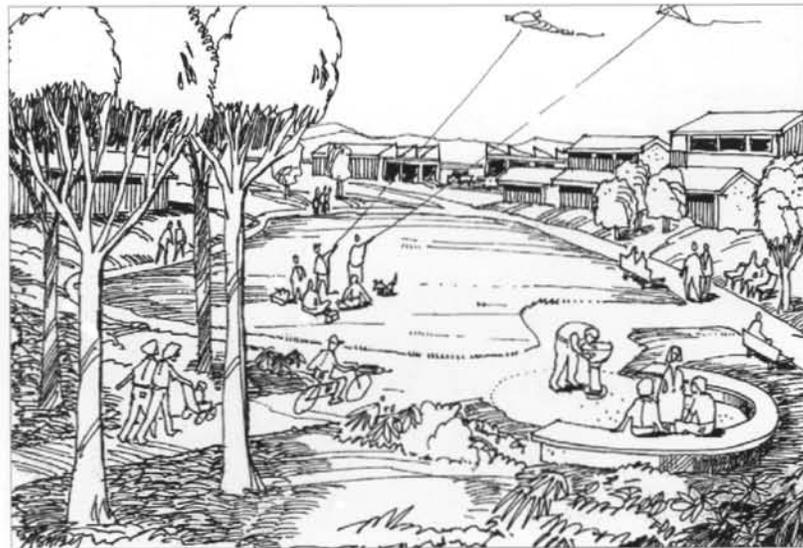


### 3. DEVELOPMENT PLAN

**F**or most refuges, a development plan is created which indicates where on the Refuge facilities are to be built and then funds—mostly federal—are sought to implement that plan. In this as in so many other ways, the Rocky Mountain Arsenal National Wildlife Refuge will be unique. All of the Refuge's major facilities are proposed for an area off the Refuge—in the western zone. These facilities will be built and run in cooperation with other agencies and companies. The Visitor Learning Center, for example, may have an exhibit hall that is created and operated by an organization other than the U.S. Fish and Wildlife Service, perhaps a museum. Commerce City has taken the lead in planning part of the western zone, with the cooperation and appreciation of the Service. An adjacent section has been planned by the Stapleton Redevelopment Foundation in ways that are compatible with the Refuge.

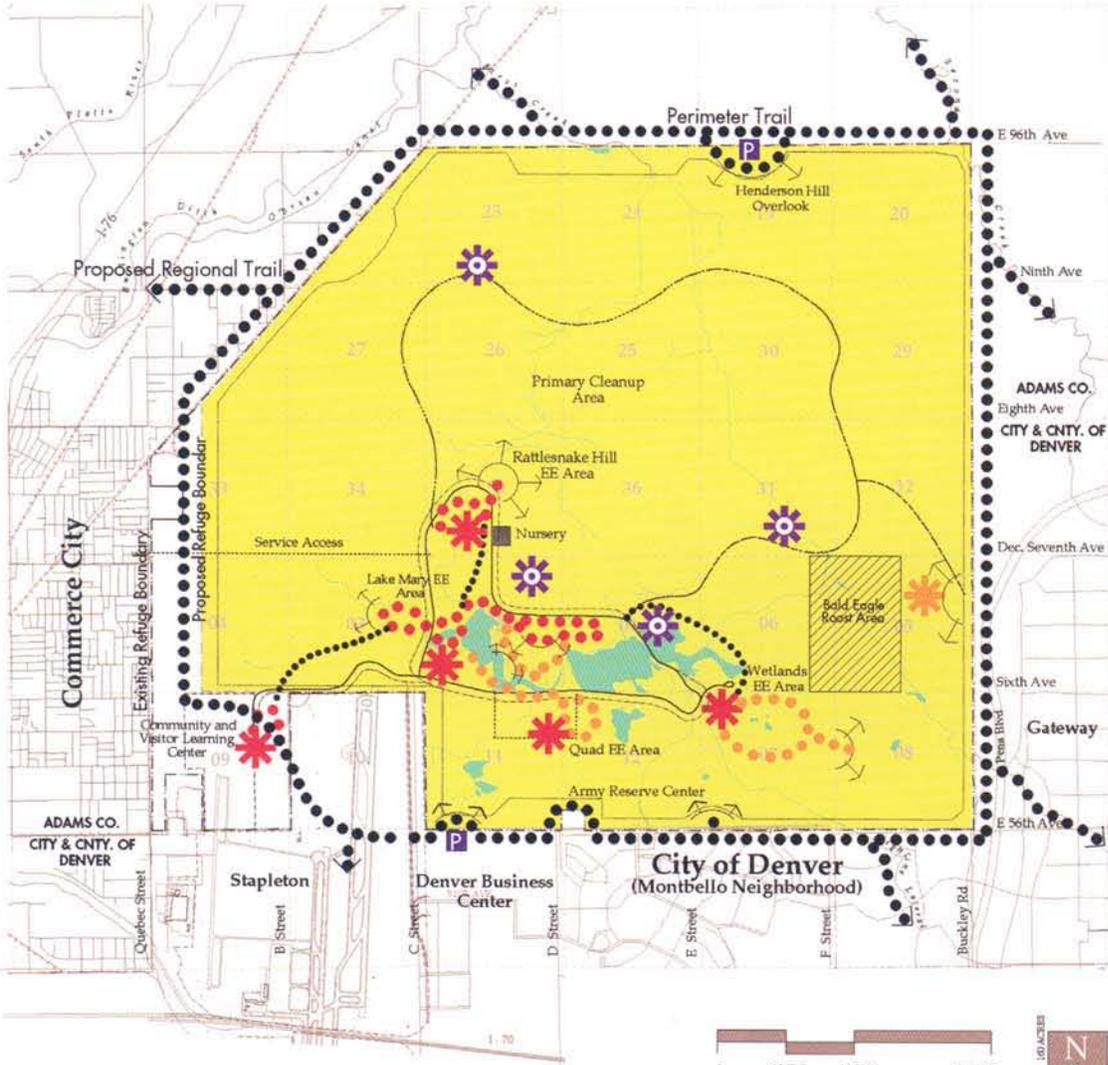
The kind of cooperation that will make such facilities possible, will also mean that they can be managed creatively and responsibly by and for the community. The Refuge will be an integral



**Figure 3.1** The Refuge's western zone will be home to the Visitor Learning Center, and the place where many activities and programs will be concentrated.

# DEVELOPMENT PLAN (Map 3.1)

- Refuge Boundary 
- Perimeter Regional Trail 
- Proposed Regional Trail 
- Tram Route 
- Optional Tram Route 
- Perimeter Maintenance Road 
- Year Round Interpretation & Environmental Education Area 
- Seasonal Interpretation & Environmental Education Area 
- Year Round Loop Trail 
- Seasonal Loop Trail 
- Perimeter Trail Overlook 
- Temporary Interpretation & Environmental Education Area 
- Perimeter Trail Viewing Area 
- Loop Connector Hiking Trail 
- Bike Route 



part of the community, not a separate, visit-it-now-and-then amenity. Not only will the Visitor Center be located in the community, it will function as a community center, rather than an isolated, narrowly focused facility.

It is the fiscal reality of the times that the federal government alone cannot come up with the money to build all of the needed Refuge facilities. If, to some degree, the Refuge is created and sustained by the community it sits within, then there isn't just one agency "owner," but literally thousands of stakeholders.

When fully developed the Refuge will feature a Gateway in its western—off-Refuge—zone that is home to the Visitor Learning Center Complex. This complex includes facilities run cooperatively by the Service and its partners. The campus of buildings here will include orientation and exhibit spaces, the Environmental Education Center, the Environmental Education Research Laboratory, Refuge Administrative offices, restaurants, a bookstore, and other compatible commercial and non-profit businesses.

## OVERVIEW

This chapter describes the facilities to be built at the Refuge. (See Map 3.1 Development Plan.)

The Gateway will be the place for the hustle and bustle of large crowds, whose main goals can be achieved here away from the Refuge's resources (Figure 3.1). For some visitors and some visits to the Refuge, visitors may go no farther into the Refuge.

