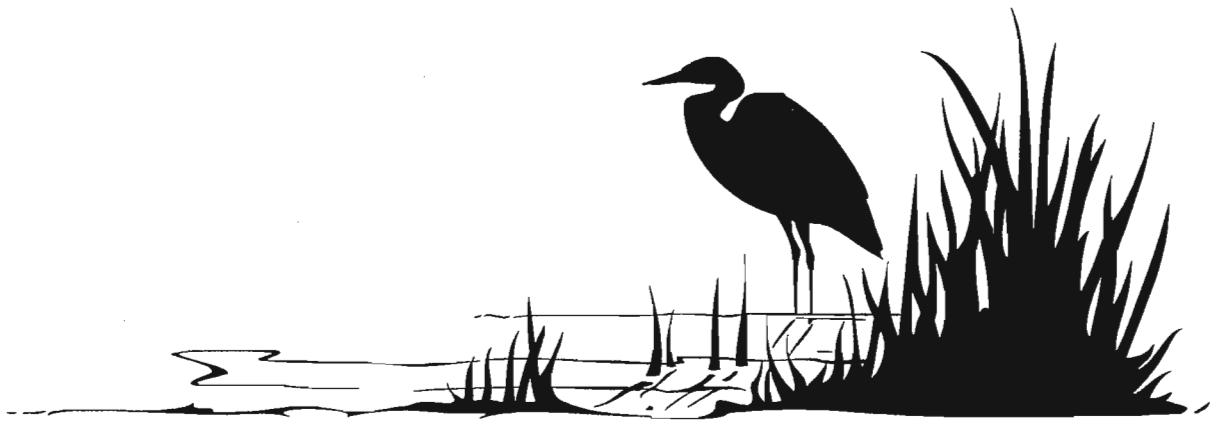

SOUTH BOULDER CREEK AREA MANAGEMENT PLAN

October 28, 1998

City of Boulder
Open Space/Real Estate Department
P.O. Box 791
Boulder, Colorado 80306
(303) 441-3440
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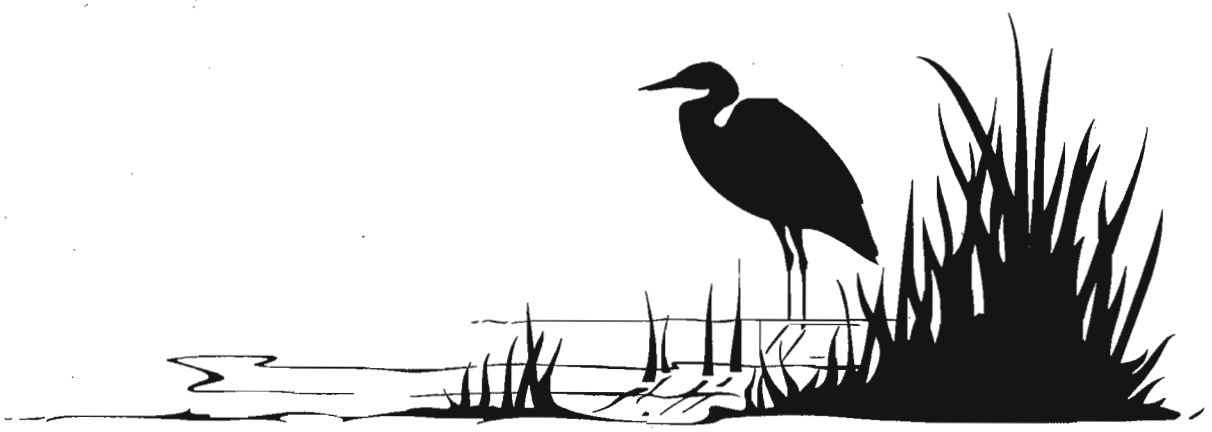

SOUTH BOULDER CREEK MANAGEMENT AREA INVENTORY REPORT

November 12, 1997

City of Boulder
Open Space/Real Estate Department
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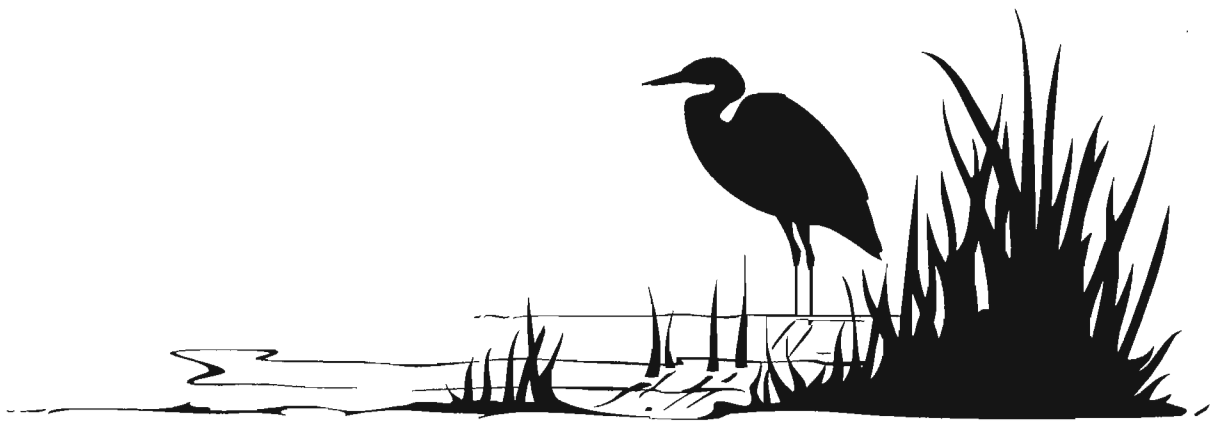

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SOUTH BOULDER CREEK INVENTORY REPORT EXECUTIVE SUMMARY

An interdisciplinary team of Open Space staff was formed during 1997 to develop a management plan for the City of Boulder Open Space lands in the South Boulder Creek Management Area. The purpose of the plan is to provide specific management direction for the natural, cultural, agricultural, and passive recreational resources, to resolve potential conflicts between management goals, and to ensure effective public participation. The South Boulder Creek Management Area is one of seven distinct areas delineated for area management planning; area delineation was based primarily on size, watershed, location, and land uses.

The *South Boulder Creek Inventory Report* will be used to integrate various resource needs with management issues in the area. Implementation techniques designed to address long-term passive recreation and natural resource management will be evaluated. The public and Open Space Board of Trustees will review the *South Boulder Creek Inventory Report* and provide recommendations for developing the South Boulder Creek Area Management Plan. A variety of opportunities for public participation in providing information and recommendations for the plan and reviewing the proposed management actions for the Management Area will exist: open houses; meetings with neighbors, interest groups and interested people; field trips; and formal public meetings.

SUMMARY OF INVENTORY REPORT

Geology

The geology of the South Boulder Creek Management Area is influenced by the subsurface uplifts visible to the west, layering of materials from ancient seas, and more recent water and wind erosion. This recent erosion is the driving force shaping the present landscape and waterways. Uplifting exposed the coal mined in the southern end of the area. Protection of fragile paleontological resources may pose conflicts for other land uses and is the principal management issue.

Water

The South Boulder Creek Management Area contains parts of several watersheds along with numerous agricultural irrigation ditches, several man-made lakes, and a natural lake. Flowing through the Management Area are Boulder Creek, South Boulder Creek, Dry Creek, and Fourmile Canyon Creek. Water flowing through these creeks is diverted into twenty-one ditch and irrigation laterals that serve water to Open Space properties in the Management Area. Management issues include water rights, low stream flows, agricultural use, and water associated plants and animals.

Soils

Most soils in the South Boulder Creek Management Area are a result of deposition. Much of the bottomlands are fertile. Area soils support a variety of land uses, including agricultural croplands, forage production, livestock grazing lands, and passive recreational uses. These soils sustain a variety of native grasslands, shrublands, wetlands, and forests, providing important habitats for native plants and animals. Minimizing soil erosion, placement of trails, and preservation of native plants are the primary management issues in the Management Area.

Vegetation

Vegetation in the South Boulder Creek Management Area consists of a complex mosaic of plant communities and agricultural fields. Six different ecosystems or major plant communities are found in the Management Area: scarp woodlands, shrublands, grasslands, riparian or stream vegetation, wet meadows, and agricultural lands. Two rare plants are found in the moist bottomlands. The Ute ladies'-tresses orchid, is found on the edges of wet areas sustained by creeks and irrigation and the toothcup grows in seasonally moist areas.

The ecological condition of the ecosystems and vegetation types varies, influenced significantly by past and present land uses. Residential, road, and trail development bisect and influence vegetation. Infestations of non-native plants are common. The primary exotic species of special concern in the Management Area are Canada thistle, purple loosestrife, diffuse knapweed, Russian olive, cheatgrass, and musk thistle. Tallgrass prairies are considered some of the best examples of this endangered ecosystem in Colorado. Shortgrass prairie patches and plains cottonwood riparian forest communities are also found in the planning area. Maintaining healthy native plant and animal communities and managing rare plants, weeds, agriculture, and prescribed fire are major management issues.

Wetlands

Wetlands cover approximately 18% of the Open Space within the South Boulder Creek Management Area and 9% of the Management Area itself. These values exceed the ratio of wetlands for the entire Open Space system (4.9%) and for the Boulder Valley Comprehensive Planning Area (6%). Four perennial streams, lakes, and extensive irrigation support the wetlands. South Boulder Creek is the best remaining example of a floodplain wetland area in the Boulder Valley that retains minimal natural functions.

Sixty-one wetlands cover approximately 667 acres of Open Space. Over half of the wetland area on Open Space is found in fourteen wetlands of 10 acres or more. A single gravel pond complex along Boulder Creek accounts for 10% of the wetlands in the Management Area. The majority of the wetlands in the Management Area are naturally occurring, although many of the wetlands are artificial and dependent upon irrigation systems. Management issues include maintaining and restoring wetlands in balance with recreational development and agricultural use.

Wildlife

The South Boulder Creek Management Area is uniquely diverse in comparison to the other six Open Space management areas due to the extensive amount of available water. Creeks, reservoirs, lakes, small ponds, and extensive irrigation ditches provide wildlife breeding and foraging habitats. The dominant habitat types are grasslands and riparian areas. These areas provide critical habitat for sensitive species. Ground-nesting birds, such as the bobolink, rely on the grasslands for breeding grounds for their young. The Management Area has the most concentrated population of Preble's meadow jumping mice in Boulder County. This mouse was recently proposed for listing as endangered under the Endangered Species Act. The Management Area is home to two fish species of special concern: the orange-spotted sunfish and the plains topminnow. Records for this Management Area reveal the presence of sixty-two species of state or federal concern: two fish species, fifty-four bird species, and six mammal species. In addition to these more sensitive species, nearly 240 vertebrate species have been documented in the Management Area out of the 383 expected. The complexity of the area and the fragmented habitat make balancing the needs of rare species, ecosystems, agriculture, and recreation a challenge.

Cultural Resources

Cultural resources from the South Boulder Creek Management Area show the extensive agricultural and mining heritage of the area. Cultural resource themes represented in the Management Area include: (1) aboriginal pre-EuroAmerican history, (2) agriculture, (3) water and irrigation systems, (4) coal mining and oil extraction, and (5) transportation.

Fitfy-six cultural resource sites and eleven isolated finds have been documented in the Management Area. Cultural resource sites include agricultural ditches, farm complexes, a mining office, and several ruins. The irrigation ditches date to 1860, and coal mining began during the same time, shortly after the start of the Colorado gold rush. Interpreting, protecting, and preserving significant and fragile archeological and historical resources are major management challenges.

Property and Real Estate

The South Boulder Creek Management Area encompasses 3,502 acres of Open Space, about 14% of Open Space land ownership. Ninety-six different Open Space properties are included in the Management Area. Most properties are owned in fee. Several properties have conservation easements owned by the City. Conservation easements usually mean that the seller retains some use and management rights associated with the property. Development of lands adjacent to Open Space results in several management concerns: designated access to Open Space, encroachment on Open Space, impacts on native animals and plants and their habitats, and increased demands for recreational opportunities.

Facilities

Several Open Space properties have houses, barns, or other facilities on them. The Open Space Program has constructed other facilities for land management purposes, primarily for passive

recreational use. Existing facilities in the South Boulder Creek Management Area include the Open Space Operations Center, a horse barn and arena, loafing sheds, a house, barns, and associated outbuildings. Some of these facilities are currently not in use. Each facility needs to be evaluated for its potential Open Space use.

Agriculture

Agricultural practices in the South Boulder Creek Management Area include cattle grazing, horse boarding, and harvesting of irrigated crops (forage and grains). Agricultural lands in the Management Area are some of the most fertile in the Boulder Valley. The Management Area contains 196 acres of nationally significant land, 1,117 acres of state significant land, and 117 acres of locally significant agricultural land. There are 1,515 acres of irrigated pasture (predominately hay/forage crops), 1,041 acres of transitional land (suitable for, but not used for, agriculture), and 895 acres of range (native grasslands). Five lessees lease 2,460 acres of agricultural property within the Management Area; they irrigate 1,531 acres--43% of the Management Area. The principal agricultural management issue is the sustainability of agricultural operations in the future with growing demands for competing land uses.

Passive Recreation

More than 720,000 visits occur annually in the South Boulder Creek Management Area. Jogging, hiking, bicycling, and dog walking were the principal passive recreational activities in the Management Area. Four designated trailheads (Bobolink, Dry Creek, Cherryvale, Cottonwood) are located in the Management Area. Approximately 6 miles of designated trails exist in the Management Area. All of the trails are open to hikers, runners, walkers, and horseback riders. The South Boulder Creek Trail (Bobolink Trailhead) is the busiest trail in the Management Area. There are also four miles of paved Greenways trails in the Management Area controlled and maintained by the City of Boulder Greenways Program.

An extensive network of undesignated trails is developing in the Management Area. Undesignated trails develop from informal use and result in unnecessary impacts to soils, fragmentation of plant and animal communities, and creation of corridors for the invasion of non-native species. Undesignated trails have developed primarily on more recently acquired Open Space where no designated trails or access points have been established. Encouraging use of designated trails and evaluating and reducing the impacts of off-trail use by eliminating undesignated trails are major management needs for the area.

Education and Outreach

Traditional "nature walks," interpretive programs, and volunteer projects, including trail maintenance and trash pickup, are conducted annually in the South Boulder Creek Management Area. Public outreach and participation are important components of the area management planning and monitoring of management actions; these components will be a focus of the education and outreach effort.

1. INTRODUCTION

The South Boulder Creek Management Area (Figure 1.1) is a unique portion of Boulder's Open Space land system. The combination of topography, climate, geology, hydrology, and soils results in a rich ecological matrix. The Ponderosa pine scarp woodlands with native grass and shrubs on Davidson Mesa, xeric tallgrass, mixed grass and shortgrass prairies, lush riparian corridors along creeks and lakes--all are significant plant communities in the Management Area. Rare plants, such as Ute ladies'-tresses orchid (*Spiranthes diluvialis*), American groundnut (*Apios americana*), and the toothcup (*Rotala ramosior*) occur in the moist lowlands. Four streams, abundant ponds and reservoirs, and extensive irrigation ditches support numerous wetlands, including sedge meadows, cattail marshes, and lake shorelines.

These diverse plant communities and water sources support a wide variety of mammals, birds, reptiles, amphibians, and invertebrates. Grassland habitats and riparian areas provide critical habitat for sensitive species such as the bobolink. Riparian areas support a myriad of wildlife, including the Preble's meadow jumping mouse that was recently proposed for listing under the Endangered Species Act. The Management Area is also home to two rare fish species: the orange-spotted sunfish and the plains topminnow. In addition to these sensitive species, nearly 240 vertebrate species have been documented in the Management Area out of the 383 that are expected. Records reveal the presence of sixty-two species of state or federal concern: fifty-four bird species, six mammal species, and two fish species.

