriate management decisions. Development of an inventory and monitoring plan would not only help provide items that should be on the lists, but it would assess whether they are reasonable within the life of this CCP. This objective is valid for studies to be conducted by refuge staff, other refuge associates, or outside sources such as universities. All studies must meet DOI science policy.

## 4.10 Infrastructure and Operations

***Goal: Effectively use money, staff, partners, volunteers, and equipment to restore and manage refuge complex habitats, conduct programs, and improve and maintain all necessary infrastructure.***

## Infrastructure and Facilities

### *Facilities*

Our visitor facilities include a Visitor Center, a Contact Station, three information kiosks, two amphitheaters, a fee station (iron ranger), and a wildlife viewing blind. A fenced pollinator garden and amphitheater are located behind the Visitor Center, with a second amphitheater at Lake Mary. A new administration building is planned and may be constructed. The Visitor Center includes an exhibit hall, a 73-seat auditorium, and discovery room. The Con-

tact Station offers self-guided learning stations and can accommodate 60 students.

We will continue to host special events and meetings that support the purposes of the refuge and the mission of the Service and the Refuge System. We will consider hosting special events and meetings for DOI and other Federal, State, and local agencies on a case-by-case basis.

We will continue to safeguard the refuge from unnatural sounds and undue light contamination to the extent possible, but we will not be able to retrofit existing structures to pursue this objective.

U.S. Army–retained sites and facilities will continue to be inaccessible to the public.

By law and policy, we will continue to abide by all State water regulations regarding the use of surface and groundwater. It is important to note that the use of all water sources on this refuge is subject to the adjudication process of the Colorado Water Court. The resulting court decrees often define when, where, and for what beneficial use water can be diverted, used, and consumed. All changes in water use described in this plan must either be within the limits described in the existing decree for the specific water source or result from a successful application to and approval by the State engineer or the court.

We will continue to acquire land within the authorized boundary areas of the refuge. These lands will be purchased from willing sellers as funding becomes available.

We will adhere to all Service polices regarding rules and regulations for oil, gas, and mineral extraction on refuge lands. Access to subsurface minerals is regulated by Federal and State laws, which, in part, require the Service, as owner of the surface estate, to place reasonable restrictions on the mineral access in order to reduce disturbance to the surface estate.

We will significantly expand the number of visitor amenities such as restrooms, shade structures, and tables to accommodate more visitors. We will develop facilities that are more appealing to family gatherings.

The Contact Station will be replaced with a building better suited to educational programming as well as providing meeting space for an array of user groups. Other new facilities will include additional viewing platforms, observation decks, and wildlife observation and photography facilities. We will reopen and improve the Wildlife Watch area; establish a bison viewing area outside the refuge; construct an overlook at Lower Derby Lake; expand and improve interpretation, photography, and wildlife observation opportunities along the Wildlife Drive by constructing more pullouts that feature interpretive panels and observation facilities; build orientation and interpretive kiosks at new pedestrian entrance points; and, if grouse establish leks, we will establish blinds where visitors can observe the birds without disturbing them.

In addition, we will allow vehicular traffic to exit the refuge at two additional sites: at 56th Avenue and Havana Street, and at 72nd Avenue and Quebec Street.

## Sustainability

Sustainability is a guiding principle of this CCP. The Service has set a goal for becoming carbon neutral by 2020 through avoiding emitting greenhouse gases, reducing unavoidable emissions, and offsetting any remaining emissions. This region's climate is conducive to the increased use of solar energy as a cost-effective and reliable form of alternative energy. The refuge's Visitor Center—which will be LEED certified in the near future—currently uses both geothermal and solar energy to reduce and offset its energy consumption while incorporating a variety of design techniques to increase energy efficiency. In addition, we use solar energy to power most of our electric wells, and we will continue to retrofit and improve our existing facilities.

We will also construct a new, more efficient administration office building and improve several other existing facilities that will receive a portion of their electricity from new solar generating systems. The Service recently issued a new CLIR Tool that we will use to gauge greenhouse gas emissions and to comprehensively assess, and over time reduce, the carbon footprints of operations and of our visitors.

## U.S. Army's Dams

Lands associated with four interconnected reservoirs and associated dams in the Irondale Gulch drainage on the refuge have already been transferred to Service ownership, but the responsibility of operation and maintenance of the dams was retained by the U.S. Army pending inspection and repair. These reservoirs are an important part of the refuge for both people and wildlife. Following floods in September 2013, USACE completed an updated dam safety report (USACE 2014) on all four dams. This report makes several recommendations that must be completed prior to transfer of these dams to the Service. The U.S. Army is currently working to schedule needed repairs and improvements. Once these are completed, the Service plans to accept transfer of the dams as a part of refuge operation.

## Energy Transmission Towers

In support of the Service's climate change policy, we implement all necessary measures to increase our facilities' energy efficiency and reduce the carbon

footprint of our refuge management operations. Additionally, we intend to modify the energy distribution lines (by either burying or relocating them) when redeveloping certain areas of the refuge. If necessary, we will coordinate with the U.S. Army prior to removal of the existing electrical substation on the refuge.

We will work to eliminate transmission towers and lines. We will take additional measures to increase energy efficiency and reduce the carbon footprint of operations by expanding our solar array and by incorporating more sustainable practices when developing or renovating additional or existing infrastructure.

## Refuge Signs

Entrance signs are located at the main and Havana gates. Guide and directional signs are posted throughout the refuge. Interpretive panels are located at the Visitor Center, Contact Station, and Wildlife Drive information kiosks. We will develop a new Sign Plan that will guide future characteristics and location of all refuge signs.

We will address navigation and new ways to bring people to the refuge (for example, through way-finding or Colorado Department of Transportation marketing). We will also use way-finding to clarify circulation inside the refuge boundary. We will incorporate positive messages into signs—focusing on what is allowed rather than what is not allowed.

We will enhance the primary entrance by coordinating with the City of Commerce City to reduce confusion at the entrance and by developing a refuge monument sign that will draw visitors. We will initiate coordination with neighboring partners to develop a unified signage plan, and will use the perimeter fencing as a communication medium for refuge signs, identification, and interpretation. Way-finding and interpretive kiosks will be built to support transportation improvements.

## Water-Control Infrastructure and Water Rights

There are five major dams on the refuge. Upper Derby Lake, Lower Derby Lake, Lake Ladora, and Lake Mary dams are currently owned and operated by the U.S. Army and are slated for transfer to the Service (as noted in section 3.2). Havana Ponds dam is owned and operated by the City of Denver and UDFCD. The refuge will not accept transfer of the U.S. Army dams until the necessary repairs on Lower Derby Lake, Lake Ladora, and Lake Mary dams are complete. Upper Derby Lake dam would be partially breached prior to transfer and would no longer be considered a dam. Havana Ponds dam breached after flooding in 2013 and is currently impaired, but it is being repaired.

## Fencing

As appropriate for refuge management needs and visitor services goals, we will maintain existing or refurbish portions of the refuge fencing to ensure we reach our CCP goals.

We will construct a new gateway arch at the main public gate, install a split-rail fence in some areas to establish a more aesthetically pleasing boundary, establish wildlife fencing that is set back from roads, and create distinct access points where the fence could be opened to foot traffic.

## Infrastructure and Facilities Objective

By 2027, implement all improvements to and development of infrastructure, buildings, and visitor services facilities in order to accommodate a growing visitor base and to realize habitat conservation objectives.

### Strategies

- Work with partners to develop a general development plan for the refuge to cover transportation, facilities, way-finding, and other development topics.
- Water-control infrastructure and water rights:
  - In 2017, the refuge will accept ownership (or transfer) of the U.S. Army dams when necessary repairs are completed. Finish the repair of Havana Ponds, which is owned and operated by the City of Denver and UDFCD.
  - We will work with these two intenties to maintain and assert our water rights. Operate and maintain the refuge's recycled water line in accordance with appropriate permits and agreements.
  - Manage water facilities in accordance with the refuge's approved water management plan.
  - Update water management plan as appropriate and necessary.
- Safety and law enforcement:

- Work with the UCFCD to include the refuge in alert system for emergencies such as flood threats.
- Partner with FHWA to investigate the vulnerability of infrastructure to extreme weather events.
- Improve law enforcement capabilities.
- Ensure closed areas are well-defined and secured by gates.
- Clearly post and share refuge regulations.

- U.S. Army–retained sites
  - Continue to coordinate with the U.S. Army, Shell, and regulatory agencies, as appropriate, on access, wildlife issues, and infrastructure maintenance and improvements in U.S. Army–retained sites.

**Rationale**

Sustainable practices will be incorporated into the development of all new or updated infrastructure.

# Staffing and Operations

## Staff and Funding

Tables 9 and 10 provide information on the funding and personnel necessary to implement this CCP.

## Volunteer Groups and Programs

At present, approximately 80 volunteers actively support refuge operations, including staffing the front desk of the Visitor Center, conducting interpretive tours and programs, performing light maintenance of trails and facilities, assisting with biological surveys, and staffing special events. A fenced pollinator garden behind the Visitor Center is maintained

**Table 9. Costs over 15 years to carry out the Rocky Mountain Arsenal National Wildlife Refuge Comprehensive Conservation Plan.**

| *Item* | *Cost* |
|---|---|
| Budget Fiscal Year 2014 | $3,550,000 |
| Salary expenditures | $1,750,000 |
| Non-salary expenditures | $1,800,000 |

**Table 10. Personnel to carry out the Rocky Mountain Arsenal National Wildlife Refuge Comprehensive Conservation Plan.**

| *Management* |
|---|
| Refuge manager |
| Deputy refuge manager |
| Supervisory refuge officer |
| Senior refuge officer |
| (2) Refuge officers |
| Outreach and partnership specialist |
| *Administration* |
| Administrative officer |
| Administrative support |
| Office clerk (1/2) |
| *Visitor services* |
| Visitor services manager |
| Environmental education specialist |
| (2) Park ranger, GS-9 |
| (2) Park ranger, GS-7 |
| (4) Park ranger* |
| *Operations and maintenance* |
| Refuge operations specialist, GS-12 |
| Fire management officer |
| Range technician (fire) |
| Range technician (fire*) |
| Equipment operator |
| (2) Maintenance worker |
| (4) Maintenance worker* |
| *Biology* |
| Assistant refuge manager |
| Refuge biologist |
| (2) Range technician* |
| (2) Bio science technician* |
| *Restoration program (ends fiscal year 2020)* |
| Assistant refuge manager |
| GIS specialist |
| Range specialist |
| Wildlife refuge specialist |
| Bio science technician |
| Maintenance worker |
| (6) Tractor operator* |
| *Student trainees* |
| To be determined |

* Seasonal

by volunteers and is in good condition. We will encourage the continuation of this project.

We will strive to increase the number of volunteer projects and substantially grow the number of refuge volunteers by recruiting from neighboring communities and throughout the Denver metropolitan area; supporting the Denver Parks and Recreation volunteer coordinator in hosting a project or program on the refuge; and using large volunteer projects (such as National Public Lands Day) to draw attention to the refuge. We will increase offerings of programs that allow visitors to drop in without prior reservations. In planning special events and other programs, we will emphasize quality over quantity. Smaller events will allow for more creativity and would cost less.

### Hours of Operation

The refuge would continue to be open from sunrise to sunset. In general, visitors would not be allowed in the refuge during hours of darkness.

### Other Operational Topics

The UDFCD would include the refuge in an alert system (text alerts) to notify of emergency water conditions, such as flood threats. We would partner with FHWA and others to investigate the vulnerability of refuge infrastructure to extreme weather events.

### Staffing Objective

Over 15 years, to accomplish habitat and public use objectives, justify and obtain new full-time equivalent (FTE) employees and seasonal employees.

#### Strategies

- Increase staff to implement the CCP, including the following:
  - Permanent full-time: 20.5
  - Seasonal: 6.0
  - Fire program: 2.5
  - Restoration: 9.0
- As visitation increases, other factors come into play, and to maintain the quality of the visitor experience, we will need to rely more on staffing the Visitor Center with seasonal or permanent staff.
- Continue to grow the refuge's volunteer base and increase the number of volunteer projects across the refuge's various programs.
- Work with partners to increase volunteer recruitment and to co-host volunteer projects at the refuge.
- As noted in the partnership objective, when possible, the refuge will contract with commercial operators or concessionaires to run interpretive programs and other visitor services activities rather than relying on volunteers.
- Maintain the Fellow program.
- Continue to utilize student trainees.

## 4.11 Access and Transportation

***Goal: Support the improvement of suitable access to the refuges, develop sustainable transportation options, and provide more connections within the refuge complex.***

## Refuge Access and Permeability

### Points and Types of Access

We will add pedestrian and bicycle access points and work with RTD to connect neighborhoods to the refuge via the public transit system. Additional travel modes including cross country skiing, jogging, and expanded bike access will be permitted. We will also consider adding another Service-owned bus with bike racks, as well as a commercial bus and a bike sharing system.

### Way-Finding and Sign Plan

We will coordinate with neighbors and partners to develop a unified approach to our way-finding and signage program.

### Refuge Access and Permeability Objective

Over the life of this CCP, the refuge staff will provide more, convenient, and welcoming access to, from, and within the refuge for all visitors.

#### Strategies

- Provide multiple new, non-motorized access points and trailheads; these trailheads will provide convenient access for pedestrians as well as bicyclists.
- Make the entrance more appealing and improve way-finding. Signage at the entrance will alert visitors that they are entering a refuge (and that it is different from a park or open space).
- Make the periphery of the refuge more inviting by treating the perimeter fence with art or more welcoming signs and posting secondary entrance signs.
- Remove the guard houses at the west entrance and, when appropriate, close the west entrance as a staff gate.
- Close the South Gate–Havana entrance, and when appropriate, close the south entrance as a staff gate.
- Make sure trailhead addresses visitor comforts and provides shade, nature play, and so on; also at the trailheads ensure there is "welcoming/please visit" messaging and information that explains what the refuge is and has to offer.
- Create refuge experiences from the perimeter trailheads that are short and easy and offer visitors a "taste" of the refuge without having to come all the way to the Visitor Center or the refuge interior.
- Work with RTD to explore the possibility of bus stops near or at trailheads and to ensure the new Pena light rail stop provides orientation to the nearby refuge. Also work with RTD to determine where "Safe Routes to School" might intersect with refuge access points.
- Work with partners to set up a bike sharing system with stations in outlying communities, at the RTD light rail and bus stops, at the refuge Visitor Center, and at trailheads.
- Work with partners to ensure perimeter trailheads have safe and signed road crossings.
- Highlight the perimeter trail and greenway both as a community connection and as a trail open to multiple uses, including wildlife viewing.
- Work with partners and adjacent municipalities to address transportation issues and barriers. For example, partner with the community recreations centers and encourage them to bring youth to the refuge.
- Continue to offer transportation grants to schools (through the Friend's Group).
- As visitation increases, consider introducing a regular shuttle on busy days from the Visitor Center to the lakes area.
- Develop a general development plan that addresses access and circulation in the refuge.

## Roads and Related Infrastructure

We will improve multiple intersections, and we will modify the large Texas Crossing on the northern Wildlife Drive. We will incorporate bike infrastructure into the road system. Signs on the refuge will be enhanced for improved movement and flow.

### Legacy Loop

We will add pull-outs and a designated cyclist–pedestrian path that is paved, detached from the road, and in compliance with accessibility standards.

### Wildlife Drive

We will expand scheduled bus or tram service (that is, not requiring reservations) in coordination with RTD. In addition, we will open the entire drive to public vehicles for one-way traffic. This added access will entail building pull-outs, improving interpretive signs and way-finding along the route, and modifying the Texas Crossing for safe public use.

### Trail System

We will build new and extend existing trails with additional trailheads and access points, such as expanded trails at Eagle Watch and Henderson Overlook. In addition, we will open some roads and trails to bicycle access. We will coordinate with stakeholders and adjacent landowners to manage pedestrian and bicycle access along the Perimeter Trail.

### Roads and Trails Objective

By 2022, we will ensure all refuge roads meet FHWA standards and will develop a multi-use trail network.

#### Strategies

- Work with FHWA and to develop a transportation plan.
- Develop a signage plan and improve road and trail way-finding with consolidated and clear signs and with digital navigation tools.
- Open and expand the auto tour for self-guided use. Enhance the driving experience with interpreted stops, an interpretive brochure and a mobile app, an overlook and restroom at the bunker, and road improvements.
- Address accessibility issues at Lake Mary and ensure visitor services facilities there comply with Americans with Disabilities Act and Architectural Barriers Act standards.
- Continue to coordinate with the Rocky Mountain Greenway Trail on signs, trail maintenance, and way-finding.

#### Rationale

Providing equitable access to all types of visitors is the vision of Rocky Mountain Arsenal for this CCP. Equitable access is one of the standards of excellence for urban refuges. The refuge works to provide equal access to the full range of visitors by addressing physical, financial, and transportation barriers. Addressing these barriers is crucial to successfully implement all urban standards of excellence. As the refuge works to improve access, community relations will strengthen. The refuge will continue to work closely with partners, community planners, and transportation agencies to achieve equitable access, to find friendly alternatives for access and transportation to the refuge, and to create a welcoming appearance. Efforts to provide equal access are intended to create an environment that is inclusive by reaching to neighboring communities and those visiting the Denver metropolitan area. Designing a trail network and Wildlife Drive that are built on sound and sustainable platforms will ensure visitors have a safe and enjoyable visit.

## 4.12 Plan Amendment and Revision

This final CCP will be reviewed annually to assess whether there is any need for revision. A revision would be warranted if significant information becomes available, such as a change in ecological conditions. Revisions to the CCP and subsequent step-down management plans will be subject to public review and compliance with NEPA. At a minimum, this plan will be reevaluated every 5 years and revised after 15 years (table 11).

## 4.13 Funding and Personnel

Refuge budgets generally include ongoing operational funds for staff, maintenance, and utility needs. Funding for one-time projects (like road construction or major maintenance) is generally provided as needed or when available. Development of future employees is a priority, and student trainees, interns, and other entry-level positions will be used whenever possible. Due to budget cuts, no permanent fire personnel are currently funded at the refuge.

As part of the cleanup and restoration of the refuge, one-time funding was provided to undertake grassland restoration. This funding will be used to support seeding, irrigation, and invasive plant management through 2020.

In general, implementing the Urban National Wildlife Refuge Initiative and aspiring to become the most visited national wildlife refuge in the country will require some additional staff (particularly rangers and maintenance) and funding (tables 9 and 10). A major issue at present is that current staffing does not provide adequate security and visitor safety. A minimum of one additional law enforcement officer is needed to address refuge hours (12–15 hours per day, 7 days per week, 362 days per year) and to ensure appropriate coverage across the three units of the refuge complex.

**Table 11. Stepdown plans from the Rocky Mountain Arsenal National Wildlife Refuge Comprehensive Conservation Plan.**

| *Name* | *Year* |
|---|---|
| Black-tailed prairie dog management plan | 2013 |
| Cultural resources management plan | 2014 |
| Fire management plan | 2013 (revised) |
| Habitat management plan | 2013 |
| Habitat restoration plan | 1999 |
| Integrated pest management plan | 2015 |
| Inventory and monitoring plan | needed |
| Law enforcement plan | needed |
| Station safety plan | 2013 (revised) |
| Visitor services management plan | needed |
| Water management plan | 2014 (revised) |

# Glossary

**adaptive management**—the rigorous application of management, research, and monitoring to gain information and experience necessary to assess and modify management activities.

**accessible/accessibility**—pertaining to physical access to areas and activities for people of different (abilities, especially those) with physical impairments.

**accession**—to record the addition of a new item to a museum or other collection.

**alternative**—a reasonable way to solve an identified problem or satisfy the stated need (40 CFR 1500.2); one of several different means of accomplishing refuge purposes and goals and contributing to the Refuge System mission (The "Fish and Wildlife Service Manual," 602 FW 1.5).

**amphibian**—a class of cold-blooded vertebrates including frogs, toads, or salamanders.

**anthropogenic**—originating in human activity.

**appropriate use**—a proposed or existing uses on national wildlife refuges that meet at least one of the following—(1) is a wildlife-dependent recreational use; (2) contributes to fulfilling refuge purposes, the Refuge System mission, or goals and objectives outline in a CCP; or (3) the refuge manager has evaluated the use and found it to be appropriate.

**baseline**—a set of critical observations, data, or information used for comparison or a control.

**biological control**—the use of organisms or viruses to control invasive plants or other pests.

**biological diversity, also biodiversity**—the variety of life and its processes, including the variety of living organisms, the genetic differences among them, and communities and ecosystems in which they occur.

**biological integrity**—biotic composition, structure, and functioning at genetic, organism, and community levels comparable with historic conditions, including the natural biological processes that shape genomes, organisms, and communities.

**canopy**—a layer of foliage, generally the uppermost layer, in a vegetative stand; midlevel or understory vegetation in multilayered stands. Canopy closure (also canopy cover) is an estimate of the amount of overhead vegetative cover.

**compatibility determination**—see compatible use.

**compatible use**—a wildlife-dependent recreational use or any other use of a refuge that, in the sound professional judgment of the Director of the U.S. Fish and Wildlife Service, will not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuge (The "Fish and Wildlife Service Manual" 603 FW 3.6). A compatibility determination supports the selection of compatible uses and identified stipulations or limits necessary to ensure compatibility.

**comprehensive conservation plan (CCP)**—a document that describes the desired future conditions of the refuge and provides long-range guidance and management direction for the refuge manager to accomplish the purposes of the refuge, contribute to the mission of the Refuge System, and to meet other relevant mandates (The "Fish and Wildlife Service Manual," 602 FW 1.5).

**cultural resources**—sites, buildings, structures and objects that are the result of human activities and are generally over 50 years old. They include prehistoric and historic sites, properties, artifacts, historic records, traditional use areas and sacred sites that may or may not have artifactual evidence.

**deaccession**—to remove an item from the listed holdings of a museum or collection.

**ecosystem**—a dynamic and interrelating complex of plant and animal communities and their associated nonliving environment; a biological community, together with its environment, functioning as a unit. For administrative purposes, the Service has designated 53 ecosystems covering the United States and its possessions. These ecosystems generally correspond with watershed boundaries and their sizes and ecological complexity vary.

**environmental health**—composition, structure, and functioning of soil, water, air and other abiotic features comparable with historic conditions, including the natural abiotic processes that shape the environment.

**environmentally preferable alternative**—the environmentally preferable alternative is the alternative that will promote the national environmental policy as expressed in NEPA's Section 101. Ordinarily, this means the alternative that causes the

least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources.

**endangered species, Federal**—a plant or animal species listed under the Endangered Species Act of 1973, as amended, that is in danger of extinction throughout all or a significant part of its range.

**endangered species, State**—a plant or animal species in danger of becoming extinct or extirpated in a particular State within the near future if factors contributing to its decline continue. Populations of these species are at critically low levels or their habitats have been degraded or depleted to a significant degree.

**endemic species**—plants or animals that occur naturally in a certain region and whose distribution is relatively limited to a particular locality.

**environmental impact statement**—a document prepared to describe the effects for proposed activities on the environment. "Environment," in this case, is defined as the natural and physical environment and the relationship of people with that environment.

**extirpated**—when a species of plant or wildlife ceases to exist in a chosen geographic area (not to be confused with extinction, when a species ceases to exist).

**Federal trust species**—all species where the Federal Government has primary jurisdiction including federally endangered or threatened species, migratory birds, anadromous fish, and certain marine mammals.

**fire management plan**—a plan that identifies and integrates all wildland fire management and related activities within the context of approved land and resource management plans. The plan defines a program to manage wildland fires (wild-fire and prescribed fire).

**fitness**—the ability of an organism to survive in its habitat and pass those genes on to subsequent generations.

**focal species**—a multispecies approach where the ecological needs of a suite of species are used to define an ideal landscape to maintain the range of habitat conditions and ecological processes required by landbirds or other species. Focal species are considered most sensitive to or limited by certain ecological processes (such as fire or nest predation) or habitat attributes (such as patch size). The needs of a suite of focal species are then used to help guide management activities.

**forb**—a broad-leaved, herbaceous plant; a seed-producing annual, biennial, or perennial plant that does not develop persistent woody tissue but dies down at the end of the growing season.

**fragmentation**—a state of discontinuity throughout a defined habitat.

**Friends group**—any formal organization whose mission is to support the goals and purposes of its associated refuge and the National Wildlife Refuge Association overall; Friends organizations and cooperative and interpretive associations.

**FTE**—a full-time equivalent; one or more job positions with tours of duty that, when combined, equate to one person employed for the standard Government work-year.

**goal**—descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units (The "Fish and Wildlife Service Manual," 620 FW 1.5).

**habitat island**—an area of wildlife habitat delineated by areas of unsuitable wildlife habitat.

**habitat management plan (HMP)**—a stepdown plan to a comprehensive conservation plan that identifies in detail how the objectives and strategies for uplands, riparian areas, river bottoms, and shorelines will be carried out.

**habitat type, also vegetation type, cover type**—a land classification system based on the concept of distinct plant associations.

**herbivory**—grazing of grass and other plants by any animal.

**indigenous**—originating or occurring naturally in a particular place.

**inholding**—non-Service land owned by private, other agency, or other group landowners that is within the boundary of a national wildlife refuge.

**integrated pest management**—methods of managing undesirable species such as invasive plants; education, prevention, physical or mechanical methods of control, biological control, responsible chemical use, and cultural methods.

**introduced species**—a species present in an area due to intentional or unintentional escape, release, dissemination, or placement into an ecosystem as a result of human activity.

**invasive species**—any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem; and whose introduction does or is likely to cause economic or environmental harm or harm to human health.

**invertebrates**—an animal that lacks an internal skeleton or backbone such as insects, butterflies, and aquatic species like snails.

**issue**—any unsettled matter that requires a management decision; for example, a Service initiative, opportunity, resource management problem, a threat to the resources of the unit, conflict in uses, public concern, or the presence of an unde-

sirable resource condition (The "Fish and Wildlife Service Manual," 602 FW 1.5).

**lacustrine**—of, relating to, or associated with lakes.

**metapopulation**—a group of spatially separated populations of the same species which interact at some level.

**migration**—regular extensive, seasonal movements of birds between their breeding regions and their wintering regions; to pass usually periodically from one region or climate to another for feeding or breeding.

**migratory birds**—birds that follow a seasonal movement from their breeding grounds to their wintering grounds. Waterfowl, shorebirds, raptors, and songbirds are all migratory birds.

**monitoring**—the process of collecting information to track changes of selected parameters over time

**national wildlife refuge**—a designated area of land, water, or an interest in land or water within the National Wildlife Refuge System, but does not include coordination areas; a complete listing of all units of the Refuge System is in the current "Annual Report of Lands Under Control of the U.S. Fish and Wildlife Service."

**National Wildlife Refuge System (Refuge System)**—various categories of areas administered by the Secretary of the Interior for the conservation of fish and wildlife including species threatened with extinction, all lands, waters, and interests therein administered by the Secretary as wildlife refuges, areas for the protection and conservation of fish and wildlife that are threatened with extinction, wildlife ranges, game ranges, wildlife management areas, and waterfowl production areas.

**native species**—a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.

**neotropical migrant**—a bird species that breeds north of the United States and Mexican border and winters primarily south of this border.

**nest success**—the percentage of nests that successfully hatch one or more eggs of the total number of nests initiated in an area.

**nongovernmental organization**—any group that is not a Federal, State, tribal, county, city, town, local, or other governmental entity.

**objective**—an objective is a concise target statement of what will be achieved, how much will be achieved, when and where it will be achieved, and who is responsible for the work; derived from goals and provide the basis for determining management strategies. Objectives should be attainable and time-specific and should be stated quantitatively to the extent possible. If objectives cannot be stated quantitatively, they may be stated qualitatively (The "Fish and Wildlife Service Manual," 602 FW 1.5).

**patch**—an area distinct from that around it; an area distinguished from its surroundings by environmental conditions.

**plant community**—an assemblage of plant species unique in its composition; occurs in particular locations under particular influences; a reflection or integration of the environmental influences on the site such as soil, temperature, elevation, solar radiation, slope, aspect, and rainfall; denotes a general kind of climax plant community, such as ponderosa pine or bunchgrass.

**preferred alternative**—the alternative which the Service believes would fulfill its statutory mission and responsibilities, giving consideration to economic, environmental, technical, and other factors.

**prescribed fire**—a wildland fire originating from a planned ignition to meet specific objectives identified in a written, approved, prescribed fire plan for which NEPA requirements (where applicable) have been met before ignition. These objectives could be hazardous fuel reduction, habitat- or wildlife-oriented, or other objectives in the prescribed fire burn plan.

**priority public use**—one of six uses authorized by the National Wildlife Refuge System Improvement Act of 1997 to have priority if found to be compatible with a refuge's purposes. This includes hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation.

**proposed action**—the alternative initially proposed to best achieve the purpose, vision, and goals of a refuge (contributes to the Refuge System mission, addresses the significant issues, and is consistent with principles of sound fish and wildlife management).

**public**—individuals, organizations, and groups; officials of Federal, State, and local government agencies; Native American tribes; and foreign nations. It may include anyone outside the core planning team. It includes those who may or may not have shown an interest in Service issues and those who do or do not realize that Service decisions may affect them.

**public involvement**—a process that offers affected and interested individuals and organizations an opportunity to become informed about, and to express their opinions on, Service actions and policies. In the process, these views are studied thoroughly and thoughtful consideration of public views is given in shaping decisions for refuge management.

**purpose of the refuge**—the purpose of a refuge is specified in or derived from the law, proclamation, Executive order, agreement, public land order, donation document, or administrative memoran-

dum establishing authorization or expanding a refuge, a refuge unit, or a refuge subunit (The "Fish and Wildlife Service Manual," 602 FW 1.5).

**refuge use**—any activity on a refuge, except administrative or law enforcement activity, carried out by or under the direction of an authorized Service employee.

**resident species- a species inhabiting a given locality throughout the year; nonmigratory species**

**resilience**—the ability to absorb disturbances, to be changed and then to reorganize and still have the same identity (keep the same basic structure and ways of functioning).

**resource of concern**—each plant and/or animal species, species groups, or communities specifically identified as worthy of specific management in refuge purpose(s), System mission, or international, national, regional, state, or ecosystem conservation plans or acts.

**restoration**—management emphasis designed to move ecosystems to desired conditions and processes, such as healthy upland habitats and aquatic systems.

**riparian area or riparian zone**—an area or habitat that is transitional from terrestrial to aquatic ecosystems including streams, lakes, wet areas, and adjacent plant communities and their associated soils that have free water at or near the surface; an area whose components are directly or indirectly attributed to the influence of water; of or relating to a river; specifically applied to ecology, "riparian" describes the land immediately adjoining and directly influenced by streams. For example, riparian vegetation includes all plant life growing on the land adjoining a stream and directly influenced by the stream.

**scoping**—the process of obtaining information from the public for input into the planning process

**shorebird**—any of a suborder (*Charadrii*) of birds such as plovers or sandpipers that frequent wetlands.

**special use permit**—a permit for special authorization from the refuge manager required for any refuge service, facility, privilege, or product of the soil provided at refuge expense and not usually available to the public through authorizations in Title 50 CFR or other public regulations (Refuge Manual, 5 RM 17.6).

**stepdown management plan**—a plan that provides the details necessary to carry out management strategies identified in the comprehensive conservation plan (The "Fish and Wildlife Service Manual," 602 FW 1.5).

**strategy**—a specific action, tool, or technique or combination of actions, tools, and techniques used to meet unit objectives (The "Fish and Wildlife Service Manual," 602 FW 1.5).

**Superfund**—the name given to the environmental program established to address abandoned hazardous waste sites. It is also the name of the fund established by the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (CERCLA).

**suppression**—all the work of extinguishing a fire or confining fire spread.

**surrogate species**—species that represent other species or aspects of the environment. These include umbrella, focal, keystone, indicator, and flagship species. It is a commonly-used scientific term for system-based conservation planning that uses a species as an indicator of landscape habitat and system conditions.

**threatened species, Federal**—species listed under the Endangered Species Act of 1973, as amended, that are likely to become endangered within the foreseeable future throughout all or a significant part of their range.

**threatened species, State**—a plant or animal species likely to become endangered in a particular State within the near future if factors contributing to population decline or habitat degradation or loss continue.

**U.S. Fish and Wildlife Service (Service, USFWS, FWS)**—the principal Federal agency responsible for conserving, protecting, and enhancing fish and wildlife and their habitats for the continuing benefit of the American people. The Service manages the 93-million-acre National Wildlife Refuge System comprised of more than 530 national wildlife refuges and thousands of waterfowl production areas. It also runs 65 national fish hatcheries and 78 ecological service field stations, the agency enforces Federal wildlife laws, manages migratory bird populations, restores national significant fisheries, conserves and restores wildlife habitat such as wetlands, administers the Endangered Species Act, and helps foreign Governments with their conservation efforts. It also oversees the Federal aid program that distributes millions of dollars in excise taxes on fishing and hunting equipment to State wildlife agencies.

**vision statement**—a concise statement of the desired future condition of the planning unit, based primarily on the Refuge System mission, specific refuge purposes, and other relevant mandates (The "Fish and Wildlife Service Manual," 602 FW 1.5).

**wildfire**—a wildland fire originating from an unplanned ignition caused by lightning, volcanoes, unauthorized and accidental human-caused fires, and escaped prescribed fires.

**wildland fire**—a general term describing any nonstructure fire that occurs in the wildland.

# Appendix A
*Key Legislation and Policies*

This appendix briefly describes the guidance for the National Wildlife Refuge System (Refuge System) as well as policies and key legislation that guide the management of the Rocky Mountain Arsenal National Wildlife Refuge.

## A.1 National Wildlife Refuge System

The mission of the Refuge System is to administer a national network of lands and waters for the conservation, management, and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

### Goals of the National Wildlife Refuge System

- Conserve a diversity of fish, wildlife, and plants and their habitats, including species that are endangered or threatened with becoming endangered.
- Develop and maintain a network of habitats for migratory birds, anadromous and interjurisdictional fish, and marine mammal populations that is strategically distributed and carefully managed to meet important life history needs of these species across their ranges.
- Conserve those ecosystems, plant communities, wetlands of national or international significance, and landscapes and seascapes that are unique, rare, declining, or underrepresented in existing protection efforts.
- Provide and enhance opportunities to participate in compatible wildlife-dependent recreation (hunting, fish, wildlife observation and photography, and environmental education and interpretation).
- Foster understanding and instill appreciation of the diversity and interconnectedness of fish, wildlife, and plants and their habitats.

### Guiding Principles of the National Wildlife Refuge System

There are four guiding principles for management and public use of the Refuge System established by Executive Order 12996:

- *Public Use*—The Refuge System provides important opportunities for compatible wildlife-dependent recreational activities involving hunting, fishing, wildlife observation and photography, and environmental education and interpretation.
- *Habitat*—Fish and wildlife will not prosper without quality habitat, and without fish and wildlife, traditional uses of refuges cannot be sustained. The Refuge System will continue to conserve and enhance the quality and diversity of fish and wildlife habitat within refuges.
- *Partnerships*—America's sportsmen and women were the first partners who insisted on protecting valuable wildlife habitat within wildlife refuges. Conservation partnerships with other Federal agencies, State agencies, tribes, organizations, industry, and the public can make significant contributions to the growth and management of the Refuge System.
- *Public Involvement*—The public should be given a full and open opportunity to participate in decisions about acquisition and management of national wildlife refuges.

## A.2 Other Legal and Policy Guidance

Management actions on national wildlife refuges are constrained by many mandates, including laws and Executive orders. The more common regulations that affect refuge management are listed below.