The western zone in which the Gateway sits is a large area that includes much more than just the Visitor Learning Center Complex. It also contains

extensive open space, some of which is devoted to types of active recreation that would not be compatible if they occurred on the Refuge itself. Also in the Gateway area, will be a wide range of businesses and other organizations with goals consistent with the Refuge's. The Gateway has been envisioned as a green industry campus where there is extensive public/private interaction and cooperation. Land uses on the part of the Gateway that is or was part of the Arsenal are restricted by federal legislation. For example, no residential or agricultural uses are permitted.

The western zone is envisioned as a cooperative zone where partnerships and collaboration with the Service are encouraged.

Within the Refuge proper, there will be a tram that transports visitors throughout the southern zone and into parts of the northern zone. No private cars will be allowed on the Refuge. The tram route, and other aspects of public use, will be adjusted seasonally in response to the changing habitat needs of sensitive wildlife species.

In the southern zone, there are trails for general public use and environmental education. Also developed in support of education are environmental education and interpretive areas, some of which include outdoor classroom facilities. Bicyclists will be allowed to use the southern tram route at specified times.

The northern zone is intentionally a quieter, less visited place. Except for around Rattlesnake Hill, there are no trails and the only access for the public is on the tram, which runs less frequently here than on the southern route.

On the eastern boundary of the Refuge is the Eagle Watch. While the bald eagles are in residence along First Creek, the public has access to the Eagle Watch along Buckley Road.

**Table 3.1** Projected costs of developing the Refuge.

<b>Refuge Restoration</b>	
Prairie	
Prairie Restoration	\$23,636,000
Wetlands & Creek	
First Creek Restoration	\$1,874,796
Bald Eagle Shallow	\$62,700
Demolition	
Bldg. Demolition/Site Clearing	\$2,247,300
Demolition Roads & Bridges	\$3,150,840
<b>Visitor Learning Center Complex</b>	
Visitor Center	\$13,497,536
Environmental Education	
Environmental Education Center	\$1,699,954
Environmental Ed. Research Lab	\$178,200
Remote Information Station	\$86,130
(3) Outdoor Classrooms	\$965,259
Temporary Mobile EE Station	\$341,550
Administration	
Administrative Offices	\$4,484,329
<b>Retrofitted Facilities</b>	
Research Lab	
Research Facilities	\$1,035,045
Maintenance	
Maintenance Facility	\$1,498,365
Prairie Plant Nursery	\$626,340
<b>Site Amenities</b>	
Trails & Environmental Ed./Interpretive Areas	
Visitor Center Trail EE/Interp. Area	\$387,689
Visitor Center Connector Trail	\$79,284
Officer's Row Trail EE/Interp. Area	\$69,628
Lake Mary Trail EE/Interp. Area	\$142,127
Lake Overlook Trail	\$135,415
Quad Connector Trail	\$53,383
Quad Trail EE/Interp. Area	\$72,329
Wetlands Trail EE/Interp. Area	\$264,627
Wetlands Connector Trail	\$89,249
Bldg. 111 Connector Trail	\$29,700
Rattlesnake Hill Trail EE/Interp. Area	\$741,544
Eagle Watch Trail EE/Interp. Area	\$133,912
Roads	
Southern Tram Route	\$1,424,308
Northern Tram Route	\$2,177,821
Entry Road @ Gateway	\$412,251
Quad Loop Road	\$103,499
Internal Perimeter Road	\$1,607,079
Outdoor Areas	
Visitor Parking at Visitor Center	\$1,583,331
Visitor Parking at Eagle Watch	\$50,861
Major Events Area	\$69,498
Picnic Area	\$12,712
Utilities	
Utility Distribution	\$217,582
Perimeter Boundary	
Perimeter Trail & Boundary Barrier	\$6,019,292
Signage	
Road Signage	\$73,524
<b>TOTAL</b>	<b>\$65,242,173</b>



Restoration of the Refuge's habitats and the demolition of some facilities will be undertaken as part of the U.S. Army's remediation over the next several decades. First Creek (Figure 3.2) will be restored according to an already developed plan (MacLaughlin 1994).

## BUDGET

The costs to accomplish Refuge development are summarized in Table 3.1 by major project. Total project cost for all phases of development is estimated at \$65,242,173. Some of these projects—such as habitat restoration—will likely be accomplished concurrently with environmental cleanup and their costs borne by those responsible for that cleanup. Another source of funds—specifically for the creation of the Visitor Learning Center—will come from the sale of 815 acres as required by the Refuge Act. Beyond those sources of funding, there may be some modest annual funding from the federal government for capital improvements. To realize the Refuge's development plan, those monies will have to be leveraged. Partnerships will continually be a way of life for the Refuge.

## DEVELOPMENT

The previous discussion gives a broad overview of the development plan and funding needs for the Refuge. More detail about the specific projects that make up the development plan is given below. Developing the Refuge will take place in three general phases related to environmental



Figure 3.2 An approved plan already exists for the restoration of First Creek.

cleanup, details of which were still being worked out as the Comprehensive Management Plan was being completed. Projects are presented here by phases.

### Phase I Development

The first phase of development, from 1996-2000, will focus on planning, design, and general site preparation. Some of this work, or preparation for it, is already underway. Experiments with prairie restoration techniques, for example, have been under way for several years. Design of the Rattlesnake Hill trail and environmental education area has proceeded concurrently with the completion of the Comprehensive Management Plan. By the end of Phase I, the Service expects to accommodate 60,000 visitors.

#### *Prairie Restoration*

In the process of environmental cleanup, the core of the Refuge will be heavily disturbed as contaminated buildings and soils are consolidated into landfills and covered. These areas will be reseeded and planted in order to re-establish native plant cover wherever practicable. However,

some areas may be seeded with non-native species to discourage prairie dogs. Additional areas will be disturbed in the process of gathering fill material for use in the landfills. These areas will also be revegetated as part of cleanup. Still other areas not affected by cleanup will be disturbed for habitat improvement as a mitigation for other habitat loss due to cleanup. Revegetation has been divided into priority areas to coincide with phasing of cleanup and availability of funds.

Most likely there will be three types of cleanup areas, each requiring different restoration techniques: Landfill and capped areas with biota barriers and a four-foot soil cover; excavated areas with a one- to three-foot soil cover placed over the excavation; excavated and borrow areas with no replacement soil.

Most habitat restoration related to cleanup will occur in the northern zone where the objective is to recreate a landscape that visually and ecologically similar to presettlement conditions and is largely self-sustaining (Figure 3.3). Special management intervention will be necessary, however,



Figure 3.3 In the northern zone, the plains ecosystem will be restored to the degree possible.

because the herds of bison that played such a vital part of native prairie ecosystems are no longer present. Artificial maintenance using controlled burns and mowing may be necessary to sustain the prairie.

Seed mixes have been developed and tested by the Service for specific conditions on the Refuge. These mixes are based on surveys of the Refuge's soils, soil moisture, and remnant prairie,

As elms and other exotic trees die, replanting should be with native species and should take place in riparian areas and swales. This approach will sustain the structure that is being provided by the exotics for wildlife, but will do it in an area and with species that are more visually and ecologically consistent with a naturally occurring high plains ecosystem.

Where appropriate, native prairie should also be established in the southern zone. Exotic vegetation in the southern zone will be managed differently than in the northern zone. Because most of the trees and shrubs of the southern zone are introduced species and because much of the wildlife habitat value there is due to the zone's culturally manipulated landscape, management will be directed toward sustaining this cultural landscape, including its introduced plant species. Therefore, a more relaxed attitude will prevail toward exotic species. The goal will be to sustain the habitat diversity that exists in the southern zone. As exotic trees and shrubs die, the first replacement to be considered will be native plants that can provide the same type of structure as what has existed. Non-natives species that have already been plant-

ed on the Refuge will also be considered in this zone, especially in preserving windbreaks or other cultural plantings. Only native species, however, will be planted along riparian areas of the southern zone.