The Management Area supports a variety of recreation uses. Common activities include jogging, bicycling, exercising pets, hiking, horseback riding, photography, and wildlife viewing. Historic meanders and elbows of South Boulder Creek offer dramatic views, and a variety of plant and animal life can be observed and studied.

Fertile soils and abundant water make the valley areas agriculturally rich and help maintain the rural character of the Boulder Valley. Agricultural operations, due to the first European settlement of the Valley more than 100 years ago, include cattle grazing, horse boarding, and harvesting of irrigated crops (hay and grains).

The Management Area contains a wealth of natural, cultural, recreational, and agricultural resources. Yet, the area's unique resources compound the management challenges, requiring trade-offs between individual resource elements. Conflicting management requirements exist between the Ute ladies'-tresses orchid (a federally threatened plant) and ground-nesting birds (they have the most rapid population declines of any North American birds). Both orchids and birds thrive in the bottomland grasslands; however, the Ute ladies'-tresses orchid is a wetland plant that requires abundant moisture, while the ground-nesting birds require dry, hummocky nest sites.

The purpose of the South Boulder Creek Area Management Plan is to resolve conflicting resource goals. It will provide long-term management and preservation of the natural and cultural resources, while providing for appropriate passive recreational use and timely opportunities for effective public input.

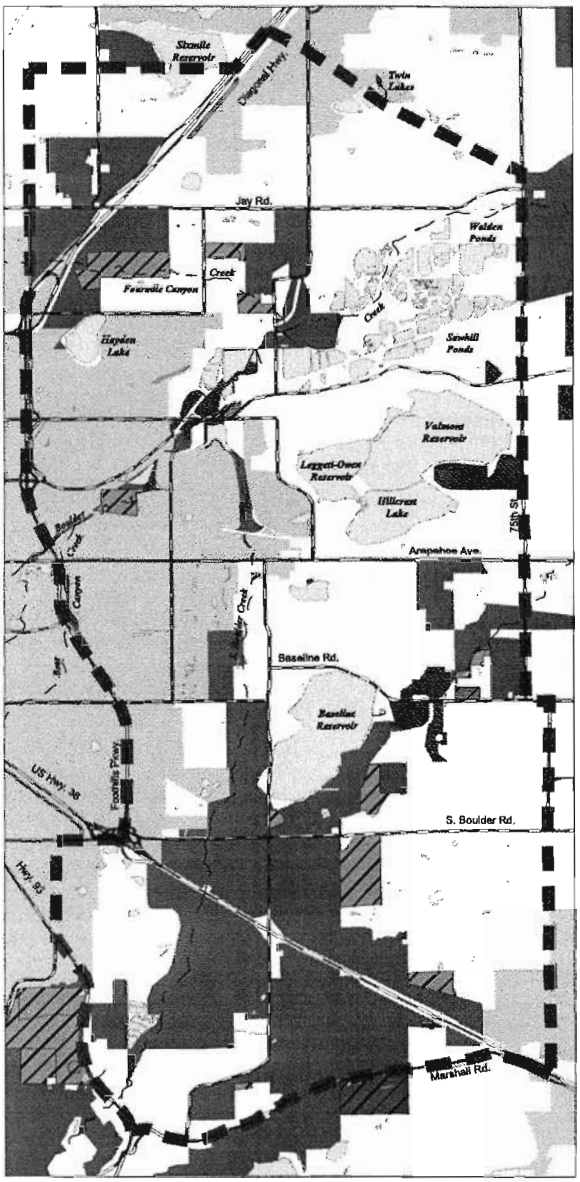

Figure 1.1
South Boulder Creek Management Area

South Boulder Creek Management Area Extents

City of Boulder Open Space
- Owned In Fee
- Easement Held By Open Space
- Closed to Public

Boulder City Limits

Roads
- Arterial
- Highway

Hydrology
- Lake
- Creek

The South Boulder Creek Management Area includes all City of Boulder Open Space lands located between Highway 93 (to the west), near the Boulder-Longmont Diagonal Highway(to the north), 75th Street (to the east), and Marshall Road (to the south).

1.1 PURPOSES OF AREA MANAGEMENT PLANS

The City of Boulder Open Space *Long Range Management Policies* (City of Boulder 1995) specifies that "area management plans" will incorporate landscape level planning (e.g., preservation of biological diversity, ecosystem functions and values, habitat fragmentation) into land and resource management activities. Area management plans will translate information, guidelines, goals, objectives, policies, and principles into strategies that work on the ground. Provisions of the *Boulder County Comprehensive Plan* and the *Boulder Valley Comprehensive Plan* will be integrated into area management plans.

Area management plans will provide the framework to link Open Space Program policies, goals, capital improvement projects, annual budgets, and work programs to the management of City of Boulder Open Space lands. This planning framework will be used to:

1. Evaluate and incorporate appropriate uses of Open Space as delineated in the City Charter with the management actions necessary to provide for these uses
2. Protect the community's Open Space investment
3. Monitor and evaluate impacts from these uses
4. Provide the basis for future management decisions

The Open Space system is divided into seven discrete areas (Figure 1.2) for area management planning purposes: South Boulder Creek, Sanitas-Dakota Ridge, Devils Thumb-South Mesa, Eldorado Mountain, Marshall Mesa, South Boulder Creek, and East Boulder. Plans for these areas will enable the Program to link broad policies and goals to the specific management needs of an area and set priorities for annual work plans and budgets. Four principal criteria have been chosen to define the management areas:

- Geographic proximity and contiguity--connectivity and landscape pattern (such as topography and plant communities)

- Watersheds--definable watersheds and the associated agricultural irrigation delivery systems

- Size of area--areas must be large enough to encompass certain identified or desired natural functions and processes but small enough to permit the collection and analysis of data in reasonable time frames

- Land use of the area--historical and current land uses influence the ecological condition of areas and are important for determining future management requirements; existing uses may be retained or changed in the future to meet management and protection objectives

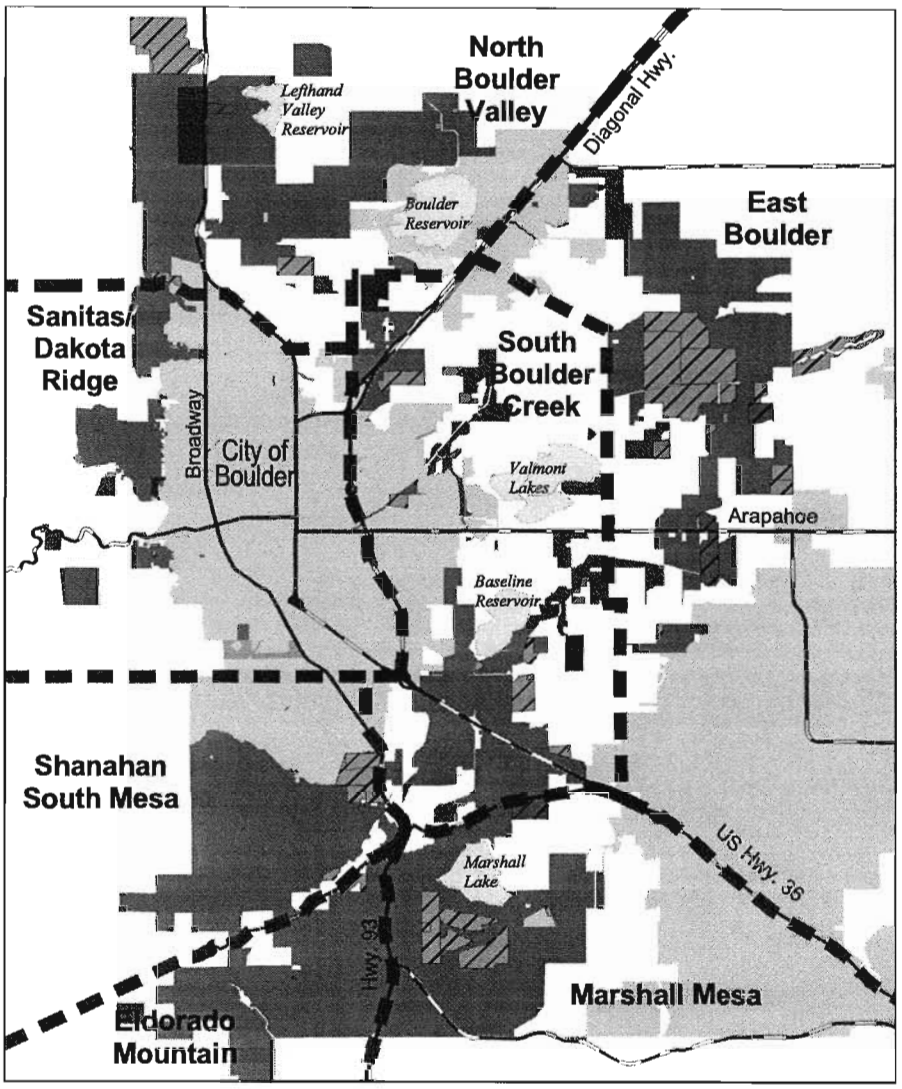

Figure 1.2: Conceptual Management Areas

The principles to be used in area management planning (City of Boulder 1995) are: (1) "involve the public" using a variety of citizen participation techniques, (2) "involve other government agencies" to ensure coordinated and compatible regional resource management, (3) "use interdisciplinary teams" to ensure adequate consideration of resource information and management needs, (4) "use best available information" to prepare analyses and databases where resource information can be stored and used in spatial and temporal analyses, (5) "use a Geographic Information System" to assist in understanding and communicating spatial information, (6) "evaluate management alternatives" accounting for a range of possible and appropriate management actions, (7) "use an ecosystem approach" that considers ecological processes and functions, and (8) "manage competing purposes" weighing potential benefits and impacts of proposed management actions and considering long-term viability and health of natural ecosystems.

1.2 GOALS OF THE SOUTH BOULDER CREEK AREA MANAGEMENT PLAN

- Assess the ecological significance and regional importance of the South Boulder Creek Management Area by evaluating the current uses and natural condition of the Management Area.

- Complete evaluations of plants, animals, natural communities, geology, hydrology, passive recreational use, agricultural use, and archaeology of City Open Space lands within the Management Area.

- Prepare suitable: (1) ecological preservation and restoration, (2) passive recreational use/ development, and (3) agricultural use/development alternatives based on the results of the completed environmental, current use, and historical use assessments.

- Present analyses of natural conditions, current uses, and proposed management alternatives for review by Open Space staff, public agencies, citizen-neighborhood-user group organizations, the general public, and the Open Space Board of Trustees.

- Formulate and implement an area management plan for the South Boulder Creek Management Area to guide environmental protection-preservation-restoration activities, passive recreational uses and appropriate agricultural uses, and to develop a monitoring program to evaluate the results of the adopted changes.

1.3 AREA MANAGEMENT PLANNING PROCESS

An interdisciplinary team of Open Space staff was formed in 1997 to develop a management plan for the City of Boulder Open Space lands in the South Boulder Creek Management Area. The purpose of the interdisciplinary team was to integrate the various skills and expertise within the Open Space Program into a common problem-solving effort. The interdisciplinary team is primarily responsible for implementing the planning process necessary to meet the goals of the Management Area. Steps in the planning process are:

1. Identify issues and concerns
2. Conduct a thorough resource inventory and complete an inventory report
3. Develop general management direction
4. Draft plan with proposed management objectives and actions
5. Adopt and implement plan
6. Monitor and revise the selected plan

The interdisciplinary team will actively seek and encourage input through a variety of techniques, including meetings, personal contact, and solicitation of opinions from interested citizens, local agencies, organizations, and Open Space staff to provide an opportunity to participate in the development of the plan. The Open Space Board of Trustees will review and approve the management plan, and the Open Space staff will implement and monitor the final adopted plan.

1.4 ROLE OF THE INVENTORY REPORT IN AREA MANAGEMENT PLANNING PROCESS

This *South Boulder Creek Inventory Report* will be used to integrate various resource needs with management issues to prepare the South Boulder Creek Area Management Plan. The data will be used by the City of Boulder Open Space Program in evaluating implementation techniques designed to address long-term passive recreation and natural resource management needs. An issues identification public meeting to help guide the inventory was held in May, 1997. The *South Boulder Creek Inventory Report* is available for public review, and the results will be presented at an open house in September, 1997.

General management direction for the Management Area will be developed to provide the foundation for the area management plan. The Open Space Board of Trustees will review the inventory report and approve the general management direction for the plan.

A draft South Boulder Creek Area Management Plan, with specific management actions, will be presented at a series of public meetings and presentations in the winter of 1998. Each open house and public meeting will be announced in local newspapers, posted on information boards throughout the Management Area, and sent to individuals and organizations that have expressed interest.

Once the South Boulder Creek Area Management Plan is adopted, the Open Space staff will develop implementation strategies and incorporate the desired management actions into annual capital improvement projects and work programs. Annual capital improvement projects and budgets are reviewed and recommended by the Open Space Board of Trustees and approved by City Council. The plan will be monitored and evaluated on an annual basis by Open Space staff.

2. THE PLANNING CONTEXT FOR AREA MANAGEMENT PLANS

Area management plans integrate the general policies in the *Long Range Management Policies*, City Charter, *Boulder Valley Comprehensive Plan*, *Boulder County Comprehensive Plan*, City ordinances and regulations, and resource management plans into specific management actions on the ground. Area management plans guide the actions that are needed to maintain the Open Space system and to determine project priorities and budgeting of Open Space funds.

Four principal planning documents guide the City of Boulder's Open Space Program's land and resource management program: City of Boulder Charter, *Long Range Management Policies*, *Boulder Valley Comprehensive Plan*, and *Boulder County Comprehensive Plan.*

2.1 LONG RANGE MANAGEMENT POLICIES

The *Long Range Management Policies* provide the general guidance and direction for management of Open Space. The *Long Range Management Policies* were approved by the Open Space Board of Trustees and adopted by the City Council in February 1995. Four basic management concepts were identified in the *Long Range Management Policies* to accomplish the goals of the Program:

- Ecosystem approach--an ecosystem approach will be employed to maintain fundamental ecological processes, where possible

- Use of interdisciplinary teams--management planning for Open Space will use interdisciplinary teams to identify, define, and recommend implementation techniques to accomplish resource and use monitoring, inventory, research, mitigation, and enforcement activities

- Best available information--current scientific research and data collection and analysis will be encouraged to fill identified information gaps to provide best available information for management planning and implementation and to investigate management issues in a problem-focused context

- Inventories and monitoring--resource inventories and long-term monitoring will provide information for temporal and spatial trend analyses and are the basis for adjustments in management to meet City Charter goals, serve the community and protect the land

2.2 CITY OF BOULDER CHARTER

Article 12, Section 176 of the Charter of the City of Boulder defines the purposes of Open Space as:

(a) Preservation or restoration of natural areas characterized by or including terrain geologic formations, flora or fauna that are unusual, spectacular, historically important, scientifically valuable, or unique or that represent outstanding or rare examples of native species;

(b) Preservation of water resources in their natural or traditional state, scenic areas or vistas, wildlife habitats or fragile ecosystems;

(c) Preservation of land for passive recreational use, such as hiking, photography or nature studies and, if specifically designated, bicycling, horseback riding or fishing.

(d) Preservation of agricultural uses and land suitable for agricultural production;

(e) Utilization of land for shaping development of the City, limiting urban sprawl and disciplining growth;

(f) Utilization of non-urban land for spatial definition of urban areas;

(g) Utilization of land to prevent encroachment on floodplains; and

(h) Preservation of land for its aesthetic or passive recreational value and its contribution to the quality of life of the community.