- American Indian Religious Freedom Act (1978): Directs agencies to consult with native traditional religious leaders to determine appropriate policy changes necessary to protect and preserve Native American religious cultural rights and practices.
- Americans with Disabilities Act (1992): Prohibits discrimination in public accommodations and services.
- Antiquities Act (1906): Authorizes the scientific investigation of antiquities on Federal land and provides penalties for unauthorized removal of objects taken or collected without a permit.
- Archaeological and Historic Preservation Act (1974): Directs the preservation of historic and archaeological data in Federal construction projects.
- Archaeological Resources Protection Act (1979), as amended: Protects materials of archaeological interest from unauthorized removal or destruction and requires Federal managers to develop plans and schedules to locate archaeological resources.
- Architectural Barriers Act (1968): Requires federally owned, leased, or funded buildings and facilities to be accessible to persons with disabilities.
- Bald and Golden Eagle Protection Act (1940): Provides for the protection of the bald eagle (the national emblem) and the golden eagle by prohibiting, except under certain specified conditions, the taking, possession, and commerce of such birds.
- Clean Air Act (1970, amended 1990): Restricts the amount of pollutants that can be emitted into the air.
- Clean Water Act (1977): Requires consultation with the U.S. Army Corps of Engineers (404 permits) for major wetland modifications.
- Data Quality Act (2001): Requires government agencies to ensure and maximize the quality, objectivity, utility, and dissemination of information by Federal agencies.
- Dingell-Johnson Act (1950): Authorizes the Secretary of the Interior to provide financial assistance for State fish restoration and management plans and projects. Financed by excise taxes paid by manufactures of rods, reels, and other fishing equipment.
- Emergency Wetlands Resources Act (1986): Promotes wetland conservation for the public benefit to help fulfill international obligations in various migratory bird treaties and conventions. The act authorizes buying wetlands with Land and Water Conservation Fund monies.
- Endangered Species Act (1973): Requires Federal agencies to carry out programs for the conservation of endangered and threatened species.
- Executive Order 11988 (1977): Requires Federal agencies to provide leadership and take action to reduce the risk of flood loss, minimize the impact of floods on human safety, and preserve the natural and beneficial values served by the floodplains.
- Executive Order 12996, Management and General Public Use of the National Wildlife Refuge System (1996): Defines the mission, purpose, and priority public uses of the National Wildlife Refuge System. It also presents four principles to guide management of the Refuge System.
- Executive Order 13007, Indian Sacred Sites (1996): Directs Federal land management and other agencies to accommodate access to and ceremonial uses of Indian sacred sites by Indian religious practitioners, avoid adversely affecting the physical integrity of such sacred sites and, where appropriate, maintain the confidentiality of sacred sites.
- Executive Order 13352, Cooperative Conservation (2004): Directs Federal agencies to implement laws relating to the environment and natural resources in a manner that promotes cooperative conservation

with an emphasis on appropriate inclusion of local participation in Federal decisionmaking in accordance with respective agency missions and policies.

- Executive Order 13443, Facilitation of Hunting Heritage and Wildlife Conservation (2007): Directs Federal land management and other agencies to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat.

- Executive Order 13653, Preparing the United States for the Impacts of Climate Change (2013): Directs Federal Government agencies to build on recent progress and pursue new strategies to improve the Nation's preparedness and resilience in preparing and adapting to climate change.

- Federal Noxious Weed Act (1990): Requires the use of integrated management systems to control or contain undesirable plant species and an interdisciplinary approach with the cooperation of other Federal and State agencies.

- Federal Records Act (1950): Requires the preservation of evidence of the Government's organization, functions, policies, decisions, operations, and activities, as well as basic historical and other information.

- Fish and Wildlife Coordination Act (1958): Allows the U.S. Fish and Wildlife Service to enter into agreements with private landowners for wildlife management purposes.

- Migratory Bird Conservation Act (1929): Establishes procedures for acquisition by purchase, rental, or gifts of areas approved by the Migratory Bird Conservation Commission.

- Migratory Bird Hunting and Conservation Stamp Act (1934): Authorizes the opening of part of a refuge to waterfowl hunting.

- Migratory Bird Treaty Act (1918): Designates the protection of migratory birds as a Federal responsibility, and enables the setting of seasons and other regulations including the closing of areas, Federal or non-Federal, to the hunting of migratory birds.

- Native American Policy (1994): Articulates the general principles that guide the U.S. Fish and Wildlife Service's government-to-government relationship to Native American governments in the conservation of fish and wildlife resources.

- National Environmental Policy Act (1969): Requires all agencies, including the U.S. Fish and Wildlife Service, to examine the environmental impacts of their actions, incorporate environmental information, and use public participation in the planning and implementation of all actions. Federal agencies must integrate this act with other planning requirements, and prepare appropriate documents to facilitate better environmental decisionmaking. [From the Code of Federal Regulations (CFR), 40 CFR 1500]

- National Historic Preservation Act (1966), as amended: Establishes as policy that the Federal Government is to provide leadership in the preservation of the Nation's prehistoric and historical resources.

- National Wildlife Refuge System Administration Act (1966): Defines the National Wildlife Refuge System and authorizes the Secretary of the Interior to permit any use of a refuge, provided such use is compatible with the major purposes for which the refuge was established.

- National Wildlife Refuge System Improvement Act of 1997: Sets the mission and administrative policy for all refuges in the National Wildlife Refuge System; mandates comprehensive conservation planning for all units of the Refuge System.

- Native American Graves Protection and Repatriation Act (1990): Requires Federal agencies and museums to inventory, determine ownership of, and repatriate cultural items under their control or possession.

- Paleontological Resources Preservation Act of 2009: Requires the Secretary of Interior and Agriculture to manage and protect paleontological resources on Federal land using scientific principles and expertise.

- Refuge Recreation Act (1962): Allows the use of refuges for recreation when such uses are compatible with the refuge's primary

purposes and when sufficient funds are available to manage the uses.

- Rehabilitation Act (1973): Requires programmatic accessibility in addition to physical accessibility for all facilities and programs funded by the Federal Government to ensure that any person can participate in any program.

- Rivers and Harbors Act (1899): Section 10 of this act requires the authorization of U.S. Army Corps of Engineers before any work in, on, over, or under navigable waters of the United States.

- Rocky Mountain Arsenal National Wildlife Refuge Act of 1992: Created the Rocky Mountain Arsenal National Wildlife Refuge out of lands transferred from the U.S. Army and established the purposes of the refuge.

- Volunteer and Community Partnership Enhancement Act (1998): Encourages the use of volunteers to help in the management of refuges within the Refuge System; facilitates partnerships between the Refuge System and non-Federal entities to promote public awareness of the resources of the Refuge System and public participation in the conservation of the resources; and encourages donations and other contributions.

- Wilderness Act (1964): The act (Public Law 88–577) [16 United States Code §§ 1131–36]) defines wilderness as "A wilderness, in contrast with those areas where man and his works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain."

# Appendix B

## *List of Planning Team, Preparers, and Contributors*

This document is the result of extensive and enthusiastic collaboration among members of the planning team, which includes refuge staff and other U.S. Fish and Wildlife Service employees as well as several contributors from our cooperating agencies and other organizations.

We are very grateful to all who have participated in the preparation of this plan, especially our cooperative agencies who attended planning team meetings; helped identify issues; provided input on alternative approaches, objectives, and strategies; helped us assess the environmental consequences of alternatives; reviewed draft planning documents; and provided extensive support and information throughout the planning process.

**Table B-1. Core planning team.**

| *Name* | *Agency and/or position* | *Contributions* |
|---|---|---|
| Jenny Axmacher | City of Commerce City, City Planner | Assistance with development of vision, goals, alternatives, and environmental consequences |
| Barbara Boyle | U.S. Fish and Wildlife Service, National Wildlife Refuge System, Region 6, Refuge Supervisor | Planning overview and assistance in developing vision, goals, and alternatives |
| Thomas Butts | Tri-County Health Department, Acting Deputy Director | Assistance with development of vision, goals, alternatives, and environmental consequences |
| Chris Cramer | City of Commerce City, Community Development, Director | Assistance with development of vision, goals, alternatives, and environmental consequences |
| Kendra Cross | U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services | Assistance with development of vision, goals, alternatives, and environmental consequences |
| Traci Ferguson | City of Commerce City, Parks and Recreation, Parks Planner | Assistance with development of vision, goals, alternatives, and environmental consequences |
| Bernardo Garza | U.S. Fish and Wildlife Service, Division of People, Planning, and Policy, Branch of Planning and Policy, Planning Team Leader | Lead planner; plan and planning team coordinator; and plan organization, writing, and review |
| Scott Gilmore | City and County of Denver, Parks and Recreation, Deputy of Parks and Planning | Assistance with development of vision, goals, alternatives, and environmental consequences |
| Toni Griffin | U.S. Fish and Wildlife Service, Division of People, Planning, and Policy, Branch of Planning and Policy, Planning Team Leader | Lead planner; plan and planning team coordinator; and plan organization, writing, and review |
| Bruce Hastings | (Former) U.S. Fish and Wildlife Service, Rocky Mountain Arsenal National Wildlife Refuge, Deputy Project Leader | Planning coordination, organization, analysis, writing, and review |
| Jay Henke | City and County of Denver, Parks and Recreation, Senior Landscape Architect | Assistance with development of vision, goals, alternatives, and environmental consequences |
| Elijah Henley | U.S. Department of Transportation, Federal Highway Administration, Central Federal Lands Highway Division, Federal Highway Administrator | Assistance with analysis and development of access and transportation alternatives and environmental consequences |

**Table B-1. Core planning team.**

| *Name* | *Agency and/or position* | *Contributions* |
|---|---|---|
| Mindy Hetrick | (Former) U.S. Fish and Wildlife Service, Rocky Mountain Arsenal National Wildlife Refuge, Wildlife Biologist | Planning development, analysis, writing, and review |
| Jeannette Hillaire-Stoufer | Denver International Airport, Planning and Development, Acting Director of Planning | Assistance with development of vision, goals, alternatives, and environmental consequences |
| Levi Hodson | U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services, Wildlife Biologist | Assistance with development of vision, goals, alternatives, and environmental consequences |
| Brandon Howes | Denver International Airport, Planning and Environmental Services, Senior Landside Planner | Assistance with development of vision, goals, alternatives, and environmental consequences |
| John Hughes | U.S. Fish and Wildlife Service, National Black-Footed Ferret Conservation Center, Wildlife Biologist | Assistance with and consultation on the reintroduction of the black-footed ferret |
| Nick Kaczor | U.S. Fish and Wildlife Service, Rocky Mountain Arsenal National Wildlife Refuge, Assistant Refuge Manager | Planning development, analysis, writing, and review |
| Melanie Kaknes | Colorado Parks and Wildlife, District Wildlife Manager—Sedalia | Assistance with development of vision, goals, alternatives, and environmental consequences |
| Edward (Mark) Kalitowski | (Former) U.S. Fish and Wildlife Service, Rocky Mountain Arsenal National Wildlife Refuge, Cartography and GIS | GIS analysis and mapping for public meetings and the plan, planning development, analysis, writing, and review |
| Carolyn Keith | City of Commerce City, Parks and Recreation, Director | Assistance with development of vision, goals, alternatives, and environmental consequences |
| Mark Kunugi | Denver International Airport, Environmental Services, Environmental Public Health Manager | Assistance with development of vision, goals, alternatives, and environmental consequences |
| William Kutosky | U.S. Fish and Wildlife Service, Rocky Mountain Arsenal National Wildlife Refuge, Wildlife Refuge Specialist | Assistance with development of CCP objectives |
| Susan Linner | U.S. Fish and Wildlife Service, Ecological Services Colorado Field Office, former Field Supervisor | Assistance with and consultation on the reintroduction of the black-footed ferret |
| David Lucas | U.S. Fish and Wildlife Service, Rocky Mountain Arsenal National Wildlife Refuge, Project Leader | Overall planning coordination, organization, analysis, writing, and review |
| Morgan Malley | U.S. Department of Transportation, Federal Highway Administration, Central Federal Lands Highway Division, Transportation Planner | Assistance with analysis and development of access and transportation alternatives and environmental consequences |
| David Mallory | Urban Drainage and Flood Control District, Program Manager | Assistance with development of vision, goals, alternatives, and environmental consequences |
| Melodie Mascarenaz | (Former) Tri-County Health Department, Rocky Mountain Arsenal Field Supervisor and former Office Director | Assistance with development of vision, goals, alternatives, and environmental consequences |
| Shannon McDowell | Adams County, Parks and Community Resources, Open Space Program Manager | Assistance with development of vision, goals, alternatives and environmental consequences |

**Table B-1. Core planning team.**

| *Name* | *Agency and/or position* | *Contributions* |
|---|---|---|
| Patsy McEntee | National Park Service, Rivers, Trails and Conservation Assistance Program, Landscape Architect | Assistance with alternatives development, mapping, and workshop coordination |
| Laurie Miskimins | U.S. Department of Transportation, Federal Highway Administration, Central Federal Lands Highway Division, Transportation Planner | Assistance with analysis and development of access and transportation alternatives and environmental consequences |
| Scott Morrissey | Denver International Airport, Environmental Services, Director of Environmental Programs | Assistance with development of vision, goals, alternatives, and environmental consequences |
| Jess Ortiz | City and County of Denver, Denver Public Works Department, Senior Engineer and Project Manager for Capital Projects Management | Assistance with development of vision, goals, alternatives, and environmental consequences |
| Tom Ronning | U.S. Fish and Wildlife Service, Rocky Mountain Arsenal National Wildlife Refuge, Wildlife Refuge Specialist | Planning coordination, organization, analysis, writing, and review |
| Cindy Souders | U.S. Fish and Wildlife Service, Rocky Mountain Arsenal National Wildlife Refuge, Supervisory Park Ranger | Planning coordination, organization, analysis, writing, and review |
| Christopher Spivey | (Former) U.S. Fish and Wildlife Service, Rocky Mountain Arsenal National Wildlife Refuge, Federal Wildlife Officer | Planning coordination, organization, analysis, writing, and review |
| Ed Tagliente | U.S. Fish and Wildlife Service, Rocky Mountain Arsenal National Wildlife Refuge, Park Ranger | Assistance with development of CCP objectives |
| Kelly Uhing | City and County of Denver, Parks and Recreation, Natural Areas Program, City Naturalist | Assistance with development of vision, goals, alternatives, and environmental consequences |
| Rachelle Urso | City of Commerce City, Public Works and Engineering, Development Engineer | Assistance with development of vision, goals, alternatives, and environmental consequences |
| Sandy Vana-Miller | U.S. Fish and Wildlife Service, Ecological Services Colorado Field Office, Wildlife Biologist—Platte River Recovery Program | Assistance with and consultation on the reintroduction of the black-footed ferret |
| Vicki Vargas-Madrid | (Former) Colorado Parks and Wildlife, District Wildlife Manager | Assistance with development of vision, goals, alternatives, and environmental consequences |
| Mitchel Werner | (Former) U.S. Fish and Wildlife Service, Division of Biological Resources, Branch of Planning, Writer and Editor | Review, editing, and document layout |
| Scott Whiteaker | U.S. Fish and Wildlife Service, Rocky Mountain Arsenal National Wildlife Refuge, Wildlife Refuge Specialist | Planning coordination, organization, analysis, writing, and review |
| Terry Wright | (Former) U.S. Fish and Wildlife Service, Rocky Mountain Arsenal National Wildlife Refuge, Rangeland Management Specialist | Assistance with writing and review of cultural resources CCP sections |

**Table B-2. Other contributors and reviewers.**

| *Name* | *Agency and/or position* | *Contributions* |
|---|---|---|
| Crystal Chick | Colorado Parks and Wildlife, District Wildlife Manager—Denver | Document review |
| Catherine Cullinane Thomas | U.S. Geological Survey, Fort Collins Science Center, Policy Analysis and Science Assistance Branch, Economist | Regional economic profile, analysis of socioeconomic impacts |

**Table B-2. Other contributors and reviewers.**

| *Name* | *Agency and/or position* | *Contributions* |
|---|---|---|
| Susan Drobniak | U.S. Fish and Wildlife Service, Rocky Mountain Arsenal National Wildlife Refuge | Assistance with overview of visitor services |
| Diane Emmons | U.S. Fish and Wildlife Service, National Wildlife Refuge System, Region 6, Division of Education and Visitor Services, Chief | Assistance with overview of visitor services |
| Wes Erickson | U.S. Army, Rocky Mountain Arsenal | Document review |
| Pete Gober | U.S. Fish and Wildlife Service, National Black-Footed Ferret Conservation Center, Recovery Coordinator | Assistance with and consultation on the reintroduction of the black-footed ferret |
| Joelle Greenland | Adams County, Parks and Community Resources, Long Range Planning | Document review |
| Damian Highmam | Denver Water, Recycled Water Section | Document review |
| Christopher Huber | U.S. Geological Survey, Fort Collins Science Center, Policy Analysis and Science Assistance Branch, Economist | Regional economic profile, analysis of socioeconomic impacts |
| Tina Jackson | Colorado Parks and Wildlife | Document review |
| Julie Lyke | U.S. Fish and Wildlife Service, National Black-Footed Ferret Conservation Center, Deputy Recovery Coordinator | Assistance with and consultation on the reintroduction of the black-footed ferret |
| Heather McDermott | Adams County, Parks and Community Resources, Emergency Management | Document review |
| Holly Miller | U.S. Geological Survey, Fort Collins Science Center, Policy Analysis and Science Assistance Branch, Social Scientist | Regional economic profile, analysis of socioeconomic impacts |
| Ken Morgan | Colorado Parks and Wildlife | Document review |
| Leslie Richardson | U.S. Geological Survey, Fort Collins Science Center, Policy Analysis and Science Assistance Branch | Regional economic profile, analysis of socioeconomic impacts |
| Charles Scharmann | U.S. Army, Rocky Mountain Arsenal, Program Manager | Document review |
| Rudy Schuster | U.S. Geological Survey, Fort Collins Science Center, Policy Analysis and Science Assistance Branch, Chief and Social Scientist | Regional economic profile, analysis of socioeconomic impacts |
| Earlene Swann | U.S. Geological Survey, Fort Collins Science Center, Policy Analysis and Science Assistance Branch, Social Scientist | Regional economic profile, analysis of socioeconomic impacts |
| Craig Tessmer | Adams County, Parks and Community Resources, Environmental Services | Document review |
| Melvie Uhland | U.S. Fish and Wildlife Service, National Wildlife Refuge System, Region 6, Division of Education and Visitor Services, Outdoor Recreation Planner | Assistance with overview of visitor services |

**Table B-3. Consultants.**

| *Name* | *Agency and/or position* | *Contributions* |
|---|---|---|
| Mimi Mather | Root House Studio, Principal | Facilitation of planning team and public meetings; development of visual and printed resources |
| Heidi West | Total Quality NEPA, Principal | Assistance with NEPA procedures, analysis, environmental consequences, workshops, and other NEPA issues and documentation |

# Appendix C
*Public Involvement*

Following the guidance found in NEPA, the Improvement Act, and our planning policies, we have made sure that all interested groups and the public have had an opportunity to be involved in the planning process. This appendix outlines our outreach efforts during the development of the CCP and EIS.

## C.1 Public Scoping Activities

A notice of intent to develop a CCP and a request for comments was published in the Federal Register on August 7, 2013 (78 FR Doc. 2013-19052). The notice of intent notified the public of our intent to begin the CCP and EIS process, of how the public may contact us and provide us with comments, and of the several public meetings we would subsequently have in the refuge vicinity.

## C.2 Public Outreach

Early in the preplanning phase, we identified a process that would be inclusive of many interests, would involve a range of activities for keeping the public informed, and would ensure meaningful public input. To date, we have used various methods to solicit guidance and feedback from interested citizens, organizations, and government agencies. These methods have included outreach materials; public scoping meetings; open house meetings; agency meetings (planning team); briefings and presentations; and letters, email, and telephone calls.

### Planning Updates

A Planning Update was mailed in the middle of June 2013 ahead of the four public meetings we held near the refuge. The planning update outlined the planning process; the dates, times, and locations of the public scoping meetings; and ways for the public to get involved in the planning process and provide us with their comments. We announced the information contained in the planning update during local agency meetings. The planning update distribution list consisted of individuals, agencies, and organizations who previously expressed an interest in refuge activities. The Service developed and distributed a planning update announcing the availability of the final EIS and record of decision. The Service will publish and distribute a planning update to notify the public of the availability of the final CCP.

### Press Release

Our division of external affairs sent press releases to all appropriate media organizations throughout Colorado including congressional offices, other federal and state agency offices, and tribal agencies announcing the planning process and notifying the public of the schedule and location of the public meetings and of the release of final documents available to the public. News articles about the refuge and the planning process appeared in local newspapers and online publications prior to the meetings.

### Project Web Site

The project's planning Web site was established in early May 2013. The site provides information about the public scoping meetings, as well as downloadable versions of all available public scoping and final documents, the notices of intent and availability, the planning updates, the refuge's comprehensive management plan, the draft CCP and EIS, the final EIS, the record of decision, and the final CCP. All interested citizens were able to sign up to be on the project mailing list and to provide public comments or download public documents through the planning Web site.

## Public Scoping Meetings

The four public scoping meetings (July 25 to August 15, 2013) were a major component of the public scoping process. The purpose of these meetings was to inform the public about our planning process and about the refuge and its resources, and to solicit public concerns and planning ideas that were considered in the CCP and EIS. The four meetings were held at the following locations:

- July 25, 2013: Public scoping meeting at the Reunion Recreation Center
- July 30, 2013: Public scoping meeting at the Central Park Recreation Center
- August 7, 2013: English and Spanish bilingual public scoping meetings at the Commerce City Recreation Center
- August 15, 2013: English and Spanish public scoping meetings at the Montbello Recreation Center

Following a brief welcome and introduction, Service staff made a 15-minute presentation that outlined the following topics: (1) a description of the Service and the purpose of the Refuge System; 2) a description of the refuge and its purposes, resources, and management; (3) an overview of the CCP and EIS process; (4) the project schedule.

After the presentation, the remainder of the meeting was divided into two components: questions and answers and public comments. During the question and answer session, the facilitator took the audience's questions and we answered all of them. Most of the meeting time was spent in the question and answer session. After all the questions were answered, we took comments from those who wanted to offer them. This format enabled participants to have their questions answered about the planning process and also identified many of the important issues.

## Other Briefings

We briefed or gave presentations to the City of Commerce City Council, the Denver Parks and Recreation Department, the Denver International Airport management, the Rocky Mountain Arsenal Committee, and others.

# C.3 Agency and Tribal Coordination

In accordance with the Service's planning policy, the preplanning and scoping process began with formal notification and a personal invitation to Native American tribes; other Federal, State, and local agencies with a land management interest; locally elected officials; and municipalities, inviting them to participate as cooperating agencies and members of the planning team.

## Native American Tribes

We sent letters of notification about the planning process, including an invitation to participate on the planning team, to the following tribes: Northern Arapaho Tribe, Northern Cheyenne Tribe, Southern Ute Tribe, and Ute Mountain Tribe.

## Federal, State, and Local Agencies

We sent letters of notification about the planning process including an invitation to participate on the planning team to the following agencies, groups and municipalities: Environmental Protection Agency, Federal Highway Administration, U.S. Department of Agriculture–APHIS, U.S. Army, Colorado Parks and Wildlife, Colorado Department of Public Health and Environment, Tri-County Health Department, Adams County Board of Commissioners, Commerce City, City and County of Denver, and the Denver International Airport.

# C.4 Cooperating Agencies

The following agencies participated as cooperating agencies in the development of the draft CCP and EIS: Adams County Board of Commissioners, City of Commerce City, City and County of Denver, Colorado Parks and Wildlife, Denver International Airport, Denver Water, Tri-County Health Department, Urban Drainage and Flood Control District, U.S. Army, U.S. Department of Agriculture–Animal and Plant Health Inspection Service, and U.S. Department of Transportation–Federal Highway Administration. They provided input on the refuge's vision and goals, alternatives development, environmental

consequences, the internal and public review of the draft CCP and EIS and the final EIS. We greatly value the input received from the cooperating agencies.

# C.5 Scoping Results

The following summarizes the methods for comment collection and analysis and a summary of the comments. The planning team collected comments, questions, and concerns about the future of the refuge through public meetings, letters, email, and other methods as described in "Public Outreach" above.

## Methods for Comment Collection and Analysis

The objective of the scoping process was to gather the full range of comments, questions, and concerns that the public has about management of the refuge or the planning process. All comments, questions, or issues—whether from written submissions or recorded at the public meetings—were organized by topic. Every effort was made to document all issues, questions, and concerns. Regardless of whether comments and questions were general or about specific points of concern, they were added to the list one time.

We provided the following optional questions to the public:

- What are the qualities and characteristics that you most value about the Rocky Mountain Arsenal National Wildlife Refuge?
- What do you consider to be the most important issues concerning the Rocky Mountain Arsenal National Wildlife Refuge that should be addressed in the refuge planning process?
- What opportunities exist to manage wildlife habitat, provide for priority wildlife-dependent public uses, and develop partnerships with the community?

All the comments we received from individuals on our NEPA documents became part of the official public record. We handle all requests for information contained in comments in accordance with the Freedom of Information Act, NEPA (40 CFR 1506.6 (f)) and other Department of Interior and Service policies and procedures.

## Summary of the Scoping Comments

During the initial scoping process, we received input on a wide array of topics and subtopics. Comments were submitted in writing or offered at the public meetings held in July and August in Denver, City of Commerce City, Stapleton, and Montbello, Colorado.

1. Big Ideas

- Work to connect people to nature, particularly the grasslands. It takes education for people to appreciate the grasslands.
- People see it as a no-man's land and have no idea what is there. We need to get the word out about the beautiful resources.
- It is a challenge to overcome the refuge's history and reputation and to reframe it as a welcoming place for neighbors.
- Set clear expectations. Educate people about what is there (wildlife and habitats). It is not a zoo—seeing wildlife is not a guarantee—it is about experiencing a natural setting.
- Maintain the quiet, the soundscape, and the sense of retreat from the surrounding urban setting.
- Work toward authentic engagement with partnership organizations for environmental education in classrooms and outside. It should be well documented and in place to outlive staffing changes.
- We don't want history to fade into the background. It is an important piece of this unique refuge. Leave behind some of the Arsenal's history. Balance sharing the site's history and the evolution of the property with reassuring people that it is now clean and that visitors are welcome.

2. Suggestions for New or Expanded Facilities

- Add more hiking trails.

- Acquire a mobile visitor center (to take off-site or to have on other parts of the refuge. It could offer interpretive information and sell snacks).

- Add signs that explain the reasoning behind rules and regulations.

3. Access and Modes of Travel

- Provide access to areas up north that are great for bird watching.

- Allow biking on the roads.

- Expand the bus tour and Wildlife Drive.

- Reopen the Havana Street entrance. The Montbello neighborhood feels cut off. The neighborhood appreciated having access right there instead of having to go on the highway.

- Improve transportation connections to the refuge from neighborhoods (bus, safe bike routes).

4. Ideas for Interpretation

- Offer audio interpretation for the auto tour route.

- Increase the amount of interpretive signs.

- Interpretation should extend outside the Visitor Center. Interpret natural resources and history onsite.

- Interpret the history, evolution, and restoration of the site. We don't want these historical layers to get lost.

- Consider using artwork or interpretive sculptures to spur conversation and reflection about the history and evolution of the site.

- Invite a storyteller to come out and share the site's history.

- Share insights into animal behavior, little facts that enhance the visitors' experience.

- Provide backpacks that families can "check out" at the Visitor Center that are full of activities that get kids excited.

5. Ideas for Environmental Education

- This area of Denver lacks environmental education opportunities.

- Increase outreach to schools and encourage use by school groups.

- Work with schools. Get the kids out there and they will get their parents out there if they get excited about it.

- Have K–8 grassland program set in place.

- Encourage more interactions between the refuge and smaller nature and education organizations.

6. Hunting

- Do not allow hunting.

- Hunting has taken over as the dominant use on other refuges.

7. Outreach and Community Engagement

- Bring in nontraditional visitors.

- Provide more activities for families.

- Create more opportunities for Citizen Science.

- Remove some of the chain link fencing (along 56th Avenue) to make it appear more natural, more welcoming.

- Educate the surrounding communities about what is on the refuge and why we are conserving species.

- Distribute more information about the refuge. Make public announcements.

- Host contests on impressions of the refuge.

- It is important to take a critical look at the messages we are giving to people of color as we go through this process. Show people of color in our communications. Train staff to understand cultural diversity.

Subsequently, we identified eight significant issues or topics to address (please refer to chapter 1):

8. Seize the opportunity to connect people to nature at the refuge.

9. Improve promotions and conduct more outreach about the refuge and what it has to offer.

10. Set clear expectations about what a wildlife refuge is, does, and offers.

11. Maintain the sense of retreat from the surrounding urban setting.

12. Collaborate with partners to improve environmental education opportunities on and off the refuge.

13. Interpret the site's history.

14. Build new visitor facilities and expand programming (such as more trails, better signs, enhanced interpretive media, more environmental education, greater outreach).

15. Improve access and transportation systems (such as more biking opportunities, additional entry points, expanded wildlife drive, neighborhood connections).

## C.6 Development of Draft Alternatives

This phase of the project began in the winter of 2013–2014. The core planning team developed four approaches to managing the refuge. This included three action alternatives, with a proposed action, and the no-action alternative. Each of the draft alternatives presented a different approach for future management with a varied focus on wildlife and habitat management and visitor services. Following further input from other Service staff and our cooperating agencies, we refined and adjusted the alternatives.

## C.7 Development of Final EIS and Final CCP

After reviewing all comments received during the public review period of the draft CCP and EIS, we chose alternative C as the preferred alternative and published the final EIS and record of decision in 2015. We crafted the objectives for the different goals of the refuge and developed and released this final CCP in 2016.

## C.8 List of Officials, Agencies, Groups and Individuals on Our Mailing List

### Federal Elected Officials

Michael Bennett (Senator)
Cory Gardner (Senator)
Ed Perlmutter (Representative—7th District)
Diana DeGette (Representative—1st District)
Jared Polis (Representative—2nd District)

### Federal Agencies

Federal Aviation Administration
Martin Hestmark (Environmental Protection Agency)
Greg Hargreaves (Environmental Protection Agency)
Elijah Henley (Federal Highways Administration)
Charlie Scharmann (U.S. Army)
Wes Erickson (U.S. Army)
Sherry Skipper (U.S. Fish and Wildlife Service)
Laurie Miskimins (U.S. Department of Transportation)
Kendra Cross (U.S. Department of Agriculture)
Patsy McEntee (National Park Service)

### Native American Tribes

Jim Shakespeare (Northern Arapaho Tribe)
John Robinson (Northern Cheyenne Tribe)
William Walks Along (Northern Cheyenne Tribe)
Jimmy Newton (Southern Ute Indian Tribe)
Steve Whiteman (Southern Ute Indian Tribe)
Gary Hayes (Ute Mountain Ute Tribe)
George Wells, Jr. (Ute Mountain Ute Tribe)

## Colorado Elected Officials

Jessie Ulibarri (State Senator—District 21)
Dominick Moreno (State Representative—District 32)

## Colorado State Agencies

Bob Broscheid (Colorado Parks and Wildlife)
Melanie Kaknes (Colorado Parks and Wildlife)
Vicki Vargas Madrid (Colorado Parks and Wildlife)
Scott Babcock (Colorado Parks and Wildlife)
Gary Baughman (Colorado Department of Public Health and Environment)
Susan Newton (Colorado Department of Public Health and Environment)
Sarah Gallup (Colorado Department of Public Health and Environment)

## Local Government

Sean Ford (City of Commerce City)
James Hayes (City of Commerce City)
Mike Brown (City of Commerce City)
Rene Bullock (City of Commerce City)
Carolyn Keith (City of Commerce City)
Rick Teter (City of Commerce City)
Lysa Gallegos (City of Commerce City)
Tracy Ferguson (City of Commerce City)
Rick Anderson (Adams County)
Heather McDermott (Adams County)
Jeanne Shreve (Adams County)
Abel Montoya (Adams County)
Ronald Pena (Adams County, SAC Fire)
James Jones (Adams County, SACWSD)
Larry Quintana (Adams County, School District 14)
Kandy Steel (Adams County, School District 14)
Dr. Robyn Duran (Adams County, School District 14)
Gionni Thompson (Adams City High School)
Chris Herndon (City and County of Denver)
Jay Henke (City and County of Denver)
Jess Ortiz (City and County of Denver, Public Works)
Scott Gilmore (City and County of Denver, Parks and Recreation)
Kelly Uhing (City and County of Denver, PR Natural Areas)
Damian Higham (City and County of Denver, Denver Water)
Kenneth Conright (Tri-County Health Department)
Courtney Tomlin (Tri-County Health Department)
David Mallory (Urban Drainage and Flood Control District)
Brandon Howes (Denver International Airport)
Jeannette Stoufer (Denver International Airport)
Mark Kunugi (Denver International Airport)
Scott Morrissey (Denver International Airport)
Stapleton Development Corporation

## Public Libraries

Brighton Branch Library
Commerce City Branch Library
State Library
Montbello Branch Library
Denver Public Library

## Organizations

Carolyn Boller (Friends of the Front Range Wildlife Refuges)
Norma Portnoy (Kids First Program in association with Adams County, School District 14)
National Wildlife Federation
Audubon Society
Rocky Mountain Greenway Steering Committee
Stapleton Citizens' Advisory Board

# Appendix D

## *Rocky Mountain Arsenal National Wildlife Refuge Act of 1992*



Public Law 102-402
102d Congress

Oct. 9, 1992
[H.R. 1435]

An Act

To direct the Secretary of the Army to transfer jurisdiction over the Rocky Mountain Arsenal, Colorado, to the Secretary of the Interior.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

**SECTION 1. SHORT TITLE AND DEFINITIONS.**

(a) SHORT TITLE.—This act may be cited as the "Rocky Mountain Arsenal National Wildlife Refuge Act of 1992."

(b) DEFINITIONS.—For purposes of this Act:

(1) The term "Arsenal" means the Rocky Mountain Arsenal in the State of Colorado.

(2) The term "refuge" means the Rocky Mountain Arsenal National Wildlife Refuge established pursuant to section 4(a)

(3) The term "hazardous substance" has the meaning given such term by section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601 (14)).

(4) The term "pollutant or contaminant" has the meaning given such term by section 101(33) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601(14)).

(5) The term "response action" has the meaning given the term "response" by section 101(25) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601(25)).

(6) The term "person" has the meaning given that term by section 101(21) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601(21)).

**SEC. 2 TRANSFER OF MANAGEMENT RESPONSIBILITIES AND JURISDICTION OVER THE ROCKY MOUNTAIN ARSENAL.**

(a) TRANSFER OF MANAGEMENT RESPONSIBILITIES.—(1) Not later than October 1, 1992, the Secretary of the Army and the Secretary of the Interior shall enter into a memorandum of understanding under which—

(A) the Secretary of the Army shall transfer to the Secretary of the Interior, without reimbursement, all responsibility to manage for wildlife and public use purposes the real property comprising the Rocky Mountain Arsenal in the State of Colorado, except the property and facilities required to be retained under subsection (c) or designated for disposal under section 5; and

(B) The Secretary of the Interior shall manage that real property as if it were a unit of the National Wildlife Refuge System established for the purposes provided in section 4. (2) The management of the property by the Secretary of the Interior shall be subject to (A) any response action at the Arsenal carried out by or under that authority of the Secretary of the Army under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601 et seq.) and other applicable provisions of law, and (B) any action required under any other statute to remediate petroleum products or their derivatives (including motor oil and aviation fuel) carried out by or under the authority of the Secretary of the Army. In the case of any conflict between management of the property by the Secretary of the Interior and any such response action or other action, the response action or other action shall take priority.

(b) TRANSFER OF JURISDICTION.—(1) Upon receipt of the certification described in paragraph (2), the Secretary of the Army shall transfer to the Secretary of the Interior jurisdiction over the real property comprising the Arsenal, except the property and facilities required to be retained under subsection (c) or designated for disposal under section 5. The transfer shall be made without cost to the Secretary of the Interior and shall include such improvements on the property as the Secretary of the Interior may request in writing for refuge management purposes.

(2) The transfer of real property under paragraph (1) may occur only after the Administrator of the Environmental Protection Agency certifies to the Secretary of the Army that response action required at the Arsenal and any action required under any other statute to remediate petroleum products or their derivatives (including motor oil and aviation fuel) at the Arsenal have been completed, except operation and maintenance associated with those actions.

(3) The exact acreage and legal description of the real property subject to transfer under paragraph (1) shall be determined by a survey mutually satisfactory to the Secretary of the Army and the Secretary of the Interior. The Secretary of the Army shall bear any costs related to the survey.