### **Building Demolition**

For the most part, buildings with the greatest historical significance are contaminated or sit on contaminated soil and must be demolished. The U.S Army and the Service has identified those buildings that are not contaminated and have

potential use or interpretive value. Approximately 75 buildings that are not contaminated or have no future use will be demolished (Figure 3.4). These buildings have little cultural/historic significance.

Responsible disposal of material will be in keeping with the land stewardship values promoted by the Refuge.

The buildings currently used by the Service will eventually

be demolished when new facilities are built. Many of these buildings are ill suited for the kinds of future uses required at the Refuge and have prohibitive maintenance costs associated with them.

Grading and revegetation will return the building sites to a condition prescribed in the revegetation plan.

### **Road Demolition**

Road closures will result in the demolition of about 30 miles of existing roads, seven bridges, and ten culverts. Regrading and revegetation will return the roadways to their pre-construction profiles. Some existing roads such as the mainte-



Figure 3.4 Most existing buildings on the Refuge will be demolished.

nance road off 72nd Avenue will be retained. Road demolition will be phased with cleanup operations and the construction of the tram routes.

Materials taken from closed roads may be used as fill in cleanup operations. As roads are demolished and reclaimed, additional habitat will be created on the Refuge.

In the northern zone, in particular, the goal is to remove evidence of roads and other disturbance to the greatest degree possible so that the view can approximate pre-settlement times.

In some parts of the southern zone, the new tram route will correspond to the alignment of the existing, historic grid road network. This will be done to help emphasize and explain the historical use of the land. This will be particularly true when the existing roads have associated with them significant vegetation, such as windbreaks.

### ***Remote Information Facilities***

Informational signage and limited exhibits at locations, including Denver International Airport, will help direct visitors to the Refuge and its facilities. These exhibits will be semi-portable—either in the form of a free-standing kiosk or a wall-mounted display.

Though an “information station” may be accompanied by a Refuge representative, the design should be equally effective without the presence of such staff. To the degree possible, the facility should project an image consistent with the aesthetic of both the Refuge facilities and the specific location of the “information station.”

Materials should reflect a sensitivity to conservation of natural resources and environmental air quality.



**Figure 3.5** Outdoor classrooms, at locations such as the wetland environmental education area, will accommodate groups of up to sixty students.

### ***Outdoor Classroom***

These “living classrooms” will accommodate groups of sixty students at specific Refuge sites (Rattlesnake Hill, Lakes, Wetlands) chosen to best fulfill the goals of the environmental education program (Figure 3.5). These facilities are comprised of 1000-square foot, primitive shelters over a hard surface, with tables and benches to accommodate students. Also included will be 100 square feet of enclosed storage for education materials and moveable furniture. An accessible, porous-surface trail will connect a parking area and restrooms with the shelter.

The outdoor classrooms facilitate education within natural settings. Because the Refuge itself represents the most significant educational resource, the most effective education at the Refuge occurs in the field. Programs will actively engage students in exploring and resolving issues that affect the dynamics of nature.

Classroom structures should project an image and identity of their particular place and purposes. Further, the design and function of the facility

should exemplify conservation and stewardship of natural resources.

### **Temporary, Mobile Environmental Education Facility**

The mobile classroom will be a fully equipped vehicle that can be located temporarily at places on the Refuge where specific management activities provide environmental opportunities. In addition, the vehicle will be able to go off-Refuge to schools. Because restoration and management activities will always be changing over time, the opportunity to have a mobile environmental education and interpretive facility will provide flexibility in responding to these changing situations. Some schools have inadequate facilities for environmental education and the mobile facility will also help with these situations.

When used on the Refuge, the mobile classroom will be accessed by bus or tram. It will include seating for students, storage for educational materials, and a retractable shelter. Both interpretive and environmental education programs will be conducted using the resources of this facility. Students may use the vehicle as a temporary classroom, and will also be supplied from it with equipment necessary to conduct their studies. Examples of when this facility could be useful include areas of habitat restoration that might be particularly interesting to study for a year or two, but not beyond that. Sites of some research projects might similarly be of interest.

### **Road Signage**

Signage is required to direct visitors to the Refuge and to advertise its presence. On-refuge signage is required to control tram, bus, and bicycle traffic. Regulatory signs will be needed to explain the rules and regulations.

Signs will include those at the main entrance, the entrance to the Visitor Learning Center Complex, along the maintenance road, highway signs along Peña Boulevard, I-70, State Highway 2 and 56th Avenue announcing the Refuge to visitors; and roadway traffic control signs and regulatory signs along the tram route and entry road.

Signage on Refuge property will meet the requirements of the Service sign graphics standards. Where permitted, materials will be natural, such as wood and stone, and of a color compatible with the landscape. Highway signs will comply with the Colorado Department of Transportation.

### **Southern Tram Route**

This tram route is a loop through the southern half of the Refuge (Figure 3.6). It starts at the Visitor Learning Center in section 9 and runs by

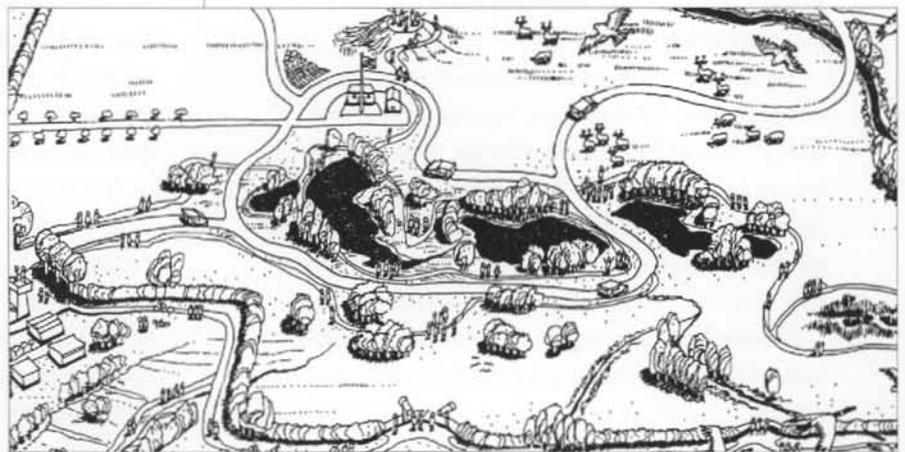


Figure 3.6 The southern tram route provides access from the Visitor Learning Center to lakes and associated trails of the southern half of the Refuge.



Figure 3.7 The tram will be the means by which most visitors reach designations within the Refuge.

all of the main trails and environmental education facilities on the Refuge, encircling the lakes. The tram route is designed to limit vehicular access to the Refuge to trams and buses for public use, and will be the main road for Service vehicles. The tram route will accommodate a bicycle lane, and will allow for spontaneous stops by buses, trams and bicyclists to view wildlife and other things with interpretive potential (Figure 3.7). Tram stops at specific trailheads will allow visitors flexibility in their itineraries.

Regular tram schedules will be combined with special tours and environmental education group visits. Trams will start from the Visitor Learning Center and follow the tram route onto the Refuge to the 5.5 mile-long loop. A gravel loop drive through the Quad area will be used seasonally as part of the tour, and will allow access for students to this environmental education area.

On the Refuge, bicycles will be confined to the wide shoulder along the tram route, and times of access and numbers of cyclists will be controlled. Parking at environmental education trailheads will be for buses with environmental education student groups, and other special groups.

### ***Rattlesnake Hill Environmental Education Area***

From Rattlesnake Hill one can get an expansive overview of the whole Refuge and its context, including the plains, downtown Denver, and the mountains beyond. This small hill is located in section 35 to the north of the Army headquarters. It will be served by the southern tram route via a loop which will drop-off visitors to the south of the hill, or by trail. The trail is part of a larger trail system connected to the lakes.

The hill is a significant resource in its own right, being a remnant of a South Platte River terrace, with the cobble soils supporting unique vegetation.