The guidance provided by the City Charter may result in conflicting management objectives in certain areas. Area management plans will incorporate the general guidance of the City Charter into resource analyses and will provide the basis for resolving conflicting management goals on specific Open Space lands.

2.3 BOULDER VALLEY COMPREHENSIVE PLAN

The *Boulder Valley Comprehensive Plan* establishes a blueprint for coordination between the City of Boulder and Boulder County on planning issues involving both agencies. The Boulder Valley is a Community Service Area within Boulder County where the City and County have agreed upon a set of land-use and management policies to implement joint planning objectives.

The current *Boulder Valley Comprehensive Plan*, adopted by both the City and the County in 1977, and updated most recently in November 1996, describes the City's current Open Space Plan as providing "the basic structure of the Boulder Valley Comprehensive Plan" (City of Boulder 1996a). The *Boulder Valley Comprehensive Plan* includes the purposes and functions of Open Space as defined by the City Charter. Other community, environmental, and design policies set goals for protecting many features of the Boulder Valley, including the appearance of major entryways, agricultural areas, critical habitat areas, and aquifer and ground water recharge areas. Many of the policies and maps in the *Boulder County Comprehensive Plan*, defining the protection and management of significant agricultural lands, wildlife and plant habitats, natural landmarks and natural areas, and archaeologically sensitive areas, are part of the *Boulder Valley Comprehensive Plan*. The 1996 update of the *Boulder Valley Comprehensive Plan* added a Natural Ecosystem Map and related policies. All of these maps and policies apply to one or more areas to be addressed in the South Boulder Creek Area Management Plan.

The 1996 update of the *Boulder Valley Comprehensive Plan* listed general policy direction for resource and land protection and management. Restoring, maintaining, and sustaining the environmental quality of the Boulder Valley are principal emphases of the revised *Boulder Valley Comprehensive Plan*. Protecting and restoring native ecosystems, biological diversity, and natural processes are essential elements of these policies. Preservation of agricultural lands, wetlands, open space, and historic and cultural resources, and the provision of passive recreational uses are other major components of the environmental sections of the *Boulder Valley Comprehensive Plan* (see Appendix 2.1 for a listing of applicable policies).

2.3.1 Natural Ecosystems Map

The Boulder Valley Natural Ecosystems Map, designating significant, high-quality native ecosystems or restorable native ecosystems in the Boulder Valley is an overlay of the *Boulder Valley Comprehensive Plan* land use map. Boulder Valley natural ecosystems are defined as places that support natural ecosystems of native plants and animals or possess important ecological, biological, or geological values. Boulder Valley natural ecosystems may also contain features that are rare, unique or sensitive to human disturbance and are essential to maintain the scientific and educational importance of places representing the rich natural history of the Boulder Valley. The Natural Ecosystems Map also identifies connections and buffers that are important for sustaining biological diversity and viable habitats for native species, for protecting the ecological health of certain natural systems, and for buffering potential impacts from adjacent land uses. Most of the Open Space in the South Boulder Creek Management Area has been designated as significant natural ecosystems on the Boulder Valley Natural Ecosystems Map.

The purpose of the Boulder Valley Natural Ecosystems Map is to guide City and County planning decisions in the protection of wildlife and plant habitats. Natural ecosystem designations will not necessarily preclude development or human use of a particular area but will serve to educate agencies and landowners about environmental concerns in particular areas.

Information contained in the Natural Ecosystems Map may be used in a broad range of planning decisions including service area changes, land use designation changes, annexations and zonings, development reviews, Valley-wide planning, subcommunity and departmental master planning, land acquisitions, and private land management.

2.4 BOULDER COUNTY COMPREHENSIVE PLAN

County comprehensive plans are mandated by state law and guide county land use. Most lands in the Management Area are under the land use jurisdiction of Boulder County. Boulder County adopted one of the earliest and most comprehensive county land use plans in Colorado. The *Boulder County Comprehensive Plan* is revised every five years and is adopted by the Boulder County Planning Commission and Boulder County Commissioners. The Plan has four principal elements: land use, parks and open space, environmental resources (including Environmental Conservation Areas), and cultural resources (Boulder County 1997). The Plan is also a guide for development in the County's rural areas outside municipal planning boundaries. Revisions are prepared with the cooperation of municipalities but are not subject to their approval.

Several major goals and policies in the *Boulder County Comprehensive Plan* are relevant to Open Space area management planning. Open space should meet human needs, and public use of open space should be consistent with the purposes of the acquisition of the land and resource management plans. Preservation and conservation of agricultural lands are primary goals for Boulder County as is maintenance of the rural character of the County. A County-wide trail system is identified. Coordination and cooperation with private landowners to accomplish the goals of the Comprehensive Plan are keys. Preservation of rare plant habitats and natural communities are Comprehensive Plan goals. Qualified historic and cultural sites and resources are identified and protected in the County. Preservation of identified natural areas, natural landmarks, riparian ecosystems, and critical wildlife habitats are key elements of the *Boulder County Comprehensive Plan.*

2.4.1 Critical Wildlife Habitats

The Management Area is within the historical or current ranges of several federally-listed threatened or endangered animals: gray wolf, black-footed ferret, peregrine falcon, and bald eagle.

The area has the highest known population of Preble's meadow jumping mice (*Zapus hudsonius preblei*) in Boulder County. This mouse was recently proposed for listing as endangered under the Endangered Species Act. More than forty-two of the seventy-six native breeding bird species of special concern listed in the *Boulder County Comprehensive Plan* are known or expected to occur in the Management Area. Six of the forty-two mammals of special concern listed in the plan are known or expected to occur in the Management Area. Prairie dog towns in the Management Area have provided a major prey base and habitat for a variety of birds, mammals,

reptiles and amphibians, and invertebrates. Periodic episodes of sylvatic plague result in large die-offs of prairie dogs and the subsequent slow recolonization from surviving colonies.

A native fish survey was conducted for a portion of South Boulder Creek. Two fish species of special concern are known from South Boulder Creek: the orange-spotted sunfish and the plains topminnow. Twenty native fish are listed as species of special concern in the *Boulder County Comprehensive Plan.* Twenty-four reptiles and amphibians are listed as species of special concern in the *Boulder County Comprehensive Plan*; seven are known to occur in the South Boulder Creek Management Area. The *Boulder County Comprehensive Plan* does not list any invertebrate species of special concern.

2.4.2 Rare Plant Habitats and Natural Communities

Preservation of rare plant habitats and natural communities (including riparian areas and wetlands) as functioning native ecosystems is policy direction provided in the *Boulder County Comprehensive Plan.* The *Boulder County Comprehensive Plan* lists forty plant species of special concern in Boulder County (Colorado Natural Heritage Program 1995). Colorado plant species of special concern are "geographically restricted, with few occurrences and with threats to a significant proportion of the known occurrences." Ute ladies'-tresses orchid (*Spiranthes diluvialis)* is a rare, perennial species belonging to the orchid family. It is listed as threatened under the Endangered Species Act. American groundnut (*Apios americana*) is a Great Plains species that is near the western edge of its range in Colorado. It is listed in Colorado as a species of special concern. Toothcup (*Rotala ramosior*) is a rare species known in Boulder Valley from two ephemeral (seasonal) wetland sites within and near the Management Area. These occurrences were only recently discovered and documented. The Colorado Natural Heritage Program lists the species as extremely rare.

The Management Area has three of the eleven plant communities of statewide significance identified in the *Boulder County Comprehensive Plan.* All of the plant communities of statewide significance are either geographically isolated, not protected in sufficient size, or threatened by current land uses. The eastern slope of the northern Colorado Front Range is known to be particularly rich in unique, rare, or threatened plant communities. The combination of topography, climate, geology, and soils results in this rich ecological diversity. Xeric tallgrass prairie, wet prairie, and mixed grass prairie are significant plant communities in the Management Area.

2.4.3 Environmental Conservation Areas

Environmental Conservation Areas "are large and relatively undeveloped areas of the County that possess a high degree of naturalness, contain high-quality or unique landscape features, and/or have significant restoration potential. Size, quality, and geographic location make them an important tool for combating the affects [sic] of habitat fragmentation." Environmental

Conservation Areas are delineated by the County as areas capable of meeting criteria of size, naturalness, ecological condition and quality, connectivity, and sufficient information.

Thirteen Environmental Conservation Areas are designated in the *Boulder County Comprehensive Plan.* Environmental Conservation Area #12, White Rocks-Gunbarrel Hill, lies immediately to the east of the Management Area. The area along Boulder Creek is delineated as a connection to the Environmental Conservation Area. Environmental Conservation Area # 8, Boulder Mountain Parks/South Boulder Creek, extends into the southern end of the Management Area.

2.4.4 Agricultural Preservation

Preservation of agricultural lands is a policy goal of the *Boulder County Comprehensive Plan.* This is accomplished by designating lands of national, statewide, and local importance and discouraging the conversion of these lands to urban uses. The Boulder Valley Area is rich in these lands with 4,000 acres of national importance, 5,000 acres of statewide importance, and 2,800 acres of local importance. Of this area, Open Space currently owns or has easements on 1,970 acres of national importance, 2,962 acres of statewide importance, and 2,227 acres of local importance. In the Management Area Open Space controls 196 acres of national importance, 1,171 acres of statewide importance, and 177 acres of local importance. Soil types and access to irrigation water are two important criteria for these designations.

2.5 SOUTH BOULDER CREEK STATE NATURAL AREA

City of Boulder Open Space has nominated areas along South Boulder Creek to be registered as a Colorado Natural Area as part of the Colorado Natural Areas Program. This designation is a cooperative effort with the state and will help provide long-term protection for the area.

The proposed "South Boulder Creek Natural Area" contains several rare, threatened, and endangered species and has many unique larger-scale environmental attributes. The Ute ladies'-tresses orchid is listed as threatened under the Endangered Species Act, and the Preble's meadow jumping mouse is proposed for listing as endangered. Populations of the bobolink, a locally rare neotropical migrant bird, plus two rare fish, the plains top minnow and orange-spotted sunfish exist in the area. Environmental values associated with the proposed natural area include the high-quality plains riparian wet meadows and floodplains that retain some of the best remaining occurrences of tallgrass prairie in the state.

The South Boulder Creek Natural Area proposed for registration with Colorado Natural Areas Program is adjacent to the Colorado Tallgrass Natural Area that was designated in 1984. The association of both of these natural areas ensures that some of the best examples of plains riparian areas and native grasslands in the state are protected through cooperative agreements between the City of Boulder and the State of Colorado.

3. A BRIEF NATURAL HISTORY OF THE BOULDER VALLEY

3.1 INTRODUCTION

Colorado's Front Range and the Boulder Valley form the boundary between the Southern Rocky Mountain and Great Plains physiographic regions. This physiographic transition represents a contrast between plunging, fast-flowing creeks, extreme changes in elevation, and forested mountains to the west and gently rolling hills covered with expanses of shortgrass and mixed grass prairies carved by occasional meandering streams to the east. While the meeting of the two physiographic regions create environmental conditions that support a wide diversity of plants, animals, and human settlement, the effects of local topography and micro-climate further influence vegetation, wildlife, and land use diversity.

3.2 TOPOGRAPHY

In contrast to the striking topography of the Flatirons just west of the Management Area, the topography of the Management Area is subtle and dominated by gently rolling hills and broad floodplains. The powerful influence of geology and water is evident within the Management Area. Four streams--Dry Creek, Fourmile Canyon Creek, South Boulder Creek, and Boulder Creek--flow through the Management Area forming a distinctive drainage pattern draining west to northeast. The landscape pattern is dominated by erosional terraces and pediments capped by alluvium deposited over the last 600,000 years. Landscape variation is characterized by gently rolling hills that become progressively lower and broader as they extend eastward (Figure 3.1*[1]).

3.3 CLIMATE

The climate of the Boulder area, including the Management Area, is characteristic of a continental type which is distinguished by intense sunlight and relatively low humidity and precipitation. Further, a large daily and seasonal range of temperature fluctuation is common.

While characteristics of a continental climate describe the Boulder Valley generally, the influence of physiography on the area's microclimate is conspicuous. The Boulder Valley typically experiences temperatures that are slightly cooler in the summer and slightly warmer in the winter when compared with temperatures just twenty miles to the northeast. Boulder's mean maximum summer (July) temperature is 87 degrees Fahrenheit, with a mean maximum winter (January) temperature of 44 degrees Fahrenheit (Colorado Climate Center 1997).

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[1]Figures marked with an * are not incorporated into the text. They are located in the set of maps and figures at the end of the report.

Generally, temperature--frost-free days--dictate the length of the growing season. In Boulder there are typically 148 frost-free growing days (Moreland and Moreland 1975).

Prevailing winds blow from the west. These westerly winds are notably influenced by the physiography of the eastern slope of the Front Range. Cooler air flows over the crest of the mountains and accelerates and warms as it flows down the eastern side. Mountain valleys channel the wind causing even greater velocities. Winds in excess of 90 miles per hour occur about one year in five (Paddock 1964), and several locations in the Boulder Valley have experienced winds in excess of 120 miles per hour.

3.4 HYDROLOGY OF THE SOUTH BOULDER CREEK MANAGEMENT AREA

The Management Area is located within the Boulder Creek watershed, which is in turn part of the St.Vrain and South Platte watersheds. Hydrology of the area is affected by an extensive network of streams, irrigation ditches and laterals, wetlands, surface water (numerous small lakes and ponds), a shallow water table, and an extensive alluvial aquifer.

While an abundance of water is a defining characteristic of the Management Area, continual impacts from land use, water diversions, gravel mining, and streambed channelization have altered the hydrologic function.

Generally, surface and ground water moves across the Management Area, draining west to northeast (Figure 3.2). Geology controls drainage patterns. Important aquifers include the stream and terrace alluvium and the Fox Hills sandstone. The underlying bedrock is the impermeable Pierre Shale.

Four streams--South Boulder Creek, Fourmile Canyon Creek, Dry Creek, and Boulder Creek--flow through the Management Area. Water development projects have altered their hydrologic regimes. Fourmile Canyon Creek and Dry Creek are intermittent streams that carry seasonal moisture runoff, and are also used as conduits for water delivery by irrigation companies. Boulder Creek and South Boulder Creek are perennial streams with fluctuating seasonal water flows. Instream flows are influenced by snowmelt runoff, summer thunderstorms, and water release from storage reservoirs.

Within the Management Area an extensive network of twenty-one ditches and numerous laterals supply water to irrigated pastures and hay fields. Flood irrigation is used to supply water to more than 1,500 acres. Subsidiary effects from flood irrigation include augmented aquifer recharge, support of wetlands, and provision of seasonal moisture in low-lying areas and bottom land grasslands.