(c) PROPERTY AND FACILITIES EXCLUDED FROM TRANSFERS.—

(1) PROPERTY USED FOR ENVIRONMENTAL CLEANUP PURPOSES.—The Secretary of the Army shall retain jurisdiction, authority, and control over all real property at the Arsenal to be used for water treatment; the treatment, storage, or disposal of hazardous substances, pollutants, or contaminants; or other purposes related to response action at the Arsenal and any action required under any other statute to remediate petroleum products or their derivatives (including motor oil and aviation fuel) at the Arsenal. The Secretary of the Army shall consult with the Secretary of the Interior regarding the identification and management of all real property retained under this paragraph and ensure that activities carried out on that property are—

(A) consistent with the purposes for which the refuge is to be established under section 4(c), to the extent practicable; and

(B) consistent with the provisions of sections 2(a)(2) and 4(e).

(2) PROPERTY USED FOR LEASE OF PUBLIC FACILITIES.—(A) The Secretary of the Army shall retain jurisdiction, authority, and control over the following real property at the Arsenal:

(i) Approximately 12.08 acres containing the South Adams County Water Treatment Plant and described in Department of the Army lease No. DACA 45-1-87-6121.

(ii) Approximately 63.04 acres containing a United States Postal Service facility and described in Department of the Army lease No. DACA 45-4-71-6185.

(B) Nothing in this Act shall affect the validity or continued operation of leases of the Department of the Army in existence on the date of the enactment of this act and involving the property described in subparagraph (A)

**SEC. 3. CONTINUATION OF RESPONSIBILITY AND LIABILITY OF THE SECRETARY OF THE ARMY FOR ENVIRONMENTAL CLEANUP.**

(a) RESPONSIBILITY.—Notwithstanding the memorandum of understanding required under section 2(a), the Secretary of the Army shall, with respect to the real property at the Arsenal that is subject to the memorandum, continue to carry out (1) response action at that property under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601 et seq.) and other applicable provisions of law, and (2) any action required under any other statute to remediate petroleum products or their derivatives (including motor oil and aviation fuel). The management by the Secretary of the Interior of such real property shall be subject to any such response action or other action at the property being carried out by or under the authority of the Secretary of the Army under such provisions of law.

(b) LIABILITY.—(1) Nothing in this Act shall relieve, and no action may be taken under this Act to relieve, the Secretary of the Army or any other person from any obligation or other liability at the Arsenal under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601 et seq.) and other applicable provisions of law. (2) After the transfer of jurisdiction under section 2(b), the Secretary of the Army shall retain any obligation or other liability at the Arsenal under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601 et seq.) and other applicable provisions of law and shall be accorded all easements and access as may be reasonably required to carry out such obligation or other liability.

(c) DEGREE OF CLEANUP.—Nothing in this Act shall be construed to restrict or lessen the degree of cleanup at the Arsenal required to be carried out under applicable provisions of law.

(d) PAYMENT OF RESPONSE ACTION COSTS.—Any Federal department or agency that had or has operations at the Arsenal resulting in the release or threatened release of hazardous substance, pollutants, or contaminants shall pay the cost of related response actions or related actions under other statutes to remediate petroleum products or their derivatives, including motor oil and aviation fuel.

(e) CONSULTATION.—In carrying out response actions at the Arsenal, the Secretary of the Army shall consult with Secretary of the Interior to ensure that such actions are carried out in a manner—

(1) to the extent practicable, consistent with the purposes set forth in section 4(c) for which the refuge will be established after the certification required under section 2(b)(2); and

(2) consistent with the provisions of sections 2(a)(2) and 4(e).

(f) EXISTING LAW.—The Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.), the Migratory Bird Treaty Act (16 U.S.C. 703 et seq.), and the Bald Eagle Protection Act (16 U.S.C. 668 et seq.) shall apply to all actions at the Arsenal.

(g) RESPONSE ACTIONS.—(1) The future establishment of the refuge shall not restrict or lessen in any way any response action or degree of cleanup under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 or other applicable provisions of law, or any response action required under any other statute to remediate petroleum products or their derivatives (including motor oil and aviation fuel), required to be carried out by or under the authority of the Secretary of the Army at the arsenal and surrounding areas, including areas, including (but not limited to)—

(A) the substance or performance of the remedial investigation and feasibility study or endangerment assessments;

(B) the contents and conclusions of the remedial investigation and feasibility study or the endangerment assessment reports; or

(C) the selection and implementation of response action and any action required under any other statute to remediate petroleum products or their derivatives (including motor oil and aviation fuel) for the Arsenal and surrounding areas.

(2) All response action and action required under any other statute to remediate petroleum products or their derivatives (including motor oil and aviation fuel) carried out at the Arsenal shall attain a degree of cleanup of hazardous substances, pollutants, and contaminants that, at a minimum, is sufficient to full meet the purposes set forth in section 4(c) for which the refuge will be established and the permit access to all real property comprising the refuge by refuge personnel, wildlife researchers, and visitors.

**SEC. 4. ESTABLISHMENT OF THE ROCKY MOUNTAIN ARSENAL NATIONAL WILDLIFE REFUGE.**

(a) ESTABLISHMENT.—Not later than 30 days after the transfer of jurisdiction under section 2(b), the Secretary of the Interior shall establish a national wildlife refuge that shall be known as the Rocky Mountain Arsenal National Wildlife Refuge and consist of the real property required to be transferred under such section. The Secretary of the Interior shall publish a notice of the establishment of the refuge in the Federal Register.

(b) ADMINISTRATION.—

(1) IN GENERAL.—The Secretary of the Interior shall manage the refuge in accordance with the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd et seq.) and other applicable law.

(2) CONSULTATION.—In developing plans for the management of fish and wildlife at and public use of the refuge, the Secretary of the Interior shall—

(A) consult with the Colorado Department of Natural Resources and local governments adjacent to the refuge; and

(B) provide an opportunity for public comment on such plans.

(3) The Secretary of the Interior and the Administrator of the Federal Aviation Administration shall confer from time to time as necessary to coordinate the management of the refuge with the operations of the Denver International Airport.

(c) PURPOSES OF THE REFUGE.—The refuge is established for the following purposes:

(1) To conserve and enhance populations of fish, wildlife, and plants within the refuge, including populations of waterfowl, raptors, passerines, and marsh and water birds.

(2) To conserve species listed as threatened or endangered under the Endangered Species Act and species that are candidates for such listing.

(3) To provide maximum fish and wildlife oriented public uses at levels compatible with the conservation and enhancement of wildlife and wildlife habitat.

(4) To provide opportunities for compatible scientific research.

(5) To provide opportunities for compatible environmental and land use education

(6) To conserve and enhance the land and water of the refuge in a manner that will conserve and enhance the natural diversity of fish, wildlife, plants and their habitats.

(7) To protect and enhance the quality of aquatic habitat within the refuge.

(8) To fulfill international treaty obligations of the United States with respect to fish and wildlife and their habitats.

(d) LIMITATIONS.—

(1) PROHIBITION AGAINST ANNEXATION.—Notwithstanding section 4(a)(2) of the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C 668dd(a)(2)), the Secretary of the Interior shall not allow the annexation of lands within the refuge by any unit of general local government.

(2) PROHIBITION AGAINST THROUGH ROADS.—Public roads may not be constructed through the refuge.

**SEC. 5. DISPOSAL OF CERTAIN REAL PROPERTY AT THE ARSENAL FOR COMMERCIAL, HIGHWAY, OR OTHER PUBLIC USE.**

(a) PROPERTY DESIGNATED FOR DISPOSAL UNDER THIS SECTION.—The following areas of real property at the Arsenal are designated for disposal under this section for commercial, highway, or other public use purposes:

(1) An area of real property consisting of approximately 815 acres located at the Arsenal, the approximate legal description of which is section 9, T3S-R67W, and the W2W2 of section 4, the W4E2W2 of section 4, T3S-R67W, and the SW4SW4 of section 33, the W4E2W2 of section 33, and the W2NW4 of section 33, T2SR67W; except that the area designated shall not include the approximately 63.04 acres containing a United States Postal Service facility and described in Department of the Army lease No. DACA 45-4-71-6185 and the water wells located in buildings 385, 386, and 387 at the Arsenal and associated facilities and easements necessary to operate and maintain the water wells, which shall be treated in the manner provided in section 2.

(2) To permit the widening of existing roads, an area of real property of not more than 100 feet inside the boundary of the Arsenal on—

(A) the Northwest side of the Arsenal adjacent to Colorado Highway #2;

(B) the Northern side of the Arsenal adjacent to 96th Avenue; and

(C) the Southern side of the Arsenal adjacent to 56th Avenue.

(b) TRANSFER FOR HIGHWAY PURPOSES.—The Secretary of the Army shall convey those parcels of real property described in subsection (a)(2) to the State or the appropriate unit of general local government at no cost to allow for the improvement of public roads in existence on the date of the enactment of this Act or for the provision of alternative means of transportation.

(c) TRANSFER FOR SALE.—(1) The Secretary of the Army shall transfer to the Administrator of the General Services Administration those parcels of the area of real property described in subsection (a)(1). The transferred property shall be sold in advertised sales as surplus property under the provision of the Federal Property and Administrative Services Act of 1949 (40 U.S.C. 471 et seq.), except that the provisions of such Act relating to reduced- or no cost transfers to other governmental entities shall not apply to this property.*

(2) Any amounts realized by the United States upon the sale of property as described in paragraph (1) shall be transferred to the Director of the United States Fish and Wildlife Service to be used, to the extent provided for in appropriation Acts, to supplement the funds otherwise available for construction of a visitor and education center at the refuge.

(d) LIMITATIONS.—

(1) PERPETUAL RESTRICTIONS.—(A) The disposal of real property under this section shall be subject to perpetual restrictions that are attached to any deed to such property and that prohibit—

(i) the use of the property for residential or industrial purposes;

(ii) the use of ground water located under, or surface water located on, the property as a source of potable water;

(iii) hunting and fishing on the property, excluding hunting and fishing for nonconsumptive use subject to appropriate restrictions; and

(iv) agricultural use of the property, including all farming activities such as the raising of livestock, crops, or vegetables, but excluding agricultural practices used in response action or used of or erosion control.

(B) Nothing in subparagraph (A) shall be construed to restrict or lessen the degree of cleanup required to be carried out under applicable provisions of law at the property designated for disposal under this section.

(2) DISPOSAL IN ACCORDANCE WITH CERCLA.—The disposal of real property under this section shall be carried out in compliance with section 120(h) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9620(h)) and other applicable provisions of law.

Approved October 9, 1992.

* The National Defense Authorization Act of 1998 (Public Law 105-85) replaced the second sentence with "Section 5(c)(1) of Public Law 102-402 (106 Stat. 1966; 16 U.S.C. 668dd note) is amended by striking out the second sentence: 'The Administrator shall convey the transferred property to Commerce City, Colorado for consideration in an amount equal to the fair market value of the property (as determined jointly by the Administrator and the City).'"

# Appendix E
*Compatibility Determinations*

## E.1 Uses

We have developed draft compatibility determinations for the following uses. As per our planning policy, we provided these compatibility determinations in our draft CCP and EIS as part of the public review.

- Hunting
- Fishing
- Wildlife observation, photography, environmental education, and interpretation
- Commercial photography
- Research
- Refuge Perimeter Trail

## E.2 Establishing Authority and Refuge Purposes

The mission of the National Wildlife Refuge System (Refuge System) is "to administer a national network of lands and waters for the conservation, management, and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."

The refuge was established by the Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 (Public Law 102-402). Section 4 (c) of this Act outlined the following purposes for the refuge:

(1) To conserve and enhance populations of fish, wildlife, and plants within the refuge, including populations of waterfowl, raptors, passerines, and marsh and water birds.

(2) To conserve species listed as threatened or endangered under the Endangered Species Act and species that are candidates for such listing.

(3) To provide maximum fish and wildlife oriented public uses at levels compatible with the conservation and enhancement of wildlife and wildlife habitat.

(4) To provide opportunities for compatible scientific research.

(5) To provide opportunities for compatible environmental and land use education.

(6) To conserve and enhance the land and water of the refuge in a manner that will conserve and enhance the natural diversity of fish, wildlife, plants, and their habitats.

(7) To protect and enhance the quality of aquatic habitat within the refuge.

(8) To fulfill international treaty obligations of the United States with respect to fish and wildlife and their habitats.

## E.3 Description of Use

### Hunting

The refuge proposes to provide safe and sustainable big game and migratory bird hunting opportunities within designated areas. Under the authority of the National Wildlife Refuge Administration Act, the Secretary of the Interior can authorize hunting on any unit of the Refuge System as long as it is compatible with the purposes for which the refuge was established.

Specifically, the refuge proposes limited programs for white-tailed deer, mule deer, and doves. All hunts will be based on a lottery and will only be offered to youth and hunters with disabilities. The refuge is atypical because it is surrounded by a large fence that prevents big game from entering or exiting the refuge. In the past, this has allowed deer populations to exceed carrying capacity. Doves are typically

migratory and only spend some of their time on the refuge. Hunting will be restricted to areas that are not open to other public uses.

In addition, the refuge proposes a new hunter education program specifically for youth.

## Availability of Resources

We will have a full-time law enforcement officer to help administer the hunting program. Other staff will be trained to assist with hunter education programs.

## Anticipated Impacts of Use

Big game hunting will be limited to archery only. Upland bird hunting requires the use of shotguns. As with all hunting programs that use firearms, human safety is an important consideration. Hunters, other refuge users, and refuge staff are exposed to potential hazards whenever firearms are present. Harvest of individual animals can have adverse effects on larger populations if sustainable harvest practices are not used. Hunting activity in one area of a refuge often causes animals to move to other portions of the refuge. We often maintain areas that are closed to hunting along with areas where hunting is allowed. Hunter education programs will be offered indoors at existing facilities and will require a temporary archery range.

## Determination

Hunting of big game and doves and hunter education programs are compatible uses of the Rocky Mountain Arsenal National Wildlife Refuge.

## Stipulations Necessary to Ensure Compatibility

- All hunting will require a permit.
- Plans for specific hunting programs will ensure reasonable human safety by only allowing hunting in areas closed to other public uses, maintaining hunter densities at or below reasonable levels, providing information to hunters regarding areas they are hunting in and associated conditions, and maintaining law enforcement and staff presence to enable response to emergencies and provide information in the field.
- Plans for specific hunting programs will exclude areas from hunting activity if there is a risk to human safety or if there is a risk of property damage from firearm discharge.
- Illegal activities, including hunting violations, will be reduced by providing well-thought-out information and sufficient law enforcement presence.
- All hunting programs will be coordinated with Colorado Parks and Wildlife (CPW).
- All hunting programs will consider population objectives. Dove hunting will follow seasons and bag limits provided by CPW.
- The refuge manager will have the ability to close or modify entire hunting programs, including access, timing, and methods, in response to unforeseen conditions in order to ensure public safety and best management of natural resources.
- Refuge staff will regularly solicit feedback from hunters regarding safety, the overall quality of their hunting experience, and any suggestions they may have.

## Justification

Consistent with our habitat management plan (HMP), there may be a need to manage big game populations on the refuge. The Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 specifically encourages fish and wildlife recreational opportunities, and hunting is one of the wildlife-dependent recreational activities that is encouraged on national wildlife refuges. The refuge also provides a unique venue for hunter education and the exposure of youth to quality hunting opportunities, as defined in the U.S. Fish and Wildlife Service's (Service's) guidelines for wildlife-dependent recreation (FWS 2006b). Under this policy, providing quality experiences is highlighted as an important component of a hunting program (605 FW1, 605FW2). Promoting safety, providing reasonable opportunities for success, and working collaboratively with the State wildlife agencies are just a few of the key elements that should be considered in providing for quality experiences. For example, a quality experience could mean that participants could expect reasonable harvest opportunities, uncrowded conditions, few conflicts between hunters, relatively undisturbed wildlife, and limited interference from or dependence on mechanized aspects of the sport.

*Mandatory 15-year reevaluation date: 2030*

# Fishing

Even prior to the establishment of the refuge, fishing had been a cherished wildlife-dependent recreational opportunity at this site. Over the years, there have been periodic changes to the timing and location of fishing. Fishing is now allowed on Lake Mary and Lake Ladora; it is not allowed on other lakes on the refuge.

Current sport fishing regulations (50 Code of Federal Regulations [CFR] § 32.25) state that fishing be catch and release, requires a permit, and is permitted from sunrise to sunset from April 15 through October 15 annually. Additional conditions are found in the refuge's fishing permit and are modified periodically. Wading is permitted, but the use of boats and other flotation devices is prohibited.

## Anticipated Impacts of Use

Fishing occurs in artificial, warm-water lakes on the refuge. The lakes were originally created as irrigation infrastructure and now support a warm-water recreational fishery. All fishing is for warm-water species such as largemouth bass, sunfish, northern pike, and catfish. In accordance with our HMP, fisheries are monitored and stocked to provide a quality sportfishing experience focusing on angler satisfaction. Infrastructure that localizes habitat disturbance and impacts has already been created to support recreational fishing. Our lakes also support a variety of waterfowl and shorebirds and provide needed forage for bald eagles that overwinter at the refuge. Our season (April 15 through October 15) limits fishing-related disturbances to other wildlife.

## Availability of Resources

We currently have a full-time law enforcement officer to help administer the fishing program. Other staff and volunteers assist in monitoring fisheries and with special fishing programs.

## Determination

Fishing and fishing programs are compatible uses of the Rocky Mountain Arsenal National Wildlife Refuge.

## Stipulations Necessary to Ensure Compatibility

- All fishing will require a permit.
- The majority of lakes on the refuge are interconnected and near one another. A fishing season (April 15 through October 15) will limit disturbance to waterfowl, shorebirds, and bald eagles.
- The size and number of fish in our lakes is limited by lake size. To ensure a quality fishing experience, as defined by angler satisfaction and average catch rates, catch-and-release fishing will be needed.
- Illegal activities, including fishing violations, will be reduced by providing well-thought-out information and sufficient law enforcement presence.
- Periodic monitoring of the health and composition of our fisheries will be required. Stocking of both sport and forage fish may be required.
- All fishing programs will be coordinated with CPW.
- The refuge manager will have the ability to close or modify entire fishing programs, including access, timing, and methods, in response to unforeseen conditions to ensure public safety and the best management of natural resources.
- Refuge staff will regularly solicit feedback from those who fish regarding the safety and overall quality of their fishing experience and will solicit suggestions for improvement.

## Justification

The Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 specifically encourages fish and wildlife recreational opportunities, and fishing is one of the wildlife-dependent recreational activities encouraged on national wildlife refuges. Due to the refuge's location in a major urban area, fishing is very accessible and is consistent with our goals for connecting with urban populations. Both the refuge's HMP and aquatic management stepdown plan (FWS 2006a) provide goals and strategies for managing lacustrine habitats and providing quality sport fishery on individual lakes. There are only minor costs associated with this program. The majority of costs are recouped through the collection of fishing permit fees.

*Mandatory 15-year reevaluation date: 2030*

# Wildlife Observation, Photography, Interpretation, and Environmental Education

The National Wildlife Refuge System Improvement Act of 1997 (Improvement Act) identifies six wildlife-dependent recreational activities as priority public uses and encourages their implementation on refuges when they are found compatible with refuge purposes and when adequate resources are available to manage these activities on refuge lands. This compatibility determination considers wildlife observation, photography, interpretation, and environmental education. The compatibility of the other two activities identified in the Act, hunting and fishing, are assessed above.

Compatible access for priority public uses will be improved on the refuge. The majority of infrastructure is already in place and will no longer be restricted to public use. Modes of access that facilitate wildlife-dependent uses—walking, jogging, cross-country skiing, snowshoeing, and bicycles—will be favored in the refuge's Environmental Education Zone. Due to the presence of wild bison, vehicle use will be favored in the native prairie areas of the refuge. As needed, seasonal closures will be used to limit disturbances to wildlife.

Additional trails or viewing platforms could be considered to enhance viewing opportunities. Limited commercial opportunities such as nature programming, tours, and photography could be considered.

Specifically:

- Several existing administrative roads will be converted to act as new bicycle and pedestrian trails, providing new access to the refuge from surrounding communities.
- A new bicycle and pedestrian trail will be constructed through the Environmental Education Zone. The primary purpose of this trail is to reduce safety risks between vehicles and nonmotorized modes of transportation, but the trail will also provide a connection across the refuge to adjoining trail systems.
- A new accessible trail will be constructed from Lower Derby Lake to the Rod and Gun Pond viewing blind.
- Both auto tour routes will be opened to the public. The Legacy Loop will be open for all modes of transportation and Wildlife Drive will be open for vehicular use.
- Several new parking areas, trails, and observation platforms will be constructed to improve transportation and provide opportunities for wildlife observation and photography.
- The Wildlife Watch area, previously known as the Eagle Watch, will be reopened and rehabilitated for wildlife viewing and photography access.
- The road to Rattlesnake Hill and accessible trails in this area will be reopened to the public.
- The current environmental education facilities near Lake Mary will be improved.

## *Anticipated Impacts of Use*

The proposed changes seek to better accommodate increasing public use. Additional wildlife disturbance could occur from opening auto tour routes, opening areas to nonmotorized access, expanding wildlife-viewing nature trails, and providing new access to surrounding communities and existing trail systems. Repurposing and improving existing facilities will result in no direct impact, but will likely further increase use.

Increased human presence on the refuge will have impacts on wildlife. Each wildlife species responds differently to human presence or disturbance, with those species having more specific and narrow habitat needs being more susceptible to disturbance. Research has shown that human presence associated with roads and trails can result in a simplification of avian communities (fewer specialists and more generalists), reduced nest success, and reduced habitat quality. Many species are more likely to flush with increased human presence, resulting in less time spent foraging, with a potentially adverse effect on building suitable energy reserves for egg laying and migration, food delivery rates to young, territory establishment and defense, and mate attraction. For many species, especially medium-sized and large mammals, the presence of dogs can greatly magnify the effects of disturbance. Research has shown that various activities result in differing levels of disturbance. Pedestrian and bicycle use results in greater disturbance than vehicle use. Trails and roads create habitat edges, which lead to increased predation, parasitism, and displacement of interior-sensitive birds. Trails and roads can restrict animal movement and dispersal.

Increasing public use of the refuge will require a corresponding increase in law enforcement resources to ensure public safety.

### Availability of Resources

We currently have a full-time law enforcement officer to monitor and enforce refuge regulations. Other staff and volunteers will assist with providing information to the public on wildlife disturbance and monitoring of impacts.

### Determination

Wildlife interpretation, environmental education, wildlife photography, and wildlife observation are compatible uses of the Rocky Mountain Arsenal National Wildlife Refuge.

### Stipulations Necessary to Ensure Compatibility

- Monitoring of focal or surrogate species will be used to ascertain adverse effects on wildlife associated with increased public use on the refuge.
- Dogs will not be allowed out of vehicles on the refuge.
- Visitors on the wildlife observation trails will be required to stay on the trail.
- For safety around bison, visitors on the larger auto tour route will be restricted to their vehicles or the immediate areas outside their vehicles.
- Visitors will not be allowed within our bald eagle management areas or other sensitive habitat during critical periods of the year.
- Existing infrastructure (administrative roads and trails) and footprints will be used as much as possible in the expansion of nonmotorized access to the refuge, reducing ground disturbance, associated habitat loss, and the spread of weeds.
- The refuge manager will have the ability to close or modify any activity, including access, timing, and methods, in response to unforeseen conditions in order to ensure public safety and the best management of natural resources.
- Interpretive information will be posted and included in refuge brochures describing the impact of disturbance on wildlife and simple practices for the visitor to reduce disturbance.

### Justification

The urban location, accessibility, and abundant wildlife resources found on the refuge attract many visitors. At present, our bison herd is the largest draw. Historically, access for visitors wanting to participate in nonconsumptive recreation on the refuge has been limited. The Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 specifically encourages wildlife-dependent recreational opportunities and environmental education. Wildlife observation, photography, interpretation, and environmental education are wildlife-dependent recreational activities that are encouraged on national wildlife refuges. It is the intent of this determination and the CCP to provide well-thought-out and desirable access opportunities without materially interfering with achievement of refuge wildlife management goals.

*Mandatory 15-year reevaluation date: 2030*

## Commercial Photography

For many years, the refuge has issued special use permits for commercial photography. Due to our relatively easy access to wildlife, demand for these permits is high. Our permits often provide access to areas of the refuge that are generally closed to the public, but this will occur less as more areas of the refuge are opened to the public.

Commercial filming is defined as the digital recording or filming of a visual image or sound recording by a person, business, or other entity for a market audience, such as for a documentary, television or feature film, advertising, or similar project. It does not include news coverage or visitor use. Still photography is defined as the capturing of a still image on film or in a digital format. These descriptions and further information about these activities are found in 43 CFR Part 5 (Department of the Interior) and 50 CFR Part 27 (Fish and Wildlife Service).

Under 50 CFR § 27.71, special use permits for commercial filming and still photography are required when

- it takes place at location(s) where or when members of the public are generally not allowed; or (2) it uses model(s), sets(s), or prop(s) that are not a part of the location's

natural or cultural resources or administrative facilities; or (3) the agency would incur additional administrative costs to monitor the activity; or (4) the agency would need to provide management and oversight to:

- i. avoid impairment or incompatible use of the resources and values of the site; or
- ii. limit resource damage; or
- iii. minimize health or safety risks to the visiting public.

These permit requests are evaluated on an individual basis, using Department of the Interior, Service, and Refuge System policies (for example, 43 CFR Part 5, 50 CFR Part 7, 8 RM 16). Commercial filming will be managed on the refuge through the special use permitting process to minimize the possibility of damage to cultural or natural resources or interference with other visitors to the area.

## Anticipated Impacts of Use

Wildlife photography can adversely affect wildlife by altering wildlife behavior, reproduction, distribution, and habitat (Knight and Cole 1995, Purdy et al. 1987). Of the wildlife observation techniques, photographers tend to have the largest disturbance impacts (Dobb 1998, Klein 1993, Morton 1995). While wildlife observers frequently stop to view species, wildlife photographers are more likely to approach wildlife (Klein 1993). Even a slow approach by photographers tends to have behavioral consequences to wildlife species (Klein 1993). Other impacts include the potential for photographers to remain close to wildlife for extended periods of time in an attempt to habituate the wildlife subject to their presence (Dobb 1998) and the tendency of casual photographers, with low-power lenses, to get much closer to their subjects than other activities would require (Morton 1995), including wandering off trails. This usually results in increased disturbance to wildlife and habitat, including trampling of plants. Klein (1993) recommended that refuges provide observation and photography blinds to reduce disturbance to wildlife that can result from approach by visitors. Potential impacts from this use include purposeful or inadvertent disturbance of wildlife. Large commercial activities could also interfere with priority public uses.

Special use permit conditions and associated monitoring of permitted activities will be designed to minimize wildlife and habitat impacts of this use. A special use permit request will be denied if the commercial filming, audio recording, or still photography activities are found not to be compatible with refuge purposes.

## Availability of Resources

We currently have a full-time law enforcement officer to monitor compliance of permittees. The refuge will incur minimal expense for administrative costs for review of applications and issuance of a special use permit. Special use permits for commercial filming and still photography will require payment of a location fee and reimbursement for actual costs incurred in processing the permit request and administering the permit.

## Determination

Commercial filming, audio recording, and still photography are compatible uses of the Rocky Mountain Arsenal National Wildlife Refuge.

## Stipulations Necessary to Ensure Compatibility

- All commercial filming will require a special use permit.
- Special use permits will identify conditions that protect the refuge's values, purposes, and resources; ensure public health and safety; and prevent unreasonable disruption of the public's use and enjoyment of the refuge. Such conditions may include specifying road conditions when access will not be allowed, establishing time limitations, and identifying routes of access into refuges. These conditions will be identified to prevent excessive disturbances to wildlife, damage to habitat or refuge infrastructure, or conflicts with other visitor services or management activities.
- The special use permit will stipulate that imagery produced on refuge lands will be made available to the refuge to use in environmental education and interpretation, outreach, internal documents, or other suitable uses. In addition, any commercial products must include appropriate credits to the refuge, the Refuge System, and the Service.
- Any commercial filming, still photography, or audio recording permits that are requested must demonstrate a means to extend public appreciation and understanding of wildlife or natural habitats; to enhance education, appreciation, and understanding of the Refuge System; or to facili-

tate outreach and education goals of the refuge.

- Aerial filming or photography of wildlife may result in disturbance of animals in violation of applicable regulations.

- Still photography and audio recording will also require a special use permit (with specific conditions as outlined above) under one or more of the following conditions:

  - It would occur in places where or when members of the public are not allowed.

  - It would use model(s), set(s), or prop(s) that are not part of the location's natural or cultural resources or administrative facilities.

  - The refuge would incur additional administrative costs to monitor the activity.

  - The refuge would need to provide management and oversight to avoid impairment of the resources and values of the site; limit resource damage; or minimize health and safety risks to the visiting public.

  - The photographer(s) would intentionally manipulate vegetation to create a shot (for example cutting vegetation to create a blind).

- To reduce impacts on refuge lands and resources, refuge staff will ensure that all commercial filmmakers, commercial still photographers, and commercial audio recorders comply with policies, rules, and regulations, and refuge staff will monitor and assess the activities of all filmmakers, photographers, and audio recorders.

### *Justification*

Commercial filming, still photography, or audio recording are economic uses that must contribute to the achievement of the refuge purposes, the mission of the Refuge System, or the mission of the Service. Under certain circumstances, providing opportunities for commercial filming, still photography, and audio recording that meet the above requirements should result in increased public awareness of the refuge's ecological importance as well as advancing the public's knowledge and support for the Refuge System and the Service. The stipulations outlined above and conditions imposed in the special use permits issued to commercial filmmakers, still photographers, and audio recorders will ensure that these wildlife-dependent activities occur without adverse effects on refuge resources or refuge visitors.

*Mandatory 15-year reevaluation date: 2030*

## Research

The refuge occasionally receives requests to conduct research. Recent examples include projects assessing the effects of bison grazing, efficacy of plague vaccines, and the use of geolocators on burrowing owls. Priority will be given to studies that contribute to the enhancement, protection, preservation, and management of native plants, fish, wildlife populations, and habitat on the refuge. Research applicants must submit a proposal that outlines (1) the objectives of the study; (2) the justification for the study; (3) a detailed study methodology and schedule; and (4) potential impacts on refuge wildlife and habitat, including disturbance (short- and long-term), injury, or mortality. This proposal must include (1) a description of mitigation measures the researcher would take to reduce disturbances or impacts; (2) personnel required and their qualifications and experience; (3) status of necessary permits (such as scientific collecting permits and endangered species permits); (4) costs to refuge and refuge staff time requested, if any; and (5) product delivery schedules such as anticipated progress reports and end products such as reports or publications. Refuge staff and others, as appropriate, will review research proposals and issue special use permits if approved.

Evaluation criteria will include the following:

- Research that will contribute to specific refuge management issues will be given higher priority than other requests.

- Research that will conflict with other ongoing research, monitoring, or management programs will not be approved.

- Research projects that can be conducted off-refuge will be less likely to be approved.

- Research that causes undue disturbance or is intrusive will likely not be approved. The degree and type of disturbance will be carefully weighed when evaluating a research request.

- Evaluation of the research proposal will determine if any effort has been made to

reduce disturbance through study design, including adjusting location, timing, number of permittees, study methods, and number of study sites.

- Evaluation of the research proposal will determine if any mitigation planning is included to minimize disturbances or impacts or to reclaim resultant disturbed areas.

- Evaluation of the research proposal will determine if staffing or logistics makes it impossible for the refuge to monitor researcher activity in a sensitive area.

- Specific timelines, including the length of the project and product delivery dates, will be considered and agreed upon before approval. All projects will be reviewed annually.

## Anticipated Impacts of Use

Some degree of disturbance is expected with all research activities, since they often include areas of the refuge closed to the public or with limited public access, and some research requires collecting samples from, or the direct handling of, wildlife. However, minimal impacts on refuge wildlife and habitats are expected to result from research studies because special use permits will specify conditions to ensure that impacts on wildlife and habitats are reduced.

## Availability of Resources

We currently have staff to review and evaluate these requests. Our experience shows us that the nominal cost of issuing special use permits and managing research projects is typically offset by the value of information acquired from the research.

## Determination

Research is a compatible use of the Rocky Mountain Arsenal National Wildlife Refuge.

## Stipulations Necessary to Ensure Compatibility

- All research will require a special use permit.

- Special use permits will identify the conditions that protect the refuge's values, purposes, and resources; ensure public health and safety; and prevent unreasonable disruption of the public's use and enjoyment of the refuge. Such conditions may include specifying road conditions when access will not be allowed, establishing time limitations, and identifying routes of access into refuges. These conditions will be identified to prevent excessive disturbances to wildlife, damage to habitat or refuge infrastructure, or conflicts with other visitor services or management activities.

- Extremely sensitive wildlife habitat areas and wildlife species will be provided sufficient protection from disturbance by limiting proposed research activities in these areas. All refuge rules and regulations will be strictly enforced unless otherwise exempted by refuge management.

- Refuge staff will use the criteria for evaluating a research proposal, as outlined above, when determining whether to approve a proposed study on the refuge. If proposed research methods are evaluated and determined to have potential impacts on refuge resources (habitat and wildlife), it must be demonstrated that the research is necessary for refuge resource conservation management. Measures to reduce potential impacts will need to be developed and included as part of the study design. In addition, these measures will be listed as conditions and requirements of the special use permit.

- Refuge staff will monitor research activities for compliance with conditions of the special use permit. At any time, refuge staff may accompany the researchers to determine potential impacts. Staff may determine that previously approved research and special use permits should be terminated based on observed impacts. The refuge manager will also have the ability to cancel a special use permit if the researcher is out of compliance, or to ensure wildlife and habitat protection.

## Justification

The Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 specifically includes research as a purpose for the refuge. The program as described is determined to be compatible. Potential impacts of research activities on refuge resources will be reduced because sufficient restrictions will be

included in the required special use permits and all activities will be monitored by refuge staff. At a minimum, research activities will have no significant impact on refuge resources and are expected to contribute to the enhancement, protection, preservation, and management of refuge wildlife populations and their habitats.

*Mandatory 15-year reevaluation date: 2030*

## Refuge Perimeter Trail

The idea of a nonmotorized trail following the 26-mile perimeter of the refuge was first envisioned in the refuge's comprehensive management plan (FWS 1996a). Over time, much of this trail has been constructed, and the remainder necessary for completion is still proposed and underway. The majority of this trail is on lands immediately adjacent to the refuge, but not owned by the refuge. There are small sections of the trail that must cross refuge lands.

### *Anticipated Impacts of Use*

The construction of trails will have an immediate and temporary impact. Once constructed, increased human presence will have impacts on wildlife. However, the majority of the perimeter trail exists solely on the periphery of wildlife habitat.

### *Availability of Resources*

The City of Commerce City maintains the portions of the trail that it has constructed in Commerce City and Adams County. Future trail segments will be constructed on City of Denver lands, and maintenance and upkeep will be the City of Denver's responsibility. There will be limited costs involved in the maintenance and upkeep of the perimeter trail system.

### *Determination*

Construction and maintenance of a perimeter trail is a compatible use of the Rocky Mountain Arsenal National Wildlife Refuge.

### *Stipulations Necessary to Ensure Compatibility*

- All activities must be limited to nonmotorized use to reduce or eliminate disturbance of refuge wildlife and visitors.

### *Justification*

The Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 specifically encourages wildlife-dependent recreational opportunities. The perimeter trail provides necessary access to the refuge and creates important connections to other trail networks.