As designed, this site will present an opportunity for visitors to get an overview of the history, cleanup, and natural resources of the Refuge. Visitors will arrive by tram, bus, or by the connector trail which comes from the lakes to the south. There will be restroom facilities and a place to gather close to the drop-off area, an outdoor classroom, and a trailhead for the trail to the top of Rattlesnake Hill.

The plant nursery, greenhouse, and seed cleaning and storage facility will be located adjacent to the parking area and open to the public and environmental education groups. The maintenance and research facility in this same area will provide opportunities for interpretation and an explanation of their role in the management of the Refuge. The trail to the top of the hill will be used to interpret the history and current activities on the Refuge.

Visitors will have the opportunity to see some of the remnant historical artifacts which were interpreted in the Visitor Learning Center. The panorama of the Refuge allows for the interpretation of the zone management plan adopted by the Service.

### ***Prairie Nursery***

The nursery will be a 10-acre site adjacent to the existing maintenance facility. It will be used for the propagation of prairie plant material for habitat restoration (Figure 3.8). Accessible by the public from the Rattlesnake Hill Trail, it will also serve as an interpretation and environmental education area, where visitors can learn about prairie restoration and environmental cleanup.

Plant material will be carefully collected from prairie remnants with a genotype indigenous to the Refuge. This will help supply the Refuge with ecologically appropriate seed and plants needed for restoration.

Buildings will include approximately 5000 square feet of seed cleaning and storage area, a lathe-house, a 600-square foot headhouse, and a 1440-square foot greenhouse. The seed cleaning and storage area will also accommodate storage of vehicles and other equipment.

Visiting this facility will help visitors understand the care that is required to restore prairie and help emphasize that the Refuge's management activities demonstrate the land and wildlife stewardship which its public programs talk about.



**Figure 3.8** Prairie restoration will be supported by a prairie plant nursery.

### ***Wetlands Trail and Environmental Education Area***

This trail and environmental education area is located in section 7, east of the Highline Canal Lateral. Four wetlands are in section 7. They will be served by a tram/bus drop-off loop off the southern tram route. The area can be reached by foot from the lakes overlook trail via the seasonal wetlands connector trail. The wetlands are artificial, having been created to mitigate for wetland loss as a result of cleanup.

The wetlands are a habitat distinct from most of the rest of the prairie grasslands. Only guided public access will be allowed in the winter months. Some of the wetlands hold water only seasonally, and they all are supplied with supplemental water from the Highline Canal Lateral. They provide habitat for waterfowl and serve as a water source for the wildlife on the Refuge. They also provide an opportunity for students to view wildlife and carry out closeup studies of aquatic invertebrates and littoral and aquatic vegetation. Hands-on, interactive experiences will be emphasized. Overlooks will allow visitors to view waterfowl.

The Highline Canal Lateral is an historic part of the Refuge. In the past it supplied water for agriculture and weapons and chemical production. It is currently used to help maintain both the wetlands and the Refuge's lake levels so that wildlife dependent on the lakes can continue to thrive.

The wetlands site will have a series or loop trails of varying lengths. The trails are accessed from a tram turnaround/drop-off and parking area for one bus and five cars. The trailhead will have signage and two handicap-accessible toilets accessed by a hard surface trail. The trails will likely be of crushed stone. The facilities will accommodate groups of up to sixty students,

divided into groups of ten. There will be a permanent outdoor classroom with seating, tables, storage for teaching materials, and shelter sufficient for sixty students (Figure 3.9). There will be a minimum of three interpretive stops for use by up to ten students, including access to one of the wetlands via a dock, a viewing blind at the high point of the trail and access to the Highline Lateral.

A 2.5 mile-long loop trail of crushed stone will go as far east as a high point west of F Street above the easternmost wetland. A spotting scope will provide enhanced wildlife viewing. Because of the seasonal use of this area by sensitive wildlife, visitors will have to be carefully managed. During some times of the year there will be no unescorted public access. Access to the water's edge should be safe and easy for environmental education activities while reducing impacts on the wetland and wildlife (Figure 3.10).

#### **Perimeter Barrier**

The existing perimeter fence will be set back along the southern, western, and northern boundary as a result of easements and land sales described in the Refuge Act. This provides the opportunity to mitigate the visual impact of the fence. The fence must be capable of preventing the movement of deer off the Refuge and reducing the trespassing and poaching, but still can be

much softer than the current one.

During cleanup, sources of borrow material may be needed. By taking soil from along the perimeter area and using it for fill, swales could

be created which could help to camouflage the perimeter fence. The boundary will be modified in conjunction with an off-refuge boundary trail system which will provide continuous connections for existing and proposed trails. This will include interpretive stops and two overlooks for off-refuge wildlife viewing.

The modified boundary will be less visually intrusive and a friendlier barrier than that which now exists.

The perimeter trail, just outside the fence, will provide a place for activities such as rollerblading, which are incompatible with Refuge purposes. These trails will also provide continuity for the envisioned regional trail systems.

The overlooks and interpretive stops will provide year-round wildlife viewing and are ways of engaging the interest of members of the surrounding community.



**Figure 3.10** Access to the water's edge should be controlled to reduce impacts to wetland wildlife.



**Figure 3.9** An environmental education trail loop includes a permanent outdoor classroom with seating, tables, storage for teaching materials, and shelter sufficient for sixty students.

The interpretive stops and overlooks will maximize viewing wildlife with minimum disturbance by taking advantage of topography, vegetation, and other natural features. The emphasis will be placed on design reflecting stewardship of the land in terms of trail, barrier, and overlook location, materials use, and respect for historical (natural and artificial) artifacts. Construction techniques should minimize disturbance of the land, and materials choice combined with maintenance practices should limit post-construction impacts. Both the natural and artificial elements associated with the barrier and trail have the opportunity to be interpreted.

### Phase II Development

The second phase of development, which will run from the year 2000 to the end of environmental cleanup, will include the Refuge's major facilities. By the end of Phase II, the Service expects to accommodate 90,000-150,000 visitors.

Most of the Refuge's major facilities will be contained within a complex of buildings or a single building in the western zone. This Visitor Learning Center Complex will include the Visitor Learning Center, Environmental Education Center, Environmental Education Laboratory, and Refuge Administrative offices.

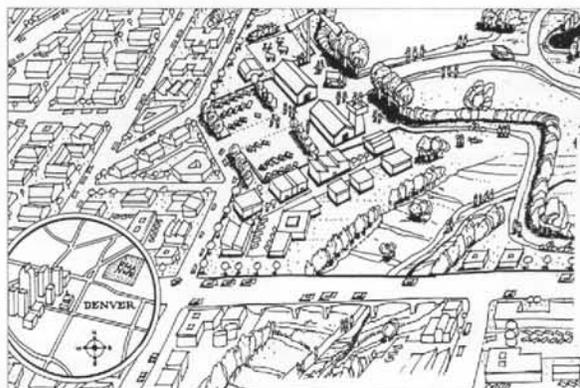
#### **Visitor Learning Center**

The Visitor Learning Center is in the Refuge Gateway, section 9 (Figure 3.11). Visitors will arrive by way of Quebec Street or 56th Avenue by private or public transportation. The center will be adjacent to the perimeter greenbelt trail which will be part of a regional trail system. The center is situated outside the proposed Refuge boundary, and access onto the Refuge from the center will be

by tram, bus, bicycle, or pedestrian trail through a single entry point. It will be in close proximity to the Environmental Education Center, the other main component of the Visitor Learning Center.

The Center forms a direct link between the adjacent community and the Refuge. It will serve as a catalyst for compatible development of other institutions and facilities in the Gateway area. By locating what will become the most visited facility off the Refuge, the impacts on the Refuge habitat and wildlife will be reduced. It is primarily a public facility of 25,000 square feet in size, shared with 19,000 square feet of Refuge administrative space, which includes the public use staff. It will serve as a transfer point for visitors entering the Refuge with adjacent parking for private vehicles. It will house exhibit galleries for interpretive exhibits, a 200 seat theater/auditorium, a multipurpose room, a lunch room, an information desk, and a retail bookstore. Additional amenities such as restrooms, telephones, and vending areas will also be provided.