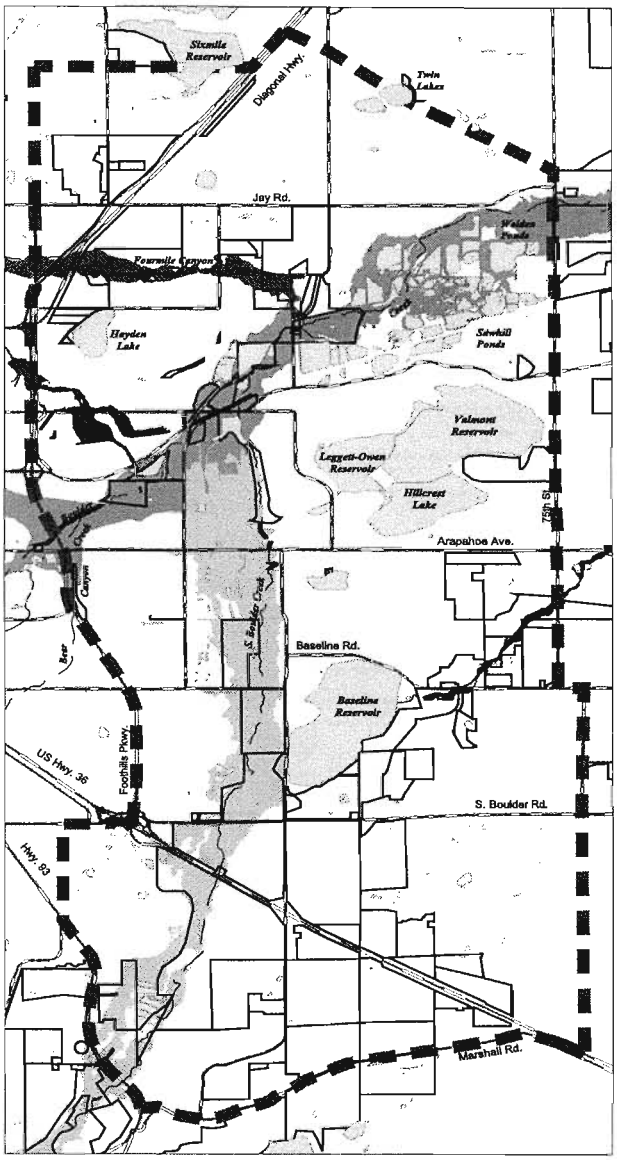


Figure 3.2:
Floodplain Information

Floodplain Information
- South Boulder Creek
- Boulder Creek
- Fourmile Canyon Creek
- Wonderland Creek
- Dry Creek No. 3

South Boulder Creek Management Area Extents

City of Boulder Open Space

Roads
- Arterial
- Highway

Hydrology
- Lake
- Creek

Wetlands reflect hydrology and topography. Distribution of wetlands is concentrated along floodplains and low-lying areas of all four streams in the Management Area. Eighteen percent of the area is made up of wetlands. Functionally, wetlands contribute to flood storage, aquifer recharge, and surface and ground water movement.

Surface water is comprised of several large storage reservoirs (Hayden Lake, Baseline, Valmont, Leggett-Owen, Hillcrest Reservoirs) and numerous, unnamed, small lakes and ponds. The reservoirs are components of regional water delivery systems. The most notable hydrologic concerns for these water bodies are water quality and sedimentation carried into lakes from irrigation feeder canals.

3.5 SOUTH BOULDER CREEK MANAGEMENT AREA COMPLEXITY: SPECIES DIVERSITY, RIPARIAN AREAS, AND AGRICULTURE

An abundance of water resources, wildlife habitat, and species diversity contribute to the unique ecology of the Management Area and include an extensive series of wetlands and riparian areas, as well as native tallgrass and midgrass prairies in the drainage swales and bottom lands. Low-elevation riparian forests grow along the South Boulder Creek, as well as parts of Boulder Creek, Fourmile Canyon Creek, and Dry Creek.

Tallgrass and midgrass prairie fields provide critical nesting areas for several species of ground-nesting birds, including the grasshopper and savannah sparrows and a disjunct population of bobolink. Seasonally moist fields are thought to be critically important to the Preble's meadow jumping mouse--recently proposed for listing under the Endangered Species Act.

The broad floodplains in the south central part of the Management Area contain the proposed South Boulder Creek Natural Area. The proposed natural area includes low-elevation riparian forests, tallgrass and mixed grass prairie, rare orchids, and several unique species of wildlife. Agricultural hay production and livestock grazing spanning a period of nearly 140 years exert a major ecological influence on the area.

The regional importance of the area is reflected in its diversity of native grasslands, habitats for plant and animal species of special concern, potential for natural area restoration and connectivity to other public lands.

3.6 SOUTHWEST IN THE NORTH

One of the most important ecological phenomena representative of the Boulder Valley's position along the Front Range is the northward penetration of plant and animal species commonly associated with warmer climates of the Sonoran desert to the Southwest. The Mexican wood rat is one of the best examples of several animal and plant species on the edges of their ranges and the "southwest influence" in the Boulder Valley. Species on the edges of their ranges are significant in the way they respond to evolutionary pressures and changes in climate and landscape disturbances. Here, on these edges, the dynamic of range extensions and retreats is played out. Gene flow on the edge of range occurs largely undetected but determines the expansion or contraction of the species' range.

3.7 NATURAL PROCESSES AND WESTERN LANDSCAPES

Natural processes influence the character of the land, and the plants and animals that live there vary spatially and temporally. Geologic processes occurring over thousands and millions of years determined the foundation of the landforms found along South Boulder Creek. Climate

and climatic changes over hundreds and thousands of years forced species to adapt or die. Plants and animals chronicle the story of humid cycles of greater moisture and arid cycles of scant moisture. Tree rings, pack rat middens, pollen cores and fossils reveal these things. Plants and animals adapted to climate changes. They moved around on the land in a dynamic ebb and flow of species responding to change. Drought is the constant in the Great Plains since the end of the last glacial epoch 15,000 years ago. Only in the last 100 years have landscapes been viewed as static and inert.

3.7.1 Flooding

Periodic flooding was an essential element of a dynamic landscape before permanent settlement along the Front Range. Seasonal flooding replenished wetlands in floodplains, created new stream meanders, and deposited silt along stream terraces. Floods were a primary influence on the kinds of vegetation of the floodplains. Native animals adapted to periodic flooding. Most of the low elevation shrub/forest communities along the Front Range were dependent on periodic flooding for sustenance and regeneration. High-water flows scoured stream channels, created sandbars, and dispersed seeds. However, since European settlement, streams and riparian ecosystems have undergone extensive changes (Williams 1978). The effects of dam construction, water diversion, and channelization have resulted in major impacts on riparian ecosystems, particularly low-elevation riparian shrub-forest communities.

3.7.2 Fire

Historically, fire-evolved natural communities of plants and animals developed over time where frequent small-scale fires and periodic large-scale fires determined what appeared on the land. Prairie grasslands had fire frequencies estimated between three and fifteen years. Lower treeline marks the meeting of forest and grassland on the eastern mountain front. The invasion and retreat of trees into the grasslands resulted from changing moisture regimes and fire frequencies during extensive periods of aridity interspersed with occasional wetter periods. Ponderosa pine savannahs at this grassland-forest transition area had fires burning every eight to twelve years. Fire frequency levels for montane woodlands ranged from a minimum of 1-3 years to a maximum of 29-162 years (Veblen et al. 1996). Lightning-caused fires comprise the majority of historic fires prior to European settlement. Indigenous peoples set fires to improve hunting opportunities. Most human-caused fires occurred in grasslands, although some fires ran into the ponderosa pine woodlands.

3.7.3 Grazing

Ungulate grazing has influenced the nature of grasslands in western North America for thousands of years. Large herds of bison, elk, and antelope moved seasonally across the prairies. Intensive grazing by herds was short duration and seasonal, influenced by natural barriers. Recovery of grasslands from grazing was dependent upon climatic conditions and grazing intervals but was sufficient to support periodic grazing from migratory herds.

In addition to large herds of herbivores, extensive colonies of prairie dogs stretched across the short- and mixed grass priairies of the Front Range. These fossorial animals caused changes in the vegetation composition and structure because of their foraging and burrowing activities. Populations within prairie dog towns frequently grew to hundreds of thousands, followed by sudden and rapid die-offs. These fluctuations were part of the complex and dynamic processes shaping the vegetation communities across the landscape.

3.7.4 Settlement

Permanent land uses or human settlements did not occur prior to European settlement of the region 140 years ago. Seasonal migrations marked the movement of animal and human inhabitants over the land. Settlement has exerted perhaps the most profound change in the dynamic natural processes of this region. Humans have become the primary change agents on the land. Water was redirected and rechanneled, fires were extinguished, and forests cut. Native grazing herds were slaughtered, replaced by exotic livestock, and grazing patterns changed from migratory herds to fenced and confined cattle pastures. Exotic plants and weeds replaced native plant communities. Human populations swelled to where the elimination of natural processes, such as flooding, was necessary to ensure the safety and convenience of developing urbanized areas.

3.7.5 Development

During the 100 years between settlement in 1860 and established patterns of urban and suburban development in 1960, the Management Area was characterized by a mix of farms and cattle ranches dependent upon the annual delivery of mountain water to irrigate the former prairies. Farms and ranches serviced the developing college town of Boulder and the growing Denver metropolitan area. Many of these farms and ranches were bought up for residential development in the 1950s and 1960s. Much of the Open Space in the Management Area was purchased from the late 1960s through the late 1970s. Traditional farming and ranching practices continued under Open Space Program management through leases with former landowners or local farmers and ranchers.

3.7.6 Recreation

The Management Area's rolling topography, streams, and aesthetic vistas provide an idyllic setting for a variety of recreation activities. Initially, recreational uses in the Management Area were limited mostly to a system of old cow paths and farm roads to accommodate hikers, horseback riders, dog walkers, and bicyclists. Some parts of the Management Area were managed as wildlife habitats, especially grasslands where ground-nesting birds persisted. The South Boulder Creek Management Area became less isolated from residential development and growing recreational uses in the 1980s and 1990s. Estimates derived from a system-wide visitation study (Zeller et al. 1993) indicate that approximately 1,485,000 visits occurred system-wide on Open Space lands from June 1, 1992-May 31, 1993.

3.8 THE INVENTORY REPORT

The South Boulder Creek Inventory Report and Area Management Plan is the first comprehensive evaluation of the natural resources of the South Boulder Creek Management Area. The inventory report serves as the foundation for the management direction and commitment necessary to maintain and preserve this place, the natural processes that make it what it is, and the vision of what it will be in the future.

The remainder of this report describes the various visitor and natural and cultural resources of the Management Area. Each chapter includes a brief introduction and summary description of resource information, management issues, and data gaps. The methods used to compile information for various chapters are detailed in Appendix 3.1. In many cases, specific areas of Open Space are noted by property name.

4. GEOLOGY

4.1 INTRODUCTION

The Boulder Valley, including the South Boulder Creek Management Area, has a varied and distinctive geologic history that spans nearly two billion years. Driven by the pressures of plate tectonics, the "basement" geology was created by the actions of volcanism, uplifting, subsidence, folding, and faulting. Advancing and retreating "ancestral seas" continued the development process by depositing layers of sand, silt, mud, and organic detritus. Further, episodes of glaciation, wind, and water erosion resulted in depositional and erosional geologic layers.

4.2 RESOURCE INFORMATION

The Management Area lies at the boundary between the eastern extent of the Rocky Mountains and western edge of the Colorado Piedmont of the Great Plains. Underlying geology of the area is characterized by approximately 10,000 feet of folded and faulted sedimentary strata, while surficial rock consists of a thin veneer (1-60 feet) of alluvial deposits. In geologic time, rock in the Management Area, is relatively young--120 million years old. In contrast, less than five miles west of the Management Area, granite and gneiss are roughly 1.8 billion years old (Rodeck 1964).

4.2.1 Bedrock Geology

The most extensive sedimentary formations in the Management Area are Pierre Shale and Fox Hills Sandstone. These sedimentary rocks were deposited in the Cretaceous Period (130-65 million years before present) during the Mesozoic Era. Beginning about 120 million years ago the Front Range was covered by a relative shallow sea. This sea varied in depth, advanced, and retreated across the area many times over a period of about 70 million years. The advance and retreat of the sea is believed to be related to plate tectonic events to the west. Layers of sand, silt, and organic material were deposited in horizontal layers in the sea. Eventually, accumulated material reached depths of about 10,000 feet (Bilodeau et al. 1987).

The Tertiary Era (63-1 million years before present), was characterized by periods of mountain building, erosion, deposition, and volcanism. Warm climates evolved into dryer climates. Regional uplift accompanied by extensive faulting occurred. During the Tertiary Era, the shale and sandstone were intruded with molten basalt which formed dikes and rhyodacitic sills (Rodeck 1964) such as the Valmont Dike. Episodic uplifting folded, bent, and fractured the originally horizontal layers of shale and sandstone into their present shape and incline, while erosion scoured and removed the uppermost layers.

Pierre Shale is the most extensive rock in the Management Area. Shale outcrops occur just east of the foothills and northeast of the City of Boulder. Characteristically gray to black clay and

sandy shale vary in thickness (5,000-10,000 feet), their composition is generally uniform, and they erode easily. Fox Hills Sandstone is less extensive than the Pierre Shale and outcrops in the southeast margin of the Management Area near Marshall. The rock is tan to sandy colored, fine to medium grained, and friable.

4.2.2 Surficial Geology

The history of surficial geology begins in Quaternary Period--the last million years. This period is characterized by three major episodes of glaciation and several cycles of erosion (Rodeck 1964). Extensive deposits of alluvium and wind-blown sand and dust cover the Management Area (Moreland and Moreland 1975).

The pattern of alluvial deposition resembles a stair-step-like pattern, with older deposits occurring in topographically higher areas and younger deposits occurring in the topographically lower portions of the Management Area. The youngest alluvium is found in existing stream channels (Bilodeau et al. 1987).

Generally, surficial geology is characterized as belonging in one of two main groups, pediment or terraced alluvium (Bilodeau et al. 1987). These groups are further divided into five units: Verdos, Slocum, Louviers, Broadway, and Valley Fill alluvium. Descriptions of the alluvium is as follows.

Verdos alluvium is about 600,000 years old and ranges from 15-35 feet in depth. It is most common east of the University of Colorado campus. The alluvium consists of fairly well stratified sand and gravel (partially decomposed pebbles, cobbles, and boulders in a clayey matrix) (Bilodeau et al. 1987).

Slocum alluvium is generally 260,000-150,000 years old and found 80-130 feet above present streams. It is generally less than 30 feet thick. Its texture is more fine than Verdos alluvium.

The Louviers alluvium is about 140,000 years old and is found on stream terraces along existing streams. It is stratified sand, pebbles, and cobbles in a clayey silt matrix (Bilodeau et al. 1987). The material is a major source of commercial gravel and sand in the Boulder Valley, although it is highly irregular in depth ranging from between 3 and 20 feet (Bilodeau et al. 1987).

Broadway alluvium is the youngest terrace material at 30,000 years old. The material may be up to 30 feet thick. It is comprised of cobbly pebble gravel and has a poorly developed soil at the surface.

Valley fill alluvium--a term applied to alluvium that fill the modern stream valleys of the Boulder Valley--is the most extensive alluvium in the Management Area (Bilodeau et al. 1987). There are two types of valley fill alluvium: Piney Creek and Post-Piney Creek.

Piney Creek alluvium is roughly 2,800 years old and consists of small boulders, silt, sand, and clay interstratified with humic-rich layers. It may be as thick as 20 feet and is found from 4 to 20 feet above present-day streams (Scott 1963).

Post-Piney Creek alluvium is derived from Piney Creek alluvium and consists of grayish-brown, humic, fine sand and silt, with loosely consolidated pebble and cobble. These deposits may be 1.5 to 20 feet deep and cover the entire floodplain of modern streams. The alluvium exhibits little or no soil development (Costa and Bilodeau 1982).

Finally, wind deposited eolian sand and silt, accumulated over the last 1,200 years, is most extensive east of Boulder. It is generally 3 to 25 feet thick and has a brown Holocen soil developed in the upper surface (Trimble 1975).

Both bedrock and surficial geology have an influence on the resources of the Management Area affecting climate, hydrology, vegetation, wetlands, wildlife, agriculture, and recreation by providing the foundation from which these resources exist. A graphic depiction of the geology helps to convey the diversity and spatial arrangement of Management Area's rock resources (Figure 4.1).