*Mandatory 15-year reevaluation date: 2030*

# E.4 Approval of Compatibility Determinations

Submitted by:

David Lucas, Project Leader — Date
U.S. Fish and Wildlife Service
Rocky Mountain Arsenal National Wildlife Refuge Complex
Commerce City, Colorado

Reviewed by:

Bernard J. Petersen, Refuge Supervisor — Date
U.S. Fish and Wildlife Service
National Wildlife Refuge System
Lakewood, Colorado

Approved by:

Will Meeks, Assistant Regional Director — Date
U.S. Fish and Wildlife Service
National Wildlife Refuge System
Lakewood, Colorado

# Appendix F

*Standards of Excellence for Urban National Wildlife Refuges*

## F.1 Introduction

Conserving the Future: Wildlife Refuges and the Next Generation sets out an ambitious plan to enhance the relevance of the National Wildlife Refuge System (System) and the U.S. Fish and Wildlife Service (Service) to a rapidly changing America. In particular, it recognizes the importance of building a connected conservation constituency to the future of the System and to conserving natural resources. To build a representative and nationwide constituency, it also recognizes the pressing need to connect with ever growing populations in urban areas. To this end, the Conserving the Future document contains a specific recommendation:

> "RECOMMENDATION 13: Create an urban refuge initiative that defines excellence in our existing urban refuges, establishes the framework for creating new urban refuge partnerships and implements a refuge presence in 10 demographically and geographically varied cities across America by 2015."

The overall goal of the Urban Wildlife Conservation Program is to actively engage urban communities in wildlife conservation in partnership with the Service. The Urban Standards of Excellence serve as a framework for our success in the Urban Program.

The Urban Standards were developed in the past 3 years by the Urban Wildlife Refuge Team, with involvement from Service staff, partners, and the public through discussions during an Urban Academy at the National Conservation Training Center (in West Virginia), a public comment period, and a Directorate review. Each of the standards includes big picture questions, payoffs, and guideposts to check progress along the way. Evaluation tools and best practices are currently in development at several urban wildlife refuges.

The Urban Standards will help us determine if we are achieving our objectives, help us prioritize our work with urban audiences, and give us a way to measure progress in building a connected conservation constituency. The complete standards can be found at www.fws.gov/urban.

In brief, the Urban Standards of Excellence are:

1. Know and Relate to the Community: Understand the values, interests, cultures, and needs of the surrounding/adjacent community.

2. Connect Urban People with Nature via Stepping Stones of Engagement: Engage all demographic groups, providing varied opportunities to connect with and care for nature.

3. Build Partnerships: Utilize diverse partnerships within the community to achieve common goals for land stewardship and conservation of natural resources for the benefit of the community.

4. Be a Community Asset: Contribute resources toward improving the quality of community life, thereby strengthening the urban community as a whole.

5. Ensure Adequate Long-Term Resources: Have sufficient funding and appropriate staffing to attain and maintain excellence.

6. Provide Equitable Access: Accessible to all people living and working in nearby communities.

7. Ensure Visitors Feel Safe and Welcome: Maintain a high standard of facility maintenance, minimize real threats to safety and welcome and engage individuals from all demographic groups.

8. Model Sustainability: Adopt and showcase sustainable practices, proclaim the benefits of connecting with the natural world, and inspire sustainable actions for the benefit of wildlife and people.

The approach to excellence for urban national wildlife refuges must be as flexible and unique as the communities the refuges serve. The Service must strive to understand both human environments and natural environments in order to understand the expectations of the urban community. The Service

must strive to provide programs and leadership on conservation initiatives and projects that are relevant to the community as they conserve wildlife and habitats. Service staff, volunteers, and partners must engage urban communities and make meaningful connections to wildlife, especially in communities where opportunities to learn about and enjoy nature and wildlife are limited. This may start by building awareness, then fostering deeper understanding, followed by growing participation through programs that bring more people from the urban world into the larger conservation community.

Urban refuges are great places to build a broader conservation constituency, but the challenge is far too big for any one agency or organization to tackle alone. The Urban Wildlife Refuge Initiative 2 recognizes the importance of embracing traditional and new partnerships and collaborations. A variety of entities whose interests may be conservation, education, human health, or other subjects ultimately can help achieve conservation of wildlife, plants, and their habitats that are essential to maintaining a healthy planet for people.

## F.2 Using The Standards

- The term "urban refuge" is used throughout these standards. However, readers should be mindful that these standards apply not only to Service lands in urban areas, but also, to the greatest extent possible, to all urban projects where the Service is a partner.

- Each urban refuge or partnership is unique. As such, a range of strategies and evaluation tools are provided to choose from.

- The objectives for each standard set Service expectations for urban refuges to plan for the future, to measure success, and to take advantage of the extraordinary opportunities to build a conservation constituency with the urban public.

- These standards are designed to complement other Conserving the Future recommendations and step-down plans. Visit www.americaswildlife.org to reference other plans, particularly the Friends Mentoring Action Plan; Strategic Plan for Volunteers, Friends Organizations, and Community Partners; Environmental Education Strategic Plan; Interpretation Strategic Plan; and Strategic Communications Plan.

- To keep the Standards of Excellence current and relevant, they will be reviewed and updated by the Refuge System at a minimum of every 5 years.

To view the entire document entitled "Draft Urban Standards of Excellence," please visit http://www.fws.gov/urban/soe.php.

# Appendix G
## *Visitor Projections*

In April 2014, to assist with this developing the CCP and EIS, refuge staff developed some projections of future visitation. The following assumptions were used in this exercise:

- Alternative A (no action)—Under this alternative, we expect no significant changes to infrastructure or opportunities, but we still expect an increase in visitation due to word of mouth. Visitation would increase in a linear fashion from the current 300,000 visitors per year.

- Alternative B (traditional refuge)—Under this alternative, we expect minor increases in infrastructure and opportunities with a minor annual increase in visitation and a minor annual increase in programming.

- Alternative C (urban refuge)—Under this alternative, our focus is on increasing opportunities onsite with some offsite work resulting in rather dramatic annual increases in visitation (8 percent annually—exponential).

- Alternative D (gateway refuge)—Under this alternative, we focus on offsite opportunities, and visitation would be similar to alternative B (4 percent annually). It is not possible to model the collective impact of visitation in this alternative.

Using these assumptions, we calculated visitor projections; these are shown in the table G-1.

In addition, because we have seen visitation change dramatically with each change in program-

**Table G-1. Initial visitor projections.**

| *Alternative* | *A* | *B* | *C* | *D* | |
|---|---|---|---|---|---|
| 2013 | 300,000 | 300,000 | 300,000 | 300,000 | |
| 2014 | 315,000 | 325,000 | 330,000 | 320,000 | |
| 2015 | 330,000 | 350,000 | 360,000 | 340,000 | Implement |
| 2016 | 345,000 | 375,000 | 388,800 | 353,600 | |
| 2017 | 360,000 | 400,000 | 419,904 | 367,744 | |
| 2018 | 375,000 | 425,000 | 453,496 | 382,454 | |
| 2019 | 390,000 | 450,000 | 489,776 | 397,752 | |
| 2020 | 405,000 | 475,000 | 528,958 | 413,662 | |
| 2021 | 420,000 | 500,000 | 571,275 | 430,208 | |
| 2022 | 435,000 | 525,000 | 616,977 | 447,417 | |
| 2023 | 450,000 | 550,000 | 666,335 | 465,313 | |
| 2024 | 465,000 | 575,000 | 719,642 | 483,926 | |
| 2025 | 480,000 | 600,000 | 777,213 | 503,283 | |
| 2026 | 495,000 | 625,000 | 839,390 | 523,414 | |
| 2027 | 510,000 | 650,000 | 906,541 | 544,351 | |
| 2028 | 525,000 | 675,000 | 979,065 | 566,125 | |
| 2029 | 540,000 | 700,000 | 1,057,390 | 588,770 | Year 15 |
| 2030 | 555,000 | 725,000 | 1,141,981 | 612,321 | |
| 2031 | 570,000 | 750,000 | 1,233,339 | 636,814 | |
| 2032 | 585,000 | 775,000 | 1,332,006 | 662,286 | |
| 2033 | 600,000 | 800,000 | 1,438,567 | 688,778 | |
| 2034 | 615,000 | 825,000 | 1,553,652 | 716,329 | Year 20 |

ming and opportunity (for example, opening the auto tour route), we also calculated visitor projections with the following assumptions: adding only a handful of new opportunities under alternative B, increasing opportunities every year or so under alternative C, and providing fewer opportunities under alternative D. Projections are shown in table G-2.

To calculate final visitation projections, we simply used averaged the projections generated by the two methods described above. Final projects are shown in table G-3.

**Table G-2. Revised visitor projections.**

| *Alternative* | *A* | *B* | *C* | *D* | |
|---|---|---|---|---|---|
| 2013 | 300,000 | 300,000 | 300,000 | 300,000 | |
| 2014 | 300,000 | 300,000 | 300,000 | 300,000 | |
| 2015 | 300,000 | 350,000 | 450,000 | 325,000 | Implement |
| 2016 | 300,000 | 350,000 | 500,000 | 325,000 | |
| 2017 | 300,000 | 350,000 | 550,000 | 375,000 | |
| 2018 | 300,000 | 350,000 | 550,000 | 425,000 | |
| 2019 | 300,000 | 400,000 | 550,000 | 425,000 | |
| 2020 | 300,000 | 400,000 | 550,000 | 425,000 | |
| 2021 | 300,000 | 400,000 | 750,000 | 425,000 | |
| 2022 | 300,000 | 400,000 | 750,000 | 425,000 | |
| 2023 | 300,000 | 400,000 | 750,000 | 425,000 | |
| 2024 | 300,000 | 400,000 | 750,000 | 500,000 | |
| 2025 | 300,000 | 400,000 | 850,000 | 500,000 | |
| 2026 | 300,000 | 450,000 | 850,000 | 550,000 | |
| 2027 | 300,000 | 450,000 | 850,000 | 600,000 | |
| 2028 | 300,000 | 450,000 | 1,000,000 | 600,000 | |
| 2029 | 300,000 | 450,000 | 1,000,000 | 600,000 | Year 15 |
| 2030 | 300,000 | 450,000 | 1,000,000 | 600,000 | |
| 2031 | 300,000 | 450,000 | 1,000,000 | 600,000 | |
| 2032 | 300,000 | 450,000 | 1,250,000 | 600,000 | |
| 2033 | 300,000 | 450,000 | 1,250,000 | 600,000 | |
| 2034 | 300,000 | 450,000 | 1,250,000 | 600,000 | Year 20 |

**Table G-3. Final visitor projections.**

| *Alternative* | *A* | *B* | *C* | *D* | |
|---|---|---|---|---|---|
| 2013 | 300,000 | 300,000 | 300,000 | 300,000 | |
| 2014 | 307,500 | 312,500 | 315,000 | 310,000 | |
| 2015 | 315,000 | 350,000 | 405,000 | 332,500 | Implement |
| 2016 | 322,500 | 362,500 | 444,400 | 339,470 | |
| 2017 | 330,000 | 375,000 | 484,952 | 371,726 | |
| 2018 | 337,500 | 387,500 | 501,748 | 404,279 | |
| 2019 | 345,000 | 425,000 | 519,888 | 412,142 | |
| 2020 | 352,500 | 437,500 | 539,479 | 420,327 | |
| 2021 | 360,000 | 450,000 | 660,637 | 428,848 | |
| 2022 | 367,500 | 462,500 | 683,488 | 437,718 | |
| 2023 | 375,000 | 475,000 | 708,167 | 446,952 | |

**Table G-3. Final visitor projections.**

| | | | | | |
|---|---|---|---|---|---|
| 2024 | 382,500 | 487,500 | 734,821 | 494,065 | |
| 2025 | 390,000 | 500,000 | 813,606 | 504,072 | |
| 2026 | 397,500 | 537,500 | 844,695 | 539,489 | |
| 2027 | 405,000 | 550,000 | 878,271 | 575,333 | |
| 2028 | 412,500 | 562,500 | 989,532 | 586,621 | |
| 2029 | 420,000 | 575,000 | 1,028,695 | 598,373 | Year 15 |
| 2030 | 427,500 | 587,500 | 1,070,990 | 610,606 | |
| 2031 | 435,000 | 600,000 | 1,116,670 | 623,341 | |
| 2032 | 442,500 | 612,500 | 1,291,003 | 636,598 | |
| 2033 | 450,000 | 625,000 | 1,344,284 | 650,398 | |
| 2034 | 457,500 | 637,500 | 1,401,826 | 664,765 | Year 20 |

# Appendix H
## *List of Plant and Animal Species*

**Table H-1. Plants found on the Rocky Mountain Arsenal National Wildlife Refuge, 2014.**

| *Common name* | *Scientific name* |
|---|---|
| Maple family | Aceraceae |
| Box-elder | *Acer negundo* |
| Silver maple | *Acer saccharinum* |
| Agave family | Agavaceae |
| Yucca/Soapweed | *Yucca glauca* |
| Water plantain family | Alismataceae |
| Narrowleaf water plantain | *Alisma gramineum* |
| Arrowhead | *Saggitaria cuneata* |
| Amaranth family | Amaranthaceae |
| Tumble pigweed * | *Amaranthus albus* |
| Sandhill pigweed | *Amaranthus arenicola* |
| Prostrate pigweed * | *Amaranthus blitoides* |
| Palmer's pigweed * | *Amaranthus palmerii* |
| Redroot pigweed * | *Amaranthus retroflexus* |
| Cottonwool | *Froelichia floridana* |
| Froelichia/snakecotton | *Froelichia gracilis* |
| Sumac family | Anacardiaceae |
| Skunkbush sumac | *Rhus trilobata* |
| Parsley family | Apiaceae |
| Cutleaf waterparsnip | *Berula erecta* |
| Poison hemlock * (C) | *Conium maculatum* |
| Mountain springparsley | *Cymopterus montanus* |
| Queen Anne's lace * | *Daucus carota* |
| Biscuitroot | *Lomatium orientale* |
| Dogbane family | Apocynaceae |
| Dogbane/Indian hemp | *Apocynum cannabinum* |
| Milkweed family | Asclepiadaceae |
| Swamp milkweed | *Asclepias incarnata* |
| Little milkweed/Plains milkweed | *Asclepias pumila* |
| Showy milkweed | *Asclepias speciosa* |
| Horsetail milkweed | *Asclepias subverticillata* |
| Butterfly milkweed | *Asclepias tuberosa* |
| Green milkweed | *Asclepias viridiflora* |
| Sunflower family | Asteraceae |
| Yarrow | *Achillea lanulosa* |
| Russian knapweed * (B) | *Acroptilon repens* |

| | |
|---|---|
| Annual bursage/flatspine bur ragweed | *Ambrosia acanthicarpa* |
| Common ragweed * | *Ambrosia artemisiifolia* |
| Western ragweed | *Ambrosia psilostachya* |
| Tomentose ragweed/skeletonleaf bur ragweed | *Ambrosia tomentosa* |
| Great ragweed/giant ragweed * | *Ambrosia trifida* |
| Pearly everlasting | *Anaphalis margaritacea* |
| Rosy pussytoes/pink pussytoes | *Antennaria rosea* |
| Wormwood/absinthium * (B) | *Artemisia absinthium* |
| Field sagewort | *Artemisia campestris* |
| Tarragon/dragon sagewort | *Artemisia dracunculus* |
| Sand sagebrush | *Artemisia filifolia* |
| Fringed sagebrush/prairie sagewort | *Artemisia frigida* |
| White sagebrush/Louisiana sagewort | *Artemisia ludoviciana* |
| Big sagebrush | *Artemisia tridentata* |
| Nodding beggartick/nodding bur-marigold | *Bidens cernua* |
| Devil's beggartick/beggar's tick | *Bidens frondosa* |
| False boneset | *Brickellia eupatorioides* |
| Musk thistle* (B) | *Carduus nutans* |
| Diffuse knapweed * (B) | *Centaurea diffusa* |
| Spotted knapweed * (B) | *Centaurea stoebe* ssp. *micranthos* |
| Chicory * (C) | *Cichorium intybus* |
| Canada thistle * (B) | *Cirsium arvense* |
| Prairie thistle/hoary thistle | *Cirsium canescens* |
| Yellowspine thistle | *Cirsium ochrocentrum* |
| Wavy-leaf thistle | *Cirsium undulatum* |
| Bull thistle * (B) | *Cirsium vulgare* |
| Horseweed | *Conyza canadensis* |
| Plains coreopsis | *Coreopsis tinctoria* |
| Garden cosmos * | *Cosmos bipinnatus* |
| Carelessweed or giant sumpweed * | *Cyclachaena xanthifolia* |
| Fetid marigold | *Dyssodia papposa* |
| Purple coneflower | *Echinacea purpurea* |
| Rubber rabbitbrush | *Ericameria nauseosa* var. *nauseosa* |
| Spreading fleabane | *Erigeron divergens* |
| Shaggy fleabane/shaggy daisy | *Erigeron pumilus* |
| Flat top goldenrod | *Euthamia graminifolia* |
| Western golden top | *Euthamia occidentalis* |
| Bighead pygmycudweed | *Evax prolifera* |
| Blanket flower | *Gaillardia aristata* |
| Fringed quickweed/shaggy soldier * | *Galinsoga quadriradiata* |
| Western marsh cudweed/lowland cudweed | *Gnaphalium palustre* |
| Marsh cudweed * | *Gnaphalium uliginosum* |
| Curlycup gumweed | *Grindelia squarrosa* |
| Broom snake weed | *Gutierrezia sarothrae* |
| Common sunflower/annual sunflower | *Helianthus annuus* |
| Texas blueweed | *Helianthus ciliaris* |

| | |
|---|---|
| Prairie sunflower | *Helianthus petiolaris* |
| Hairy false goldenaster | *Heterotheca villosa* |
| Fineleaf hymenopappus | *Hymenopappus filifolius* |
| Prickly lettuce * | *Lactuca serriola* |
| Blue lettuce | *Lactuca tatarica* |
| Dotted gayfeather/dotted blazing star | *Liatris punctata* |
| Rush skeletonweed/rush skeletonplant | *Lygodesmia juncea* |
| Bigelow's tansyaster | *Machaeranthera bigelovii* var. *bigelovii* |
| Hoary tansyaster | *Machaeranthera canescens* |
| Lacy tansyaster | *Machaeranthera pinnatifida* |
| Wavy-leaf false dandelion/prairie false dandelion | *Nothocalais cuspidata* |
| Scotch thistle * (B) | *Onopordum acanthium* |
| Engelmann's false goldenweed | *Oonopsis engelmannii* |
| Prairie groundsel/Platte's groundsel | *Packera plattensis* |
| Threetooth ragwort | *Packera tridenticulata* |
| Oppositeleaf bahia/plains bahia | *Picradeniopsis oppositifolia* |
| Wright's Cudweed | *Pseudognaphalium canescens* |
| Cottonbatting plant/winged cudweed | *Pseudognaphalium stramineum* |
| Prairie coneflower | *Ratibida columnifera* |
| Green prairie coneflower | *Ratibida tagetes* |
| Black-eyed Susan | *Rudbeckia hirta* |
| Cutleaf vipergrass/false salsify * | *Scorzonera laciniata* |
| Riddell's ragwort/riddell groundsel | *Senecio riddellii* |
| Broom groundsel | *Senecio spartioides* |
| Tall goldenrod | *Solidago altissima* |
| Giant goldenrod | *Solidago gigantea* |
| Missouri goldenrod | *Solidago missouriensis* |
| Soft goldenrod/velvety goldenrod | *Solidago mollis* |
| Showy goldenrod | *Solidago speciosa* |
| Perennial sowthistle * (C) | *Sonchus arvensis* |
| Spiny sow-thistle * | *Sonchus asper* |
| Wirelettuce/brownplume wirelettuce | *Stephanomeria pauciflora* |
| White heath aster | *Symphyotrichum ericoides* var. *ericoides* |
| White prairie aster | *Symphyotrichum falcatum* var. *falcatum* |
| Common dandelion * | *Taraxacum officinale* |
| Hopi tea greenthread | *Thelesperma megapotamicum* |
| Yellow salsify * | *Tragopogon dubius* |
| Golden crownbeard/cowpen daisy | *Verbesina encelioides* |
| Baldwin's ironweed | *Vernonia baldwinii* |
| Rough cocklebur/common cocklebur * | *Xanthium strumarium* |
| Barberry family | Berberidaceae |
| Common barberry * | *Berberis vulgaris* |
| Catalpa family | Bignoniaceae |
| Northern catalpa/showy catalpa * | *Catalpa speciosa* |
| Borage family | Boraginaceae |
| Fendler cryptantha/sanddune cryptantha | *Cryptantha fendleri* |

| | |
|---|---|
| Little cryptantha/small cryptantha | *Cryptantha minima* |
| Houndstongue/gypsyflower * (B) | *Cynoglossum officinale* |
| Flatspine stickseed/sand stickseed | *Lappula occidentalis* var. *occidentalis* |
| Puccoon/narrowleaf stoneseed | *Lithospermum incisum* |
| Mustard family | Brassicaceae |
| Desert madwort/desert Alyssum * | *Alyssum desertorum* |
| Alyssum/ small-flowered alyssum * | *Alyssum simplex* |
| Shepherd's purse * | *Capsella bursa-pastoris* |
| Lenspod whitetop * | *Cardaria chalepensis* |
| Hoary cress * (B) | *Cardaria draba* |
| Common blue mustard/crossflower * | *Chorispora tenella* |
| Mountain tansy-mustard | *Descurainia incana* |
| Pinnate tansy mustard/western tansymustard | *Descurainia pinnata* |
| Herb sophia/flixweed * | *Descurainia sophia* |
| Carolina draba/white draba | *Draba reptans* |
| Western wallflower | *Erysimum asperum* |
| Sanddune wallflower | *Erysimum capitatum* |
| Common pepperweed/prairie peppergrass | *Lepidium densiflorum* |
| Broadleaved pepperweed/perennial pepperweed * (B) | *Lepidium latifolium* |
| Clasping pepperweed * | *Lepidium perfoliatum* |
| Foothill bladderpod | *Lesquerella ludoviciana* |
| Watercress * | *Nasturtium officinale* |
| Spreading yellowcress | *Rorippa sinuata* |
| Tall tumble-mustard * | *Sisymbrium altissimum* |
| Tumble-mustard/hedgemustard * | *Sisymbrium officinale* |
| Field pennycress * | *Thlaspi arvense* |
| Cactus family | Cactaceae |
| Nylon hedgehog cactus | *Echinocereus viridiflorus* |
| Spinystar/pincushion cactus/ball cactus | *Escobaria vivipara* var. *vivipara* |
| Plains prickly pear cactus | *Opuntia polyacantha* |
| Bellflower family | Campanulaceae |
| Common harebell/bluebell bellflower | *Campanula rotundifolia* |
| Caper family | Capparaceae |
| Rocky Mountain beeplant | *Cleome serrulata* |
| Redwhisker clammyweed | *Polanisia dodecandra* |
| Honeysuckle family | Caprifoliaceae |
| Western snowberry | *Symphoricarpos occidentalis* |
| Carnation family | Caryophyllaceae |
| Baby's breath * | *Gypsophila paniculata* |
| Bouncingbet * (B) | *Saponaria officinalis* |
| Sand spurry * | *Spergularia rubra* |
| Hornwort family | Ceratophyllaceae |
| Coon's tail/Hornwort | *Ceratophyllum demersum* |
| Goosefoot family | Chenopodiaceae |
| Four-wing saltbush | *Atriplex canescens* |
| Twoscale saltbush/orache * | *Atriplex heterosperma* |

| | |
|---|---|
| Spear saltbush* | *Atriplex patula* |
| Fivehorn smotherweed/five hook bassia* | *Bassia hyssopifolia* |
| Lambsquarters/white goosefoot* | *Chenopodium album* |
| Netseed lambquarters/pitseed goosefoot | *Chenopodium berlandieri* |
| Oakleaf goosefoot * | *Chenopodium glaucum* |
| Mealy goosefoot | *Chenopodium incanum* |
| Narrowleaf goosefoot | *Chenopodium leptophyllum* |
| Over's goosefoot * | *Chenopodium overi* |
| Red goosefoot | *Chenopodium rubrum* |
| Winged pigweed | *Cycloloma atriplicifolium* |
| Burningbush/Kochia * | *Kochia scoparia* |
| Winterfat | *Krascheninnikovia lanata* |
| Slender Russian-thistle * | *Salsola collina* |
| Russian-thistle * | *Salsola tragus* |
| St. John's-Wort family | Clusiaceae |
| Common St. Johnswort * (C) | *Hypericum perforatum* |
| Spiderwort family | Commelinaceae |
| Prairie spiderwort | *Tradescantia occidentalis* |
| Morning glory family | Convolvulaceae |
| Field bindweed * (C) | *Convolvulus arvensis* |
| Shaggy dwarf morning glory | *Evolvulus nuttallianus* |
| Bush morning glory | *Ipomoea leptophylla* |
| Cucumber family | Cucurbitaceae |
| Wild gourd/Stinking gourd | *Cucurbita foetidissima* |
| Cypress family | Cupressaceae |
| Rocky Mountain juniper | *Juniperus scopulorum* |
| Sedge family | Cyperaceae |
| Slenderbeak sedge | *Carex athrostachya* |
| Threadleaf sedge | *Carex filifolia* |
| Dryspike sedge | *Carex siccata* |
| Woolly sedge | *Carex pellita* |
| Nebraska sedge | *Carex nebrascensis* |
| Sun sedge | *Carex inops* ssp. *heliophila* |
| Clustered field sedge | *Carex praegracilis* |
| Bearded flat sedge | *Cyperus squarrosus* |
| Redroot flatsedge | *Cyperus erythrorhizos* |
| Needle spikerush/slender spikerush | *Eleocharis acicularis* |
| Common Spikerush/pale spikerush | *Eleocharis macrostachya* |
| Schweinitz's flatsedge | *Cyperus schweinitzii* |
| Chairmaker's bulrush | *Schoenoplectus americanus* |
| Great bulrush | *Schoenoplectus lacustris* |
| Common threesquare bulrush | *Schoenoplectus pungens* |
| Rocky Mountain bulrush | *Schoenoplectus saximontanus* |
| Softstem bullrush | *Schoenoplectus tabernaemontani* |
| Oleaster family | Elaeagnaceae |
| Russian-olive * (B) | *Elaeagnus angustifolia* |

| | |
|---|---|
| Silver buffaloberry | *Shepherdia argentea* |
| **Horsetail family** | **Equisetaceae** |
| Smooth horsetail | *Equisetum laevigatum* |
| **Spurge family** | **Euphorbiaceae** |
| Ribseed sandmat | *Chamaesyce glyptosperma* |
| Spotted sandmat/spotted spurge | *Chamaesyce maculata* |
| Prostrate sandmat/protrate spurge | *Chamaesyce prostrata* |
| Thymeleaf sandmat | *Chamaesyce serpyllifolia* |
| Texas croton | *Croton texensis* |
| Toothed spurge | *Euphorbia dentata* |
| Leafy spurge * (B) | *Euphorbia esula* var. *uralensis* |
| Snow-on-the-mountain | *Euphorbia marginata* |
| Warty spurge | *Euphorbia spathulata* |
| **Pea family** | **Fabaceae** |
| Lead plant | *Amorpha canescens* |
| Purple milkvetch | *Astragalus agrestis* |
| Two-grooved milkvetch | *Astragalus bisulcatus* |
| Painted milkvetch | *Astragalus ceramicus* |
| Ground plum | *Astragalus crassicarpus* |
| Lotus milkvetch | *Astragalus lotiflorus* |
| Missouri milkvetch | *Astragalus missouriensis* |
| Golden prairie-clover | *Dalea aurea* |
| Andean prairie clover/compact prairie-clover | *Dalea cylindriceps* |
| Purple prairie-clover | *Dalea purpurea* |
| Honey locust * | *Gleditsia triacanthos* |
| Wild licorice/American licorice | *Glycyrrhiza lepidota* |
| Silvery lupine | *Lupinus argenteus* |
| Black medick* | *Medicago lupulina* |
| Alfalfa * | *Medicago sativa* |
| White sweetclover * | *Melilotus albus* |
| Yellow sweetclover * | *Melilotus officinalis* |
| Purple locoweed | *Oxytropis lambertii* |
| Lemon scurfpea/narrowleaf scurfpea | *Psoralidium lanceolatum* |
| Slimflower scurfpea | *Psoralidium tenuiflorum* |
| New Mexico locust* | *Robinia neomexicana* |
| Black locust* | *Robinia pseudoacacia* |
| Silky sophora | *Sophora nuttalliana* |
| Strawberry clover* | *Trifolium fragiferum* |
| American vetch | *Vicia americana* |
| Wooly vetch * | *Vicia villosa* |
| **Oak family** | **Fagaceae** |
| White oak* | *Quercus alba* |
| **Fumitory family** | **Fumariaceae** |
| Golden smoke/golden corydalis | *Corydalis aurea* |
| **Geranium family** | **Geraniaceae** |
| Redstem filaree/redstem stork's bill * (C) | *Erodium cicutarium* |

| Gooseberry family | Grossulariaceae |
|---|---|
| Golden currant | *Ribes aureum* |
| **Water milfoil family** | **Haloragaceae** |
| Shortspike watermilfoil | *Myriophyllum sibiricum* |
| **Iris family** | **Iridaceae** |
| Rocky Mountain iris/blue flag | *Iris missouriensis* |
| **Rush family** | **Juncaceae** |
| Arctic rush | *Juncus arcticus* var. *balticus* |
| Toad rush | *Juncus bufonius* |
| Roundfruit rush* | *Juncus compressus* |
| Inland rush | *Juncus interior* |
| Poverty rush | *Juncus tenuis* |
| **Mint family** | **Lamiaceae** |
| Rough false pennyroyal | *Hedeoma hispida* |
| American water horehound | *Lycopus americanus* |
| Field mint/wild mint | *Mentha arvensis* |
| Spearmint* | *Mentha spicata* |
| Plains beebalm/pony beebalm | *Monarda pectinata* |
| Catnip* | *Nepeta cataria* |
| Blue sage/Azure blue sage | *Salvia azurea* |
| Lanceleaf Sage/Rocky Mountain sage | *Salvia reflexa* |
| Marsh skullcap | *Scutellaria galericulata* |
| Canada germander/western germander | *Teucrium canadense* |
| **Duckweed family** | **Lemnaceae** |
| Common duckweed | *Lemna minor* |
| **Lily family** | **Liliaceae** |
| Garden asparagus * | *Asparagus officinalis* |
| Common sand lily/common starlily | *Leucocrinum montanum* |
| Feathery false lily of the valley | *Maianthemum racemosum* ssp. *amplexicaule* |
| Meadow deathcamas | *Zigadenus venenosus* var. *gramineus* |
| **Flax family** | **Linaceae** |
| Lewis flax/blue flax | *Linum lewisii* |
| **Loasa family** | **Loasaceae** |
| Whitestem blazingstar | *Mentzelia albicaulis* |
| Bractless blazingstar | *Mentzelia nuda* |
| Loosestrife famlly | *Lythraceae* |
| Grand redstem/toothcup | *Ammannia robusta* |
| **Mallow family** | **Malvaceae** |
| Velvetleaf * (C) | *Abutilon theophrasti* |
| Purple poppymallow/winecups | *Callirhoe involucrata* |
| Flower of an hour* | *Hibiscus trionum* |
| Common mallow * | *Malva neglecta* |
| Alkali mallow * | *Malvella leprosa* |
| Scarlet globemallow | *Sphaeralcea coccinea* |
| **Pepperwort family** | **Marsileaceae** |
| Hairy water clover | *Marsilea vestita* |

| Mulberry family | Moraceae |
|---|---|
| White mulberry* | *Morus alba* |
| **Four-o'clock family** | **Nyctaginaceae** |
| Snowball sand verbena/fragrant sand verbena | *Abronia fragrans* |
| Narrowleaf four o'clock/narrowleaf umbrella-wort | *Oxybaphus linearis* |
| Heartleaf four o'clock/heartleaf umbrella-wort | *Oxybaphus nyctagineus* |
| **Olive family** | **Oleaceae** |
| Green ash | *Fraxinus pennsylvanica* |
| European Privet* | *Ligustrum vulgare* |
| Common lilac* | *Syringa vulgaris* |
| **Evening primrose family** | **Onagraceae** |
| Yellow sundrops/serrate evening-primrose | *Calylophus serrulatus* |
| Panicled willow herb/tall annual willowherb | *Epilobium brachycarpum* |
| American willow-herb/fringed willowherb | *Epilobium ciliatum* |
| Scarlet beeblossom | *Gaura coccinea* |
| Velvetweed | *Gaura parviflora* |
| Pinyon groundsmoke/branching groundsmoke | *Gayophytum ramosissimum* |
| Prairie evening-primrose/whitest evening primrose | *Oenothera albicaulis* |
| Tufted evening primrose/stemless evening-primrose | *Oenothera caespitosa* |
| Crownleaf evening primrose | *Oenothera coronopifolia* |
| Nuttall's evening-primrose | *Oenothera nuttallii* |
| Hairy evening primrose | *Oenothera villosa* |
| **Orchid family** | **Orchidaceae** |
| Striped coralroot/hooded coralroot | *Corallorhiza striata* |
| **Poppy family** | **Papaveraceae** |
| Crested prickly poppy | *Argemone polyanthemos* |
| **Pine family** | **Pinaceae** |
| Blue spruce | *Picea pungens* |
| Austrian pine* | *Pinus nigra* |
| Ponderosa pine | *Pinus ponderosa* |
| Scots pine* | *Pinus sylvestris* |
| **Plantain family** | **Plantaginaceae** |
| Narrowleaf plantain* | *Plantago lanceolata* |
| Broadleaf plantain* | *Plantago major* |
| Woolly plantain | *Plantago patagonica* |
| **Grass family** | **Poaceae** |
| Indian ricegrass | *Achnatherum hymenoides* |
| Jointed goatgrass * (B) | *Aegilops cylindrica* |
| Crested wheatgrass * | *Agropyron cristatum* |
| Redtop* | *Agrostis gigantea* |
| Big bluestem | *Andropogon gerardii* |
| Sand bluestem | *Andropogon hallii* |
| Poverty threeawn | *Aristida divaricata* |
| Fendler's threeawn | *Aristida purpurea* var. *fendleriana* |
| Purple threeawn | *Aristida purpurea* var. *purpurea* |
| Common oat/cultivated oats * | *Avena sativa* |

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|---|---|
| Sloughgrass | *Beckmannia syzigachne* |
| Yellow bluestem* | *Bothriochloa ischaemum* |
| Silver beardgrass | *Bothriochloa laguroides* |
| Sideoats grama | *Bouteloua curtipendula* |
| Blue grama | *Bouteloua gracilis* |
| Smooth brome * | *Bromus inermis* |
| Japanese brome/field brome * | *Bromus japonicus* |
| Cheatgrass/downy brome *( C ) | *Bromus tectorum* |
| Buffalograss | *Buchloe dactyloides* |
| Prairie sandreed | *Calamovilfa longifolia* |
| Longspine sandbur/mat sandbur | *Cenchrus longispinus* |
| Tumble windmillgrass | *Chloris verticillata* |
| Feather fingergrass | *Chloris virgata* |
| Bermudagrass * | *Cynodon dactylon* |
| Hairy crabgrass * | *Digitaria sanguinalis* |
| Inland saltgrass/desert saltgrass | *Distichlis stricta* |
| Barnyardgrass * | *Echinochloa crus-galli* |
| Canada wildrye | *Elymus canadensis* |
| Squirreltail | *Elymus elymoides* |
| Thickspike wheatgrass * | *Elymus lanceolatus* ssp. *lanceolatus* |
| Quackgrass * (C) | *Elymus repens* |
| Slender wheatgrass | *Elymus trachycaulus* |
| Stinkgrass * | *Eragrostis cilianensis* |
| Tufted lovegrass | *Eragrostis pectinacea* |
| Red lovegrass | *Eragrostis secundiflora* |
| Purple lovegrass | *Eragrostis spectabilis* |
| Needle and thread | *Hesperostipa comata* |
| Foxtail barley | *Hordeum jubatum* |
| Little barley | *Hordeum pusillum* |
| Junegrass | *Koeleria macrantha* |
| Rice cutgrass | *Leersia oryzoides* |
| Perennial ryegrass * | *Lolium perenne* |
| Alkali muhly/scratchgrass | *Muhlenbergia asperifolia* |
| Sandhill muhly | *Muhlenbergia pungens* |
| Marsh muhly | *Muhlenbergia racemosa* |
| Ring muhly | *Muhlenbergia torreyi* |
| False buffaloegrass | *Munroa squarrosa* |
| Green needlegrass | *Nassella viridula* |
| Witchgrass | *Panicum capillare* |
| Switchgrass | *Panicum virgatum* |
| Western wheatgrass | *Pascopyrum smithii* |
| Dallisgrass * | *Paspalum dilatatum* |
| Reed canarygrass * | *Phalaris arundinacea* |
| Timothy * | *Phleum pratense* |
| Canada bluegrass * | *Poa compressa* |
| Kentucky bluegrass * | *Poa pratensis* |
| Sandberg bluegrass | *Poa secunda* |