The Center will orient visitors to both the off-Refuge and on-Refuge public use facilities. The



**Figure 3.11** The Visitor Learning Center, Environmental Education Center, Environmental Education Laboratory, and Refuge Administrative offices will all be part of a complex in the Refuge Gateway, the western zone.

exhibits and bookstore will provide interpretation of the Refuge's history and natural resources (Figure 3.12). In addition, the Center will act as a community resource for meetings and events. It will be the starting point for tram, bicycle, and hiking tours of the Refuge, and as such will act as the gateway into the Refuge. As the entry into the Refuge, user fees will be collected here.

### **Environmental Education Center**

The Environmental Education Center is part of the Visitor Learning Center and will be the main environmental education facility at the Refuge. It will consist of 4,250 square feet of space, including staff offices, a demonstration research laboratory, classrooms, and storage space. For short visits, times when there are unsuitable weather conditions, and when permanent, well-equipped classroom facilities are required, the Environmental Education Center will be used. There will be access from the Environmental Education Center to the Visitor Center to share the multi-purpose room and resource center. The Environmental Education Center also services the outdoor classrooms and the temporary mobile environmental education classroom. Materials and data gathered both at the adjacent Visitor Center environmental education and interpretive area and from the Refuge can be studied here. Students can access the Refuge from the Center by bus or tram.

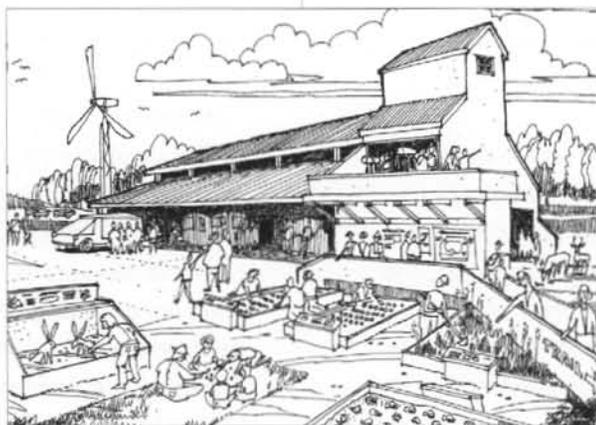


Figure 3.12 The Visitor Learning Center shall provide visitor orientation and visitor interpretation while acting as a community resource for meetings and events.

### **Environmental Education Laboratory**

The Environmental Education Laboratory will be housed within the Environmental Education Center. It will consist of 4,250 square feet of space, including staff spaces, a demonstration research laboratory, classrooms, and storage space. The laboratory is part of the main indoor environmental education facility at the Refuge. It will be used by Service biologists for ongoing research which can be used to demonstrate how wildlife is monitored and studied and thus how the Refuge is managed (Figure 3.13).

Students will be able to observe this work without interrupting the biologists.

### **The Lakes Environmental Education Area**

Lake Mary is at the lower end of the lake system. It is currently in use as the main environmental education area on the Refuge, partly because it is adjacent to the current Visitor Center. It will form the hub of future environ-

mental education and interpretive programs, providing access to a number of loop trails and trails to the Quad and Rattlesnake Hill environmental education areas (Figure 3.14). It can be reached either from the Visitor Learning Center by the connector trail via Officers Row, or from stops on the southern tram route. Being the least polluted of the lakes, it can be used for the study of aquatic habitat, wildlife, and fishing. Revegetation plots and a planned introduced prairie dog village will offer examples of components of the prairie ecosystem.



**Figure 3.13** The Environmental Education Center will provide facilities for environmental education programs and will complement the remote education areas.

One of the few remaining intact homesteads still stands in the area, which, in combination with the lakes built to store irrigation water, can be used to illustrate the Refuge's agrarian past. The Lakes environmental education area is also a departure point for the catch-and-release fishing program at Lakes Ladora and Lower Derby. The lakes also played an important role in weapons and chemical production, and the subsequent pollution is the consequence of that past. The area is already used for environmental education and has a number of trails which will require some augmentation for long-term use. An amphitheater and boardwalk are recent additions to the area.

There will be an outdoor classroom with a storage area for environmental education materials, seating and shelter. Restrooms will be located close to the tram stop. Programs will include study of aquatic habitat and wildlife, fishing, prairie plant species, prairie dog ecosystem, agricultural and industrial/weapons production history, and water issues on the Refuge.

### ***Administrative Offices***

The facilities for the Refuge management staff will be located in close proximity to the Visitor Learning Center. Staff offices, conference rooms, a resource center, a volunteer's center, and reception and lobby areas, including space for traveling exhibits will require about 12,000 feet of space. Support facilities shall include workroom, communications room, locker rooms, restrooms and showers, storage, and access to a shared lunchroom (see Visitor Learning Center). Mechanical, electrical, and telecommunication spaces will be included.

### ***Research Facility***

The main Refuge research facility will be located in the existing Army facility in the Building 111 complex in section 35. An on-site research laboratory is required at the Refuge because of the need for on-going bio-monitoring and additional wildlife research. Sharing an existing facility with the Army is a convenient solution to this need.

In addition, it will be possible for environmental education groups to see on-going research on the Refuge. The research laboratory can be used as a demonstration of some of the management activities needed to run the Refuge. This includes demonstrating the need for bio-monitoring associated with Refuge contamination, and wildlife population health and dynamics.



**Figure 3.14** The Lakes Area will provide access to a number of loop trails.

### **Visitor Learning Center Trail and Environmental Education Area**

This trail leaves the Visitor Learning and Environmental Education Center and winds through the demonstration and display facilities. The trail is off-Refuge in section 9, part of the Gateway development. This area will be the most heavily used outdoor facility associated with the Refuge. It is appropriate that it will be located outside the new Refuge boundary where potential negative impacts on the Refuge's resources are avoided. Major events will be held here, and activities determined to be incompatible with the Refuge, such as picnicking, can occur in this area.

Short-term visitors will be able to gain an insight into the nature of the Refuge in this education area, without having to take a tram or trail onto the Refuge. Students will be able to participate in hands-on environmental educational experiences, using the Environmental Education Center as the base for their activities. The public will be able to observe environmental education in action. The Visitor Learning Center facilities and the infrastructure which supports them will be interpreted. These facilities will illustrate the main tenets of the Refuge messages, demonstrating how careful planning can minimize the impact of development on the land and thus on wildlife (Figure 3.15). These facilities may incorporate alternative energy sources, a wetland wastewater



Figure 3.15 Where possible, topography and vegetation will be used to shield viewers from wildlife. In some cases, structures will be built.

treatment plant, backyard habitat demonstration areas and a recycling center.

### **Visitor Center Connector Trail**

The accessible trail takes visitors by foot from the Visitor Learning Center through the Refuge entrance to the Officers' Row Trail. This provides an alternative to the tram as a means of accessing

the Refuge. At the Visitor Learning Center, a trailhead will provide information regarding the Refuge. The trail will offer wildlife viewing opportunities and will include interpretive signs. The length of the trail will be determined by the final location of the Visitor Learning Center in the western Zone, but the trail from the Refuge boundary to Officers' Row will be

approximately one mile in length. The trail will be eight feet wide crushed stone. Visitors using the trail can leave the Refuge the same way, or catch a tram.

Some visitors may wish to access the Refuge by foot, and the trail will allow greater freedom than the tram schedule. The visual experience of the Refuge landscape and its wildlife and supporting facilities should have an attraction component that entices people to visit and return several times. The visitor will walk from the artificial landscape in the western zone into the more natural landscape of the Refuge. The trail and associated facilities should be visually compatible with the land-

scape. The trail should provide short, long, enclosed, and open views.

### **Entry Road**

The 1.5 mile-long entry road connects the Visitor Learning Center with the southern tram route. The road is predominantly off-Refuge



Figure 3.16 The entry road will travel through the open landscape of the western zone.