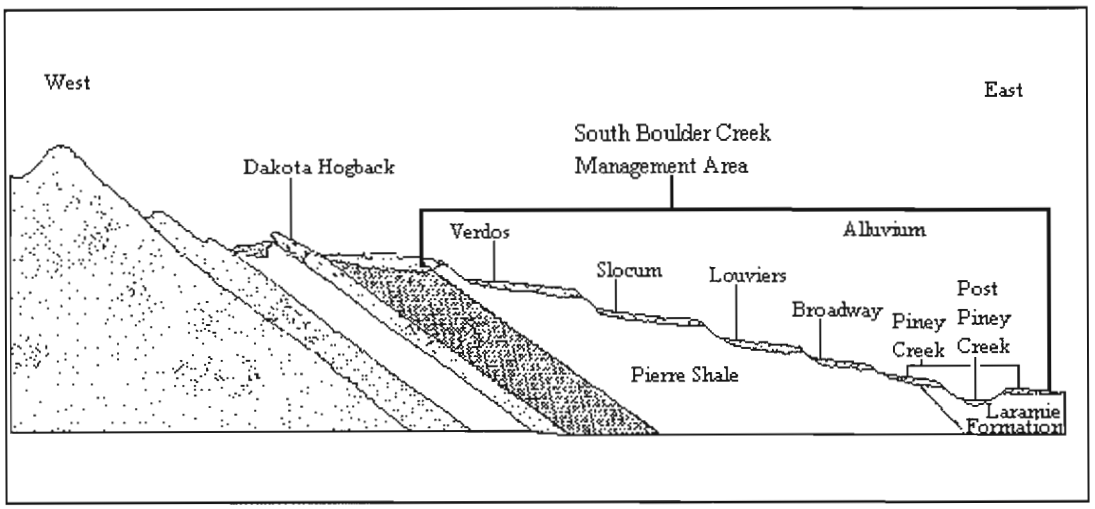


Figure 4.1: Geology of South Boulder Creek Management Area
Source: Modified from Scott, 1963 (Not to scale)

4.2.3 Key Features

Valmont Dike
The prominent Valmont Dike is a vertical igneous intrusion (into shale) that occurred in the Tertiary Era (65-2 million years ago). Molten basalt was thrust upward through the older Cretaceous Era (135-65 million years old) Pierre Shale at right angles. Over time, the softer shale was eroded by the elements of climate and Boulder Creek leaving the harder rock as a reminder of the dynamic processes of geology. The Valmont Dike exists in stark contrast to the flatter depositional character of the adjacent management area.

Fossils
Rocks of the Mesozoic Era contain numerous fossils. Within the Management Area some outcrops of the Pierre Shale contain abundant and diverse fossils. These fossils (mostly ammonites and clams) include *Inoceramus, Oblongus, Buculites, Scaphites, Cirroceras, Solenoceras,* and *Ophiomorpha* (Chronic 1964).

The sedimentary material that makes up the Fox Hills Sandstone accumulated over a period of about 65 million years (between 135 and 70 million years ago). This time frame coincided with a period of great diversity in life forms. Near Marshall, numerous leaf flora fossils have been discovered, including redwood *(Sequoia),* sabal *(Sabal),* oak *(Quercus),* fig *(Ficus),* cinnamon *(Cinnamomum),* pistacio *(Pistacia),* ash *(Fraxinus),* lotus *Nelumbo,* and magnolia *(Magnolia),* (Chronic 1964), (Table 4.1).

While some paleontologically significant resources have been documented in the Management Area (near Marshall) and are curated by the University of Colorado Museum, a systematic inventory of the Management Area is necessary.

Table 4.1: Geologic Time Chart of Rock and Fossils of the Boulder Area
Source: Modified from Chronic 1964

Geologic Time		**Years ago (10^6)**	**Rocks and Fossils**	
Eras	**Periods**		**Rocks**	**Fossils**
Cenozoic	Quaternary Tertiary	2 70	Local alluvial deposits only	mammoth
Mesozoic	Cretaceous Jurassic Triassic	135 180 225	10,000' depth gray shale limestones, sandstones	clams, snails, crabs, fish, ammonites, wood, dinosaurs
Paleozoic	Permian Pennsylvanian	270 305	2,000' depth red conglomerates, shales, sandstones	reptiles, algae, snails, amphibians

4.3 ISSUES

- Protection of fragile paleontological resources and areas may pose conflicts for other land uses, such as facility location/development, trail location/development, and others. Illegal collection of fossils and erosion of sites are principal management issues. Knowing where fossils exist is necessary to protect the resource.

- Sand and gravel mining in riparian floodplains. Open Space must continue purchasing remaining mineral rights to protect fragile riparian areas on public lands.

4.4 DATA GAPS

- Inventories of significant fossils are major data gaps in the South Boulder Creek Management Area. This data gap can be remedied by identifying significant fossil sites and the specific resources they contain.

- Information on the hydrolgeolgic conditions within the Management Area is not well known. Data regarding stream and ground water interactions with the surficial alluvial deposits would be beneficial to wetland and water resource management. This data gap could be partly closed by performing bibliographic research on the ground water resources of the area.

- Inventory mineral resources (sand, gravel, oil, gas) and determine priorities of mineral rights for purchase.

5. WATER RESOURCES

5.1 INTRODUCTION

The South Boulder Creek Management Area contains parts of several watersheds, along with numerous agricultural irrigation facilities and several natural and human-made lakes. Flowing through the Management Area are Boulder Creek, South Boulder Creek, Dry Creek, and Fourmile Canyon Creek. Water flowing through these creeks is diverted into twenty-one ditches that serve water to Open Space properties in the Management Area.

The hydrology of the creeks in the Management Area is dominated by water from snowmelt and summer thunderstorms. Water flow in the creeks tends to be at a minimum in January and February and at a maximum in June. All of the creeks have been extensively modified by water resource development for municipal, industrial, and agricultural purposes.

Water used by Open Space for agricultural irrigation also provides important environmental benefits such as supporting wetlands and their associated flora and fauna.

5.2 RESOURCE INFORMATION

5.2.1 Water in the South Boulder Creek Management Area

Boulder Creek
Boulder Creek extends from the confluence of North and Middle Boulder Creeks at Boulder Falls in Boulder Canyon downstream to its confluence with the St. Vrain River east of Longmont. The hydrology of Boulder Creek through the City of Boulder is dominated by the effects of the Public Service Company of Colorado hydropower releases and diversions for various agricultural ditches. During spring and fall, flows in Boulder Creek are often quite low as diversions are made via the Anderson, Boulder and White Rock, and Wellman Ditches to fill off-stream reservoirs.

Observed flows in Boulder Creek tend to be at a minimum in January and February when flows are typically less than 25 cubic feet/second and at a maximum in late May and early June when flows peak at about 175 cubic feet/second. Natural flows[2] tend to be at a minimum in October and November when flows are typically less than 25 cubic feet/second and at a maximum in late May and early June when flows peak at nearly 450 cubic feet/second (WBLA 1988).

[2] Natural flow is the observed stream flow that is adjusted to remove the effects of upstream man-made activities such as water diversions, reservoir storage, or water imports from other basins.

South Boulder Creek
The South Boulder Creek watershed rises to about 11,000 feet along the Continental Divide. Above Eldorado Springs, the catchment area has steep, rugged slopes and is heavily timbered. Below Eldorado Springs, South Boulder Creek flows through the high plains and has its confluence with Boulder Creek in Boulder at an elevation of 5,170 feet. Snowfall is responsible for most of the surface runoff. Natural flows in South Boulder Creek typically range from a peak of over 300 cubic feet per/second in June to a low of less than 10 cubic feet/second in January or February. During the fall and winter months, natural flows generally range between 5 cubic feet/second and 30 cubic feet/second, although occasional periods with flows as low as 2 cubic feet/second have occurred in January or February (Hydrosphere 1994). South Boulder Creek's natural stream flow hydrology is dominated by municipal, industrial, and agricultural water storage and delivery operations. Flow measurements on South Boulder Creek take place at the U.S. Geological Survey gage at Eldorado Springs.

Below the mouth of Eldorado Canyon, South Boulder Creek is a gaining stream. This means that ground water generally flows to the creek thereby increasing flows in the downstream direction. The likely cause of the gaining nature of the stream is agricultural return flows, ditch seepage, and flows from storm events. At the points where the creek is often completely dewatered during the winter, such as at the Community Ditch headgate and the Valmont Reservoir inlet, water flows are observed in the creek several hundred feet further downstream.

Dry Creek
Dry Creek, which is also known as the Dry Creek Carrier, is a naturally-occurring, intermittent stream channel that was extended upstream to intersect South Boulder Creek at South Boulder Road to serve a number of ditches with South Boulder Creek water. Dry Creek is also used to convey South Boulder Creek water to Boulder Creek.

At the time this inventory report was compiled, no hydrologic data for Dry Creek was located and remains a data gap that should be addressed.

Fourmile Canyon Creek
Fourmile Canyon Creek originates near Sunshine Saddle in steep and rocky terrain. The basin is narrow and steep in the foothills but becomes less steep through the City of Boulder. The overall length of the basin is approximately 6.5 miles. Fourmile Canyon Creek empties into Boulder Creek approximately 3,000 feet north of Valmont Butte. The hydrology of the creek is dominated by cloudburst storms. Snowmelt runoff does not significantly influence the peak flows in the creek (Greenhorn and O'Mara 1987).

Water Infrastructure
A variety of facilities supply water to Open Space. These include ditches, seeps, springs, wells, and mines.

The terminology used for ditches is complex. There is one set of terminology for the ditch infrastructure and a second set of terminology for ditch ownership and organization. In general, a "ditch" is a water diversion and transportation facility that is used to deliver water to one or more water users.

The ditch infrastructure consists of a headgate, ditch, smaller headgates, laterals, and various other pipes, pumps, siphons, and flumes that are used to get the water to the point of use. Generally, water is diverted out of a stream at a headgate and flows into a ditch or canal. The headgate located on the stream is often called the "main headgate" because it is located at the decreed point of diversion (the start of the ditch) and the water commissioner must authorize water to be diverted at this point. The canal that delivers water is commonly referred to as the "ditch" by water users and is the terminology used in this chapter. Smaller headgates along the ditch are then used to deliver water to "laterals" which are the small ditches that are used to deliver water to fields or other water uses. Like the ditch, laterals also supply water to one or more water users. Once water reaches a field, small laterals called "field laterals" distribute water to different locations on a field. Finally, there are a number structures that serve as headgates and include screw gates, slide gates, wood boards, valves, pumps, and so on.

Ditches can be owned by individuals, companies, or governmental entities. In Colorado, as in much of the arid west, water was first diverted by individual effort. However, the settlers soon realized that it was impractical for everyone to have their own ditch and so they worked together to divert and manage water efficiently and to spread out the high cost of building the structures. The framers of the Colorado Constitution recognized the importance of agriculture and the need for the ditches that sustain it so they provided for private action right-of-way across public and private lands to construct ditches.

According to Vranesh (1987):

> The organization of these ditches varies in form, size, and complexity. Ditch organizations are either incorporated or unincorporated, and either for hire, or profit, or for their member's use alone. Unincorporated ditches are held by tenants in common or by partners. "Carrier ditch" is the common designation for a ditch for hire, while a ditch intended for use by its owner is referred to as a "mutual ditch." "Mutual water association" and "voluntary ditch" are also terms used to describe unincorporated forms of the mutual ditch.
>
> Individual efforts to establish ditch companies soon gave way to more complex organizations. The corporate activity of canal building commenced with the organization of the Larimer and Weld Irrigation Company in 1879 to construct a large ditch out of the Cache La Poudre River. This ditch, owned and financed by English capitalists, furnished water for profit to ultimate users and for use on their own lands.

> Ultimately, even carrier ditches were unable to deal with the cost and expense of carrying water long distances for use on lands away from rivers. Irrigation districts were formed, with taxing power to raise money for construction and operating expenses, the formation of districts was ultimately followed by the formation of water conservancy and water conservation districts in order to develop large transbasin projects.

While ditches primarily divert and distribute water from streams, they also are used to collect and divert water from seeps, springs, mines, wetlands, and other natural water courses. In this chapter, the term "ditch" is used for a water conveyance structure if it appears as a ditch in the State Engineer's Office water rights listing or in the original decree for the water right. For this reason, the "Church Mine No. 1 and No. 2 Ditch," which technically diverts water from an old mine adit, is listed as a ditch because the State Engineer's Office calls it a ditch. And the "Arnold-Harrop Ditch," which technically diverts seepage from the Farmers Ditch, is called a ditch because that is what it is called in the original decree.

A field inventory of the irrigation facilities serving Open Space properties within the Management Area was completed between November 1996 and January 1997. This information provides a 1996-1997 snapshot of irrigation facilities and irrigated lands managed by Open Space. Information collected during this inventory includes:

- The boundaries of irrigated areas were delineated on 1"=200' and 1"= 100' orthophotos flown for the City of Boulder in April 29,1993; notes were taken as to whether the land is currently irrigated (i.e., during the 1996 growing season) or historically (i.e., previous to the 1996 growing season

- The type of irrigation method (i.e., flood, furrow, gated pipe, etc.)

- The location of ditches and laterals serving Open Space properties was recorded on the orthophotos; information for laterals and headgates serving properties other than Open Space was not recorded, nor was information on the main ditches (e.g., structures such as culverts that is the responsibility of the ditch company and not Open Space). The only exception is the main headgate on the creek for each ditch. For laterals serving Open Space properties, the location, type, and condition of individual segments (steel pipe, concrete lining, siphons, flumes, culverts, earthen lining, etc.) were recorded

- The location and physical condition of headgates, division boxes, measuring devices, and other facilities were recorded on the orthophotos; information on the physical condition of these structures was recorded. For use within the database, two broad categories of physical condition were assigned-- "good" implies that minimal repair, maintenance, or replacement will be necessary within the next five years given normal operating circumstances, and "poor" implies that routine maintenance is overdue or that more extensive repair or replacement is necessary. For structures in the poor category, detailed descriptions of the work needed are included within the comment field of the database.

All the information recorded on the orthophotos was digitized and incorporated as a coverage within the Open Space Geographic Information System. All of the descriptive information was incorporated within the Open Space Water Resources Database in Microsoft Access 7.0. The map of the South Boulder Creek Management Area Irrigation Features (Figure 5.1*) summarizes the data collected during the irrigation inventory.

5.2.2 Water Rights Held by Open Space

Colorado Water Law
Colorado administers its water by a system known as the Prior Appropriation Doctrine. This system is often referred to as "first in time, first in right." This system allows anyone to establish a water right to divert water from a stream so long as they put the water to beneficial use. Every water right is defined by the date the right was first established, the location of its diversion point, and the time of its use. A water right can only be used so long as the person using the water does not injure other more senior water rights.

Water can be diverted from a stream when a water right is in priority or, in other words, when all senior rights are satisfied and there is still water in the stream. If there is insufficient water available from the stream, the more junior water rights are shut down. In Colorado, the State Engineer's Office administers the water rights and has a water commissioner in each basin who is responsible for turning on and shutting down the various diversions.

Water rights are property rights and can be bought and sold. Individuals, private companies, and government agencies can all own water rights. Decreed water rights allow water to be diverted from streams, wells, seeps, springs, wetlands, mines, or other water sources.

Agricultural water rights are often held by a ditch company that is controlled by the shareholders in the company. The amount of water an individual shareholder gets is related to the number of shares they own relative to the total number of shares in the company. The amount of water the company receives is related to the water rights it owns and the runoff in the stream.

Water Ownership
Open Space water ownership information was compiled for this inventory. Table 5.1 is a summary of the ownership of shares in the various ditches that supply Open Space in the Management Area. Available information regarding yield per share, water rights, and number of shares owned is included in the table.