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|---|---|
| Annual rabbitsfoot grass* | *Polypogon monspeliensis* |
| Tumblegrass | *Schedonnardus paniculatus* |
| Tall fescue * | *Schedonorus arundinaceus* |
| Meadow fescue * | *Schedonorus pratensis* |
| Little bluestem | *Schizachyrium scoparium* |
| Cereal rye * | *Secale cereale* |
| Yellow foxtail* | *Setaria pumila* ssp. *pumila* |
| Green bristlegrass* | *Setaria viridis* |
| Yellow indiangrass | *Sorghastrum nutans* |
| Grain sorghum /Sorghum Sudan hybrid* | *Sorghum bicolor* ssp. *bicolor* |
| Prairie cordgrass | *Spartina pectinata* |
| Praire wedgegrass | *Sphenopholis obtusata* |
| Alkalai sacaton | *Sporobolus airoides* |
| Sand dropseed | *Sporobolus cryptandrus* |
| Intermediate wheatgrass/pubescent wheatgrass* | *Thinopyrum intermedium* |
| Intermediate wheatgrass * | *Thinopyrum intermedium* |
| Tall wheatgrass * | *Thinopyrum ponticum* |
| Slim tridens | *Tridens muticus* |
| Eastern gamma grass | *Tripsacum dactyloides* |
| Winter wheat * | *Triticum* sp. |
| Six weeks fescue | *Vulpia octoflora* |
| **Phlox family** | **Polemoniaceae** |
| Iron ipomopsis | *Ipomopsis laxiflora* |
| Granite prickly phlox/Prickly gilia | *Linanthus pungens* |
| **Buckwheat family** | **Polygonaceae** |
| Annual wild buckwheat | *Eriogonum annuum* |
| Spreading buckwheat | *Eriogonum effusum* |
| Black bindweed * | *Polygonum convolvulus*var. *Convolvulus* |
| Oval-leaf knotweed * | *Polygonum arenastrum* |
| Prostrate knotweed * | *Polygonum aviculare* |
| Smartweed | *Polygonum lapathifolia* |
| Pennsylvania smartweed/pinkweed | *Polygonum pensylvanicum* |
| Spotted lady's thumb * | *Polygonum persicaria* |
| Bushy knotweed/branched knotweed | *Polygonum ramosissimum* |
| Curly dock * | *Rumex crispus* |
| Golden dock | *Rumex maritimus* |
| Narrowleaf dock * | *Rumex stenophyllus* |
| Willow Dock/Mexican dock | *Rumex salicifolius* var. *mexicanus* |
| Veiny dock/wild begonia | *Rumex venosus* |
| **Purslane family** | **Portlulacaceae** |
| Common purslane/little hogweed* | *Portulaca oleracea* |
| Prairie fameflower/sunbright | *Phemeranthus parviflorus* |
| **Primrose family** | **Primulaceae** |
| Fringed loose-strife | *Steironema ciliatum* |
| **Buttercup family** | **Ranunculaceae** |
| Western virgin's bower/western white clematis | *Clematis ligusticifolia* |

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|---|---|
| Plains larkspur | *Delphinium carolinianum* ssp. *virescens* |
| Tiny mousetail | *Myosurus minimus* |
| **Rose family** | **Rosaceae** |
| Common apple * | *Malus pumila* |
| Norwegian cinquefoil | *Potentilla norvegica* |
| Cinquefoil * | *Potentilla paradoxa* |
| Prairie cinquefoil/Pennsylvania cinquefoil | *Potentilla pensylvanica* |
| American plum | *Prunus americana* |
| Sand cherry | *Prunus pumila* var. *besseyi* |
| Black chokecherry | *Prunus virginiana*var. *melanocarpa* |
| Prairie rose | *Rosa arkansana* |
| Woods' rose | *Rosa woodsii* |
| **Willow family** | **Salicaceae** |
| White poplar * | *Populus alba* |
| Eastern cottonwood/plains cottonwood | *Populus deltoides* |
| Quaking aspen | *Populus tremuloides* |
| Peachleaf willow | *Salix amygdaloides* |
| Coyote willow/narrowleaf willow | *Salix exigua* |
| Shining willow | *Salix lucida* |
| **Sandalwood family** | **Santalaceae** |
| Bastard toadflax | *Comandra umbellata* |
| **Figwort family** | **Scrophulariaceae** |
| Water mudwort | *Limosella aquatica* |
| Dalmatian toadflax * (B) | *Linaria dalmatica* ssp. *dalmatica* |
| Butter and eggs/yellow toadflax * (B) | *Linaria vulgaris* |
| Roundleaf monkeyflower/smooth monkeyflower | *Mimulus glabratus* |
| White beardtongue/white penstemon | *Penstemon albidus* |
| Broadbeard beardtongue/narrowleaf penstemon | *Penstemon angustifolius* |
| Shell-leaf penstemon/large beardtongue | *Penstemon grandiflorus* |
| Common mullein * (C) | *Verbascum thapsus* |
| American speedwell | *Veronica americana* |
| Water speedwell | *Veronica anagallis-aquatica* |
| **Quassia family** | **Simaroubaceae** |
| Tree-of-heaven * | *Ailanthus altissima* |
| **Nightshade family** | **Solanaceae** |
| Matrimony bush * | *Lycium barbarum* |
| Ivyleaf groundcherry | *Physalis hederifolia* |
| Clammy groundcherry | *Physalis heterophylla* |
| Prairie groundcherry | *Physalis hispida* |
| Virginia groundcherry | *Physalis virginiana* |
| Chinese lantern | *Quincula lobata* |
| Hairy nightshade/hoe nightshade* | *Solanum physalifolium* |
| Buffalo bur | *Solanum rostratum* |
| Cutleaf nightshade | *Solanum triflorum* |
| **Tamarix family** | **Tamaricaceae** |
| Tamarisk * (B) | *Tamarix* spp. |

| Cattail family | Typhaceae |
|---|---|
| Narrowleaf cattail * | *Typha angustifolia* |
| Broadleaf cattail | *Typha latifolia* |
| **Elm family** | **Ulmaceae** |
| Netleaf hackberry | *Celtis laevigata* var. *reticulata* |
| American elm* | *Ulmus americana* |
| Siberian elm * | *Ulmus pumila* |
| **Nettle family** | **Urticaceae** |
| Stinging nettle | *Urtica dioica* |
| **Vervain family** | **Verbenaceae** |
| Wedgeleaf fogfruit/wedgeleaf | *Phyla cuneifolia* |
| Prostrate vervain/bigbract verbena | *Verbena bracteata* |
| Swamp vervain/blue vervain | *Verbena hastata* |
| **Violet family** | **Violaceae** |
| Nuttall's violet/yellow violet | *Viola nuttallii* |
| **Grape family** | **Vitaceae** |
| Western woodbine | *Parthenocissus vitacea* |
| Riverbank grape | *Vitis riparia* |
| **Horned pondweed family** | **Zannichellianceae** |
| Horned pondweed | *Zannichellia palustris* |
| **Creosote bush family** | **Zygophyllaceae** |
| Puncturevine * (C) | *Tribulus terrestris* |

* Introduced species.
(A) (B) (C) Colorado noxious weed listing.

**Table H-2. Fish found on the Rocky Mountain Arsenal National Wildlife Refuge, 2014.**

| *Common name* | *Scientific name* |
|---|---|
| Common carp* | *Cyprinus carpio* |
| Grass carp* | *Ctenopharyngodon idella* |
| Fathead minnow^ | *Pimephales promelas* |
| Black bullhead | *Amerius melas* |
| Channel catfish^ | *Ictalurus punctatus* |
| Northern pike | *Esox lucius* |
| Brook stickleback | *Culaea inconstans* |
| Black crappie | *Pomoxis nigromaculatus* |
| Green sunfish | *Lepomis cyanellus* |
| Bluegill^ | *Lepomis macrochirus* |
| Pumpkinseed | *Lepomis gibbosus* |
| Largemouth bass^ | *Micropterus salmoides* |
| Western mosquitofish | *Gambusia affinis* |
| Yellow perch | *Perca flavescens* |

* Exotic.
^ Stocked native transplant.

**Table H-3. Herptiles found on the Rocky Mountain Arsenal National Wildlife Refuge, 2014.**

| *Common name* | *Scientific name* |
|---|---|
| Amphibians | |
| Tiger salamander ^ | *Ambystoma tigrinum* |
| Plains spadefoot | *Spea bombifrons* |
| Great plains toad | *Anaxyrus cognatus* |
| Woodhouse's toad | *Anaxyrus woodhousii* |
| Midland chorus frog | *Pseudacris triseriata* |
| Bullfrog ^ | *Lithobates catesbeianus* |
| Northern leopard frog | *Lithobates pipiens* |
| Reptiles | |
| Snapping turtle ^ | *Chelydra serpentina* |
| Western painted turtle | *Chrysemys picta* |
| Ornate box turtle | *Terrepene ornata* |
| Red-eared slider * | *Trachemys scripta* |
| Spiny softshell | *Apalone spinifera* |
| Lesser earless lizard | *Holbrookia maculata* |
| Short-horned lizard | *Phrynosoma hernandesi* |
| Prairie lizard | *Sceloporus undulatus* |
| Many-lined skink | *Plestiodon multivirgatus* |
| Six-lined racerunner | *Cnemidiphorus sexlineata* |
| Yellowbelly racer | *Coluber constrictor* |
| Western hognose snake | *Heterodon nasicus* |
| Bullsnake | *Pituophis catenifer* |
| Western terrestrial garter snake | *Thamnophis elegans* |
| Plains garter snake | *Thamnophis radix* |
| Common garter snake | *Thamnophis sirtalis* |
| Prairie rattlesnake | *Crotalus viridis* |

^ Game species.

* Unregulated.

**Table H-4. Birds found on the Rocky Mountain Arsenal National Wildlife Refuge, 2014.**

| *Common name* | *Scientific name* |
|---|---|
| Geese, swans, and ducks | |
| Greater white-fronted goose * | *Anser albifrons* |
| Snow goose | *Chen caerulescens* |
| Ross's goose * | *Chen rossii* |
| Cackling goose | *Branta hutchinsii* |
| Canada goose + | *Branta canadensis* |
| Trumpeter swan * | *Cygnus buccinator* |
| Tundra swan * | *Cygnus columbianus* |
| Wood duck + | *Aix sponsa* |
| Gadwall | *Anas strepera* |
| Eurasian wigeon * | *Anas penelope* |
| American wigeon | *Anas americana* |
| Mallard + | *Anas platyrhynchos* |

| | |
|---|---|
| Blue-winged teal + | *Anas discors* |
| Cinnamon teal | *Anas cyanoptera* |
| Northern shoveler | *Anas clypeata* |
| Northern pintail + | *Anas acuta* |
| Green-winged teal | *Anas crecca* |
| Canvasback | *Aythya valisineria* |
| Redhead + | *Aythya americana* |
| Ring-necked duck | *Aythya collaris* |
| Greater scaup * | *Aythya marila* |
| Lesser scaup | *Aythya affinis* |
| Surf scoter * | *Melanitta perspicillata* |
| White-winged scoter * | *Melanitta fusca* |
| Black scoter * | *Melanitta americana* |
| Bufflehead | *Bucephala albeola* |
| Common goldeneye | *Bucephala clangula* |
| Barrow's goldeneye | *Bucephala islandica* |
| Hooded merganser | *Lophodytes cucullatus* |
| Common merganser | *Mergus merganser* |
| Red-breasted merganser | *Mergus serrator* |
| Ruddy duck | *Oxyura jamaicensis* |
| **Loons** | |
| Pacific loon * | *Gavia pacifica* |
| Common loon * | *Gavia immer* |
| **Grebes** | |
| Pied-billed grebe + | *Podilymbus podiceps* |
| Horned grebe * | *Podiceps auritus* |
| Red-necked grebe * | *Podiceps grisegena* |
| Eared grebe | *Podiceps nigricollis* |
| Western grebe | *Aechmophorus occidentalis* |
| Clark's grebe * | *Aechmophorus clarkii* |
| **Cormorants** | |
| Double-crested cormorant | *Phalacrocorax auritus* |
| **Pelicans** | |
| American white pelican | *Pelecanus erythrorhynchos* |
| **Bitterns, herons, and egrets** | |
| American bittern * | *Botaurus lentiginosus* |
| Great blue heron | *Ardea herodias* |
| Great egret * | *Ardea alba* |
| Snowy egret | *Egretta thula* |
| Little blue heron * | *Egretta caerulea* |
| Tricolored heron * | *Egretta tricolor* |
| Cattle egret * | *Bubulcus ibis* |
| Green heron * | *Butorides virescens* |
| Black-crowned night-heron | *Nycticorax nycticorax* |
| **Ibis** | |
| White-faced ibis | *Plegadis chihi* |

| New world vultures | |
|---|---|
| Turkey vulture | *Cathartes aura* |
| **Osprey, hawks, and eagles** | |
| Osprey | *Pandion haliaetus* |
| Bald eagle + | *Haliaeetus leucocephalus* |
| Northern harrier + | *Circus cyaneus* |
| Sharp-shinned hawk | *Accipiter striatus* |
| Cooper's hawk | *Accipiter cooperii* |
| Northern goshawk * | *Accipiter gentilis* |
| Broad-winged hawk * | *Buteo platypterus* |
| Swainson's hawk + | *Buteo swainsoni* |
| Red-tailed hawk + | *Buteo jamaicensis* |
| Ferruginous hawk | *Buteo regalis* |
| Rough-legged hawk | *Buteo lagopus* |
| Golden eagle | *Aquila chrysaetos* |
| **Rails and coots** | |
| Virginia rail + | *Rallus limicola* |
| Sora | *Porzana carolina* |
| American coot + | *Fulica americana* |
| **Cranes** | |
| Sandhill crane | *Grus canadensis* |
| **Stilts and avocets** | |
| Black-necked stilt * | *Himantopus mexicanus* |
| American avocet + | *Recurvirostra americana* |
| **Plovers** | |
| Black-bellied plover * | *Pluvialis squatarola* |
| American golden-plover * | *Pluvialis dominica* |
| Snowy plover * | *Charadrius nivosus* |
| Semipalmated plover * | *Charadrius semipalmatus* |
| Killdeer + | *Charadrius vociferus* |
| Mountain plover * | *Charadrius montanus* |
| **Sandpipers and phalaropes** | |
| Spotted sandpiper + | *Actitis macularius* |
| Solitary sandpiper | *Tringa solitaria* |
| Greater yellowlegs | *Tringa melanoleuca* |
| Willet | *Tringa semipalmata* |
| Lesser yellowlegs | *Tringa flavipes* |
| Upland sandpiper * | *Bartramia longicauda* |
| Whimbrel * | *Numenius phaeopus* |
| Long-billed curlew | *Numenius americanus* |
| Marbled godwit * | *Limosa fedoa* |
| Stilt sandpiper * | *Calidris himantopus* |
| Sanderling * | *Calidris alba* |
| Baird's sandpiper | *Calidris bairdii* |
| Least sandpiper * | *Calidris minutilla* |
| White-rumped sandpiper * | *Calidris fuscicollis* |

| | |
|---|---|
| Pectoral sandpiper * | *Calidris melanotos* |
| Semipalmated sandpiper * | *Calidris pusilla* |
| Western sandpiper * | *Calidris mauri* |
| Long-billed dowitcher | *Limnodromus scolopaceus* |
| Wilson's snipe | *Gallinago delicata* |
| Wilson's phalarope | *Phalaropus tricolor* |
| Red-necked phalarope * | *Phalaropus lobatus* |
| **Gulls and terns** | |
| Sabine's gull * | *Xema sabini* |
| Bonaparte's gull * | *Chroicocephalus philadelphia* |
| Franklin's gull | *Leucophaeus pipixcan* |
| Ring-billed gull | *Larus delawarensis* |
| California gull | *Larus californicus* |
| Herring gull | *Larus argentatus* |
| Thayer's gull * | *Larus thayeri* |
| Lesser black-backed gull * | *Larus fuscus* |
| Caspian tern * | *Hydroprogne caspia* |
| Black tern * | *Chlidonias niger* |
| Common tern * | *Sterna hirundo* |
| Arctic tern | *Sterna paradisaea* |
| Forster's tern * | *Sterna forsteri* |
| **Pigeons and doves** | |
| Rock pigeon (I) + | *Columba livia* |
| Eurasian collared-dove (I)+ | *Streptopelia decaocto* |
| White-winged dove * | *Zenaida asiatica* |
| Mourning dove + | *Zenaida macroura* |
| **Cuckoos** | |
| Yellow-billed cuckoo * | *Coccyzus americanus* |
| **Barn owls** | |
| Barn owl | *Tyto alba* |
| **Typical owls** | |
| Eastern screech-owl * | *Megascops asio* |
| Great horned owl + | *Bubo virginianus* |
| Snowy owl * | *Bubo scandiacus* |
| Burrowing owl + | *Athene cunicularia* |
| Long-eared owl + | *Asio otus* |
| Short-eared Owl + | *Asio flammeus* |
| Northern saw-whet owl * | *Aegolius acadicus* |
| **Nightjars** | |
| Common nighthawk + | *Chordeiles minor* |
| Common poorwill * | *Phalaenoptilus nuttallii* |
| **Swifts** | |
| Chimney swift * | *Chaetura pelagica* |
| **Hummingbirds** | |
| Broad-tailed hummingbird * | *Selasphorus platycercus* |
| Rufous hummingbird * | *Selasphorus rufus* |

| | |
|---|---|
| Calliope hummingbird * | *Selasphorus calliope* |
| **Kingfishers** | |
| Belted kingfisher + | *Megaceryle alcyon* |
| **Woodpeckers** | |
| Lewis's woodpecker * | *Melanerpes lewis* |
| Red-headed woodpecker + | *Melanerpes erythrocephalus* |
| Red-bellied woodpecker * | *Melanerpes carolinus* |
| Red-naped sapsucker * | *Sphyrapicus nuchalis* |
| Downy woodpecker + | *Picoides pubescens* |
| Hairy woodpecker + | *Picoides villosus* |
| Northern flicker + | *Colaptes auratus* |
| **Falcons and caracaras** | |
| American kestrel + | *Falco sparverius* |
| Merlin | *Falco columbarius* |
| Peregrine falcon | *Falco peregrinus* |
| Prairie falcon | *Falco mexicanus* |
| **Tyrant flycatchers** | |
| Olive-sided flycatcher * | *Contopus cooperi* |
| Western wood-pewee + | *Contopus sordidulus* |
| Willow flycatcher * | *Empidonax traillii* |
| Least flycatcher * | *Empidonax minimus* |
| Hammond's flycatcher * | *Empidonax hammondii* |
| Gray flycatcher * | *Empidonax wrightii* |
| Dusky flycatcher | *Empidonax oberholseri* |
| Cordilleran flycatcher * | *Empidonax occidentalis* |
| Eastern phoebe * | *Sayornis phoebe* |
| Say's phoebe + | *Sayornis saya* |
| Ash-throated flycatcher * | *Myiarchus cinerascens* |
| Great crested flycatcher * | *Myiarchus crinitus* |
| Cassin's kingbird | *Tyrannus vociferans* |
| Western kingbird + | *Tyrannus verticalis* |
| Eastern kingbird + | *Tyrannus tyrannus* |
| Scissor-tailed flycatcher * | *Tyrannus forficatus* |
| **Shrikes** | |
| Loggerhead shrike + | *Lanius ludovicianus* |
| Northern shrike | *Lanius excubitor* |
| **Vireos** | |
| Plumbeous vireo * | *Vireo plumbeus* |
| Cassin's vireo 8 | *Vireo cassinii* |
| Blue-headed vireo * | *Vireo solitarius* |
| Warbling vireo | *Vireo gilvus* |
| Philadelphia vireo * | *Vireo philadelphicus* |
| Red-eyed vireo * | *Vireo olivaceus* |
| **Jays and crows** | |
| Blue jay + | *Cyanocitta cristata* |
| Western scrub-jay * | *Aphelocoma californica* |

| | |
|---|---|
| Black-billed magpie + | *Pica hudsonia* |
| American crow | *Corvus brachyrhynchos* |
| Common raven * | *Corvus corax* |
| **Larks** | |
| Horned lark + | *Eremophila alpestris* |
| **Swallows** | |
| Tree swallow + | *Tachycineta bicolor* |
| Violet-green swallow | *Tachycineta thalassina* |
| Northern rough-winged swallow + | *Stelgidopteryx serripennis* |
| Bank swallow + | *Riparia riparia* |
| Barn swallow + | *Hirundo rustica* |
| Cliff swallow + | *Petrochelidon pyrrhonota* |
| **Chickadees and titmice** | |
| Black-capped chickadee + | *Poecile atricapillus* |
| Mountain chickadee * | *Poecile gambeli* |
| **Nuthatches** | |
| Red-breasted nuthatch * | *Sitta canadensis* |
| White-breasted nuthatch + | *Sitta carolinensis* |
| Pygmy nuthatch * | *Sitta pygmaea* |
| **Creepers** | |
| Brown creeper * | *Certhia americana* |
| **Wrens** | |
| House wren + | *Troglodytes aedon* |
| Rock wren | *Salpinctes obsoletus* |
| Winter wren * | *Troglodytes hiemalis* |
| Marsh wren * | *Cistothorus palustris* |
| Bewick's wren * | *Thryomanes bewickii* |
| **Gnatcatchers** | |
| Blue-gray gnatcatcher + | *Polioptila caerulea* |
| **Kinglets** | |
| Golden-crowned kinglet * | *Regulus satrapa* |
| Ruby-crowned kinglet | *Regulus calendula* |
| **Thrushes** | |
| Eastern bluebird + | *Sialia sialis* |
| Western bluebird * | *Sialia mexicana* |
| Mountain bluebird | *Sialia currucoides* |
| Townsend's solitaire | *Myadestes townsendi* |
| Veery * | *Catharus fuscescens* |
| Gray-cheeked thrush * | *Catharus minimus* |
| Swainson's thrush | *Catharus ustulatus* |
| Hermit thrush | *Catharus guttatus* |
| Wood thrush * | *Hylocichla mustelina* |
| American robin + | *Turdus migratorius* |
| **Mimic thrushes** | |
| Gray catbird * | *Dumetella carolinensis* |
| Brown thrasher | *Toxostoma rufum* |

| | |
|---|---|
| Sage thrasher | *Oreoscoptes montanus* |
| Northern mockingbird + | *Mimus polyglottos* |
| **Starlings** | |
| European starling (I)+ | *Sturnus vulgaris* |
| **Pipits** | |
| American pipit * | *Anthus rubescens* |
| **Waxwings** | |
| Bohemian waxwing * | *Bombycilla garrulus* |
| Cedar waxwing * | *Bombycilla cedrorum* |
| **Longspurs** | |
| Lapland longspur * | *Calcarius lapponicus* |
| McCown's longspur * | *Rhynchophanes mccownii* |
| **Wood warblers** | |
| Ovenbird * | *Seiurus aurocapilla* |
| Worm-eating warbler * | *Helmitheros vermivorum* |
| Northern waterthrush * | *Parkesia noveboracensis* |
| Black-and-white warbler * | *Mniotilta varia* |
| Orange-crowned warbler | *Oreothlypis celata* |
| Nashville warbler * | *Oreothlypis ruficapilla* |
| Virginia's warbler | *Oreothlypis virginiae* |
| MacGillivray's warbler * | *Geothlypis tolmiei* |
| Common yellowthroat + | *Geothlypis trichas* |
| Hooded warbler * | *Setophaga citrina* |
| American redstart * | *Setophaga ruticilla* |
| Bay-breasted warbler * | *Setophaga castanea* |
| Yellow warbler + | *Setophaga petechia* |
| Blackpoll warbler + | *Setophaga striata* |
| Black-throated blue warbler * | *Setophaga caerulescens* |
| Palm warbler * | *Setophaga palmarum* |
| Yellow-rumped warbler | *Setophaga coronata* |
| Prairie warbler * | *Setophaga discolor* |
| Black-throated gray warbler * | *Setophaga nigrescens* |
| Townsend's warbler * | *Setophaga townsendi* |
| Hermit warbler * | *Setophaga occidentalis* |
| Wilson's warbler | *Cardellina pusilla* |
| Yellow-breasted chat * | *Icteria virens* |
| **Towhees and sparrows** | |
| Green-tailed towhee | *Pipilo chlorurus* |
| Spotted towhee | *Pipilo maculatus* |
| Cassin's sparrow | *Peucaea cassinii* |
| American tree sparrow | *Spizella arborea* |
| Chipping sparrow | *Spizella passerina* |
| Clay-colored sparrow | *Spizella pallida* |
| Brewer's sparrow | *Spizella breweri* |
| Field sparrow * | *Spizella pusilla* |
| Vesper sparrow + | *Pooecetes gramineus* |

| | |
|---|---|
| Lark sparrow + | *Chondestes grammacus* |
| Black-throated sparrow * | *Amphispiza bilineata* |
| Lark bunting + | *Calamospiza melanocorys* |
| Savannah sparrow * | *Passerculus sandwichensis* |
| Grasshopper sparrow + | *Ammodramus savannarum* |
| Fox sparrow * | *Passerella iliaca* |
| Song sparrow + | *Melospiza melodia* |
| Lincoln's sparrow | *Melospiza lincolnii* |
| Swamp sparrow * | *Melospiza georgiana* |
| White-throated sparrow * | *Zonotrichia albicollis* |
| Harris's sparrow * | *Zonotrichia querula* |
| White-crowned sparrow | *Zonotrichia leucophrys* |
| Golden-crowned sparrow | *Zonotrichia atricapilla* |
| Dark-eyed junco | *Junco hyemalis* |
| **Cardinals, tanagers, and allies** | |
| Scarlet tanager * | *Piranga olivacea* |
| Western tanager | *Piranga ludoviciana* |
| Rose-breasted grosbeak | *Pheucticus ludovicianus* |
| Black-headed grosbeak + | *Pheucticus melanocephalus* |
| Blue grosbeak + | *Passerina caerulea* |
| Lazuli bunting | *Passerina amoena* |
| Indigo bunting * | *Passerina cyanea* |
| Dickcissel * | *Spiza americana* |
| **Blackbirds and orioles** | |
| Bobolink * | *Dolichonyx oryzivorus* |
| Red-winged blackbird + | *Agelaius phoeniceus* |
| Western meadowlark + | *Sturnella neglecta* |
| Yellow-headed blackbird + | *Xanthocephalus xanthocephalus* |
| Brewer's blackbird + | *Euphagus cyanocephalus* |
| Common grackle + | *Quiscalus quiscula* |
| Great-tailed grackle * | *Quiscalus mexicanus* |
| Brown-headed cowbird + | *Molothrus ater* |
| Orchard oriole | *Icterus spurius* |
| Bullock's oriole + | *Icterus bullockii* |
| **Finches** | |
| House finch + | *Haemorhous mexicanus* |
| Common redpoll * | *Acanthis flammea* |
| Pine siskin * | *Spinus pinus* |
| Lesser goldfinch * | *Spinus psaltria* |
| American goldfinch | *Spinus tristis* |
| Evening grosbeak * | *Coccothraustes vespertinus* |
| **Old world sparrows** | |
| House sparrow (I)+ | *Passer domesticus* |

+ Known to nest on complex.

* Rare or accidental sightings.

*(I)* Introduced.

**Table H-5. Mammals found on the Rocky Mountain Arsenal National Wildlife Refuge, 2014.**

| *Common name* | *Scientific name* |
|---|---|
| Insectivores | |
| North American least shrew | *Cryptotis parva* |
| Bats | |
| Silver-haired bat | *Lasionycteris noctivagans* |
| Little brown bat | *Myotis lucifugus* |
| Big brown bat | *Eptesicus fuscus* |
| Hoary bat | *Lasiurus cinereus* |
| Lagomorphs | |
| Desert cottontail | *Sylvilagus audobonii* |
| Eastern cottontail | *Sylvilagus floridanus* |
| Black-tailed jackrabbit | *Lepus californicus* |
| Rodents | |
| Spotted ground squirrel | *Spermophilus spilosoma* |
| Thirteen-lined round squirrel | *Spermophilus tridecemlineatus* |
| Black-tailed prairie dog | *Cynomys ludovicianus* |
| Fox squirrel | *Sciurus niger* |
| Northern pocket gopher | *Thomomys talpoides* |
| Plains pocket gopher | *Geomys bursarius* |
| Plains pocket mouse | *Perognathus flavescens* |
| Silky pocket mouse | *Perognathus flavus* |
| Hispid pocket mouse | *Chaetodipus hispidus* |
| Ord's kangaroo rat | *Dipodomys ordii* |
| American beaver | *Castor canadensis* |
| Western harvest mouse | *Reithrodontomys megalotis* |
| Deer mouse | *Peromyscus maniculatus* |
| Northern grasshopper mouse | *Onychomys leucogastor* |
| House mouse | *Mus musculus* |
| Prairie vole | *Microtus ochrogaster* |
| Meadow vole | *Microtus pennslyvanicus* |
| Common muskrat | *Ondatra ziebethicus* |
| Carnivores | |
| Red fox | *Vulpes vulpes* |
| Coyote | *Canis latrans* |
| Raccoon | *Procyon lotor* |
| Long-tailed weasel | *Mustela frenata* |
| American mink | *Mustela vison* |
| American badger | *Taxidea taxus* |
| Striped skunk | *Mephitis mephitis* |
| Bobcat | *Lynx rufus* |
| Ungulates | |
| Mule deer | *Odocoileus hemionus* |
| White-tailed deer | *Odocoileus virginianus* |
| Bison | *Bison bison* |

# Appendix I

## *Section 7 Biological Opinion— Black-Footed Ferret Reintroduction*

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Colorado Field Office
P.O. Box 25486, DFC (65412)
Denver, Colorado 80225-0486

IN REPLY REFER TO:
TAILS: 06E24000-2014-F-0855

APR 21 2015

Memorandum

To: David Lucas, Project Leader, Rocky Mountain Arsenal National Wildlife Refuge (Refuge or RMA NWR), Commerce City, Colorado

From: Charles A. Pelizza, Acting Field Supervisor, Colorado Field Office, U.S. Fish and Wildlife Service (Service), Region 6, Denver, Colorado

Subject: Intra-Service Section 7 Consultation on the Reintroduction of Black-footed Ferrets to the Refuge (Project) in Commerce City, Colorado

Thank you for your request for formal consultation with the Service's Colorado Field Office (CFO) pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544), as amended (ESA). Your final intra-service Biological Assessment (BA) dated January 12, 2015, was received by us on the same date. The BA described impacts that may result from the proposed reintroduction of black-footed ferrets to the Refuge in Adams and Denver counties, Colorado, pursuant to the Regional Director's section 10(a)(1)(A) recovery permit. The proposed action may affect the black-footed ferret (*Mustela nigripes*; hereafter, ferret or BFF) and we concur with that determination.

In your BA, you also determined that the proposed action will have "no effect" on the following listed species: Mexican spotted owl (*Strix occidentalis lucida*), Ute ladies'-tresses orchid (*Spiranthes diluvialis)*, the Colorado butterfly plant (*Gaura neomexicana* ssp. *coloradensis*), and Preble's meadow jumping mouse (*Zapus hudsonius preblei*). We agree with your determinations on those species. An earlier biological opinion (BO# ES/LK- 6-CO-13-F-020, TAILS: 06E24000-2013-F-0612) covered the potential effects of water use at the Refuge on federally listed species and designated critical habitat associated with the Platte River in Nebraska.

This biological opinion is based on information provided in the January 12, 2015, intra-service BA from the Refuge, the March 16, 2015, Black-Footed Ferret Allocation Request for the Rocky Mountain Arsenal National Wildlife Refuge, final rules/field work undertaken to reintroduce ferrets at other sites throughout the ferret's range, and other sources of information. Literature cited in this biological opinion is not a complete bibliography of all literature available on the species of concern, reintroduction actions and their effects, or on

other subjects considered in this opinion. A complete administrative record of this consultation is on file at this office and the Refuge.

**Consultation Background / History**

| | |
|---|---|
| 2010 | The Refuge mapped current prairie dog acreage and determined that sufficient black-tailed prairie dog habitat exists to accommodate a ferret reintroduction for year-round occupation by ferrets. |
| February 25, 2013 | Service CFO and Refuge Planning staffs met for an initial discussion of the upcoming planning process for the Refuge's Comprehensive Conservation Plan (CCP). |
| April 24, 2013 | Conference call between the Service's Refuge Planning, CFO, and National Black-footed Ferret Conservation Center (BFF Conservation Center) staffs was held for a preliminary discussion of ferret reintroduction and the CCP planning process for the Refuge. |
| May 1, 2013 | The Refuge conducted a public meeting to review various "step down" management plans including its Black-tailed Prairie Dog Management Plan and Habitat Management Plan. |
| May 6, 2013 | The Refuge conducted a Service pre-planning meeting [and tour] to discuss the RMA NWR and Two Ponds NWR CCP Work Plan, including a discussion about black-footed ferret reintroduction. |
| June 26, 2013 | The Refuge held a "Kickoff" meeting for cooperating agencies participating in the development of the CCP, including the possible reintroduction of ferrets. |
| July 2, 2013 | The Refuge issued its Black-tailed Prairie Dog Management Plan, which included a discussion of potential ferret reintroduction (Plan available online at: <https://ecos.fws.gov/ServCat/Reference/Profile/29135>). |
| July 25-Aug. 15, 2013 | The Refuge conducted public scoping meetings in Reunion, Commerce City, Stapleton, and Montbello/Green Valley Ranch to discuss the CCP development. |
| August 19, 2013 | Denver International Airport (DIA) representatives, Service endangered species staff, and Refuge personnel met at the Refuge to discuss a potential release of ferrets on the Refuge. |

| | |
|---|---|
| September 6, 2013 | The Refuge issued its Habitat Management Plan, which included a discussion of potential ferret reintroduction (Plan available online at: <https://ecos.fws.gov/ServCat/Reference/Profile/29133>). |
| October 22, 2013 | DIA, USDA, and Refuge staffs visited the BFF Conservation Center. |
| February 24-26, 2014 | The Refuge conducted an Alternatives Development Workshop for biological programs, including species reintroductions, for the CCP. |
| April 30, 2014 | The CFO received a preliminary first draft BA from Mike Dixon (for the Refuge). |
| April-May, 2014 | The Refuge prairie dog management zones were dusted with deltamethrin. |
| May 8, 2014 | Conference call between the CFO, Refuge, and BFF Conservation Center staffs was held to discuss the preliminary draft BA. |
| May 16, 2014 | A preferred alternative, which included ferret reintroduction, was selected and refined for the CCP. |
| May 27, 2014 | The CFO received the May 27, 2014, draft BA from the Refuge. |
| June 11, 2014 | Conference call between the CFO, Refuge, and BFF Conservation Center staffs was held to discuss the May 27, 2014, draft BA. |
| July 26, 2014 | The CFO received the July 25, 2014, draft BA from the Refuge. |
| July-August, 2014 | Black-tailed prairie dog management zones were inventoried to determine prairie dog densities and overall BFF habitat conditions. (Report available online at: <https://ecos.fws.gov/ServCat/Reference/Profile/42958>). |
| August 25, 2014 | The CFO, Refuge, and BFF Conservation Center staffs met to discuss the July 25, 2014, draft BA. |
| December 1, 2014 | Internal review of the draft CCP began with the planning team. |
| December 30, 2014 | Conference call between the CFO and Refuge staffs was held to discuss the consultation process and schedule, BA, and BO. |
| January 7, 2015 | Conference call between the CFO and Refuge staffs was held to discuss the October 28, 2014, draft BA. |

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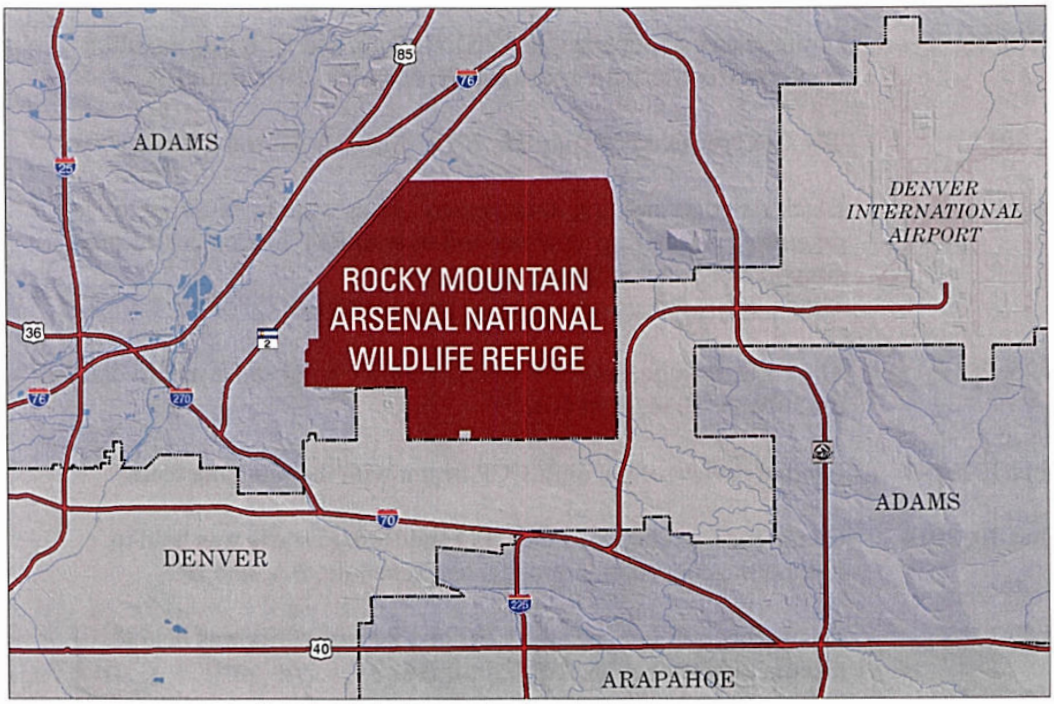
| January 12, 2015 | The CFO received the final, revised BA from the Refuge. |
| March 16, 2015 | The Refuge submitted its 2015 Black-footed Ferret Allocation Request to the Black-footed Ferret Recovery Coordinator (cc: CFO) to become a ferret reintroduction site. |
| April 2015 | A draft CCP/EIS was issued for public review/comment. |

## BIOLOGICAL OPINION

### DESCRIPTION OF THE PROPOSED ACTION

The proposed action is the Service's reintroduction of black-footed ferrets at the Refuge; this would occur pursuant to the Regional Director's 10(a)(1)(A) recovery permit and would not designate critical habitat. The 15,998-acre Refuge is located immediately adjacent to the cities of Denver (south and east) and Commerce City (north and west) in Adams and Denver counties (Figure 1, from the January 12, 2015, BA). The reintroduction would occur within the current prairie dog management zones located on the Refuge and entirely within the jurisdictional boundaries of Refuge.