(Figure 3.16) and will be an 18-foot wide asphalt curbsless road, with a four-foot wide attached asphalt bike path. The road will predominantly be used by the Refuge tram, school buses, and Service vehicles. The road will be connected to the public road system adjacent to the Visitor Learning Center but will not be accessible by private vehicles. There will be a turnaround with bus parking at the Visitor Learning Center. At the Refuge boundary, there will be a gateway and a cattle-guard which can be locked in the evenings. The nature of the road will be in keeping with the on-Refuge tram route to act as a precursor to the Refuge proper.

With the new Visitor Learning Center planned off-Refuge, there is a need for a connector road to provide access to the internal tram routes, both for visitor access and for the Service personnel.

The visual experience of the Refuge landscape and its wildlife and supporting facilities should have an attraction component that entices people to visit and return several times. The entry road should be visually compatible with the landscape (Figure 3.17) and while off-Refuge create an appropriate experiential introduction to the Refuge. The road should provide short, long, enclosed and open views.

### **Visitor Learning Center Parking**

The parking lots will be adjacent to the environmental education and Visitor Learning Center. The lots will include a drop off area for cars and buses. The main lot will be hard surfaced and will have parking spaces for 125 cars, 10 recreational vehicles, and four buses. When fully developed, the lot will have parking spaces for 550 cars, 20 recreational vehicles and eight buses. Special events overflow parking on a grassy area needs to accommodate additional traffic of between 720 cars for current, and 2,500 cars for fully developed conditions. The lots will conform to Americans with Disabilities Act (ADA) requirements. Paved sidewalks will connect the lot with the arrival plaza at the Visitor Learning Center.

Attendance figures for the Refuge when fully developed anticipate peak weekend visitation of 1,130 vehicles with special events days drawing up to 6,325 vehicles. Current attendance sees 250 and 1,690 vehicles respectively. This requires a range of parking lot size for non-special event traffic of between one for the current usage, and an additional five acres for the fully developed Refuge. Overflow traffic for special events would have to be in the range of six acres for the current usage, an additional 20 acres for the fully developed Refuge.

The visual experience of the Refuge landscape and its wildlife and supporting facilities should have an attraction component that entices people to visit and return several times. The entry road should be visually compatible with the landscape and while off-Refuge create an appropriate experiential introduction to the Refuge. The road should provide short, long, enclosed, and open views.

#### **Events Area**

Adjacent to the Visitor Learning Center, the Events area can only be accessed through the Center. The Events Area is designed to accommodate large numbers of people for special events. This concentration of people will not assemble on the Refuge, and will be dispersed by the time they enter the Refuge, thus reducing their impact on the Refuge's habitat and wildlife. Events such as bald eagle and prairie days will see large numbers of people visiting the Refuge. The events area will consist of a partially covered outdoor amphitheater with seating for 50 people and a grass area for an additional 100 people. Large groups participating in environmental education programs will be able to use this as an outdoor classroom, and will have access to the adjacent outdoor environmental education area.

#### **Officers Row Trail**

Officers Row Trail loops through what was once U.S. Army officers housing at the Arsenal. Formal rows of trees survive here which were planted by the Army.

The trail will be connected to both to the Visitor Learning Center Connector Trail and the lakes environmental education area. It will be a six-foot wide crushed stone, universally accessible trail.

Existing woody vegetation will provide a shady place for visitors and school groups of up to sixty children. The trail emerges from the vegetation at the west end of the loop and provides views of Denver and the Front Range and across Irondale Gulch. School groups will start at the outdoor classroom at the Lakes Area, which will provide toilet and classroom storage facilities. There will be two interpretive stops along the trail.

Officers Row Trail offers opportunities for teaching why much of the exotic woody vegetation on the Refuge exists today. It helps illustrate aspects of the Refuge's recent history and provides opportunities for teaching about complex water and drainage issues.

The trees provide habitat for a range of wildlife and a nearby prairie dog town is a convenient demonstration of a major part of the Refuge's ecosystem. The trail is part of a complex of trails associated with the Lakes Area and allows for absorption of a large number of visitors and school groups in this area.

#### **Building 111 Connector Trail**

This trail already exists as a six-foot wide crushed stone path connecting the existing Visitor Center with Building 111. It includes an internal loop and bridge over the Sand Creek Lateral. A trailhead at both ends and interpretive signs will be added. An existing homestead at the trailhead could be interpreted as part of the Refuge's history.

The existing trail should be augmented with signage for the unfamiliar visitor. The most intact example of a remaining homestead on the Refuge is along the trail and should be interpreted.

### **Lake Overlook Trail**

This trail consists of both a year-round and a seasonal trail. The year-round trail loops to the north of Lakes Ladora and Lower Derby on a bench above the lakes (3.17). The seasonally open loop follows the Sand Creek Lateral below the bench close to the northern edge of Lake Ladora and returns to join the year round trail. To the north of the trails is South Plants, to the south are the lakes and drainageway with their aquatic and littoral environments. A spotting scope pro-

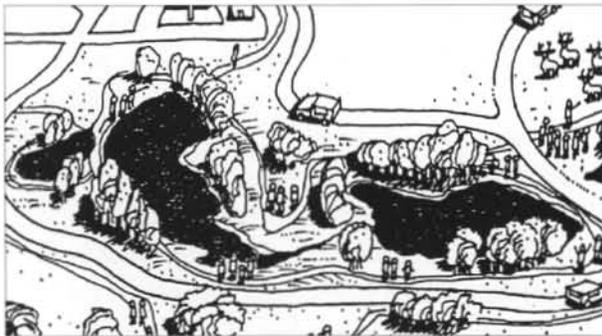


Figure 3.17 The Lake Overlook Trail loops to the north of Lakes Ladora and Lower Derby on a bench above the lakes.

vides enhanced wildlife viewing at a high point on the bench, and seating along the trail provide areas for more prolonged contemplation.

The trail above Lake Ladora will be used to teach visitors about shore birds, water fowl and bald eagles. The history of the Refuge, both agricultural and industrial, can be illustrated in this location.

### **Quad Connector Trail**

The Quad Connector Trail is an extension of the existing trail which connects Lake Mary with the existing anglers' toilets. The trail is currently an accessible six-foot wide crushed stone path, with interpretive signs along its length. It will only be

open seasonally and may be gated to control visitors. A new spur out onto the point at Lake Ladora in combination with a blind will provide visitors with the opportunity to watch shore birds and waterfowl (Figure 3.14). It will also be designed as an access point for wading anglers. To the south of the anglers' toilets, the trail will continue to connect with the Quad Trail.

This trail is nearly complete but will be supplemented to enhance current wildlife viewing opportunities, reduce bank erosion by anglers, and connect with a larger trail system and with the anglers' toilets.

The visitor will walk adjacent to a lake dominated landscape. The trail and associated facilities should be visually compatible with the landscape. The trail should provide short, long, enclosed and open views.

### **Quad Trail and Environmental Education/ Interpretation Area**

The Quad is located in section 11, to the south of the lakes. It will be accessed by bus or tram off the southern tram route. A stabilized gravel loop road will provide access along existing track alignments. A turnaround will allow students to disembark. Access by foot can be achieved via the Quad connector trail from the south side of Lake Ladora. Old aerial photographs show this area to have had a particularly high density of homesteads. These have resulted in the remnant tracks, rows of cottonwood and poplar trees and the colonies of New Mexico locust thickets which make this area rich in wildlife - particularly deer who prefer the vegetative cover during over the open grasslands on hot summer days.

The Rod and Gun Club Pond to the east can be overlooked from a loop trail. This pond is only seasonally inundated, but is wet for most of the

year. The combination of fragments of cultural landscape with the rich wildlife make this a valuable educational resource. The area is already used for environmental education and has a number of tracks and trails which will require little augmenting for long-term use. The area will only be available for seasonal use, with access by the public and environmental education groups confined to the spring, summer, and autumn months. The trail system will be able to accommodate up to forty students at one time, broken out into groups of ten or fewer. Studies will include an understanding of settler history, wildlife, and vegetation. There will also be opportunities to better understand the role of the Service in the management of the Refuge habitat and wildlife.