Table 5.1: Ditches in the South Boulder Creek Management Area with City of Boulder Interest

NAME	TOTAL CITY OWNERSHIP	TOTAL OPEN SPACE SHARES	TOTAL DITCH SHARES OUTSTANDING	AVERAGE YIELD PER SHARE (AF/SHARE)	AVERAGE OS YIELD	Measuring Device	Physical Capacity	Decreed Capacity	COMMENTS	OPEN SPACE PROPERTIES SERVED BY DITCH IN MANAGEMENT AREA	OPEN SPACE PROPERTIES POTENTIALLY SERVED BY DITCH IN MANAGEMENT AREA
ARNOLD-HARROP DITCH	100%	100%	N/A	N/A		NONE			Diverted seepage right; no other owners are known	Nu-West Harrington	
BOULDER & LEFT HAND DITCH	0.5	0.5	130	7.9	3.95	4 FT PAR	35	84.3		NONE	Andrus
BOULDER & WHITE ROCK DITCH	214.25	178.25	5,500	1.45	258.4625	10 FT PAR	100	190.5	Bylaws limit transfers of shares w/in ditch to prevent delivery requirements up-ditch from the Supply Canal as agreed to in stipulation 80SA102; two lakes compose Panama #1 Reservoir with 500 outstanding shares; Boulder Weld Reservoir Co. has 946 shares.	McKenzie (131.5 shares)	
BUTTE MILL DITCH	11.1	9.75	42	21.9	213.525	5 FT PAR	50	110.8		Eccher	
CHURCH MINE DITCH #1 & #2	100%	100%	N/A	N/A	N/A	NONE			Diverted spring from mine	Church	
COTTONWOOD NO. 2 DITCH	3.67	3.67	20	78.95	289.7465	4 FT PAR	30	33.7	Also known as Original Cottonwood Ditch	Lewis (.67 sh) Methvin (1 sh)	
DAVIDSON DITCH	504.5	504.5	3,103 (annual meeting minutes says there are "about" 3,200 shares)	1.04	524.68	8 FT PAR	100	125		Church (13.5 sh) Short (45 sh) Yunker (30 sh)	Church of Christ
DRY CREEK DAVIDSON DITCH	172	172	620	0.95	163.4	4 FT PAR	20	17	24 shares may be owned by another City Department. Total City ownership is certain.	NONE	
DRY CREEK NO. 2 DITCH	97.06	81.201	300	5.4	438.4854	5 FT PAR	20	69		Burke I/II (6.6 sh) Gebhard (8 sh) Rolling Rock Ranch (5.6 sh) Van Vleet (20.4 sh)	Mary Clyncke Fancher
EAST BOULDER DITCH	0.1751	0.1751	44.195 12	114	19.9614	5 FT PAR	24	24	Shares a headgate with Jones & Donnelly Ditch; PSCO uses ditch to transport Dry Creek #2, Jones & Donnelly, and Enterprise Ditch water	Lentsch/Sombrero	Burke II
ENTERPRISE DITCH	4.6	4.6	(Case 85 CW 277 says 44 shares)	22.68	104.328	4 FT PAR	35	50.3		Lewis (.75 sh) Methvin (1.35 sh)	Aweida II Merle-Smith Ute Industrial Park
FARMER'S DITCH	68.97	23.2107	100	79.2	1838.28744	8 FT PAR	55	58.7		Belgrove (1.625 sh) Harrington Lousberg (1.25 sh) McKenzie (2 sh) Nu-West Ditzel (1.125)	
GREEN DITCH	17.5	3	32	47	141	5 FT PAR	35	34.5		Biddle (13 sh)	

Table 5.1: Ditches in the South Boulder Creek Management Area with City of Boulder Interest

NAME	TOTAL CITY OWNERSHIP	TOTAL OPEN SPACE SHARES	TOTAL DITCH SHARES OUTSTANDING	AVERAGE YIELD PER SHARE (AF/SHARE)	AVERAGE OS YIELD	Measuring Device	Physical Capacity	Decreed Capacity	COMMENTS	OPEN SPACE PROPERTIES SERVED BY DITCH IN MANAGEMENT AREA	OPEN SPACE PROPERTIES POTENTIALLY SERVED BY DITCH IN MANAGEMENT AREA
HOWARD DITCH	21.349	5.99	35.039	31	185.69	4 FT PAR	36	27.9	Occasionally the Town of Erie borrows Howard Ditch water from Louisville and diverts it through the South Boulder Canyon Ditch, after receiving permission for a temporary plan from the SEO. Includes 2 shares of Superphostical lateral; OS has also leased .	Burke I/II (2 sh) Gebhard (2sh)	
JONES & DONNELLY DITCH	88	64	351 shares (Hydrosphere shows 613.5 for ditch before transfers)	2.2	140.8	3 FT PAR	10	14.3 prior to Public Service Co. change of use case in 1985 or 86, 8.17cfs now	Shares a headgate with Leggett Owen Feeder Canal and delivers water to Butte Mill Ditch	Biddle (3 sh) Eccher (6 sh)	
MARSHALLVILLE DITCH	26.667	26.667	80	13.74	366.40458	6 FT PAR	40	31.9		Van Vleet (4 sh)	
MCGINN DITCH	13	13	40	38.7	503.1	4 FT PAR	18	17.2		Baseline/75 (2 sh) Klein (0 sh) St. Walburga (2.5) Van Vleet (1 sh)	Clough Suitts
NORTH BOULDER FARMERS DITCH	1264.2	502	5,760 (Case 94 CW 285 indicates that there are 5,712 shares)	0.76	381.52	5 FT PAR	0	0	Shared headgate with Boulder & White Rock and Boulder & Lefthand Ditches. 10 FT PAR on combined headgate at stream.	Andrus (168 sh)	Colorado Open Lands
SOUTH BOULDER BEAR CREEK DITCH	1.75	1.75	20	63.3	110.775	4 FT PAR	20	129.1		NONE	Rolling Rock Ranch
SOUTH BOULDER CANYON DITCH	57	57	610	3.5	199.5	6 FT PAR	75	96	Occasionally the Town of Erie borrows Howard Ditch water from Louisville and diverts it through this ditch, after receiving permission for a temporary plan from the SEO.	Van Vleet (20 sh)	
SCHEARER DITCH	100%	100%		1,543	1,543	4 FT PAR	26	26		Van Vleet Suitts	

Water Leasing
Lease holders of Open Space properties are allocated water through the agricultural lease. Open Space notifies the ditch companies as to who is authorized to call water. The lease holder has the responsibility for contacting the ditch company superintendent to receive irrigation water. The lease holders are also responsible for the day-to-day water management on the properties they lease. Typical maintenance responsibilities of the lessee include cleaning irrigation laterals, adjusting water flows to various fields, and coordinating the use of water with other water users on shared laterals. Open Space has the responsibility for maintenance and replacement of irrigation structures. If a property is not leased but is irrigated, the on-the-ground, day-to-day water management responsibilities fall to Open Space personnel.

Table 5.2 is a summary of the number of properties in the Management Area with information regarding the number of shares of ditch company stock assigned for use at the lease as well as information as to whether a ditch can potentially serve the property.

5.2.3 South Boulder Creek

The natural hydrology of South Boulder Creek has been extensively modified by municipal, industrial, and agricultural water use. By using major landmarks or water diversion facilities, South Boulder Creek can be segmented into several reaches with more or less distinctive features. The segments identified are between the Denver Board of Water Commissioners' (Denver Water) Gross Reservoir and the mouth of South Boulder Creek. These reaches include:

- Gross Reservoir outlet to the South Boulder Diversion Dam (Segment 1)
- South Boulder Diversion Dam to Community Ditch (Segment 2)
- Community Ditch to Highway 93 (Segment 3)
- Highway 93 to South Boulder Road (Segment 4)
- South Boulder Road to Valmont Reservoir inlet (Segment 5)
- Valmont Reservoir inlet to mouth of South Boulder Creek (Segment 6)

Segments 1, 2, and 3 are included but lie outside of the Management Area. Reaches that are upstream from Highway 93 have been included because water management activities in these upstream reaches largely control the timing and quantity of flows in the downstream reaches within the Management Area. Reaches of South Boulder Creek above the outlet for Gross Reservoir were not included because Gross Reservoir serves to re-regulate the timing and quantity of flows from the upper watershed.

Segment 1, from Gross Reservoir outlet to the South Boulder Diversion Dam, is unique because the flows in this stream reach include senior South Boulder Creek water rights passed through Gross Reservoir, all "free water" (i.e., water not subject to a call) during high flow periods, plus all South Boulder Creek and west slope water stored and re-regulated through Denver Water's Gross Reservoir.

TABLE 5.2: Lease Information Regarding Open Space Properties in the South Boulder Creek Management Area

Township	Range	Section	Property	Irrigated Today?	Historically irrigated?	Ditches Serving Property	Potentially Irrigable from ditch?	Water Shares Dedicated In Lease Agreement	Comments
1N	70W	15	Andrus	Yes	Yes	North Boulder Farmer's		168 shares: North Boulder Farmers	Needs a new headgate; additional shares owned by OS could be used at this
1N	70W	28	Arnold, William	No	?			N/A	
1N	70W	35	Aweida II	No	Yes?		Enterprise	0 shares	A small piece on the SE side may be irrigable.
1N	70W	36	Baseline 75th	Yes	Yes	McGinn via Burke Hodgston lateral		2 shares: McGuinn	
1N	70W	16	Belgrove	Yes	Yes	Farmers		1.625 shares: Farmers	
1N	70W	24	Biddle (utilities)	Yes	Yes	Green		13 shares: Green 3 shrs: Jones and Donnelly	
1N	70W	34	Boulder Conservative Synagogue	No?	?			None	
1S	70W	3	Burke I	Yes	Yes	Howard		2 shares: Howard 6.6 shrs: Dry Creek No. 2	
1N	70W	34	Burke II	Yes	Yes	Howard		Burke I and Burke II are managed together	
1N	70W	10	Celestial Seasonings	No	?			None	A lateral from Farmers Ditch crosses the property.
1N	70W	21	Center Green Heights	No?	?			None	
1S	70W	15	Church	Yes	Yes	Church Mine	Goodhue	13.5 shares: Davidson	
1S	70W	11	Church of Christ	Yes	Yes	Davidson		None	
1S	70W	14	City on the Hill	No	No?		No	None	
1S	70W	2	Clough	No	Yes	McGinn		0 shares	
1S	70W	4	Clyncke, Mary	No	Yes	Dry Creek # 2		0 shares	
1N	70W	36	Cohagen	No?	Yes			0 shares	
1N	70W	36	Cohagen, conservation easement	Yes?	?	McGinn?		0 shares	
1N	70W	22	Colorado Open Lands, Phase I	No	Yes		North Boulder Farmer's	0 shares	Some irrigation may be possible via Jones Donnelly and Butte Mill.
1N	70W	28	Colorado Open Lands, Phase I					0 shares	
1N	70W	22	Colorado Open Lands, Phase II	No	Yes			0 shares	
1N	70W	27	Colorado Open Lands, Phase II					0 shares	
1N	70W	27	Copper Door	No	?			N/A	
1N	70W	33	Corzine	No	No			N/A	
1N	70W	22	Cottonwood Farms	No?	?			N/A	
1N	70W	28	Cottonwood Grove	No	?			N/A	
1S	70W	14	Damyanovich	No	Probably no		No	N/A	
1N	70W	34	Eason/Sombrero	No	yes		East Boulder	None	
1N	70W	24	Eccher	Yes	Yes	Jones and Donnelly (delivered through Butte Mill)		6 shares: Jones and Donnelly	
1S	70W	16	Fancher (Loveland Redi Mix)	No	Yes		Possibly from Dry Creek #2	None	
1N	70W	27	Flatiron Industrial Park	No	?			None	
1N	70W	28	Foothills Parkway Industrial Park	No	?			None	
1S	70W	14	Gallucci	No	Probably no	None	No	N/A	
1S	70W	3	Gebhard	Yes	Yes	Dry Creek # 2; Howard		8 shares:Dry Creek # 2 2 shares: Howard	
1S	70W	3	Greenbelt Meadows Subdivision	No	Probably yes		Dry Creek #2	N/A	
1N	70W	16	Harrington	Yes	Yes	Farmers		N/A	
1N	70W	33	Hatch-Quinby-Phipps	No	?		Probably no	N/A	
1S	70W	15	Hogan Brothers	No	No?		No	N/A	
1S	70W	2	Hoover Hill	No				N/A	
1N	70W	15	James, access easement	No				N/A	
1N	70W	15	James, air space restriction	No				N/A	
1N	70W	15	James, development rights	No	No			N/A	
1S	70W	14	Jirkovsky	No	No		No	None	
1S	70W	2	Klein	No*	Yes	McGinn	Yes	0 shares	* Some lateral repairs done in 1996; high seepage loss prevented irrigation.
1N	70W	22	LakeCentre, I	No	?			N/A	
1N	70W	22	LakeCentre, II	No	?			N/A	
1S	70W	15	Lauffenberger Trail	No				N/A	
1N	70W	34	Lentsch	No	yes		East Boulder	None	
1N	70W	36	Lewis	Yes	Yes	Cottonwod # 2; Enterprise?		0.67 shares: Original Cottonwood 0.75 shares: Enterprise	
1N	70W	16	Lousberg	Yes	Yes	Farmers		1.25 shares: Farmers	
1S	70W	15	Matheson, conservation easement	No	No?		No	N/A	
1N	70W	16	McKenzie	Yes	Yes	Farmers; Boulder and White Rock		131.25 shares: Boulder & White Rock 2 shares: Farmers	Acquired 168 shares of North Boulder Farmer's (April 9,1993) for irrigation water augmentation for McKenzie and Canino properties.
1N	70W	16	McKenzie, development rights	Yes	Yes			0 shares	

TABLE 5.2: Lease Information Regarding Open Space Properties in the South Boulder Creek Management Area

Township	Range	Section	Property	Irrigated Today?	Historically irrigated?	Ditches Serving Property	Potentially Irrigable from ditch?	Water Shares Dedicated In Lease Agreement	Comments
1N	70W	35	Merle-Smith	No	Yes		Enterprise	None	Enterprise no longer reaches this property. Acquired 0.5 shares Enterprise with purchase(currently used on Methvin or Lewis properties).
1N	70W	35	Methvin (Brandt)	Yes	Yes	Enterprise		1 share:Cottonwood # 2 1.35 shares: Enterprise	Possibly Cottonwood # 2
1S	70W	16	Moad/Cillesan	No	No			N/A	Need to check if irrigated with Rollllling Rock.
1N	70W	21	N.B.I.	No	?			N/A	Boulder & White Rock on west side.
1N	70W	21	Noble Park	No?				N/A	
1N	70W	21	Northcreek	No?				N/A	
1N	70W	16	Nu-West	Yes	Yes	Farmers			
1S	70W	11	Oakley, conservation easement	?				N/A	
1N	70W	22	Paddock, conservation easement	Yes	Yes	North Boulder Farmer's		N/A	Need to check irrigability from Boulder & Left Hand and North Boulder Farmers
1N	70W	21	Parkside Village	?				N/A	
1N	70W	28	Pearl Street Industrial Park	No	?		Unlikely	N/A	
1N	70W	21	Plum Creek	?				N/A	
1N	70W	21	Postle	?				N/A	
1S	70W	14	Reich, development rights	No	No			N/A	Only a very small area could be irrigated through the Davidson Ditch.
1N	70W	21	Reynolds	No				N/A	
1S	70W	15	Richardson I	No	No?		No	N/A	
1N	70W	22	Robinson donation	?				N/A	
1S	70W	16	Rolling Rock Ranch	Yes	Yes	South Boulder Bear Creek; Dry Creek # 2		5.6 shares: Dry Creek No. 2	
1S	70W	14	Salaman	?				N/A	
1S	70W	11	Short	Yes	Yes	Davidson	Goodhue	45 shares: Davidson	
1N	70W	23	Short and Milne-Frey land exchang	No	?			N/A	
1N	70W	23	Short and Milne	No	?			None	
1N	70W	28	Sisk	No	No?			N/A	
1S	70W	2	St. Walburga	Yes	Yes	McGinn		2.5 shares: McGinn	
1S	70W	3	Suitts	Yes	Yes	McGinn; Schearer (tailwater)		None	Property also has an adjudicated seep
1S	70W	3	Suitts, development rights	No	No			None	
1N	70W	21	Sunrise Center I	No?	?			N/A	
1N	70W	22	Sunrise Center II	No?				N/A	
1N	70W	28	Syntex	No?				N/A	
1N	70W	27	Union Pacific Railroad	No	?			N/A	
1N	70W	25	Ute Industrial Park	No	Yes	Enterprise		None	
1N	70W	22	Valmont Industrial Park	No	No?			N/A	
1S	70W	10	Van Vleet	Yes	Yes	Schearer; Dry Creek # 2; South Boulder Canyon		1 share: McGuinn 20 shares: South Boulder Canyon 4 shares: Marshallville 20.4 shares:Dry Creek # 2 (1/3 undivided interest in the Hower Ditch priority 8, all of Schearer priority 2)	Purchased 3.3 shares Dry Creek # 2 (July 21, 1995) for irrigation of Van Vleet and Gebhard.
1S	70W	16	Wille	No	No			N/A	Probably too small to irrigate.
1S	70W	14	Yunker	Yes	Yes	Davidson		30 shares: Davidson	Only NE corner of property is irrigated.
			PROPERTIES UNDER CONTRACT						
			Forsberg/Lot 1 Ute	No	?		Enterprise		
			Eason/Sombrero	No	?		East Boulder		

Segment 2, South Boulder Diversion Dam to Community Ditch, includes essentially all of the South Boulder Creek flows not diverted by Denver Water at its South Boulder Creek Diversion.