Figure 1. Rocky Mountain Arsenal NWR and vicinity.



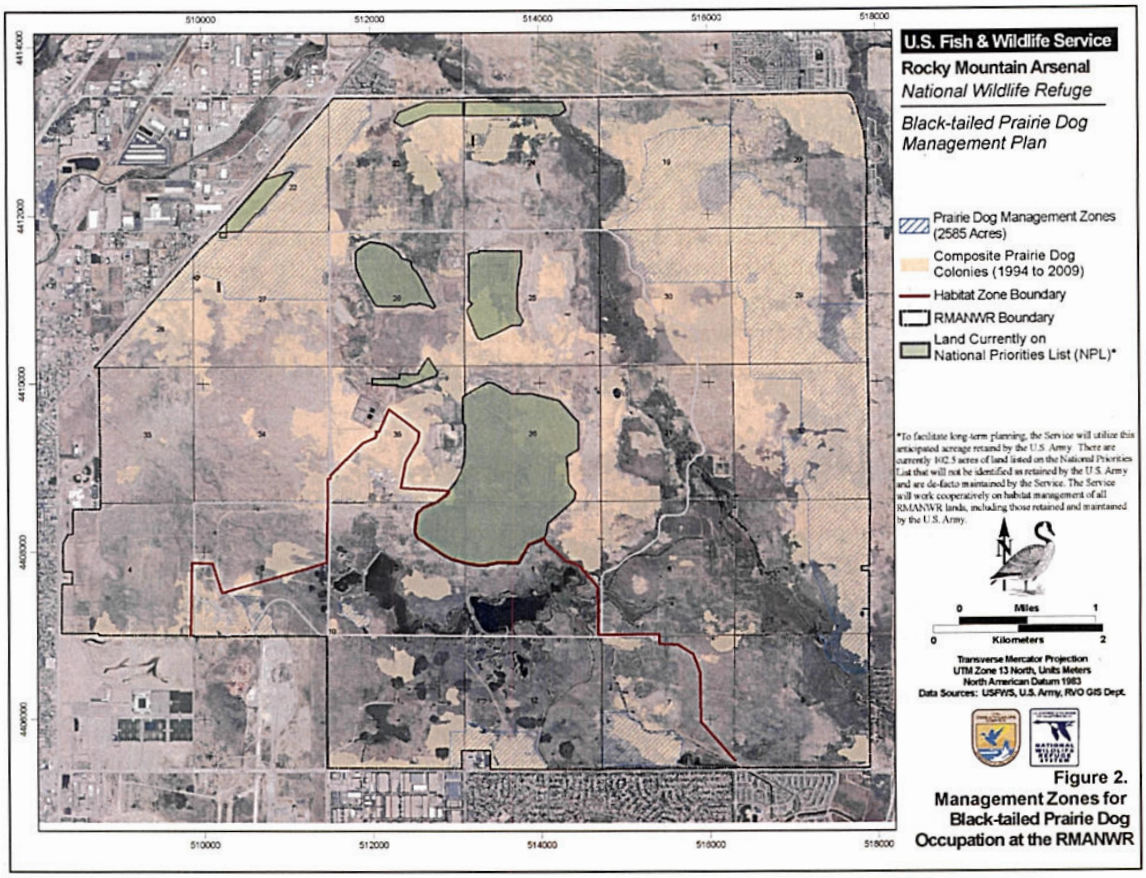
The Service is analyzing the impact of reintroducing black-footed ferrets to prairie dog colonies on the Refuge. As the lead agency for black-footed ferret recovery, the Service has an obligation to reintroduce the ferret to suitable habitats under its management, and ferret recovery has been a priority of the Service's Mountain Prairie Region since fiscal year 2014 (U.S. Fish and Wildlife Service 2013b).

The Refuge is located at the edge of the High Plains Ecoregion and has flat to gently rolling topography. The Refuge was formerly a Department of Defense facility, and a legacy of this was large-scale contamination of the site and its groundwater. While the majority of the resulting remediation is complete, the Refuge is now actively restoring habitat that was disturbed or destroyed during the remedial actions. The Refuge recently completed a habitat management plan (U.S. Fish and Wildlife Service 2013c) which is guiding this restoration. Historically, most of the Refuge was short- or mixed-grass prairie, and most of the 12,361 acres in the Prairie Zone described in the Habitat Management Plan will be restored to those vegetation types.

Both the Habitat Management Plan and the Black-tailed Prairie Dog Management Plan (U.S Fish and Wildlife Service 2013d) were drafted specifically with an eye to managing vegetation and prey in a way that is consistent with potential reintroduction of black-footed ferrets. For the next several years, management of the Refuge under these plans will focus on taking the necessary steps to restore native grassland habitat, including the control of prairie dogs outside of defined prairie dog management zones (Figure 2, from the January 12, 2015, BA) because their foraging and other activities could adversely impact restoration efforts. Therefore, while the Refuge encompasses 15,998 acres, the initial reintroduction would be focused on studying the viability of ferret reintroduction on the six prairie dog management zones described in the habitat management plan, which total 2,585 acres. Existing prairie dog colonies at the Refuge are free of sylvatic plague, and the Refuge is currently annually dusting the six prairie dog management zones to control the fleas which are a vector for that disease. Plague management is intended to continue into the future.

The Refuge is surrounded on most of three sides by urban and suburban development, but there is some limited suitable ferret habitat adjacent to the Refuge. These include small prairie dog colonies on around the Commerce City's 190-acre Prairie Gateway Open Space in the southwest corner of the Refuge. There are also colonies to the north and northeast of the Refuge in the Reunion area of Commerce City extending toward Barr Lake State Park; however, this is a rapidly urbanizing area that will not likely maintain habitat contiguous with the RMA NWR for very long. There are larger colonies on the property of DIA east of the Refuge. However, much of the prairie dog habitat on DIA lands is separated from the Refuge by the heavily trafficked Pena Boulevard and E-470 highways. Ferrets that leave the Refuge are expected to be lost to the population, and success or failure of the Refuge ferret reintroduction would rely solely upon prairie dog acreage within the Refuge.

Figure 2. Management Zones for Black-tailed Prairie Dog Occupation at the RMA NWR.




As a part of the Superfund cleanup program, the Refuge was transferred to the Service for management. Section 2(a)(2) of the Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 (Public Law 102-402) is clear that if there is ever a conflict between management of the Refuge and a response action (as defined by CERCLA), the response action "shall take priority". Cleanup of the site was officially completed in 2010, but the U.S. Army and its contractors will maintain a long-term legacy management responsibility at the Refuge.

Provided habitat conditions remain stable, and captive ferrets are available for this project, a goal of 30 ferrets (at a 60:40 male to female ratio) would be released during the first year, but that allocation could be divided between different periods throughout the year. Subsequent ferret releases would be based on requirements outlined in the Refuge's annual ferret allocation request submitted to the BFF Conservation Center. Ferrets to be released may come from existing ferret populations or from animals held and bred in captivity. Captive animals selected for release would be as genetically redundant as possible with the captive

population. All released animals would be marked with passive integrated transponder chips (chipped) and some may be fitted with radio transmitters. Both captive-raised and wild-born translocated ferrets (trapped from other authorized ferret reintroduction areas) would be released directly into targeted prairie dog complexes at about 18 weeks of age or older. Releases are likely to occur in the fall when juvenile black-footed ferrets in the wild typically become independent, exhibit dispersal behaviors and are more capable of killing their own prey, avoiding predators, and adjusting to environmental conditions. There may also be opportunities to try other release periods such as in the spring when other ferret reintroduction sites such as Arizona have shown some successes.

Release techniques would be patterned after successful procedures used at other reintroduction sites. All captive raised ferrets would be adequately "preconditioned" prior to release in the wild. Preconditioning is the process by which ferrets are allowed to live in large outdoor pens which have prairie dog burrow systems. Captive ferrets are either born in pens or are transferred to pens between 60 and 90 days of age. Ferrets exposed to "natural" burrow systems and live prey survive in the wild at significantly higher rates than do ferrets released directly from indoor cages.

A hard release with translocated wild born ferrets would occur if removal of wild born ferrets at other existing experimental reintroduction sites is determined compatible with overall ferret management goals. In such cases, wild born ferrets captured from other reintroduction sites would be transported directly to release sites on the Refuge and released immediately.

Regardless of release technique, ferrets would be placed in separate burrow systems within contiguous prairie dog colonies. Because all animals may not reach the proper age for release at once, black-footed ferrets could likely be released sequentially over a period of 3-8 weeks or longer. Translocated wild ferrets would have minimal holding periods between capture and release. Most releases would occur in September and October, when young ferrets are about 18 weeks old. Releases may also occur later in the fall or other periods throughout the year as deemed appropriate by the Black-footed Ferret Recovery Coordinator and depending upon dates that wild ferrets may become available.

Because mortality of released animals can be high, multiple releases over successive years may likely be necessary to establish a population. In the future, some ferrets may be radio-collared to determine dispersal and short term survival, but this is not expected to be a primary means of monitoring. Spotlight and/or snow track monitoring may begin as soon as ferrets are released and would continue for several years, at predetermined survey periods, typically late summer or fall.

The Refuge and its partners would continue to seek advice and test alternative release and management strategies and may make adjustments in the ferret reintroduction as warranted. In subsequent years, alternative reintroduction techniques could be tested as deemed necessary by the Refuge and its partners.

Reintroduced ferrets may be relocated by the Refuge if necessary to: 1) avoid conflict with human activities; 2) with adjacent landowner permission, relocate a ferret that has moved outside the reintroduction area and removal is deemed necessary to protect the ferret or is requested by the affected landowner; 3) improve ferret survival and recovery prospects, 4) if the habitat is filled and surplus ferrets are needed at other sites, or 5) if the reintroduction is deemed unsuccessful, remaining ferrets may be captured and moved to other suitable reintroduction sites in other states as directed by the Service. Ferret reintroduction efforts would be reevaluated should any of the following conditions occur:

- Failure to maintain sufficient habitat to support at least 30 breeding adults after five years.
- Failure to maintain suitable prairie dog habitat.
- An active case of sylvatic plague is discovered in any animal on or near the reintroduction area within six months of the scheduled release.
- Funding is not available to implement reintroduction efforts on the Refuge.

Predator management actions may be taken to reduce predation on ferrets by coyotes, badgers, and great horned owls immediately prior to release but none are planned. If necessary, other predator control efforts may be initiated if excessive predation rates are documented.

Disease surveillance would be conducted annually (beginning within 12 months of the scheduled release, and for up to 5 years post-release) by the Refuge or its partners from within the area to monitor canine distemper, tularemia and plague occurrence. Released ferrets and captured wild born ferrets would be inoculated against canine distemper and plague.

The proposed action would not affect control of prairie dogs on non-federal lands outside the Refuge. Further, the Refuge has an existing prairie dog management plan, which allows for prairie dog control on Refuge lands to address encroachment issues. If deemed necessary by the Refuge, prairie dog control would be done only by authorized personnel and in accordance with the approved Refuge Black-Tailed Prairie Dog Management Plan. Prairie dog management is necessary to ensure the success of efforts to restore native vegetation following remediation activities on the Refuge, as well as to maintain the integrity of landfills under Army jurisdiction in areas that are still part of the National Priorities List (U.S. Fish and Wildlife Service 2013b). It is not necessary to restrict prairie dog management activities on other colonies outside of the Prairie Dog Zones (Figure 2) on or off the Refuge because this ferret reintroduction is to determine whether ferrets can be established on colonies within the Refuge. Continued implementation of the existing Prairie Dog Management Plan is also compatible with ferret reintroductions because the Refuge has the mechanism in place to determine where control may occur and move ferrets as might be necessary to avoid conflicts.

Environmental cleanup of the Refuge was completed in 2010 and no additional response actions are envisioned on Refuge lands. However, if deemed necessary, a response action requiring soil excavation or removal is possible anywhere on the Refuge. This is considered an unlikely scenario. However, the Service would be involved in all projects occurring on Refuge lands and would take necessary steps to reduce take of ferrets.

As part of the proposed action, the Refuge would implement the following conservation measures to reduce impacts to black-footed ferrets:

- Ferret populations and overall survival would be monitored at least once each year in coordination with the BFF Conservation Center staff. All data, information and lessons learned would be shared with the greater biology community to improve ferret recovery.
- Plague management (e.g., dusting with deltamethrin, vaccine, etc.) and surveillance would be conducted on an annual, or as needed basis, to reduce potential impact to prairie dog colonies.
- Recurring monitoring of prairie dog colonies would occur to obtain information regarding population densities and areas of occupancy.
- Management of black-tailed prairie dog colonies through the use of prairie dog management zones; this would help the Refuge meet population goals for prairie dogs and ferrets, while also meeting habitat restoration goals.
- Predator management would occur through the removal of unnatural vertical structures that could provide perches for raptors.
- Education would be provided through media releases, displays at the Refuge, and other future opportunities.
- Formal (e.g., Memorandum of Agreements) and informal partnerships would be fostered with neighbors and conservation organizations to promote the awareness of black-footed ferrets at the Refuge and nationwide.

## STATUS OF THE SPECIES / ENVIRONMENTAL BASELINE

The black-footed ferret is a medium-sized member of the Mustelidae family typically weighing 1.4–2.5 pounds and measuring 19–24 inches in total length. Upper body parts are yellowish buff, occasionally whitish; feet and tail tip are black; and a black "mask" occurs across the eyes. It is the only ferret species native to the Americas. There are no recognized subspecies. Other ferret species in the genus include the Siberian polecat (*M. eversmanni*) and the European ferret (*M. putorius*) (Hillman and Clark 1980; Anderson et al. 1986). The black-footed ferret was first formally described in 1851 by J.J. Audubon and J. Bachman (Clark et al. 1986). The species entered North America from Siberia approximately 1–2 million years ago, spread across Beringia, and advanced southward through ice-free corridors to the Great Plains approximately 800,000 years ago (Wisely 2006). Contrary to early characterizations that addressed natural history, it was probably common historically, although its secretive habits (nocturnal and often underground) made it difficult to observe (Forrest et al. 1985; Anderson et al. 1986; Clark 1989).

Black-footed ferrets prey primarily on prairie dogs and use their burrows for shelter and denning (Henderson et al. 1969; Hillman and Linder 1973; Forrest et al. 1985). Black-footed ferrets depend almost exclusively on prairie dogs for food and shelter, and the species' range overlaps three prairie dog species (Anderson et al. 1986). With no documentation of black-footed ferret breeding outside of prairie dog colonies, the Service believes that black-footed ferrets were historically endemic to the range of three prairie dog species. There are records of black-footed ferrets from the ranges of the black-tailed prairie dog, white-tailed prairie dog, and Gunnison's prairie dog (Anderson et al. 1986) which collectively occupied approximately 100 million acres (ac) of intermontane and prairie grasslands (Biggins et al. 1997; Clark et al. 1986; Ernst et al. 2006). The historical range of the species includes 12 States (Arizona, Colorado, Kansas, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Utah, and Wyoming) and the Canadian provinces of Alberta and Saskatchewan (Anderson et al. 1986); this range is also the action area for the proposed action. Ernst (2008 pers. comm.) estimated that in the United States, this occupied habitat existed within an estimated 562 million ac of potential habitat. Ernst (2008 pers. comm.) used a geographic information system (GIS) database to predict the distribution of prairie dog habitat across the United States and concluded that historically 85 percent of all black-footed ferrets probably occurred in black-tailed prairie dog habitat, 8 percent in Gunnison's prairie dog habitat, and 7 percent in white-tailed prairie dog habitat. The Service concludes that most black-footed ferrets likely occurred in black-tailed prairie dog habitat.

The black-footed ferret breeds at approximately one year of age, from mid-March through early April, and gestation is about 42-45 days. Litter sizes average about 3.5 (Wilson and Ruff 1999). Juveniles disperse in late summer/early fall. The black-footed ferret leads a solitary existence except for mating and the period when mother and young are together (Forrest et al. 1985). It is a "searcher" predator that is generally nocturnal, appearing above ground at irregular intervals and for irregular durations (Clark et al. 1986).

The black-footed ferret's close association with prairie dogs was an important factor in its decline. From the late 1800's to approximately 1960, both prairie dog habitat and numbers were dramatically reduced by the combined effects of habitat loss from conversion of native prairie to cropland, poisoning of prairie dogs, and disease, particularly sylvatic plague (U.S. Fish and Wildlife Service 2008). Sylvatic plague, caused by a non-native bacterium, can be devastating to both prairie dogs and black-footed ferrets. By 2005, plague had been detected in prairie dogs in all 12 states throughout the historical range of the black-footed ferret (Abbott and Rocke 2012).

The black-footed ferret was considered extinct or nearly extinct when a small population was located in Mellette County, South Dakota, in 1964 (Henderson et al. 1969). The species was listed as endangered under early endangered species legislation by the Service in 1967 and was "grandfathered" into the ESA in 1973 (U.S. Fish and Wildlife Service 2008). No critical habitat has been proposed or designated for this species. The last wild black-footed ferret observed at the Mellette County site was in 1974 (Clark 1989). Attempts at captive breeding of a few captured animals from the Mellette County population failed, and when the last

captive animal died at Patuxent Wildlife Research Center in Laurel, Maryland, in 1979, the species was again presumed extinct (U.S. Fish and Wildlife Service 1988).

In 1981, a second remnant population was discovered in Meeteetse, Wyoming (Clark et al. 1986; Lockhart et al. 2006). Following disease outbreaks at Meeteetse, all surviving wild black-footed ferrets (totaling 18 individuals) were removed from the wild between 1985 and 1987 to initiate a captive breeding program (U.S. Fish and Wildlife Service 1988). Seven of the black-footed ferrets captured at Meeteetse successfully reared young, leading to a lineage of continuing captive reproduction that provides black-footed ferrets to reintroduction sites today (Hutchins et al. 1996; Garelle et al. 2006). Reintroductions began in 1991 (Table 1, U.S. Fish and Wildlife Service 2013a; updated by John Hughes, Wildlife Biologist, Black-footed Ferret Recovery Program), and all extant populations, both captive and reintroduced, descend from these seven "founder" animals (Garelle et al. 2006).

Table 1. Black-footed ferret reintroduction sites, year initiated, and prairie dog species.

| SITE (YEAR INITIATED) | PRAIRIE DOG SPECIES |
|---|---|
| Shirley Basin, Wyoming (1991) | White-tailed |
| UL Bend National Wildlife Refuge, Montana (1994) | Black-tailed |
| Badlands National Park, South Dakota (1994) | Black-tailed |
| Aubrey Valley, Arizona (1996) | Gunnison's |
| Conata Basin, South Dakota (1996) | Black-tailed |
| Fort Belknap Indian Reservation, Montana (1997) | Black-tailed |
| Coyote Basin, Colorado and Utah (1999) | White-tailed |
| Cheyenne River Indian Reservation, South Dakota (2000) | Black-tailed |
| Bureau of Land Management 40-Complex, Montana (2001) | Black-tailed |
| Wolf Creek, Colorado (2001) | White-tailed |
| Janos, Mexico (2001) | Black-tailed |
| Rosebud Indian Reservation, South Dakota (2004) | Black-tailed |
| Lower Brule Indian Reservation, South Dakota (2006) | Black-tailed |
| Wind Cave National Park, South Dakota (2007) | Black-tailed |

| | |
|---|---|
| Espee Ranch, Arizona (2007) | Gunnison's |
| Logan County, Kansas (2007) | Black-tailed |
| Northern Cheyenne Indian Reservation, Montana (2008) | Black-tailed |
| Vermejo Park Ranch, New Mexico (2008) | Black-tailed |
| Grasslands National Park, Saskatchewan (2009) | Black-tailed |
| Vermejo Park Ranch, New Mexico (2012) | Gunnison's |
| Walker Ranch, Colorado (2013) | Black-tailed |
| City of Fort Collins, Colorado (2014) | Black-tailed |
| North Holly, Colorado (2014) | Black-tailed |
| Liberty, Colorado (2014) | Black-tailed |

No wild populations of black-footed ferrets have been found since the capture of the last Meeteetse black-footed ferrets, despite extensive and intensive range-wide searches. It is unlikely that any undiscovered wild populations remain (Lockhart et al. 2006). No known extant wild populations of black-footed ferrets exist, except those at reintroduction sites.

Approximately 280 animals currently make up the current black-footed ferret captive population at six facilities which provide surplus animals for release. To date, in addition to those in the 6 captive breeding facilities, approximately 274–448 black-footed ferrets exist at 24 reintroduction sites across their historical range (Table 1). Captive breeding and the release of surplus black-footed ferrets continue in efforts to establish more populations throughout their range.

Section 10(j) of the ESA allows reintroduced populations to be designated Nonessential Experimental Populations (NEP) to ease concerns about reintroductions of threatened and endangered species and to facilitate species recovery efforts. To date, 11 black-footed ferret reintroductions have occurred through use of Section 10(j) designated NEP areas in the United States (U.S. Fish and Wildlife Service 2008). There have also been seven reintroductions in the United States that used Section 10(a)(1)(A) recovery permits, which included both site-specific permits and the Black-footed Ferret Programmatic Safe Harbor Agreement. Additionally, there have been reintroductions in Chihuahua, Mexico, and in Saskatchewan, Canada, in compliance with those countries' statutes, for a total of 20 reintroduction attempts (U.S. Fish and Wildlife Service 2008; Fargey 2010). See Table 1 for the location and date of initiation of each of the black-footed ferret reintroduction sites.

At the present time, black-footed ferret populations at active reintroduction sites persist only through the purposeful management of prairie dogs to protect both black-footed ferrets and prairie dogs from sylvatic plague. Without such management, it is likely that any extant black-footed ferret populations would be reduced to zero due to this recurring non-native disease. Therefore, baseline for the black-footed ferret under the proposed action is considered to be zero because no ferrets would occur on the Refuge until reintroduction of the species. Further, we do not expect that black-footed ferrets would persist long-term on most properties without purposeful management of prairie dogs to protect both black-footed ferrets and prairie dogs from sylvatic plague.

The Refuge is within the range of the black-tailed prairie dog, and ferrets are believed to have occurred throughout this prairie dog species' range (U.S. Fish and Wildlife Service 1988). Ferrets do not currently occur in the action area. The closest location of reintroduced ferrets is at the Soapstone Prairie Natural Area in Larimer County, Colorado, approximately 80 miles north of the Refuge. Although sylvatic plague has been documented in many parts of Colorado and in black-tailed prairie dogs on the Refuge during the 1990s, there has not been an occurrence of plague at the Refuge since 2002. As noted above, the Refuge prairie dog management zones were treated for sylvatic plague in 2014 by dusting with deltamethrin, and they will be dusted again in 2015.

**EFFECTS OF THE ACTION**

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, which will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

Under the proposed action, black-footed ferret reintroductions would be carried out on the Refuge as described above. During ferret reintroductions and monitoring, some mortality may result from transporting and handling of ferrets. While occasional ferret deaths due to handling have occurred at some ferret release sites, the use of the handling protocol outlined in Roelle et al. (2006) would minimize losses. To date, less than 0.5 percent of the more than 2,700 ferrets reintroduced have perished from transporting and handling (Gober pers. comm., 2012). Incidental take of reintroduced black-footed ferrets could occur through vehicle or equipment collisions. While such rare incidents have been documented, the likelihood of vehicle collisions is low due to the nocturnal habits of the ferrets.

Black-footed ferret survival rates 30 days after release range from 10.1 percent, for early reintroduction efforts, to 45.5 percent, for more recent reintroduction efforts that pre-conditioned ferrets prior to their release (Biggins et al. 2005). Relatively low survival rates among reintroduced ferrets are principally due to predation and other natural causes. Captive-

raised ferrets have not been exposed to the same environmental factors and therefore have not developed the same resiliency as wild ferrets. Furthermore, captive-raised ferrets may not have had sufficient experience in hunting prey or avoiding predators. According to studies at Meeteetse, Wyoming, in the 1980s, natural mortality of ferrets in the wild is high. Data presented by Forrest et al. (1988) was used for computer simulation modeling that indicated juvenile mortality rate of a stable wild population up to approximately 78.5 percent. Juvenile mortality of captive-raised ferrets is likely to be higher for the reasons stated above. However, despite the low survival rates for reintroduced ferrets, it only takes a few ferrets to establish a wild population as documented at successful ferret reintroduction sites.

The Refuge is located within an urban environment, with developed or developing residential and commercial activities to the north, west, and south, and airport operations, transit, parks, infrastructure, and commercial activities on DIA property to the east. Released ferrets and their offspring would be subject to mortality from natural factors and unintentional mortality. Ferrets which disperse off of the Refuge may be subject to direct or indirect take due to a variety of reasons, including but not limited to loss of habitat due to development, fatalities caused by domestic animals, collisions with vehicles, and aeronautic, commercial, transit, and infrastructure activities at DIA. Further, animal control activities associated with airport operations, and transit, commercial, parks, and infrastructure development on DIA may cause direct or indirect take of ferrets on DIA property.

Specific management activities on the Refuge and adjacent areas that may possibly result in the unintentional mortality of reintroduced ferrets or their offspring include mortalities associated with:

- Habitat restoration activities such as disking, plowing, seeding, mowing, spraying, or irrigation (see U.S. Fish and Wildlife Service 2013c for a full description of habitat management implementation actions).
- Prescribed fire management.
- Prairie dog control (see U.S. Fish and Wildlife Service 2013d for a full description of prairie dog management implementation actions and the proposed action, above, for details on control efforts).
- Unintentionally killing or injuring ferrets: 1) by authorized agency personnel or agents conducting management actions such as trapping, handling and monitoring of ferrets; or 2) during trapping of other wildlife species (e.g., burrowing owls).
- Vehicular traffic.
- Regular refuge operations such as the maintenance and operation of facilities and infrastructure. These may include, but are not limited to: fences, buildings, roads, water control structures (these impacts on ferrets are expected to be rare).
- Recreational shooting and trapping; because these activities are not allowed on the Refuge, they are not likely to occur/become an issue.
- General public use allowed on the Refuge consisting of, but not limited to fishing, hunting (mourning dove and deer by shotgun and archery only), interpretation,

environmental education, and wildlife observation and photography; however, these activities are also not expected to be an issue.

- Monitoring of ferrets would occur on the Refuge and, if patterns of mortality are noted, the Service would determine appropriate measures that might reduce such losses.

Substantial benefits of the proposed action include: the establishment of another ferret population in Colorado; and further development of techniques and knowledge that might be attained from successfully reintroducing ferrets into the central part of the black-tailed prairie dog range. Further, if this effort is successful, it may help reduce the threat of extinction facing the ferret by establishing an additional population of ferrets in a portion of the ferret's historical range. While the long term effects of the ferret reintroduction are expected to be beneficial and contribute to the overall recovery of the species, for the reasons described above, there could be short and long-term adverse effects to individual ferrets from the reintroduction efforts.

## CUMULATIVE EFFECTS

Cumulative effects include the effects of future state, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

The Service anticipates that states, tribes, and private landowners would continue to implement conservation actions that benefit the black-footed ferret on a limited and site-specific basis. These efforts include plague management using deltamethrin, and prairie dog management using both lethal and non-lethal techniques. The Service also anticipates that sylvatic plague would continue to present a significant challenge to black-footed ferret recovery, as the disease is widespread throughout the range of the species. The extent of non-federal activities to manage plague is not well-known, but some efforts on tribal lands in Montana show promise and may serve as a model for future plague management efforts in other areas.

The use of anticoagulant rodenticides such as Rozol® and Kaput® by non-federal entities in the range of the black-footed ferret is likely to increase, although its use may be supplanting some of the previously-used rodenticides such as zinc phosphide. Because Rozol use at ferret reintroduction sites is not allowed for this project and through previous consultations (U.S. Fish and Wildlife Service 2012), current and future ferret reintroduction sites are not expected to be seriously impacted.

## CONCLUSION

After reviewing the current status of the black-footed ferret, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the CFO's

biological opinion that the reintroduction of ferrets on the Refuge, as proposed, is not likely to jeopardize the continued existence of the ferret.

We base this conclusion on the following:

- Ferrets that would be used in this effort are not essential to the overall survival of the species.
- Precautionary measures would be implemented to reduce losses within the reintroduced population.
- The overall effect of the proposed action would be beneficial, by increasing knowledge about ferret conservation and potentially establishing a new self-sustaining population of ferrets.

The conclusions of this biological opinion are based on full implementation of the Project as described in the **DESCRIPTION OF THE PROPOSED ACTION** section of this document, including any conservation measures that were incorporated into the project design.

## INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement (ITS).

The conservation measures identified above in the **DESCRIPTION OF THE PROPOSED ACTION** section would be implemented to provide a net conservation benefit to and a contribution to the recovery of the black-footed ferret. Consequently, all of these conservation measures are hereby incorporated by reference as reasonable and prudent measures and terms and conditions within the ITS pursuant to 50 CFR §402.14(i). Such terms and conditions are non-discretionary and must be undertaken by the Refuge for the exemption under Section 7(o)(2) of the ESA to apply. If the Refuge fails to adhere to these terms and conditions, the protective coverage of Section 7(o)(2) may lapse. The amount or

extent of incidental take anticipated under the Project, associated monitoring and reporting requirements, and provisions for disposition of dead and injured animals are described below.

**AMOUNT OR EXTENT OF TAKE ANTICIPATED**

The CFO has reviewed management activities on the Refuge and we believe these activities are compatible with the objectives of the proposed ferret reintroduction, but that some incidental take could still occur. Based on information from other reintroduction sites, we anticipate that a low level of incidental take (injury or death) may occur on the Refuge due to natural causes and normal land management activities.

In addition to those activities identified above, reintroduced ferrets that move off of the Refuge may also be subjected to direct or indirect take from land uses and activities occurring off of the Refuge including, but not limited to, wildlife hazard mitigation and maintenance activities associated with airport operations and transit, commercial, parks, and infrastructure development on DIA; and similar development on other commercial and residential properties. Such anticipated take is an indirect effect of the proposed action, is included in this ITS, and therefore not a violation of the ESA. The incidental take level described herein covers accidental or unintentional take in the form of harm (injury or death) and harassment (disturbance) caused by otherwise legal activities within the Refuge and on lands outside of the Refuge. Ferret mortality due to natural predation is not considered take and does not count against the level of incidental take allotted to the Refuge. Incidental take that may occur on lands adjacent to the Refuge is covered by this ITS and, likewise, does not count against the level of incidental take allotted to the Refuge. We believe it is appropriate to cover all incidental take of ferrets that occur offsite through this ITS because we do not expect dispersing ferrets to return to the Refuge. Further, we expect most dispersing ferrets to perish if they move away from the habitat provided on the Refuge. We expect off-site ferret mortality will occur primarily from predation or plague, but if some mortality occurs from the otherwise lawful activities as described above, we are covering that mortality completely through this ITS. Accordingly, adjacent landowners are not required to obtain incidental take permits for otherwise legal activities that may unintentionally take ferrets that leave the Refuge.

We anticipate that all ferrets that move off the Refuge will be lost due to natural causes (e.g., predation or starvation) or incidental take. Based on the lack of habitat outside the Refuge, we expect most off-Refuge losses to be from natural causes. Ferret movement off of the Refuge is most likely to happen as the habitat within the Refuge becomes occupied by ferrets. In cooperation with DIA and the other adjacent landowners, the Refuge would attempt to trap these ferrets and relocate them to the Refuge or other suitable areas determined by the Services' Black-Footed Ferret Recovery Coordinator.

The following information was used to set a level of incidental take for the Refuge for the proposed action. Information contained in the effects section concerning natural mortality of ferrets introduced into the wild can be used to bracket the anticipated level of incidental take.

Human-caused mortality is expected to be greater than 1.7 percent, but should be less than 21.5 percent (100 percent minus the estimated natural mortality of 78.5 percent). With a range of 1.7 percent to 21.5 percent, the midpoint of this range is 11.6 percent.

Therefore, based on data from studies of ferrets in the wild at Meeteetse, Wyoming, data from other reintroduction sites, and population modeling (see administrative record), the CFO estimates the annual incidental take level from human-caused mortality could be up to 12 percent of the estimated fall-monitored ferret population in the Refuge. In the first year following black-footed ferret releases, incidental take will be measured against the total number of ferrets released. In subsequent years, incidental take will be measured against the total number of ferrets known or estimated to exist in the wild in the reintroduction area, i.e., ferrets that survived release from previous years, their offspring, and any additional released ferrets. Implementation of the terms and conditions below should reduce the injury and death below the 12 percent level.

The CFO anticipates that the following take of ferrets could occur as a result of the proposed action:

1. No more than 12% of the current year's estimated fall ferret population will be killed or wounded as a result of normal land-use practices and refuge activities within the Refuge. If observed injury or mortality of 12% of the estimated fall ferret population is reached (3 ferrets the first year based on the projected 30-ferret allocation), the CFO and Black-Footed Ferret Recovery Coordinator will evaluate whether reinitiation of consultation is appropriate.