#### ***Wetlands Connector Trail***

This 1.5-mile long trail is a seasonal connection from the Lake Overlook Trail with the Wetlands Trail following the northern edge of Lower and Upper Derby Lakes. The six-foot wide crushed stone trail crosses two drainage ditches. Because of the vegetative cover, and proximity to wetlands and the lakes, this trail provides high quality wildlife viewing opportunities. Low public use combined with interpretive signs and blinds along the trail offer the greatest opportunity to appreciate wildlife.

This connector trail provides visitors with the opportunity to take extensive hikes through some of the most varied habitat on the Refuge, including historic landscapes, lakelands, and mitigation wetlands.

#### ***Eagle Watch Trail***

The existing Eagle Watch facility consists of a gravel parking area, a hard surface trail to a large blind with spotting scopes, and remote cam-

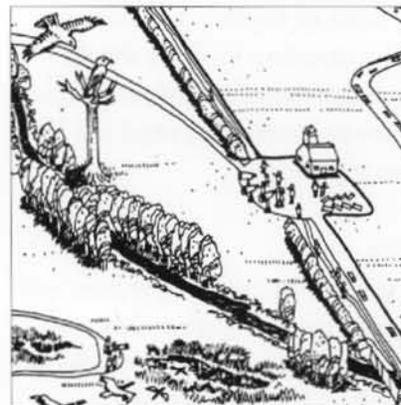
eras for eagle viewing (Figure 3.16). The trail should be expanded to include part of the prairie dog community, and will be a hard-surfaced, six-foot wide trail to accommodate heavy visitor use and snow plowing operations. The barn on the east side of Buckley Road has the potential to be an interpretive area.

The bald eagle is at one end of a complex food web with the prairie dog being the highest profile "engine" which drives that ecosystem. As part of the interpretation of the bald eagle, the expansion of the trail system into the prairie dog communities will offer opportunities to interpret prairie dog habitat, communities and management.

#### ***Eagle Watch Visitor Parking***

The parking lot at the Eagle Watch will be expanded to accommodate fifty cars, three recreational vehicles, and two buses (Figure 3.18). The lot will include a turnaround and drop-off and all vehicular surfaces will be gravel. The lots will conform to ADA requirements. A gate which can be used seasonally will be located at Buckley Road off 56th Avenue.

With the anticipated increase in visitation at the Refuge and the development of a spur off the northern tram loop there will be a need for enlarging the existing parking lot



**Figure 3.18** The existing Eagle Watch facility consists of a gravel parking area, a hard surface trail to a large blind with spotting scopes, and remote cameras for eagle viewing.

and providing a tram/bus turnaround. The gate at Buckley Road will provide visitors with only seasonal access to the Eagle Watch.

The lot will be oriented to avoid interrupting the visual and physical connection out over the Refuge. The design will minimize the lots' scale and plantings will break up the mass of hard surfaces and vehicles.

Stormwater runoff will be handled as surface drainage and allowed to infiltrate into the surrounding landscape. The design will accommodate trams and buses from the tram route and off of Buckley Road and the perimeter trail.

### **Quad Loop Road**

An existing two-track road will be upgraded to a stabilized gravel road to accommodate trams and buses for access by tours and school groups.

The Quad is an important seasonal environmental education area, and a special landscape which can be appreciated as part of the tram tour.

The visual experience of the Refuge landscape and its wildlife and supporting facilities should have an attraction component that entices people to visit and return several times. The road will follow the existing two track road.

### **Utility Distribution**

New electrical, gas, sewer, and phone lines will be run underground to the new Visitor Center, administration and environmental education facilities. These utilities will be part of the Commerce

City system. With current preliminary location information for these facilities, the lines will need to be approximately 0.5 miles long. All stormwater runoff on-site will be detained to maintain historic flows off-site. No additional stormwater drainage systems will be necessary.

New facilities require new utilities. Existing

Refuge utility systems will be maintained by the Army for their own requirements, but are more remote from the proposed new facilities than are city utilities.

Where possible, self-sustaining utility systems will be installed, such as supplementary use of solar power, wind power, and wetland wastewater treatment.

Long-term cost benefits will determine appropri-

ateness. Conventional utilities will be buried.

Alternative systems will be designed to be interpreted as part of the Refuge. All utility installations will be designed to meet or exceed appropriate engineering standards.

### **Perimeter Greenbelt Trail**

The perimeter trail follows the Refuge boundary with the exception of where it crosses the Stapleton redevelopment and passes by the Visitor Learning Center at the Refuge Gateway. It can be accessed anywhere along its route, particularly at the two overlooks where limited parking is available and from regional trails which connect to it. It can also be accessed by people using the parking lot at the Visitor Learning Center. The perime-

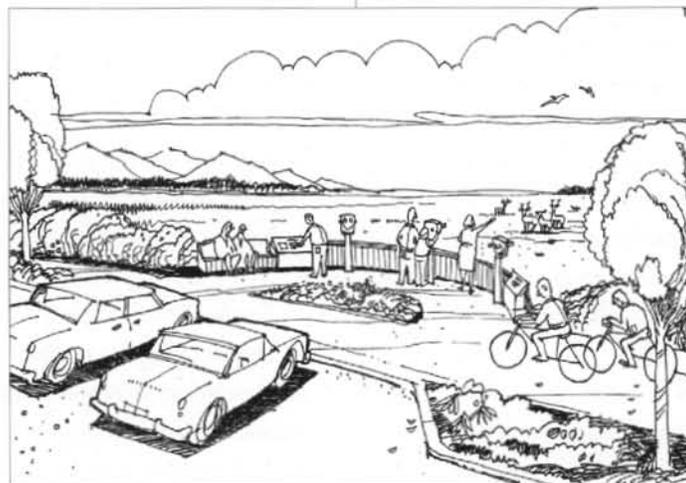


Figure 3.19 Overlooks and interpretive stops provide visual access to the Refuge without diurnal and seasonal restrictions.

ter trail is an opportunity to allow the public visual access to the Refuge while minimizing disturbance to wildlife and habitat. The trail permits the continuation of regional trails without them crossing the Refuge.

The trail accommodates activities which are not compatible with the Refuge management objectives, such as rollerblading, jogging, and walking with dogs, to occur close to the Refuge. As adjacent activities permit, the perimeter fence can be moved, its visual impact lessened, and interpretive opportunities taken to help to knit the Refuge with its neighbors. The hard surfaced trail will be 25-miles long, and eight-feet wide. It will be multi-purpose for use by human powered wheeled vehicles, joggers, and walkers. The perimeter trail will connect to and act as a continuation of a regional trail system. An overlook and one viewing area are planned along the southern boundary (Figure 3.19). A second overlook is located at Henderson Hill. All of these areas will include interpretive signage, and the overlooks will have some parking. Seasonal access can be gained to the Eagle Watch off the perimeter trail. Visitors can use the trail to reach the Visitor Learning Center.

### ***Bald Eagle Shallows***

With the opening of Denver International Airport, there has been increased residential and commercial development adjacent to the Refuge. With the additional impervious surfaces of such development (e.g., streets and parking lots), stormwater runoff will increase the frequency and volume of flows onto the Refuge will rise. (This is particularly important on First Creek because increased flows could contribute to headcutting and further destabilize the cottonwoods that serve as bald eagle roosts.)

In anticipation of these flows, Bald Eagle Shallows along First Creek would be enlarged and a new outlet structure will be installed as part of a basin-wide stormwater detention plan.

Special care will be taken in enlarging the pond to minimize destruction of adjacent sandhills prairie.

### **Phase III**

The final phase of Refuge development will extend from the end of cleanup on. By the end of Phase III, the Refuge could accommodate up to 360,000 visitors with its projected staff and programs.