Segment 3 extends from Community Ditch to Highway 93. Its hydrology is characterized by municipal and agricultural water diversions. For example, in the winter when Community Ditch is in-filling Marshall Lake for municipal purposes, South Boulder Creek is often completely dewatered below the ditch. Low volumes of flow appear in the stream due to ground water percolation so that near Highway 93 the stream typically has some water in it.

Segment 4 extends from Highway 93 to South Boulder Road. This segment lies within the Management Area, and much of the creek-front property is owned by the Open Space Program. Only agricultural diversions occur within this segment.

Segment 5 extends from South Boulder Road to the Valmont Reservoir inlet. At South Boulder Road the Baseline Reservoir inlet diverts water from South Boulder Creek primarily for agricultural and municipal purposes. A small intermittent stream, Viele channel, flows into South Boulder Creek north of South Boulder Road and often adds flows to the creek. Water diversions by the Public Service Company of Colorado at the Valmont Reservoir inlet often take any water remaining in the creek.

Segment 6 extends from the Valmont Reservoir inlet to the mouth of South Boulder Creek. This is a highly impacted reach of South Boulder Creek because the Public Service Company of Colorado often diverts all South Boulder Creek flows. In addition, from Arapaho Road downstream to its confluence with Boulder Creek, the creek is channelized to move control flood flows. In this reach, South Boulder Creek also flows through a pond created at the site of an old gravel mine.

South Boulder Creek Instream Flow Needs

The numerous municipal, industrial, and agricultural water diversions on South Boulder Creek have created a water deficit that affects the creek ecology during various times of the year. To manage for a healthy stream environment, minimum instream flow goals are often developed. The minimum instream flow goals depend on the management purposes to be supported. For example, flows needed for recreation are often different than the flows needed to support aquatic life. Similarly, the flows needed to support sport fishes are often different than the flows needed for native fishes.

Hydrosphere Resources Corp. met with the Colorado Division of Wildlife and utilized Division of Wildlife analyses to estimate the minimum instream flow needs for South Boulder Creek to sustain an adult trout population. Hydrosphere (1994) identified preliminary minimum instream flow goals and the amount of water needed to meet those goals for South Boulder Creek. Hydrosphere's recommendations are as follows:

Instream Flow Goals

Stream Reach	Irrigation Season (April 15-October 31)	Storage Season (November 1-April 14)
Upper Reach (Segments 1 and 2)	22.0 cubic feet/second	8.0 cubic feet/second
Lower Reach (Segments 2, 3, 4, 5, 6)	6.0 cubic feet/second	2.5 cubic feet/second

Enhancement Requirement to Meet Instream Flow Goals

Stream Reach	Irrigation Season (April 15-October 31)	Storage Season (November 1-April 14)
Upper Reach (Segments 1 and 2)	Minor amounts	8.0 cubic feet/second
Lower Reach (Segments 2, 3, 4, 5, 6)	6.0 cubic feet/second	2.5 cubic feet/second

South Boulder Creek Instream Flow Protection

On December 12, 1980, the Colorado Water Conservation Board appropriated a summer (May 1-September 30) instream flow of 15 cubic feet/second and a winter flow (October 1-April 30) of 6 cubic feet/second in South Boulder Creek from the outlet of Gross Reservoir to the U.S. Geological Survey gage at Eldorado Springs (80 CW 379). The Colorado Water Conservation Board also appropriated a summer instream flow of 15 cubic feet/second and a winter flow of 2 cubic feet/second in South Boulder Creek from the U.S. Geological Survey gage at Eldorado Springs to the South Boulder Road bridge (80 CW 379). These are the only instream flow requirements for South Boulder Creek below Gross Reservoir.

The Colorado Water Conservation Board instream flow appropriation is extremely junior and serves only to prevent further degradation of current flow conditions. Water rights with a senior priority to the Colorado Water Conservation Board appropriation are not affected. However, all new water rights filings or changes to water rights filed for after the date of the Colorado Water Conservation Board appropriation cannot injure the Colorado Water Conservation Board right. For this reason, the Colorado Water Conservation Board appropriation serves to prevent further deterioration of the stream flow conditions but at the same time does not serve to improve the stream flow conditions on South Boulder Creek.

The Colorado Water Conservation Board instream flow decree does not constitute a minimum instream flow program for South Boulder Creek. The Colorado Water Conservation Board instream flow decree is one step in providing that minimum instream goals identified by Hydrosphere (1994) are met. The Hydrosphere study identifies management options to meet the minimum instream flow goals and are too extensive to reproduce here.

The City of Boulder Raw Water Master Plan (WBLA 1988) recognized that stream flows in the natural waterways of the Boulder Creek Basin are a "major ecological and economic issue." The Raw Water Master Plan also states:

> On South Boulder Creek flows frequently fall below the levels of the Colorado Water Conservation Board's instream flow right due to its extremely junior priority. The City's options for enhancing flows in this reach are limited because the only South Boulder Creek water rights owned by the City are those used to irrigate various Open Space parcels. The City has two major interests in South Boulder Creek: protecting the flow regime to prevent a worsening of water calls on Main Boulder Creek, and maintaining instream flows to enhance open space values. Therefore, the City should actively support the Colorado Water Conservation Board in protecting South Boulder Creek instream flows in water court proceedings.

Two additional paragraphs from the Raw Water Master Plan are also relevant:

> It should be noted that the virgin flows of these stream segments have frequently been less than the recommended minimum stream goals, i.e., that under completely natural conditions, flows in these reaches would periodically be less than those stated in these goals).
>
> It should also be kept in mind that basic delivery of municipal water supply consistent with the City's water supply service reliability criteria should take precedence over instream flow goals during times of drought or emergency.

One section of the *Boulder Valley Comprehensive Plan* (City of Boulder 1996a) is particularly relevant to water use within this Management Area. It states:

> 4.26 Flood Management.
> The functional and aesthetic qualities of drainage courses and waterways shall be preserved and enhanced. A noncontainment approach to flood management shall be used on Boulder Creek. A generally non-structural approach to flood control that emphasizes a natural appearance shall be used on all major water courses and drainageways. In some cases a structural solution may be used, consistent with adopted master plans.

It is presumed that the term "Boulder Creek" includes tributaries such as South Boulder Creek.

South Boulder Creek Aquatic Habitat Improvements

In 1992 the Boulder Flycasters Chapter of Trout Unlimited cooperated with Open Space to develop a South Boulder Creek Habitat Design Plan between Highway 93 and South Boulder Road. The project emphasized stream modifications designed to enhance trout habitat. Some of the modifications include the construction of current deflectors, pool and riffle development, and fish passage structures. Some of the trout habitat enhancements were implemented between 1992 and 1994 for a stream reach extending from South Boulder Road to an area just south of

the U.S. 36 overpass. Following high water in 1995, these structures were damaged and then partially reconstructed in 1996.

A related improvement that resulted from the Trout Unlimited work was the rebuilding of the Schearer Ditch headgate. The old headgate, which was falling into disrepair, was reconstructed in 1995 to allow the full appropriation of the ditch to be diverted and also provided low flow fish passage. Other headgates along South Boulder Creek impede low flow fish passage and should be evaluated for reconstruction in a manner similar to the Schearer Ditch headgate.

5.2.4 Irrigation Issues Pertaining to Specific Open Space Properties

Several properties or groups of properties have been identified that contain various site specific issues related to irrigation.

With some irrigation system improvements, the St. Walburga, Suitts, and Kline properties can be managed more efficiently as one large property for the purposes of irrigation. Presently, irrigation of these properties occurs via the McGinn and Shearer Ditches. With the subdivision of the St. Walburga property at the time of its acquisition, several irrigation infrastructure issues were also created. Some of these problems have been addressed, but the partitioning of water between land owned by the Parish and Open Space needs to be resolved. A new headgate from McGinn Ditch should be installed as well as ditching new field laterals.

The Ute Industrial Park property is not presently irrigated. However, a portion of this property was historically irrigated via the Enterprise Ditch, and irrigation could be reestablished on the western part of the property utilizing existing water rights and the installation of a new headgate. A new headgate could also be used to help facilitate land reclamation of the eastern portion of the property. A decision needs to be made to determine the long-term use of the site in light of its irrigation potential and other natural resource issues such as agricultural leasing, weed control, reclamation needs, prairie dogs, etc. The acquisition of the property came with two wells, a conditional water right, and a plan for augmentation for their use. The conditional water right would also allow a small, partially excavated pond to be filled with water from the Enterprise Ditch. Initial excavation for the pond took place prior to the acquisition of the properties by Open Space. Decisions need to be made as to what should be done with the conditional water right, what arrangements are needed to administer the plan for augmentation, and a final determination on the need to build the pond.

The Andrus property was historically but not presently irrigated using shares of the North Boulder Farmers Ditch that are owned by Open Space. The existing headgate is no longer useable. Two headgates and associated field laterals would need to be installed to irrigate this property. If a decision is made to not irrigate the property, the sale, trade, or lease of the North Boulder Farmers Ditch shares should be investigated.

A portion of the Burke I property that is not presently irrigated could be irrigated using shares of the Enterprise Ditch owned by Open Space. This portion of the Burke I property was historically irrigated by the Enterprise Ditch. Portions of the old field lateral are still visible. A draft headgate design has been prepared for this site.

A portion of the Church property is irrigated with water from the Church Mine Ditch No. 1 and No. 2. The Church Mine Ditch No. 1 and No. 2 are springs flowing from the abandoned Church mine that have been decreed for irrigation. Visual inspection of the water suggests that very high iron concentrations occur in the water because of the deep red color of the water and red staining of the field laterals. There appears to be no water quality data available for the water and is therefore a data gap. Water quality sampling should be performed, particularly for metals and other common constituents that may affect the long-term productivity of agriculture at the site.

Ditches Serving Open Space Properties

Within the Management Area, the Open Space Program holds interests in twenty-one ditches. However, only eighteen of these ditches serve water to Open Space properties within the Management Area (Appendix 5.1). Furthermore, only nine ditches serve water to Open Space properties that lie entirely within the Management Area. Additionally, two of these ditches, the Arnold-Harrop Ditch and the Church Mine Ditch No. 1 and No. 2, are respectively a seepage right and spring right that divert water into small irrigation ditches.

Open Space owns shares in ditch companies and also owns several ditches outright. The amount of water Open Space receives from a ditch company is related to the percentage of shares Open Space owns to the total number of shares in the ditch company. The amount of water that each ditch company share provides is a function of several variables including the date(s) water was originally appropriated in the ditch, annual stream flow variation, and the physical ditch capacity and efficiency.

Ditch management has various effects on Open Space management and operations[3]. Ditches provide essential supplemental water that make agricultural operations viable on Open Space. Ditch management also affects Open Space in other ways besides simply supplying water. Positive impacts include the provision of artificial riparian habitat, seepage from earthen-lined ditches that support wetlands and associated animal and plant habitat, recreational opportunities such as trail corridors, and the provision of lush green spaces. Adverse impacts include provision of vectors for weed and nonnative species introduction, unsightly maintenance such as the removal of cottonwood trees along the banks, and ditch cleaning activities that leave spoils piles along the ditch banks. Holding shares in ditch companies requires the close cooperation of Open Space personnel with numerous ditch companies and the field personnel from those companies.

[3]Appendix 5.2 contains the Program's *Long Range Management Policies* for water management.

5.3 ISSUES

Instream Flow Issues

Boulder Creek
The City of Boulder Utilities Department administers an instream flow program for Boulder Creek. This ongoing program has been successful in maintaining minimum stream flows for Boulder Creek. For this reason, instream flow issues for Boulder Creek will not be discussed further. However, no instream flow program presently exists for South Boulder Creek. Furthermore, Open Space manages a large amount of land along the creek so instream flow issues on South Boulder Creek are discussed in detail below.

South Boulder Creek
A number of instream flow issues relevant to the long-term management of South Boulder Creek have been identified and are summarized below.

- What is each stream reach managed for? In other words, should a particular reach be managed to optimize native species and another to manage for sport fishes?

- Should Open Space work to improve the instream flow conditions on South Boulder Creek? If so, what are the opportunities for Open Space to improve instream flow conditions on South Boulder Creek?

- What are the other entities that can play a role in improving the instream flow conditions on South Boulder Creek?

- How do headgates for each ditch affect fish migration?

- What opportunities are there to improve fish habitat and migration?

- Are particular segments degraded or modified that can potentially serve as restoration sites to improve aquatic habitat?

- What opportunities are there to change water management practices to maintain and/or enhance wetlands and riparian areas along South Boulder Creek?

- What are the specific minimum flows needed to maintain self-sustaining populations of native and non-native fish populations, macroinvetebrate communities, and threatened and endangered species for all reaches of South Boulder Creek?

- What are the flow conditions needed to maintain the riparian zone and wetlands on South Boulder Creek?

- How should Open Space balance its use of water for agriculture and land management with endangered species management and management of instream flows while protecting the water rights that it owns?

- What is the overall water quality of South Boulder Creek, and is it suitable for the various management objectives identified for each segment?

- What are the flow conditions needed to maintain the riparian zone and wetlands on South Boulder Creek?

- How should Open Space balance its use of water for agriculture and land management with endangered species management and management of instream flows while protecting the water rights that it owns? What is the overall water quality of South Boulder Creek, and is it suitable for the various management objectives identified for each segment?

Relicensing of Gross Reservoir
Denver Water is engaged in relicensing Gross Reservoir, located on South Boulder Creek, through the Federal Energy Regulatory Commission. The City of Boulder is a party to this proceeding. Public Works/Utilities and Open Space staff are working jointly on this issue.

Through this process, Denver Water is attempting to reauthorize the reservoir and is also proposing to install a hydroelectric power plant at Gross Dam. Denver Water has not proposed enlarging Gross Reservoir in its filings with the Federal Energy Regulatory Commission. However, Denver Water has not ruled out enlarging Gross Reservoir in the future.