2. All ferrets that leave the Refuge and are taken incidentally during the course of conducting otherwise legal activities are covered by this ITS. We anticipate this number will be very low given that 24 years of ferret reintroductions have produced very few ferret sightings outside of release areas and reported mortalities away from reintroduction sites are exceedingly rare.

**EFFECT OF THE TAKE**

In this biological opinion, the CFO determines that this level of anticipated take is not likely to result in jeopardy to the species. We believe prairie dog colonies off of the Refuge are not necessary to the success of the Refuge's ferret reintroduction efforts; therefore, management of prairie dogs or other activities on those adjacent lands that may result in incidental take of ferrets are not restricted by this action.

**REASONABLE AND PRUDENT MEASURES**

The CFO believes that the following Reasonable and Prudent Measures (1, 2, and 3) are necessary and appropriate to minimize or avoid the impacts of incidental take of black-footed ferrets resulting from the proposed action. These reasonable and prudent measures, and their

implementing terms and conditions (bulleted items) that also outline monitoring and reporting requirements, are non-discretionary:

1. The proposed action identifies the conservation measures that will be implemented to benefit the black-footed ferret. All of these conservation measures, which are described above, are hereby incorporated by reference as reasonable and prudent measures within the ITS.
2. The Refuge shall maximize the probability of success of ferret reintroduction by allowing for adaptive management, implementing up-to-date scientific procedures, providing public education, and coordinating with neighboring land users.
3. The Refuge shall ensure that the information to evaluate the success of the reintroduction is accomplished via appropriate monitoring and reporting measures.

**TERMS AND CONDITIONS**

In order to be exempt from the prohibitions of Section 9 of the ESA, the following terms and conditions, which implement the reasonable and prudent measures described above, must be followed.

**To Implement Reasonable and Prudent Measure 1:**

- The Refuge will work to fully implement the conservation measures described in the proposed action.

**To Implement Reasonable and Prudent Measure 2:**

- The Refuge shall implement the ferret reintroduction effort as described in the proposed action.
- The Refuge shall implement an information and education program that provides the public and agency personnel in the affected counties in Colorado with details of ferret recovery efforts.
- The Refuge shall seek cooperation in reporting the taking or occurrence of ferrets in or near the Refuge.
- The Refuge shall work with land users in the area to seek their cooperation in designing improved management strategies for attaining the goals and objectives of the Project.
- The Refuge shall attempt to capture and remove ferrets from non-refuge lands if necessary and/or requested.
- The Refuge shall add, as appropriate, emerging strategies and contingencies to the ferret reintroduction efforts to minimize unnecessary harm to ferrets.
- The Refuge shall add, as appropriate, strategies and contingencies to its reintroduction and management plans to minimize unnecessary harm to ferrets.

**To Implement Reasonable and Prudent Measure 3:**

- The Refuge shall provide a primary ferret program contact for agencies, private landowners, and the public users in the affected area; follow up reports of injured or killed ferrets; immediately notify the Field Supervisor, Colorado Field Office, Lakewood, Colorado, (303) 236-4774, and submit follow-up reports of injured or killed ferrets; and immediately notify the Service's Law Enforcement Office as described below in the "Disposition of Dead or Injured Listed Species" section.
- Pursuant to the Regional Director's 10(a)(1)(A) recovery permit, the Refuge shall annually monitor the ferret population and its habitat and document the potential of ongoing activities or circumstances which may present unanticipated hazards to ferrets.
- The Refuge shall record and manage information on ferret mortalities as described below.

**Review Requirement**

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize incidental take that might otherwise result from the proposed action. If, during the course of the action, the level of incidental take is exceeded, such incidental take would represent new information requiring review of the reasonable and prudent measures provided. The Refuge must immediately provide an explanation of the causes of the taking and review with the CFO the need for possible modification of the reasonable and prudent measures.

If the incidental take level of 12 percent of the entire ferret population (as determined by fall annual monitoring) attributable to the proposed action is reached in any year within the Refuge, the entire reintroduction project will be reevaluated in coordination with the CFO and Black-Footed Ferret Recovery Coordinator to determine whether better management measures are needed or could be undertaken to reduce ferret mortality from human factors and to determine if section 7 consultation should be reinitiated.

**Disposition of Dead or Injured Federally Listed Species**

Upon locating a dead, injured, or sick listed species, initial notification shall be made to the Service's Law Enforcement Office, 9297 S. Wadsworth Blvd., Littleton, Colorado 80128-5599 (Phone: 720 981-2777, Fax: 720 981-2727) within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph if possible, and any other pertinent information. The notification shall be sent to the Law Enforcement Office with a copy to this office. Caution must be taken in handling sick or injured animals to ensure effective treatment and care, and in handling dead specimens to preserve the biological material in the best possible state.

The Black-Footed Ferret Recovery Coordinator should also be notified at U.S. Fish and Wildlife Service, P.O. Box 190, Wellington, CO 80549. Phone: 970-897-2730 x 224, Fax: 970-897-2943, Mobile: 720-626-5260.

## CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. We recommend the Refuge work with DIA to incorporate the use of rodenticides that present a lower risk of secondary poisoning than anticoagulants for prairie dog control efforts on DIA property.
2. We recommend the Refuge continue to refine contingencies to deal with a disease epizootic (plague, canine distemper, etc.) that may occur in the area and that might necessitate the rescue of the ferret population on the Refuge. Disease contingency strategies should be included in annual ferret allocation proposals submitted by the Refuge to the Black-footed Ferret Recovery Program and CFO.
3. We recommend the Refuge continue to participate on the Black-footed Ferret Recovery Implementation Team and Colorado Black-footed Ferret Working Group.

In order for the CFO to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the CFO requests notification of the implementation of any conservation recommendations. This can occur during annual Black-footed Ferret Recovery Implementation Team meetings or through other methods at the Refuge's discretion.

## REINITIATION NOTICE

This concludes formal consultation on the action outlined in the January 12, 2015, request from the Refuge. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any activities causing such take must cease pending reinitiation. Reinitiation is not required for ongoing population management activities that

support black-footed ferret recovery at the Refuge, including periodic population supplementation through the reintroduction of additional captive-reared and/or wild-born black-footed ferrets.

The CFO appreciates your efforts to recover ferrets pursuant to the Regional Director's 10(a)(1)(A) recovery permit to benefit this species. For further information, please contact Sandy Vana-Miller at (303) 236-4748. Please refer to the consultation number, TAILS: 06E24000-2014-F-0855, in future correspondence concerning this project.

ec: Regional Director, Fish and Wildlife Service, Denver, CO (ARD-ES) (Attn: Noreen Walsh)
Assistant Regional Director, Refuges, Region 6 (Attn: Will Meeks)
Assistant Regional Director, Ecological Services, Region 6 (Attn: Bridget Fahey, Branch Chief, Endangered Species)
Black-footed Ferret Recovery Coordinator, Fish and Wildlife Service, Wellington, CO (Attn: Pete Gober)
Wildlife Biologist, Black-footed Ferret Recovery Program (Attn: John Hughes)
Supervisor, Species Conservation Program, Colorado Parks and Wildlife (Attn: Francie Pusateri)

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# Attachment

*Record of Decision for the Environmental Impact Statement– Rocky Mountain Arsenal Wildlife National Refuge*

# Record of Decision

# Record of Decision for the Final Environmental Impact Statement

*Rocky Mountain Arsenal National Wildlife Refuge*

October 2015

## Introduction

This record of decision (ROD) for the final environmental impact statement (EIS) for the comprehensive conservation plan (CCP) for the Rocky Mountain Arsenal National Wildlife Refuge, Colorado (refuge) provides the basis for management decisions we, the U.S. Fish and Wildlife Service (Service) will make in ongoing and future management of the refuge. The EIS was prepared as part of the development of a CCP in compliance with the National Environmental Policy Act (NEPA) and relevant planning policies. We propose to finalize, adopt, and implement the CCP in the next few months to provide guidance on managing the refuge for a 15-year period.

The EIS (Federal Register [FR] 80 (155):48328–31) described our proposed action and three alternatives for management of the refuge. Of these, alternative C has been selected for implementation. This refuge is part of the National Wildlife Refuge System (Refuge System), and is managed as part of a larger refuge complex that includes Two Ponds National Wildlife Refuge and Rocky Flats National Wildlife Refuge, Colorado. As part of the Refuge System, these three national wildlife refuges are managed for wildlife conservation above all else. This ROD addresses management of the Rocky Mountain Arsenal National Wildlife Refuge.

In preparing the final EIS, we worked closely with several cooperating agencies and partners: Adams County, City and County of Denver, City of Commerce City, Colorado Parks and Wildlife (CPW), Denver International Airport (DIA), Denver Water, Tri-County Health Department, Urban Drainage and Flood Control District, U.S. Army, U.S. Department of Agriculture—Animal and Plant Health Inspection Service, and U.S. Department of Transportation—Federal Highway Administration. Other Federal, State, and local governmental agencies, nongovernmental organizations, and private citizens contributed substantial input to development of the CCP.

## Background

The primary planning area for this decision is the congressionally designated boundary of the refuge, which is nestled between the City of Commerce City, the City of Denver, and DIA in Adams County, Colorado.

Wildlife habitats on the refuge include prairie grasslands, riparian areas, shrublands, planted woodlands, and lakes that provide important resources for many migratory birds, bison, deer, and a variety of other resident wildlife. The black-footed ferret, federally listed as endangered, will be reintroduced into the refuge as part of our selected CCP alternative.

Visitors take part in a variety of wildlife-dependent recreational activities on the refuge. Every year, the bison roundup, guided refuge tours, fishing, and photography attract thousands of visitors. The refuge is also open to wildlife observation, environmental education, and interpretation. As part of the CCP and EIS process, we have considered and will open the refuge to limited hunts of deer and doves.

The refuge area is rich in more than 12,000 years of prehistory and history. The refuge site has been utilized for hunting by Native Americans; for farming and ranching by European settlers; for making and assembling munitions by the U.S. Army; for developing rocket fuels, herbicides, and pesticides by chemical companies; and by resident and migratory wildlife once again. The refuge contains, safeguards, and provides interpretive opportunities for significant cultural and historical resources.

We could not accomplish our conservation mission without the many partner organizations with whom we collaborate locally and regionally. These include the Friends of the Front Range Wildlife Refuges; the City of Commerce City; the City and County of Denver; the Rocky Mountain Bird Observatory; the Denver Botanical Garden; the Butterfly Pavilion; Federal, State, and local governmental agencies; Native American tribes; and interested citizens.

## Purpose and Need for the CCP

We developed a CCP for the refuge for four reasons: (1) to comply with the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act), which requires that every unit of the Refuge System be managed in accordance with an approved CCP; (2) to comply with the Improvement Act requirement that the CCP will be updated at least every 15 years; (3) to describe the role of the refuge in supporting the mission of the Refuge System; and (4) to provide long-term guidance for management of refuge programs and activities.

The CCP will help us achieve the following:

- communicate with the public and other partners in efforts to carry out the mission of the Refuge System;
- provide a clear statement of direction for management of the refuge;
- ensure that the refuge continues to conserve fish, wildlife, and ecosystems in the face of ongoing drought, water shortages, and climate change;
- provide neighbors, visitors, and government officials with an understanding of our management actions on and around the refuge;
- ensure that our management actions are consistent with the mandates of the Improvement Act;
- ensure that management of the refuge considers other Federal, State, and local government plans;
- provide a basis for development of budget requests for the operation, maintenance, and capital improvement needs of the refuge;
- sustain the Nation's fish and wildlife resources through the combined efforts of governments, businesses, and private citizens.

## National Wildlife Refuge System

Like all national wildlife refuges, the Rocky Mountain Arsenal National Wildlife Refuge is administered under the National Wildlife Refuge System Act of 1966 as amended in 1997.

The mission of the Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

## Refuge Purposes

Each national wildlife refuge is managed to fulfill the mission of the Refuge System, as well as the specific purposes for which that refuge was established.

In 1992 Congress passed the Rocky Mountain Arsenal National Wildlife Refuge Act that established the refuge to (1) conserve and enhance populations of fish, wildlife, and plants within the refuge, including populations of waterfowl, raptors, passerines, and marsh and water birds; (2) conserve species listed as threatened or endangered under the Endangered Species Act and species that are candidates for such listing; (3) provide maximum fish and wildlife oriented public uses at levels compatible with the conservation and enhancement of wildlife and wildlife habitat; (4) provide opportunities for compatible scientific research; (5) provide opportunities for compatible environmental and land use education; (6) conserve and enhance the land and water of the refuge in a manner that will conserve and enhance the natural diversity of fish, wildlife, plants, and their habitats; (7) protect and enhance the quality of aquatic habitat within the refuge; and, (8) fulfill international treaty obligations of the United States with respect to fish and wildlife and their habitats.

The first 4,930 acres of the refuge were transferred by the U.S. Army to the Service on April 21, 2004. Today the refuge encompasses nearly 16,000 acres and is home to more than 468 plant species and 350 wildlife species, including bison, deer, a wide variety of resident and migratory birds and raptors, reptiles, amphibians, fishes, and insects.

## Vision

The refuge is part of the Rocky Mountain Arsenal National Wildlife Refuge Complex (refuge complex), which also manages the Two Ponds National Wildlife Refuge and the Rocky Flats National Wildlife Refuge. At the beginning of the planning process we developed a vision for the refuge complex that describes the focus of management and portrays a picture of the refuge complex in 15 years. It reads:

> *As the sun rises, bison thunder across the prairie, red-tailed hawks soar overhead, and the urban bustle begins. Lands once known for their agricultural and industrial uses are being restored on the Nation's premiere urban wildlife refuge, where time moves at nature's pace and wildlife have the right-of-way. Propelled by public and private partnerships, refuge stewards at Rocky Mountain Arsenal, Two Ponds, and Rocky Flats National Wildlife Refuges continue to work to repair and regenerate wildlife habitat. These prairie oases nestled within Colorado's Front Range communities welcome visitors from near and far and foster an appreciation for nature. They will connect people with the land for generations to come.*

## Goals

We developed nine goals for the refuge's CCP.

### Habitat Management Goal

Use an adaptive management framework to conserve, restore, and enhance the ecological integrity of Front Range prairie communities, including wetlands, grasslands, native shrubs, and trees.

### Wildlife Management Goal

Balance and preserve wildlife species of concern through active management.

### Visitor Services Goal

Foster the public's appreciation of natural resources and provide inclusive, accessible, high-quality, wildlife-dependent recreation, education, and interpretation.

### Communications and Outreach Goal

Through effective communication and innovative technology, engage the public and stakeholders to help them better understand the importance of natural resources, operations, and history at the refuge complex so that they are inspired to take part in and support management and restoration efforts.

### Partnerships Goal

Seek and foster strong partnerships to support research and management, enhance wildlife-dependent recreation, and promote an appreciation of nature.

### Cultural Resources Goal

Protect artifacts and interpret the archeological, agricultural, military, and industrial histories of the refuge complex and the story of its restoration in order to connect visitors and the community to the area's past.

### Research and Science Goal

Use science and promote research to advance the understanding of natural resource functions and management within the refuge complex and beyond.

### Infrastructure and Operations Goal

Effectively use money, staff, partners, volunteers, and equipment to restore and manage refuge complex habitats, conduct programs, and improve and maintain all necessary infrastructure.

### Access and Transportation Goal

Support the improvement of suitable access to the refuges, develop sustainable transportation options, and provide more connections within the refuge complex.

## Significant Issues

In the EIS, we disclosed and compared the effects of four management alternatives. These alternatives were derived to address significant issues identified during the scoping process, to support the goals stated above, and to conform to laws, regulations, and policies including Service policy directives. The significant issues addressed in the EIS included:

- habitat and wildlife management
- water rights
- connecting people with nature
- setting clear expectations about the refuge
- improving and expanding public use facilities and programs
- maintaining a sense of retreat
- interpretation of the site's history
- improving access and transportation
- reintroducing native species
- improving outreach to neighboring communities
- increasing partnership opportunities
- making the refuge more welcoming

## Decision (Alternative C)

We have selected Alternative C—Urban Refuge for implementation because it is the alternative that best meets our vision, the planning goals for the refuge CCP, and the Service's Urban Wildlife Conservation Program.

Alternative C will enable us to implement the refuge Habitat Management Plan (HMP) to maintain or restore the composition, structure, and function of the natural and modified habitats on the refuge. We will apply strategic habitat conservation principles (a structured, science-driven, and adaptive approach) in determining how best to manage our lands for fish, wildlife, and plant species, with a particular emphasis on migratory birds and listed species. Compatible wildlife-dependent public uses will be enhanced and expanded to include limited hunts. Prior to implementing a hunting program on the refuge, a Hunt Plan will be developed in accordance with Service policy; that plan will include opportunity for public comment.

### Habitat Management

Habitat management will continue to be conducted as described in our HMP. We will use an adaptive management framework to conserve, restore, and enhance the ecological integrity of the Front Range prairie communities, including the wetlands, trees, and native shrubs within those communities. We will use prescribed fire, mowing, grazing, and integrated pest management to restore and then maintain refuge habitats.

We will manage for habitat diversity in fire-maintained ecosystems using management tools like prescribed fire, as described in the refuge's approved Fire Management Plan (FMP).

We will pursue the goals specified in the refuge Habitat Restoration Plan (HRP) and the HMP to restore native prairie to develop diverse plant community mosaics that differ in composition, height, and density. These activities will promote successful long-term establishment and maintenance of seeded restoration sites, as well as existing native prairies and shrublands, to provide habitat for species of concern. We will work with DIA and adjacent cities on co-management of specific parcels of wildlife habitat (such as the bison viewing area) and to acquire and protect inholdings and lands adjacent to the existing refuge boundary.

Where appropriate, we will maintain and restore shrubland to provide suitable nesting habitat for migratory birds as well as forage and shelter for associated small mammals and deer.

We will manage wetlands to promote native emergent species, provide opportunistic benefits to wetland-dependent wildlife, and maintain spawning grounds for forage fish. We will treat cattails when 80 percent or more of the shorelines are covered within 30 feet of the shoreline.

We will inventory and sustain riparian corridors. Surface flow will likely remain unaltered without actively managing hydrology.

We will manage invasive species through the use of approved biological controls, physical controls, chemical controls, and appropriate cultural controls for the prevention, early detection, monitoring, and control (or eradication) of invasive plant species and other pests on the refuge.

We will manage herbivore populations as necessary to ensure the long-term sustainability of restored prairie and shrubland, contribute to the Service's national bison population goals, and provide suitable habitat for species of concern.

We will pursue various strategies to protect wildlife habitat, including fee-title acquisition, leases, and co-management of private lands.

### Wildlife Management

We will maintain healthy wildlife communities in harmony with the refuge's historic cultural landscape—which includes New Mexico locust thickets, old farmstead windbreaks, and other planted trees—as well as with cottonwood galleries, created wetlands and lakes, and restored grasslands.

We will restore habitat for species of concern (such as grassland-dependent birds, burrowing owls, bald eagles, neotropical migratory birds, bats, and black-footed ferrets). We will provide nesting sites for burrowing owls along with long-term quality nesting and roosting habitat for bald eagles. We will provide habitat in the refuge's Environmental Education Zone for neotropical migratory bird species that are losing suitable stop-over areas to urban development in the Denver Metropolitan area. We will maintain a mosaic of wetland and riparian habitats to provide foraging habitat in support of big brown bat populations, and will discontinue the use of artificial bat roosts.

We will reintroduce the endangered black-footed ferret and carry out studies to determine if we could also reintroduce the prairie chicken and sharp-tailed grouse to showcase native prairie ecosystems. If the studies show that the refuge habitat can sustain these bird species, then we will seek reintroduction regardless of whether these species could become self-sufficient.

We aim to release 15–40 ferrets during the first year. Subsequent ferret releases will be based on requirements outlined in the refuge's annual ferret allocation request. The release will occur directly into targeted prairie dog complexes in the fall when juvenile ferrets typically become independent; exhibit dispersal behaviors; and are more capable of killing their own prey, avoiding predators, and adjusting to environmental conditions. Public access to the northern half of the refuge will be restricted to support ferret and bison populations and research activities.

We will develop a live ferret exhibit to showcase ferret conservation efforts on the refuge and range-wide. We anticipate that the exhibit will generally display two live ferrets. Although ferrets are nocturnal and may hide from view, the exhibit will be designed to maximize the possibility of visitors viewing ferrets while providing a controlled and secure environment for the animals.

We will preserve a population of black-tailed prairie dogs as directed in the Black-Tailed Prairie Dog Management Plan (PDMP) of appropriate size to provide functions necessary to perpetuate native grasslands and support associated migratory birds and ferrets.

We will maintain a bison population as directed in the refuge bison management plan that contributes to the Department of Interior's Bison Conservation Initiative and helps maintain the structure and composition of native and restored prairies necessary to support priority grassland bird species. We will manage the bison population at or below the refuge's carrying capacity.

## Visitor Services

The CCP will provide for a wide variety of compatible wildlife-dependent recreation. We will foster the public's appreciation of natural resources and provide inclusive, high-quality, wildlife-dependent recreation, education, and interpretation. We will increase accessible trails, reopen Rattlesnake Hill and Wildlife Watch, and add more wildlife viewing facilities. We will conduct visitor use satisfaction surveys.

We will educate visitors about hunting as a management tool and partner with CPW to offer hunting education courses. We will develop an archery range and work with partners to offer instructional archery classes.

We will implement a limited archery deer hunting program and consider the possibility of a limited shotgun hunt for doves, in conjunction with State hunting seasons. Hunting would be limited to special programs for youth and people with disabilities and would be allowed by lottery draw only, restricting the number of hunters and the dates on which hunting is allowed.

We will offer catch-and-release fishing from April to October, according to State fishing regulations, and offer an annual fishing pass. We will provide introductory fishing classes or educational opportunities and increase instructional fishing programs in partnership with Environmental Learning for Kids and others. We will consider spring instructional programming, hosting fishing clinics to prepare people for the summer season, and organizing additional fishing derbies.

We will renovate refuge facilities and signage to increase the quality of fishing opportunities and assess fishing satisfaction with assistance from anglers, volunteers, and partners. We will improve access by offering shoreline fishing opportunities—an improvement over the current access that is only available from docks—and will improve Lake Mary as a developmental reservoir with more facilities, a high catch rate, and increased user-friendly access.

We will provide wildlife observation and photography opportunities and accessible facilities on the refuge, supported by self-guided auto tours, nature trails, and wildlife viewing blinds and overlooks. We will support seasonal closures to protect sensitive wildlife areas and reduce disturbance to wildlife. We will make available a limited number of commercial photography permits each year, evaluating requests on a case-by-case basis.

We will provide wildlife viewing facilities and trails at Rattlesnake Hill and Wildlife Watch and will increase the accessibility of existing trails and facilities. We will develop partnerships to lead instructional programming and guided tours. We will

develop new interpretive panels and brochures to enhance self-guided visitor opportunities. We will use improved and simplified signs and expanded law enforcement to manage public use and reduce impacts on habitat.

We will explore nontraditional ways to educate visitors about environmental topics. We will develop partnerships with other organizations and concessionaires to provide environmental education programs and summer camps. We will use current and emerging technology to extend educational "reach" and to connect with a broader audience.

We will maintain an opportunistic environmental education program dependent on staff availability, offering regular tours as well as environmental education and interpretation programs. We will update interpretive panels, brochures, factsheets, Web sites, and refuge maps, and will make use of the Contact Station to provide interpretive programs as well as to provide a venue for teachers to use our environmental education curriculum. New curricula covering black-footed ferrets will be added.

We will endeavor to provide an Environmental Education Center to offer high-quality experiences. We will partner with organizations like recreation centers, libraries, parks, and schools to deliver conservation education programs to neighboring communities. We will expand interpretive programs for adult education as a potential venue for increasing stewardship and volunteerism. We will work with partners to create refuge-inspired nature murals to help raise refuge visibility in local communities.

## Communications and Outreach

We will work with refuge volunteers to reach out to traditional and nontraditional refuge visitors, wildlife enthusiasts, and local as well as outlying communities, by participating in community outreach events such as Fishing Frenzy, Refuge Day, the Bass Pro Fishing Classic, Colorado Get Outdoors Day, the Aurora Youth Water Festival, the Barr Lake Birding Festival, and other events.

We will increase public outreach and refuge promotion in neighboring communities to increase the visibility of the refuge and overcome negative perceptions, focusing our outreach messaging to address safety concerns over the cleanup of refuge habitats, inviting visitors to participate in refuge activities and programs, and explaining the refuge's wildlife and habitat resources. We will support the Service's Urban Wildlife Conservation Program and participate in special events and career development programs for local students.

We will manage our Web site and social media platforms to reach a broad spectrum of visitors, and will distribute the Wild News publication by email. We will maintain the refuge brochure and rack card and develop brochures for trails and auto tour routes. We will encourage cross promotion among partners to raise awareness of the refuge. We will develop more bilingual resources, significantly increase our communications, and disseminate more information through existing outlets and media. To this end, we will develop a refuge communications plan built on a consistent message for outreach and media, and approaches specifically tailored to engage youth and to target specific minority groups.

We will explain the missions of the Service and Refuge System, emphasizing the distinction between a city park and a wildlife refuge, and illustrating how the refuge benefits and serves the community.

We will package refuge experiences into half- or full-day activities that appeal to the local community and will create monthly Refuge Saturdays with roundtrip refuge tours beginning and ending somewhere in the community.

We will use the latest technology to reach and connect with broad audiences, promoting the refuge as a premiere urban refuge full of opportunities for people to connect with nature.

## Partnerships

We will maintain existing partnerships and focus our attention on building and maintaining more partnerships throughout the Denver area—and especially in surrounding communities and local government agencies—to assist with outreach and to connect area residents with refuge resources and programs. We will leverage partnerships to build physical linkages between the outlying communities, regional trails, and the refuge, to support more instructional programming and reach nontraditional visitors. We will increase the use of Citizen Science and our collaboration with local schools to work on habitat restoration. We will expand partnerships to include Regional Transportation District, Denver Regional Council of Governments, and commercial partners.

## Cultural Resources

In accordance with Section 106 of the National Historic Preservation Act (NHPA), we will continue to conduct cultural resource reviews for projects that involve ground-disturbing activities or that could affect buildings or structures more than 50 years old.

We will avoid disturbing significant cultural resources unless such disturbance is necessitated by unusual circumstances. In addition, we will continue to conduct law enforcement patrols to monitor sensitive sites. We will continue to consult with the Colorado State Historic Preservation Office, Native American tribes, local governments, and members of

the general public on matters pertaining to cultural resources. We will continue to adhere to other cultural resource laws; however, research opportunities will be minimal.

Artifacts currently stored at the refuge—both prehistoric and historic items—will be cared for and inventoried. We will explore and possibly implement deaccession of some artifacts.

Significant historic buildings, structures, and sites will be preserved and interpreted using signage and bus tours. The interior and exterior of the Egli homestead, listed in the State Register of Historic Properties, will be fully restored. We will continue to protect other historic sites such as the observation bunker, the guard tower foundation, the weapons storage bunker, a wagon road, historical tree plantings, and farming equipment.

Additionally, we will: (a) increase our efforts to identify and protect significant resources; (b) seek ways to display some World War II and Cold War items at the Visitor Center; (c) enter into partnerships with the Native American community to interpret the prehistoric landscape; (d) seek full restoration of the Egli farmstead; and, (e) provide more guided interpretation of cultural resources suited for outdoor storage, such as farm equipment and some World War II and Cold War machines.

### Research and Science

Within existing funding levels, we will continue to be engaged in several research and monitoring programs, such as: (a) trapping and banding burrowing owls; (b) conducting bald eagle winter roost surveys and nest counts in cooperation with the Rocky Mountain Bird Observatory to monitor overall riparian health and bald eagle reproductive success on the refuge; (c) monitoring raptor nests in accordance with objectives in the HMP; (d) assessing fish populations through electrofishing and gillnetting in accordance with objectives in the HMP to maintain a quality sport fishery; and (e) conducting a deer census and a bison roundup each fall to assess overall and individual health and to evaluate populations for inclusion into the refuge forage allocation plan.

We will continue to support Citizen Science projects—especially the Christmas Bird Count each January, the Great Backyard Bird Count each February, and spring and fall bird counts in May and September—and collection of meteorological data to help identify trends in climate change at the refuge.

Additionally, we will: (a) evaluate prairie dog densities, especially as they relate to reintroduction of ferrets; (b) emphasize the use of public participation and social media as means of acquiring and collating data to support refuge management; (c) delegate some monitoring and data-gathering activities to volunteers and partners and develop Citizen Science projects to support monitoring of the ferret population as well as bald eagle nesting and roosting; (d) enhance monitoring of visitation commensurate with the increased access points, trails, and road system; (e) establish neighbor satisfaction surveys; (f) create additional Citizen Science opportunities, such as tracking phenological characteristics and some monitoring efforts; (g) explore opportunities for the public to participate in ferret spotlighting surveys; (h) consider installing remote cameras to monitor and provide Web-based public viewing of refuge fauna for species like bald eagles and ferrets; and (i) broaden the use of existing and emerging technologies and social media to aid in wildlife management and tracking while also engaging visitors in conservation activities.

### Rationale for Selecting Alternative C

Alternative C best balances significant management issues of this refuge with the vision and goals developed by the planning team and the purposes, missions, and management policies of the Service, as well as with the interests and perspectives of many agencies, municipalities, organizations, and the public.

Overall, we received substantial support from our cooperating agencies, local agencies, adjoining municipalities, conservation organizations, and the public for most elements in alternative C. We acknowledge the differing individual views with respect to expanding refuge access and public use opportunities by creating new access points, opening the refuge to hunting, and expanding existing visitor services programs and facilities.

In the final EIS, alternative C was slightly revised from the proposed action in the draft CCP and EIS after consideration of the comments received from agencies, other stakeholder organizations, and the public during the 60-day public comment period. These changes are reflected in the description of alternative C above and in the final EIS.

## Other Alternatives Considered

The final EIS evaluated a no-action alternative (A) and two other action alternatives (B and D), all of which are described below. We developed all the alternatives to meet the planning goals we set for the project. Some of the alternatives met specific elements of our planning goals better than others, and we considered this in our decision.

## Alternative A—No Action

Under this alternative, the management activities that we currently conduct would remain in effect. We would not develop any new management, restoration, or educational programs. We would not expand or change the current habitat, wildlife, infrastructure, and refuge operations practices, except as allowed by existing approved plans, such as the HMP, HRP, Integrated Pest Management Plan (IPMP), Water Management Plan (WMP), FMP, PDMP, and Station Safety Plan. Funding and staff levels would remain the same with little change in overall trends. Programs would follow the same direction, emphasis, and intensity as they do now.

Under this alternative there would be no new access to the refuge and the existing infrastructure and visitor services facilities and programs would remain unchanged. Volunteering and outdoor-recreation opportunities would remain at current levels and within existing sites.

We would continue to collaborate with our partner agencies and organizations to achieve our conservation and educational goals.

Our outreach efforts and avenues of communications would continue within existing levels and methods.

### Habitat Management

We would continue managing the refuge habitats as we presently do—that is, in accordance with our approved plans and in the same way as described above for alternative C.

### Wildlife Management

We would largely continue managing the refuge's wildlife as we presently do, in accordance with our approved plans, and in the same way as described for alternative C above. However, we would not seek to reintroduce black-footed ferrets or any other native animal species to the refuge.

### Visitor Services

Under this alternative we would maintain the same level, extent, and location of existing facilities and programs as we currently support.

The refuge would remain closed to all hunting and hunting-related activities (such as hunter education). The refuge would continue to be open for catch-and-release fishing from April to October in accordance with State fishing regulations.

The auto tour routes, existing refuge trails, and viewing blind would continue to provide wildlife observation, interpretation, and photographic opportunities. The Wildlife Drive and the northern portion of the refuge would remain closed to the public except for staff-led tours. We would continue to implement seasonal closures to protect sensitive wildlife areas and reduce disturbance to wildlife as necessary, and would continue issuing a limited number of commercial photography permits.

We would continue to offer environmental education programs depending on the availability of refuge staff, and would make our environmental education curriculum available to teachers. We would continue our interpretation program and offerings of regular tours and programs. We would maintain and update the refuge interpretive panels, brochures, factsheets, Web sites, and maps as funding allows. We would continue to make use of the Contact Station to provide interpretive programs as well as to provide a venue for teachers to use our environmental education curriculum.

### Communications and Outreach

We would continue to participate in community outreach events (such as Refuge Day, Colorado Get Outdoors, and similar events) with the help of refuge volunteers to reach out to traditional refuge visitors and local communities. We would continue to support the Service's Urban Wildlife Conservation Program and participate in career development programs for local students. We would reach a broad spectrum of visitors by managing Web site and social media platforms and distributing The Wild News publication and resources by email. We would continue to make our general brochure and rack card available to refuge visitors.

### Partnerships

Through partnerships with other organizations and municipalities (including those in the Rocky Mountain Greenway Trail Network and Sand Creek Greenway Partnerships), we would continue to create new trails and connect them with existing trails to form a trail network connecting the refuge with Two Ponds National Wildlife Refuge and Rocky Flats National Wildlife Refuge. Friends of the Front Range Wildlife Refuges would continue to support refuge programs and operate the Visitor Center store—Nature's Nest Books and Gifts. Partnerships with City of Commerce City Parks and Recreation and Bass Pro Shops to sponsor the annual Fishing Frenzy would continue. We would continue to work with the City and County of Denver and the Rocky Mountain Bird Observatory to implement the Urban Bird Treaty. We would continue to implement the Urban Refuge Partnership with Environmental

Learning for Kids at its property in Montbello. We would continue to develop our partnerships with the Denver Botanical Garden and Butterfly Pavilion for monarch and pollinator programs and outreach. We would continue to work with Mile High Youth Corps and Groundwork Denver for habitat restoration projects. The refuge would continue to employ Arrupe High School students—one student once a week—to assist with operation of the Visitor Center through an agreement managed by our regional Diversity and Civil Rights Office.

## Cultural Resources

In accordance with Section 106 of the NHPA, we would continue to conduct cultural resource reviews for projects that involve ground-disturbing activities or that could affect buildings or structures more than 50 years old.

We would avoid disturbing significant cultural resources unless such disturbance is necessitated by unusual circumstances. In addition, we would continue to conduct law enforcement patrols to monitor sensitive sites. We would continue to consult with the Colorado State Historic Preservation Office, Native American tribes, local governments, and members of the general public on matters pertaining to cultural resources. We would continue to adhere to other cultural resource laws; however, research opportunities would be minimal.

Artifacts currently stored at the refuge—both prehistoric and historic items—would be cared for and inventoried. We would explore and possibly implement deaccession of some artifacts.

Significant historic buildings, structures, and sites would be preserved and interpreted using signage and bus tours. The Egli House and garage, listed in the State Register of Historic Properties, would continue to be preserved through some stabilization actions and maintained in a state of arrested decay. This house and other historic sites—including the observation bunker, the guard tower foundation, the weapons storage bunker, homestead sites, a wagon road, historical tree plantings, and farming equipment—would continue to be protected.

## Research and Science

Within existing funding levels, we would continue to be engaged in several research and monitoring programs, such as: (a) trapping and banding burrowing owls; (b) conducting bald eagle winter roost surveys and nest counts in cooperation with the Rocky Mountain Bird Observatory to monitor overall riparian health and bald eagle reproductive success on the refuge; (c) monitoring raptor nests in accordance with objectives in the HMP; (d) assessing fish populations through electrofishing and gillnetting in accordance with objectives in the HMP to maintain a quality sport fishery; (e) conducting a deer census and a bison roundup each fall to assess overall and individual health and to evaluate populations for inclusion into the refuge forage allocation plan.

We would continue to support Citizen Science projects, especially the Christmas Bird Count in January, the Great Backyard Bird Count each February, spring and fall bird counts in May and September, and the collection of meteorological data to help identify trends in climate change at the refuge.

## Infrastructure and Operations

Under alternative A, the refuge's current funding, facilities, and personnel would continue unchanged, with approximately 80 volunteers continuing to support refuge operations (such as staffing the Visitor Center front desk and special events, conducting interpretive tours and programs, performing light maintenance of trails and facilities, assisting in some biological surveys, and maintaining a pollinator garden).

No new wildlife observation and photography facilities would be developed, but existing facilities would be supported. A new administration building that has been planned could be constructed.