### ***First Creek Restoration***

Restoration will return the creek to its historic channel geometry and length with minimal habitat disturbance (Figures 3.20, 3.21). In the short term, headcutting and channel entrenchment will be curtailed. The eagle roost area will be maintained as it currently exists. Appropriate vegetation communities will be planted to enhance the creek elsewhere. Historic wetlands will be restored along the creek channel. In the northern zone, in particular, the aim will be to create as nearly self-sustaining plant communities as possible.

Channel stabilization is required particularly around eagle roost trees. Returning the channel to its old alignment and reinstating historic wetlands will improve habitat value and reduce downstream flooding risks.

Disturbance of existing habitats and wildlife will be minimized geographically and temporally. Techniques will be employed to ensure that the new stream alignment and wetlands will be self-sustaining and part of a dynamic riparian system



Figure 3.20 First Creek's historic channel geometry and length will be restored.

### ***Northern Tram Route***

This tram route loops through the northern half of the Refuge. It forms the upper half of a figure eight above the southern tram route. A spur will serve the Eagle Watch on the eastern boundary of the Refuge. The tram route is designed to limit vehicular access to the Refuge to trams and buses for public use, and will be the main road for service vehicles. The tram route is designed to allow for spontaneous stops to view wildlife and other things of interpretive potential. Regular tram schedules will be combined with special tours and environmental education group visits. Visitors will start from the Visitor Learning Center and reach the northern tram route via the southern loop. The nine-mile long northern route will also provide internal access to the seasonal Eagle Watch. The route passes through the cleanup and prairie restoration zone. The landscape and its history and wildlife will be interpreted by a guide on the tram. The tram route will act as the main access road for Service vehicles.

### ***Maintenance Facility***

Most Refuge maintenance activities will be supported by the existing Army maintenance facility,

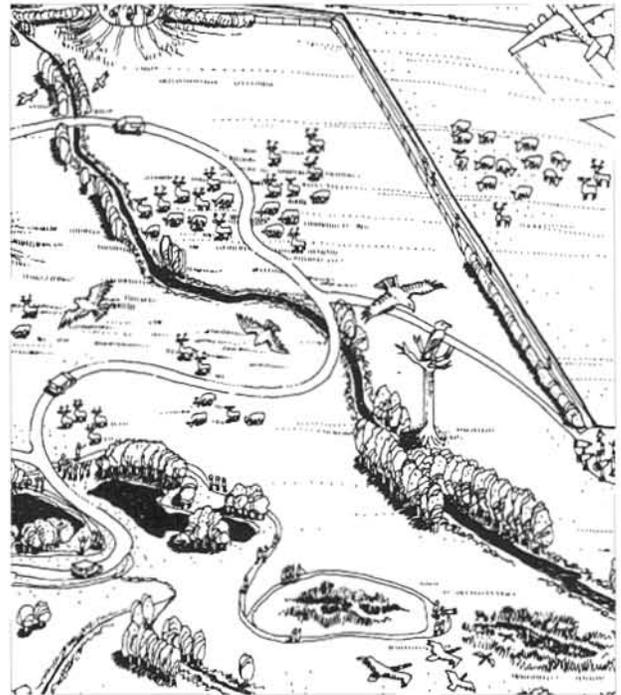


Figure 3.21 The large cottonwood trees growing along First Creek provide winter roost for bald eagles.

where there are offices, lockers, showers, restrooms, vehicle repair equipment, and some storage for parts and vehicles. Additional maintenance facilities will be required to support the Refuge.

### ***Internal Perimeter road***

An eight-foot wide, class-five gravel maintenance road will be built along the internal boundary of the Refuge. This road will provide maintenance access for the entire perimeter of the Refuge. The road will be carefully routed to avoid sensitive habitat.

Small bridges will be needed for crossing creeks and canals. The design of culverts, bridges, and "Texas Crossings" will be in keeping with Refuge design guidelines.

### **Picnic Area**

The picnic area is accessible from the Visitor Learning Center. An open area paved with crushed stone will contain twelve picnic tables and benches and three trash receptacles. Here, off-Refuge, both school groups on extended field trips and the general public will have a place to eat snacks and lunches.

The picnic area will be visually compatible with the landscape. It will be oriented to take in views of the contextual landscape of the Refuge and provide shade and shelter from the wind.

### **Species Reintroduction**

In the public meetings interest was expressed in reintroducing wildlife species that historically have been associated with prairie grassland communities but are now missing from the Refuge. A variety of candidate species were identified for reintroduction. The Service will consider four species for reintroduction: bison, pronghorn antelope, prairie chicken, and plains sharp-tailed grouse. These species will contribute to the identity of the Refuge, and assist in maintaining the grassland community structure. Each of these species is discussed briefly here.

Before any reintroductions occur, a reintroduction plan for each species will be developed which includes:

- A feasibility study,
- Translocation procedures, and
- A post-release monitoring program.

The Service has completed preliminary feasibility studies for the bison, plains sharp-tailed grouse and pronghorn antelope (U.S. Fish and Wildlife Service 1995). Studies for the greater prairie chicken have not yet been completed.

Species reintroductions will occur only after cleanup is complete, and probably after portions of the grasslands have been restored. Reintroductions will be based on biological conditions, public interest, available habitat, and funding. Ultimately, reintroduction will be the decision of the Refuge Manager. Necessary environmental analysis will be completed when appropriate.

### **Bison**

A small herd of bison may be reintroduced in the northern zone. Bison would be instrumental in educating Refuge visitors about the relationships within prairie grassland communities (Figure 3.22). The Refuge could sustain a herd of 50 to 100 animals. Bison would not be introduced until sufficient acreage of suitable grassland habitat is established. The herd would be managed in a shifting grazing pattern over about 14 square miles of the northern zone. Periodic removal of older males would be necessary to control herd size. A primary management consideration would be maintaining the adequacy of the exterior fence to contain the bison. Additional exterior and interior fencing may be necessary to control bison



**Figure 3.22** Bison may be reintroduced to the Refuge in small numbers once environmental cleanup is complete.

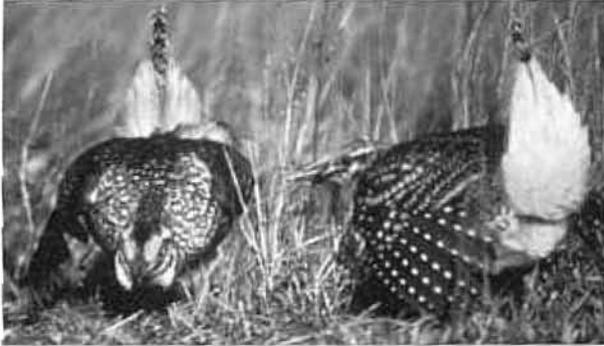


Figure 3.23 Also being considered for reintroduction are Plains Sharp-tailed grouse (shown here) and greater prairie chicken.

movement. Permanent watering facilities will be established.

#### ***Pronghorn Antelope***

Pronghorn antelope could be reintroduced throughout the Refuge. The Refuge could support a herd of 15 to 30 animals. Management concerns include population control and biological diversity. Fencing and cattle guards may be necessary to control distribution. Some culling, either through hunting or other means, may be necessary to control the antelope population.

#### ***Plains Sharp-tailed Grouse and Greater Prairie Chicken***

The other two species under consideration, the plains sharp-tailed grouse and greater prairie chicken, are less familiar to the public (Figure 3.23). The two species are similar. The males of both species have elaborate mating rituals in the spring to attract females and establish dominance.

The plains sharp-tailed grouse's historical habitat was a mixed shrub-grassland along the foothills and riparian areas throughout northeastern Colorado. The conversion of native grassland to cropland, livestock grazing, suburban development, and wildfire suppression have reduced its original range. Historically, the greater prairie chicken was less prevalent in the region. Its habitat consists of sand sage, and sand sage-bluestem grassland. Establishment of the plains sharp-tailed grouse and greater prairie chicken on the Refuge is contingent on restoration of suitable stands of native mixed grass, sand-sage and shortgrass prairies. Both these species will be considered for reintroduction after cleanup is complete and revegetation efforts are underway.