We would continue to host special events and meetings that support the purposes of the refuge and the missions of the Service and of the Refuge System. We would consider hosting special events and meetings for Department of Interior and other Federal, State, and local agencies on a case-by-case basis.

We would continue to safeguard the refuge from unnatural sounds and undue light contamination, and modify energy distribution lines (by burying or relocating them) when redeveloping certain areas of the refuge, to the extent possible. All existing signs would continue to be maintained, and there would be no changes to the refuge fencing, sign design, and material standards. The refuge would continue to be open from sunrise to sunset, and in general, visitors would not be allowed on the refuge during hours of darkness.

The Army would continue to own and operate the five major dams on the refuge until all necessary repairs have taken place, after which the dams would be transferred to the Service.

## Access and Transportation

We would continue to enable year-round automobile, bus, and pedestrian travel on the refuge as weather conditions permit. Recreational biking would continue to be allowed only on certain areas of the refuge. We would continue to have only one visi-

tor access point to the refuge, and existing way-finding signs would remain in use.

The Legacy Loop tour route would remain open to the public when the refuge is open, and the Wildlife Drive would generally remain closed to the public, except for tours guided by refuge personnel.

The infrastructure and the type and condition of the refuge roads would remain unchanged from the predominantly older asphalt roads; these roads would only receive maintenance necessary to sustain operations.

We would maintain 10 miles of refuge trails, repair flood-damaged portions of existing trails, and allow snowshoeing on refuge trails.

### Rationale for Not Selecting Alternative A

Alternative A was not selected for implementation because it would not meet our stated planning goals for communications and outreach or for access and transportation. Alternative A would meet the planning goals we developed for wildlife management, visitor services, partnerships, cultural resources, research and science, and infrastructure and operations, but to a lesser degree than other alternatives.

Implementing alternative A would not allow the staff to implement the tenets of the Urban Wildlife Conservation Program on the refuge.

Alternative A would satisfy our wildlife management goal to a lesser degree than other alternatives as it would not seek to increase wildlife diversity on the refuge by restoring native species.

Alternative A would partially satisfy our visitor services goal by maintaining the five existing priority public uses at current levels. However, under this alternative, hunting would continue to be precluded on the refuge and the Wildlife Drive and northern portion of the refuge would continue to be generally closed to the public. There would continue to be a lack of sufficient dedicated resources for providing visitor services. There would continue to be few opportunities for nontraditional visitors to participate in wildlife-dependent recreation activities on the refuge.

Alternative A would not satisfy our goal for communications and outreach because we would only maintain our existing avenues of communication and outreach efforts to neighboring communities and traditional refuge visitors. This would leave out potential nontraditional visitors and would miss the opportunity to find better ways to communicate with our refuge neighbors and communities.

Alternative A would achieve our goal for partnerships but to a lesser degree than the selected alternative by maintaining existing partnerships that help the refuge staff run part of the Visitor Center, provide some visitor programs, and support management of biological resources.

Alternative A would partially achieve our goal for cultural resources by continuing to protect cultural resources on the refuge. But this alternative would not allow the staff to better interpret or restore cultural and historical resources, as would alternatives C and D. At existing staff levels, it is difficult to increase protection and interpretation beyond basic adherence to cultural resource laws in association with implementing new projects.

Alternative A would only partially satisfy our goal for research and science by opportunistically allowing research projects on the refuge, and allowing the continuation of current inventory and monitoring programs and projects.

Alternative A would partially achieve our goal for infrastructure and operations by maintaining existing infrastructure as necessary. Staffing and funding levels would remain at present levels, and no new facilities would be built. Existing infrastructure, signage, vehicles, and other resources would be maintained but not improved.

Alternative A would fully satisfy our goal for habitat management.

As detailed in "Chapter 5—Consultation, Coordination and Responses to Comments" in the draft CCP/EIS, we received no public support to continue managing the refuge as described under the no-action alternative. None of our cooperating agencies supported alternative A.

## Alternative B—Traditional Refuge

Under this alternative our management would focus on providing what we consider traditional refuge visitor uses and in conveying the importance of conservation, wildlife protection, and the purposes of the Refuge System to our visitors, partners, and neighbors. Access to the refuge would remain more limited than under alternatives C and D, and wildlife-dependent recreation, as well as community outreach, would be minimally expanded.

### Habitat Management

Habitat management under this alternative would be the same as described for alternatives A, C and D, as it is governed by the refuge HMP completed in 2013.

### Wildlife Management

We would manage wildlife in the same way as described for alternative C above, except that we

would only seek reintroduction of prairie chicken and sharp-tailed grouse if it was determined that these species could eventually become self-sufficient.

## Visitor Services

Under this alternative, we would continue the same visitor services programs and opportunities as under alternative A, but would make the following improvements: (a) slightly increase accessible trails; (b) reopen Rattlesnake Hill and Wildlife Watch and add viewing facilities at these sites; (c) add more wildlife viewing facilities; (d) undertake minor renovations to facilities and signage to increase the quality of fishing opportunities; (e) assess fishing satisfaction with the assistance of anglers, volunteers, and partners; (f) increase accessibility of existing trails and facilities; (g) create a black-footed ferret outdoor exhibit; and (h) add new environmental education curricula covering black-footed ferrets.

Hunting would be allowed, and a hunter's education program would be instituted under this alternative as described under alternative C.

## Communications and Outreach

We would continue to use the same communications and outreach tools, resources, messages, and levels of effort as described for alternative A. However, we would enhance our emphasis on the refuge's conservation efforts as well as the overall purposes of the Refuge System.

We would target our traditional refuge use audience as well as wildlife enthusiasts. We would also increase public outreach and refuge promotion in neighboring communities to increase the visibility of the refuge and overcome negative perceptions.

We would focus our outreach messaging to address safety concerns over the cleanup of refuge habitats, invite visitors to participate in refuge activities and programs, and explain the refuge's wildlife and habitat resources.

We would encourage more cross promotion among partners to raise awareness of the refuge, develop more bilingual resources (such as a refuge Web site, signs, and brochures); slightly increase our communications; and disseminate more information through existing outlets and media.

## Partnerships

Partnerships under this alternative would be similar to those under alternative A.

## Cultural Resources

We would manage and protect cultural resources as described above for alternative A.

## Research and Science

In addition to the research activities described for alternative A, we would: (a) develop opportunities to conduct important research on the reintroduced black-footed ferret population in collaboration with the Black-Footed Ferret Center (BFFC); (b) develop an inventory and monitoring plan; (c) restart water quality monitoring and data gathering; (d) adopt the findings of the WMP; (e) reestablish yearly monitoring of cultural resources sites; (f) monitor reintroduced species for success; (g) introduce the use of hand-held devices (such as tablets) to facilitate improvements in data and information collection and monitoring; (h) increase extent of current bird counts as other opportunities arise and implement the Big Sit Bird Count; (i) initiate research and monitoring of phenological characteristics of various species of plants, birds, and pollinators; and (j) be alert to impacts of climate change on habitat and wildlife regimes at the refuge.

## Infrastructure and Operations

Under alternative B, refuge facilities would be the same as those under alternative A, but would include consideration of a new headquarters office, removing unused facilities (such as trailers and some buildings), and replacing temporary bunkhouses. Funding would decline by $100,000 and personnel would decrease by one seasonal and two full-time employees annually.

In addition to the groups and programs described for alternative A, we would help develop a reliable core group to staff the Visitor Center desk and lead various tours and programs. We would offer to support Scout projects and volunteers.

We would develop a branding scheme, entailing a set of standards for fencing and signage design and material to be implemented consistently across the entire refuge complex. Hours of operation, energy transmission facilities, dams, and water rights would be maintained and managed as described for alternative A.

## Access and Transportation

We would enhance the main general visitor access point and reevaluate the need for three employee entrances. We would allow Service-owned buses and vans, autos, recreational biking as far as the Visitor Center, and pedestrian access.

We would address navigation, investigate new ways to bring people to the refuge, and use wayfinding to clarify circulation on the refuge. We would incorporate positive messages into signs—focusing on what is allowed rather than what is not allowed—and update refuge maps in the Visitor Center and at all kiosks.

Our management of roads and infrastructure would be as described for alternative A, except that we would discontinue maintenance of, or remove, some of the section line roads. We would expand the Wildlife Drive to allow self-guided driving and would continue to provide bus-guided interpretive tours on weekends.

We would increase interpretive opportunities and accessibility on the existing trail system and would improve and build new trail connections with outlying regional trails. We would complete the Perimeter Trail and continue building a connection with the Rocky Mountain Greenway Trail. We would rehabilitate and reopen closed trails.

### Rationale for Not Selecting Alternative B

Alternative B was not selected for implementation. While this alternative would meet our stated planning goals for the CCP, the goals for communications and outreach, access and transportation, visitor services, partnerships, cultural resources, and infrastructure and operations would be met to a greater extent than under alternative A but to a lesser extent than under the selected alternative.

Although alternative B might best protect the wildlife and habitats from unintended impacts brought about by increased visitation to the refuge, its implementation would not allow the staff to implement the tenets of the Urban Wildlife Conservation Program on the refuge.

Alternative B would satisfy our visitor services goal by opening the refuge to hunting and maintaining the other existing priority public uses at or near the existing levels. We would work with CPW to implement the onsite hunter education program, perform the hunting lottery, and carry out the youth and disabled hunt on the refuge. As noted above, alternative C would also include greater refuge access, more trails, improved programs, and a newer facility.

Alternative B would partially achieve our goal for partnerships by maintaining existing partnerships that help the refuge staff run part of the Visitor Center, provide some visitor programs, and support management of biological resources. Alternative C would include a greater number and diversity of partnerships; consequently, the lack of emphasis on developing new partnerships under alternative B could result in missed opportunities to foster and develop new partnerships in other management areas.

Alternative B would meet our goal for cultural resources to some extent by continuing to protect cultural resources on the refuge. But this alternative would not allow the staff to better interpret or to restore cultural and historical resources, as would alternatives C and D.

Alternative B would address our goal for infrastructure and operations by continuing to maintain existing infrastructure and a few new facilities, such as a new headquarters building. Staffing and funding levels would decrease slightly from current levels under this alternative; in contrast, the selected alternative would increase staffing with the addition of two new law enforcement officers.

Alternative B would fully satisfy our goals for habitat management, wildlife management, and research and science.

Overall, we received only one comment in support of alternative B—a conservation organization that noted it might best protect wildlife from disturbance. For this reason, we have designated alternative B the environmentally preferable alternative as noted in the appropriate section later in this ROD. None of our cooperating agencies supported alternative B.

## Alternative D—Gateway Refuge

Under this alternative, we would emphasize increasing the visibility of the refuge, the refuge system, and other public lands in the area. Because of the way in which we would manage our staff and resources, there would be reduced visitor services programming on the refuge than under alternative C, but we would give greater emphasis to offsite programs in conjunction with our partners.

### Habitat Management

Habitat management under this alternative would be the same as under alternatives A, B, and C. Additionally, we would pursue collaborative efforts with neighbors and other groups to preserve and improve wildlife habitat connectivity.

### Wildlife Management

We would manage most wildlife, including surrogate species and native species reintroductions, much as we would under alternative B. However, a key difference from alternative C is that we would establish a ferret-specific set of partnerships and collaborative activities, sharing knowledge with entities such as CPW, the Denver Zoo, and the BFFC. In addition, we would develop partnerships with CPW to manage ferrets onsite and offsite, and would work with neigh-

boring landowners to extend the range of native species.

## Visitor Services

Hunting-related activities would be similar to those described for alternative A, with no hunting or hunter education programs as alternative C provides, but would promote hunting opportunities throughout Colorado and the Refuge System.

In addition to the fishing opportunities described for alternative C, we would explore raising permit fees to support increased fish stocking rates and expanded programming, as well as increasing fishing days and hours. We would promote fishing opportunities throughout the Refuge System and Colorado, and would partner with others to implement fishing improvements and expanded programming such as more advanced fishing classes and more partner-run fishing programs and events. We would consider offering a fishing concession.

In addition to the opportunities described for alternative C, accessibility would be incorporated into all new facilities. We would offer more partner- and concessionaire-guided tours and programming, as well as advanced photography classes. We would promote the refuge as a birding destination. If native species are reintroduced, we would offer wildlife viewing and tours led by partners or concessionaires.

In addition to the opportunities described for alternatives B and C, we would expand environmental education programming at the refuge for youth and adults. We would explore concessionaire- or partner-led summer camps on the refuge, design a career experience program, develop a summer refuge intern program, develop vocational programs for high school and college students, and work with surrounding community organizations and high schools to raise awareness of and promote conservation careers.

In addition to the opportunities mentioned under alternative C, we could collaborate with universities to expand learning opportunities, offer adult education forums, and offer expanded interpretive programs about refuge history and cultural resources.

We could develop more programs in partnership with neighboring parks and recreation departments and the Sand Creek Greenway than those described under alternative C. We would encourage partners to cross-promote refuge programs, interpret at their sites, and incorporate nature play into facilities at their sites. We could provide more offsite interpretive programming and explore developing an onsite living history program in collaboration with outside partners.

## Communications and Outreach

In addition to the target audiences mentioned under alternative C, under alternative D we would expand our target audiences to include the entire Colorado Front Range region and even international visitors. We would develop a communications plan for the entire refuge complex and recruit partners to reach out to their constituencies. We would specifically target birders, history enthusiasts, and international visitors with more appealing messages to them.

In addition to the message outlined for alternative B, we would emphasize the conservation, transformation, and evolution of the refuge. We would step up promotion of the entire refuge complex as well as other regional prairie sites, and we would coordinate with regional entities to promote improved regional access to the refuge.

We would approach and engage presently untapped resources (for example, associations and TV channels) to help us promote the refuge and would use the refuge Web site as a clearinghouse for regional events and activities.

We would use existing technology to reach and connect with broad audiences, such as: (a) employing social marketing to broaden the Service's reach, (b) engaging visitors to use social media to share wildlife sightings and plant discoveries, (c) maintaining and updating the refuge Web site, (d) soliciting partners and volunteers to post regularly on Facebook, (e) recruiting interns to explore technologies and outreach strategies, (f) sharing refuge images and videos on social media, and (g) translating the Web site into multiple languages to boost international visitation.

## Partnerships

We would focus on engaging partners to expand programming and wildlife-dependent recreation and increase their autonomy in conducting these activities. Using this approach, we would support activities such as day camps, the Master Naturalist Program, certified interpretive guide training, Backyard Habitat with the National Wildlife Federation, photography tours and classes, advanced birding with groups such as Audubon, and fishing clinics with groups like Trout Unlimited and Orvis.

We would expand our breadth of partnerships to include conservation organizations, local governments, government agencies, and private companies in expanding programming and visitor use activities both on and off the refuge. We would establish a regional prairie coalition to cross-promote programming, activities, and research among conservation groups and natural areas throughout the Front

Range. We would engage partnerships to create more physical links connecting outlying communities, regional trails, and the refuge.

We would develop specific partnerships to support ferret recovery and collaborative activities, working with groups such as CPW, Denver Zoo, and BFFC. We would also develop partnerships with CPW to manage ferrets on- and offsite, enter into collaborative efforts and partnerships with neighbors and other groups to preserve and improve wildlife habitat connectivity, and increase collaboration with other divisions of the Service and other agencies and organizations on issues related to migratory birds and federally listed species. We would seek ways to collaborate with other states and nations to address species concerns that transcend borders—leveraging, if possible, nearby cities' international sister cities to share conservation research and practices.

We would build additional partnerships with Fast Tracks, Colorado Department of Transportation, DIA (for outreach to international travelers), and Regional Transportation District (to promote increased frequency of routes providing refuge access). We would pursue other partnerships under the America's Great Outdoors initiative.

We would work with partners and corporate sponsors to host two additional large annual events. We would tie into nationwide events like Public Lands Day, Earth Day, and National Trails Day.

## Cultural Resources

We would manage cultural resources as described for alternative C, but with the following additions: (a) work with partners to establish an offsite World War II and Cold War museum owned and operated by an organization other than the Service, (b) conduct further research on prehistoric sites on the refuge, (c) undertake full restoration of the interior and exterior of the Egli farmstead to allow for reuse and comprehensive interpretation, and (d) permit and encourage occasional living history interpretation of early homesteading and farming and establish electronic and remote tools to provide interpretation.

## Research and Science

In addition to the programs described for alternative B, we would: (a) seek knowledge exchange opportunities with partners, neighbors, and other agencies; and (b) collaborate with the Colorado Department of Public Health and Environment, DIA, and the Regional Air Quality Council on air quality monitoring.

In addition to the priorities discussed for alternative C, we would do the following: (a) strive to increase collaborative research projects where the refuge serves as a field laboratory for others; (b) research prehistoric use of overlooks at First Creek and Second Creek; (c) If possible, make existing office trailers available to facilitate research on black-footed ferrets; (d) link Citizen Science opportunities with other citizen research that takes place elsewhere on the refuge complex as well as on partners' sites; (e) as appropriate, institute the use of the same data collection and modeling platforms that refuge partners and other agencies use; (f) enlarge the range of partners and other agencies with whom we would share wildlife data (such as bison and bird bands); (g) increase cooperation with universities and other higher education institutions on research initiatives; (h) explore increasing research programs to study the response of grassland birds and pollinators to restored prairie habitat; (i) study responses of coyotes to changes in prey base, parasitism, and wildlife diseases; and (j) study the extent and spread of prairie dog populations.

## Infrastructure and Operations

Staffing and budget under alternative D would be less than under alternative C but more than under alternatives A and B. We would add commercial transit operators, and a partner coordinator would replace the Service-supported volunteer coordinator.

In addition to the facilities described for alternative B, we would develop food concessions and partnerships with food truck businesses. We would also rehabilitate and improve facilities to better interpret cultural resources and enhance the visitor experience. We would rehabilitate the Army's old communications building to house exhibits interpreting the site's history. We would improve and interpret the bunker on the Wildlife Drive, and would identify and memorialize the POW internment camp and the 2013 Ivory Crush event.

Although the volunteer programs under alternative D would be similar to those under alternative C, alternative D calls for the largest volunteer program of all the alternatives, in order to support extensive offsite work. In addition to the strategies described for alternative C, we would develop a system for sharing volunteers among the three refuges in the complex, as well as among partnering groups.

Our approach to energy transmission towers and other energy-related infrastructure would be the same as under alternative C. However, in contrast to alternative C, we would: (a) develop signs to promote other regional opportunities, (b) improve the appearance and uniformity of the refuge fence and access points, (c) extend branding across the refuge complex and adjacent jurisdictions and landowners, and (d) identify additional access points where the fence

could be opened to foot traffic to promote regional connections.

Dams and water rights management, as well as hours of operation, would be the same as described for alternatives A, B, and C.

## Access and Transportation

The way-finding and signage plan under this alternative would be similar to that described for alternative B.

In addition to the management actions, facilities, and priorities described for alternative C, under this alternative we would: (a) add pedestrian and bicycle access points to Henderson Hill overlook and trail; (b) add southeast viewing access; (c) create more connections to the Rocky Mountain Greenway and a trail connection to the Fast Tracks Peña station; (d) reach out to DIA to improve the physical connections between the airport and the refuge; (e) include snowshoeing, cross-country skiing, and road or mountain bikes to the modes of transportation; (f) develop a more robust bike-sharing system with links to regional trail systems and regional B-cycle stations; (g) focus on developing and promoting the Rocky Mountain Greenway and ways to physically link the three refuges; (h) open the Wildlife Drive to public vehicles for two-way traffic; (i) incorporate bike infrastructure into the road system, including striping bike lanes and an off-street path on the Wildlife Drive; (j) stripe for two-way traffic; (k) add pullouts, traffic control, and speed bumps on the northern portion of the Wildlife Drive; (l) develop an even more extensive trail system; (m) coordinate with stakeholders and adjacent landowners to manage access along the Perimeter Trail; and (n) work to connect Rocky Mountain Greenway Trail with First Creek Trail and Second Creek Trail, improve signs, and promote trail links.

## Rationale for Not Selecting Alternative D

Alternative D was not selected for implementation even though it would fully meet all our stated planning goals for the CCP.

Both alternatives C and D would adhere closely to the visitor services goal because they include increased visitor access and transportation options. Alternative C would focus on providing visitor services that would be popular with our neighbors and the greater metropolitan community, such as hunting, hunting instruction, more fishing classes, and catch opportunities. Programs under alternative C would be targeted to neighboring communities and would include partnering with libraries, parks, and schools and could explore nontraditional methods and opportunities—such as refuge artists—that are likely to inspire urban youth. Alternative D would entail partnering with others who already offer programming and is consequently more likely to result in offsite education and visitation. Some of the programs would be geared toward local visitors as they would under alternative C.

Because alternative C focuses to a greater degree on involving local youth and adult visitors, it would meet the outreach component of the goal to a greater degree than any other alternative. Alternative D may reach a more diverse audience, but that audience would be widespread and not as likely to be unaware of the importance of natural resources. Alternative C would also focus more on the refuge than the entire Refuge System or on resources at partner agencies. Both alternatives C and D would likely inspire visitors to take part in or support the refuge's management and restoration efforts.

Under alternatives C and D, we would pursue the same partnerships as under alternative B and would explore other partnership opportunities that can support necessary research and management, as well as the expansion and promotion of wildlife-dependent recreational opportunities. Alternative D focuses on adding or expanding partnerships but may not achieve this goal as well as alternative C because it would dilute staff time to a much greater degree. Under alternative C, staff would be better able to enrich current partnerships as well as build new ones, such as partnerships supporting environmental education for community members. Both alternatives C and D adhere closely to the partnership goal.

Alternative D shares many elements in common with alternative C, and also implements the Service's Urban Wildlife Conservation Program. Although both alternatives C and D fully meet each of our goals, we are concerned that implementing alternative D would redirect focus away from the refuge itself, impairing efforts to make it the "premier urban refuge" it could be. Alternative C seeks to "first get the house in order," make the refuge more welcoming, and open more doors to the refuge to accommodate traditional and nontraditional visitors.

In part because of increased resources proposed under alternatives C and D, these alternatives would enable the staff to increase outreach and partnership efforts to find suitable groups and agencies that could properly house, curate, and interpret valuable cultural artifacts for future generations. Alternative C has been modified to include both exterior and interior restoration of the Egli House, as proposed under alternative D. Accordingly, alternatives C and D would result in the best protection of historical and cultural resources and so better adhere to this goal.

Alternatives B, C, and D would adhere closely to our stated goal for research and science. But because alternative D emphasizes collaboration with other

refuges or agency partners and wider coordination of research and data collection and sharing, it has the potential to achieve this goal to a greater degree than other alternatives. However, because the redirection of staff time and attention away from the refuge has the potential to dilute ongoing research and science on the refuge, alternative C would better advance the understanding of functions and management within the refuge complex.

Alternative C would be more expensive than D because it would be a fully Service-funded and controlled effort.

Under alternatives C and D, we propose many changes to the headquarters, fencing, and other infrastructure that we believe would maximize our resources and allow us to more effectively interact with visitors and partners. Accordingly, both alternatives C and D would adhere closely to the infrastructure and operations goal. Alternatives C and D differ in their focus, with alternative C offering substantially more opportunities to observe wildlife using new facilities like pullouts, overlooks, and viewing platforms.

Alternative C also entails more onsite facilities and programming for visitors and focuses its communications, outreach, and partnerships on local residents or organizations than does alternative D. These residents are under-served by the Service; reaching out to them is most consistent with the Service's Urban Wildlife Conservation Program.

Under alternatives C and D we propose new points and types of access to the refuge, as well as a considerable expansion and reconfiguration of the refuge's transportation options. Alternative D includes most of the trails, roads, and transportation options provided for under alternative C, but also proposes creating trail connections to areas outside the refuge, as well as opening the internal Wildlife Drive to two-way traffic. While these measures would help alternative D more fully meet the access and transportation goal, they would also redirect staff time away from habitat or wildlife management and, potentially, the quality of the visitor experience to managing security and traffic and maintaining roads and trails. Accordingly, both alternatives C and D would adhere closely to this goal.

In summary, we believe control and staff focus should be on the refuge itself rather than the region. The broadening of the refuge's research and education programs to the region is something the team believed might make an appropriate second "phase" of management and be an appropriate direction in its next CCP.

All but one commenter indicated support for alternative C, and cooperating agencies were unanimous in their support of C as the alternative the Service should select.

## Tribal Involvement and Consultation

The Service sent letters of notification about the planning process, including an invitation to participate on the planning team, to the following tribes:

- Northern Arapaho Tribe, Fort Washakie, WY
- Northern Cheyenne Tribe, Lame Deer, MT
- Pueblo of Taos, Taos, NM
- Southern Ute Tribe, Ignacio, CO
- Ute Mountain Ute Tribe, Towaoc, CO

## Public Involvement and Outreach

A notice of intent to develop a CCP and a request for comments was published in the Federal Register on August 7, 2013 (FR 78(152):48183—48185). The notice of intent notified the public of our intent to begin the CCP and EIS process.

### *Comments on the Draft CCP and EIS*

The draft CCP and EIS was released to the public for a 60-day public review and comment period on May 6, 2015, following publication of a notice of availability in the Federal Register (FR 80(87):26084—26086). We allowed comments to be submitted until July 6, 2015. We received more than 100 comments from 12 commenters: cooperating agencies, other governmental agencies, conservation organizations, and individuals. We responded to all the substantive comments we received in Chapter 5 of the final EIS.

## Comments on the Final EIS

The final EIS was published in the Federal Register on August 27, 2015 (FR 80(166):52056–52058), and the 30-day waiting period ended on October 5, 2015.

One comment, from the Environmental Protection Agency (EPA), was received during the waiting period.

The EPA recommends that the Service conducts a hydrological evaluation to assess whether altering the "Texas Crossing" along the Wildlife Drive might affect the site's hydrology—potentially affecting

groundwater recharge, flow, monitoring, extraction, or treatment—prior to altering the site's existing configuration.

The Service will carefully consider and evaluate any infrastructural and site changes to the Wildlife Drive, especially the "Texas Crossing," and will coordinate with EPA and all other appropriate agencies prior to implementing any site changes or building any new structures at this site.

The Service has and will continue to abide by existing land use restrictions at the Rocky Mountain Arsenal.

## Environmentally Preferable Alternative

The environmentally preferable alternative is defined as the "alternative that will promote the national environmental policy as expressed in NEPA's Section 101." Typically, this means the alternative that causes the least damage to the biological and physical environment. It also means the alternative that "best protects, preserves and enhances historic, cultural and natural resources" (Forty Most Asked Questions Concerning Council of Environmental Quality's National Environmental Policy Act Regulations, 1981).

Based on our environmental consequences analysis, we believe alternative B—Traditional Refuge, is most likely the environmentally preferable alternative.

The four management alternatives proposed in the draft CCP and EIS shared many similarities in their management of refuge resources. But there are also differences that set them apart.

All four alternatives analyzed in the draft CCP/EIS would enhance, restore, and manage the refuge's habitats in accordance with the approved HMP, HRP, FMP, IPMP, and WMP developed by the refuge.

All four alternatives manage most wildlife in much the same manner, by following approved management plans (such as the PDMP and bison management plan). However, the three action alternatives (B, C, and D) propose reintroducing the endangered black-footed ferret and other native species to the refuge.

Although alternative B proposes to open the refuge to limited hunting, the taking of wildlife would help to maintain the deer and dove populations within the refuge habitats' carrying capacity, thus assisting in the staff efforts to restore and maintain habitats.

For protection of cultural resources, we believe that alternative D would be environmentally preferable as it would afford the greatest level of protection to the cultural and historical resources found on the refuge by fully restoring the Egli house.

The primary source of impact on physical and cultural resources at the refuge over the 15-year life span of the CCP would be from visitor use. Therefore, for the purposes of determining which of the alternatives is environmentally preferable, we have looked at the degree to which public use programs, facilities, and infrastructure and visitor numbers would affect the natural environment within the boundary of the refuge.

Specifically, factors such as the degree of openness of the refuge to public access (that is, the number, location, and types of access points); the extent of public use facilities within the refuge boundary (such as trail configuration and situation, refuge roads, and educational facilities); the number and types of public use programs (such as fishing, environmental education, and hunter education); the levels of visitation; and, finally, the level of law enforcement necessary to ensure public and facilities safety and protection of refuge resources were important considerations.

Alternatives A and B would continue greatly limiting public access to the northern portion of the refuge and maintaining the Wildlife Drive generally closed to the public. Conversely, alternatives C and D would entail opening the Wildlife Drive and the northern portion of the refuge to the public in general.

Allowing the general public to access the northern portion of the refuge through motorized vehicles will increase disturbance to wildlife and habitats from increased noise, dust, erosion, and human intrusion to previously restricted portions of the refuge. We expect some of these impacts to be ameliorated by increased law enforcement presence under alternatives C and D, but believe that keeping them completely closed would have continued benefits for wildlife over and above those offered by law enforcement.

The ferret reintroduction proposed under the three action alternatives will have beneficial consequences on the restored prairie and shrubland habitats from decreased erosion as ferrets bring the prairie dog colony population size into check and eventually to a carrying capacity level. The reintroduction of other native species common to action alternatives would also help to create a more complete prairie ecosystem. These features are common only to alternatives B, C and D, and would not occur under alternative A.

Alternatives C and D call for improving and expanding the reach and length of the refuge's trail system from current conditions. Construction of new and refurbishment of existing trails and trail-related infrastructure would have adverse impacts on the

habitats of the refuge. Using these new trails or increasing the vehicular traffic on these roads could result in road-kills and long-term disturbance from human activity on wildlife in the vicinity, resulting in some abandonment of habitats.

Alternatives A and B would continue the use of a single visitor access point to the refuge (through the main gate), while alternatives C and D would increase access significantly through the opening of several new access points. This again means that visitors and visitor disturbance would be more widespread under alternatives C or D.

Because our mission, policies, and purpose of the refuge include visitor services, outreach, partnerships, and other goals that would result in increases in visitor use at the refuge if fully implemented, we selected alternative C as the best balance of meeting these and wildlife/habitat protection needs. However, continuing to manage the refuge primarily as a wildlife sanctuary would minimize impacts on biological and physical resources. Although alternative A would also minimize these impacts, alternative B is environmentally preferable because it would include reintroduction of black footed ferrets and other native prairie species.

## Measures to Minimize Environmental Harm

Throughout the planning process, we took into account all practicable measures to avoid or minimize environmental impacts that could result from implementation of alternative C. These measures include the following:

- Continue maintaining solar power production and recycling efforts; increase energy efficiency; and adopt other ways to reduce the refuge's carbon footprint.

- Collaborate with EPA, Tri-County Health Department, Colorado Department of Public Health and Environment, adjacent communities, and other partners to monitor ground and surface water flow levels and quality throughout the life of the plan.

- Minimize emissions and particulates by following best management practices when using motorized equipment and conducting restoration activities. Prescribed fire would be carried out under the approved FMP and stringent smoke management plans. The application and timing of prescribed fire would be considered in reducing smoke exposure to residents and workers in adjoining communities and wildlife mortality, particularly during breeding seasons.

- Plan carefully in locating and building visitor facilities, office and maintenance buildings, bunkhouses, trails, kiosks, or road improvements would minimize disturbance, particularly during critical breeding periods. Controlling the numbers of ungulates, use of fencing, and management of water structures are measures that we would incorporate into the plan.

- Use best management practices during construction activities, excavation of cultural resources, and the development of visitor services structures or facilities and other refuge infrastructure. Limit disturbing soils during dry or windy periods, using erosion controls, properly maintaining roads and culverts, and using the minimal tools necessary to accomplish the objective.

Design all new facilities, including buildings, roads, and trails, to limit their visual impact on the landscape, including reducing light pollution. Site any new use of alternative energy structures (solar panels) to limit visual impacts.

Where possible, use the following principles to minimize impacts of refuge roads and trails:

- locate roads and trails away from streams and riparian areas;

- locate roads and trails away from steep slopes and erosive soils;

- provide adequate drainage and control of erosion to avoid routing sediment into streams; and

- design roads around natural drainage patterns.

- Minimize human disturbance from habitat management activities and visitor services during the nesting season to limit impacts on biological resources. Measures could include (for example) increased visitor education, monitoring, law enforcement, and seasonal closures.

- Review any mitigation requirements for any unavoidable adverse effects on historic properties resulting from our actions

through Section 106 of the NHPA. This process will be guided by the Service's cultural resource staff in consultation with the State Historic Preservation Office and other consulting parties and obtaining all required permits as necessary.

## Consultation Requirements: Section 7 of the Endangered Species Act

Several species listed as threatened or endangered under the Endangered Species Act have a historical range that encompasses the refuge. These species were documented through an Intra-Service Section 7 Consultation. These federally listed species are black-footed ferret (*Mustela nigripes*), Mexican spotted owl (*Strix occidentalis lucida*), Colorado butterfly plant (*Gaura neomexicana coloradensis*), Ute ladies'-tresses orchid (*Spiranthes diluvialis*) and Preble's meadow jumping mouse (*Zapus hudsonius preblei*).

Surveys for these species have failed to locate any individuals of these species on the refuge. The refuge does not lie within designated critical habitat for any of these listed species.

The refuge intends to reintroduce black-footed ferrets to the black-tailed prairie dog colonies present on the refuge in early fall 2015. The black-footed ferrets to be reintroduced have been designated a non-essential population by the Service.

The Intra-Service consultation concluded that our preferred alternative (C) may affect, and is likely to adversely affect, only the black-footed ferret. Accordingly, the Service's Colorado Field Office (CFO) issued a Biological Opinion that describes likely sources of the adverse effects on the ferrets and contains an incidental take statement, reasonable and prudent measures, and conservation recommendations to minimize or avoid the impacts of the incidental take of black-footed ferrets.

There are also federally listed species whose range includes the Platte River area in Nebraska, and that could be indirectly affected by upstream water depletions in the watershed of the Platte River. These species include the whooping crane (*Grus Americana*) and the piping plover (*Charadrius melodus*).

Currently, there are no proposed or candidate species found on or near the refuge.

## Section 106 of the National Historic Preservation Act

All the Service-managed lands within the boundary of the refuge have been surveyed for cultural and historical resources. Accordingly, activities outlined under alternative C have almost no potential to negatively affect cultural resources, either by direct disturbance during construction of habitat projects and facilities related to public use or administration and operations, or indirectly by exposing cultural and historic artifacts during management actions such as habitat restoration or prescribed burning. Nevertheless, prior to any undertaking that would be subject to Section 106 of the NHPA, activities that could negatively affect cultural resources would be reviewed and options for minimizing negative effects would be discussed prior to implementation of the preferred alternative. This process would include entering into consultation with the State Historic Preservation Officer and other parties as appropriate. We will continue to protect all known cultural resources sites.

## Protection of Wetlands and Riparian Areas

Activities outlined under alternative C are aimed at restoring native prairie and shrubland habitats and sustaining wetland and riparian habitats on the refuge. We will continue to manage wetlands to promote native emergent species, provide opportunistic benefits to wetland-dependent wildlife, and maintain spawning grounds for forage fish. We will treat cattails when 80 percent or more of shorelines are covered with them within 30 feet of the shoreline.

We will inventory and sustain riparian corridors, and will allow for the natural hydrology of the site to run its course so as to avoid altering surface flows within the refuge.

These strategies are expected to help preserve the long-term function and productivity of wetland and riparian habitats and to promote communities that are ecologically resilient to climatic and hydrologic changes.

We will incorporate applicable regulatory compliance, such as wetland permitting, as appropriate into any reservoir maintenance efforts.

## Finding and Basis for Decision

We have considered the environmental and relevant concerns presented by agencies, tribes, organizations, and individuals on the proposed action to develop the final EIS and implement a CCP for the Rocky Mountain Arsenal National Wildlife Refuge.

Alternative C was selected for implementation because it achieves a reasonable balance between significant resource management issues; the purposes, missions, and management policies of the Service; and the interests and perspectives of all stakeholders.

All public and agency comments received during the environmental process were reviewed. The substantive issues and comments raised have been addressed in the final EIS. Comments and responses on the final EIS are addressed in this record of decision. Based on the above information, we have selected alternative C for implementation.

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Lakewood, Colorado

Date
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