Various issues in the present and future operation of Gross Reservoir have been identified that may impact water rights and the aquatic environment within the Management Area. These issues include the effects of the reservoir's operation on the stream flow in South Boulder Creek from November through March and the consequent impact on aquatic species; the impact on the high flows and how that impact affects the *Spiranthes diluvialis* (Ute ladies'-tresses orchid) and the *Zapus hudsonius preblei* (Preble's meadow jumping mouse); the potential for increased discharge fluctuations at Gross Reservoir caused by power plant operations; and the potential for adverse impacts on water rights owned by the City through the present water rights administration of Gross Reservoir. Staff is working with Denver Water and the Federal Energy Regulatory Commission to address these issues.

5.4 DATA GAPS

- Little information about wells on and adjacent to Open Space land has been collected to date. Information should include depth to ground water, type of use, capacity of use, water quality from well, adjudication date.

- At the time this inventory report was compiled, no hydrologic data for Dry Creek was located and remains a data gap that should be addressed.

- Little information about water rights for stock ponds, seeps and springs has been collected to date. This information will need to be collected in the future. At least three are known but have not been reviewed as part of this inventory. They include:

    1. Suitts "seep" which is also known as the L.F. Spicer Ditch
    2. Hogan "seep" on the Gebhard property
    3. Andrus Pipe

- Little physical information about ponds or other water bodies is available. Information such as the size and volume of water bodies and water quality has not been collected to date. This information will need to be collected in the future.

- A portion of the Church property is irrigated with water from the Church Mine Ditch No. 1 and No. 2. The Church Mine ditches are decreed for irrigation. Visual inspection of the water suggests that there are very high iron concentrations in the water because of the deep red color of the water and red staining of the field laterals. There appears to be no water quality data available for the water and is therefore a data gap. Water quality sampling should be performed, particularly for metals and other common constituents that may affect the long-term productivity of agriculture at the site.

- The Van Vleet property has important wetlands containing the Ute ladies'-tresses orchid. Gravel pit reclamation on the adjacent University of Colorado Flatiron property may impact the ground water conditions on the Van Vleet property and thereby affect the wetlands on the property. A data gap exists as to the baseline ground water conditions on the Van Vleet property.

- Parts of the Gebhard, Burke I, Klein, Aweida II, Merle-Smith, and the Ute Industrial Park properties, as well as properties outside of the Management Area, could be irrigated using Enterprise Ditch water. Open Space presently holds enough shares of the Enterprise Ditch to irrigate at least some of these properties. To irrigate these properties various infrastructure improvements would be necessary such as rebuilding headgates or reditching. However, additional shares of Enterprise Ditch would be necessary to irrigate all of the irrigable land on these properties. The number of acres of land that can potentially be irrigated via the Enterprise Ditch and the number of additional shares of the Enterprise Ditch that could be purchased to fully irrigate these lands are data gaps that needs to be closed.

- An augmentation plan and conditional water right exist for the Ute Industrial Park property. Open Space has a conditional water right at Ute Industrial Park. This simply means that the legal work at the site in regards to water rights is not complete. To get an absolute right, Open Space needs to pursue diligence in water court and demonstrate full use of the water.

The necessary paperwork to continue diligence was submitted to the water court earlier this year. However, since Open Space may be using Ute Industrial Park in a manner somewhat differently from what appears in the decree, we may wish to speak with the water attorneys about amending the decree and augmentation plan to more closely conform with future Open Space plans for the site.

- Pit D on the Colorado Open Lands property is owned Open Space. Pit D was originally a gravel mine and is presently permitted through the Colorado Mined Land Reclamation Board. Before the Colorado Mined Land Reclamation Board permit can be closed, a plan for augmentation of evaporative losses of water from the pit is required from the Office of the Colorado State Engineer. The water rights issues regarding Pit D need to be settled in the near future.

6. SOILS

6.1 INTRODUCTION

The *Boulder County Area Soil Survey* was published in 1975 by the U.S. Department of Agriculture Soil Conservation Service[4] (Moreland and Moreland 1975). Although the mountainous portions of the County are excluded from the survey, the soils of the entire Boulder Valley has been mapped and are a part of the survey. The information used for description and analysis of the soils of the South Boulder Creek Management Area are derived from the soil survey and data provided by the Colorado state office of the Natural Resource Conservation Service.

6.2 RESOURCE INFORMATION

6.2.1 Soil Orders

Soils are classified based upon similarity of origin, moisture regime, temperature, color, texture, and structure. Important chemical and mineralogical properties include pH, soil depth, the presence of organic matter, clay, iron, and salts. At the broadest level, soils are classified into a range of orders. Orders are related to soil-forming processes and are determined in the field by the presence or absence of diagnostic layers or horizons in the soil. There are four soil orders in Management Area: mollisols, entisols, inceptisols, ardisols, and non-soil (Figure 6.1 and Figure 6.2).

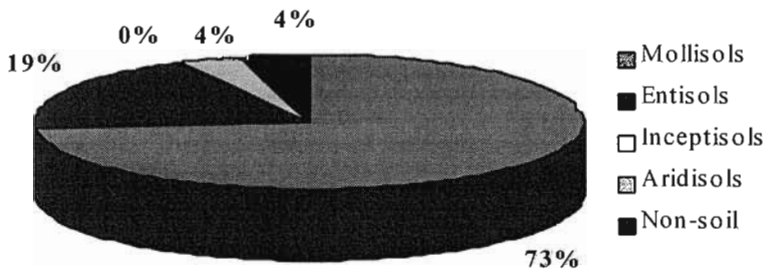


Figure 6.1:
Soil Orders of the South Boulder Creek Management Area

[4] Note: The Soil Conservation Service has been renamed the Natural Resource Conservation Service.

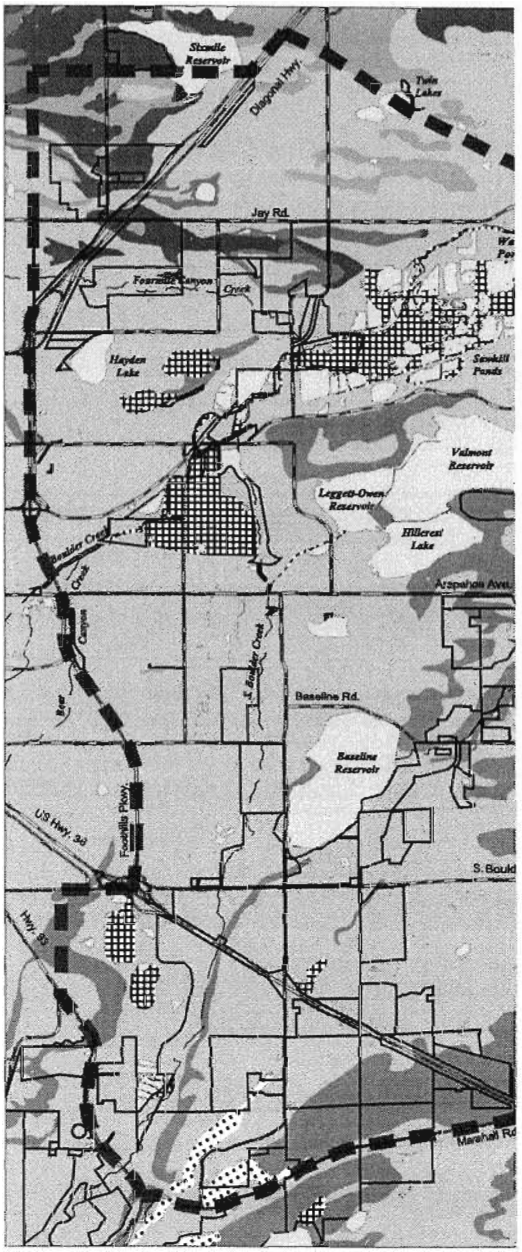


Figure 6.2:
Soil Orders of the South Boulder Creek Management Area

Soil Order
- Aridisols
- Entisols
- Inceptisols
- Mollisols
- Non Soil
- Rock Outcrop

South Boulder Creek Management Area Extents

City of Boulder Open Space

Hydrology
- Creek
- Lake

Roads
- Arterial
- Highway

Mollisols are dark grassland soils characterized by a thick dark surface horizon. Most of the important agricultural soils in North America are mollisols and developed under prairie vegetation.

Soils of the Mollisol order are the most prevalent within the Management Area--they make up about 74% of the landscape. Development of Mollisols occurred on terraces, uplands, and alluvial deposits and outwash mesas. Mollisols are most prominent on valley side slopes, small

gravely knobs, and gently rolling to nearly level terraces above drainageways. Soils having a higher clay content in their A horizon are found more frequently along the tops of rolling mesas, while soils containing more sand and loam are concentrated along bottom lands and drainageways.

Entisols are found in 19% of the Management Area. Entisols are mineral soils which lack diagnostic horizons or where horizons are just beginning to develop. They are found on either upland hills and ridges or along the side slopes of terraces and fans. Entisols found along upland hills and ridges developed from clayey residuum, weathered from sandstone, and have a high calcium content. Soils of terrace and fan side slopes are shallow, undifferentiated cobbles and stones. The soil surface is frequently a thin layer of cobble covering sandstone. In all cases there are areas where aspect, slope, climate, underlying bedrock, and erosion establish conditions which limit soil development. Although some entisols are very fertile (such as recent river deposits), the hot and dry entisols near ridge lines tend to be relatively sparsely vegetated.

Inceptisols are the third soil order in the Management Area--they make up less than 1% of the soil in the Management Area. Like entisols, inceptisols are characterized by relatively poor horizon development. Although inceptisols show horizons, these are thought to develop relatively quickly rather than from extreme or prolonged weathering. For example, soil saturation resulting from flooding can quickly alter underlying rocks and sediment-forming soils. In the Management Area, inceptisols are derived from clayey alluvium and are generally restricted to areas of poor drainage, tend to be areas of salt accumulation, and often underlie wetlands.

Less than 4% of the Management Area is mapped as aridisols. As indicated by the name, aridisols are mineral soils in dry climates. Parent material of aridisols is weathered shale and sandstone. These soils are typically characterized by surface horizons with little organic accumulation and light yellow/tan colors. Aridisols are typically not subject to intensive leaching either because of low levels of precipitation or a sheltered location.

Non-soil is an area where the entire soil profile has been removed from the site and parent material is exposed. These lands may have been mined for gravel or quarried. Additionally, the lands may include areas where rock, gravel, or other material have been hauled to an area for fill--for example, a dike or levee.

6.2.2 Soil Series

Although soil orders provide good general information regarding soil properties, soils are classified at increasingly finer levels to help farmers, ranchers, engineers, and others develop plans for conservation and land use. The soil series is a useful level of classification because most soil surveys provide maps showing the approximate boundaries of soil series. Each soil series has major horizons, or layers, that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped.

Further refinement is often provided in a soil survey to differentiate when soils of one series differ in texture, slope, stoniness or other characteristics that affect the use of a soil. On the basis of such differences, the soil series of the Management Area are divided into phases (Table 6.1). When viewed in a landscape-scale perspective, the relationships and patterns of the soil series become more apparent (Figure 6.3*).

Table 6.1: Soil Order, Series, and Phase Description
Source: Moreland and Moreland (1975)

Order	Series	Phase
Aridisols	HELDT	Heldt Clay 0-3% slopes
	HELDT	Heldt Clay 3-5% slopes
	RENOHILL	Renohill silty clay loam 1-3% slopes
	RENOHILL	Renohill silty clay loam 3-9% slopes
	ASCALON/OTERO	Ascalon-Otero complex 3-5% slopes
	ASCALON/OTERO	Ascalon-Otero complex 9-20% slopes
Aridisols	ASCALON/OTERO	Ascalon-Otero complex 5-9% slopes
Entisols	RENOHILL	Renohill loam 3-9% slopes
	SAMSIL	Samsil clay 3-12% slopes
	SAMSIL/SHINGLE	Samsil-Shingle complex 5-25% slopes
	TERRACE ESCARPMENTS	Terrace Escarpments
Inceptisols	LONGMONT	Longmont clay 0-3% slopes
	ASCALON	Ascalon sandy loam 1-3% slopes
	ASCALON	Ascalon sandy loam 3-5% slopes
	ASCALON	Ascalon sandy loam 5-9% slopes
	ASCALON/OTERO	Ascalon-Otero complex 3-5% slopes
	ASCALON/OTERO	Ascalon-Otero complex 5-9% slopes
	ASCALON/OTERO	Ascalon-Otero complex 9-20% slopes
	CALKINS	Calkins sandy loam 0-1% slopes
	CALKINS	Calkins sandy loam 1-3% slopes
	HARGREAVE	Hargreave fine sandy loam 1-3% slopes
	HARGREAVE	Hargreave fine sandy loam 3-9% slopes
	KUTCH	Kutch clay loam 3-9% slopes
	LOVELAND	Loveland soils 0-1% slopes Mollisols
	MANTER	Manter sandy loam 0-1%slopes
	MANTER	Manter sandy loam 1-3% slopes
	NEDERLAND	Nederland very cobbly sandy loam 1-3% slopes
	NIWOT	Niwot soils 0-1% slopes
	NUNN	Nunn sandy clay loam 0-1% slopes
	NUNN	Nunn clay loam 0-1% slopes
	NUNN	Nunn clay loam 1-3% slopes
	NUNN	Nunn clay loam 3-5% slopes
	NUNN	Nunn clay loam 5-9% slopes
	VALMONT	Valmont clay loam 1-3%slopes
	VALMONT	Valmont clay loam 3-5%slopes
	VALMONT	Valmont cobbly clay loam 1-5%slopes

6.2.3 Soil Characteristics

While soil classification alone provides a great deal of useful information for land managers, soil scientists have also conducted detailed evaluations of soils to better understand their suitability and limitations for specific uses. Two of these evaluations include water and wind erodibility.

Wind Erosion Ratings

Although not included in the soil survey, the Natural Resource Conservation Service has developed a *Highly Erodible Soil Listing* (Soil Conservation Service 1987) for Boulder County that provides technical information regarding susceptibility of each soil phase to wind and water erosion (Table 6.2 and Figure 6.4). Wind erosion is a more serious problem where vegetation has been removed--for example in areas used as annual cropland, overgrazed areas, or burned areas. Farming practices such as strip cropping, stubble mulch, reduced tillage, no tillage, and treatment of critical areas (reseeding, planting, etc.) can reduce the extent of wind (and water) erosion of soil in cropped systems.

Table 6.2: Susceptibility of Soils Prone to Wind Erosion

Soil Series	Phase	Susceptibility to Wind Erosion
ASCALON	AcB	Highly erodible
ASCALON	AcC	Highly erodible
ASCALON	AcD	Highly erodible
ASCALON	AoC	Highly erodible
OTERO	AoC	Highly erodible
ASCALON	AoD	Highly erodible
OTERO	AoD	Highly erodible
ASCALON	AoE	Highly erodible
OTERO	AoE	Highly erodible
CALKINS	CaA	Highly erodible
CALKINS	CaB	Highly erodible
HARGREAVE	HaB	Highly erodible
HARGREAVE	HaD	Highly erodible
HELDT	HeB	Highly erodible
HELDT	HeC	Highly erodible
KUTCH	KuD	Highly erodible
LONGMONT	LoB	Highly erodible
LOVELAND	Lv	Highly erodible
MANTER	MdA	Highly erodible
MANTER	MdB	Highly erodible
MANTER	MdD	Highly erodible
NIWOT	Nh	Not highly erodible
NUNN	NnA	Not highly erodible
NUNN	NnB	Not highly erodible
NUNN	NuA	Not highly erodible
NUNN	NuB	Not highly erodible
NUNN	NuC	Not highly erodible
NUNN	NuD	Not highly erodible
RENOHILL	RnB	Highly erodible
RENOHILL	RnD	Highly erodible
ROCK OUTCROP	Ro	Not highly erodible
SAMSIL	SaD	Highly erodible
SAMSIL	SeE	Highly erodible
SHINGLE	SeE	Highly erodible
TERRACE ESCARPMENTS	Te	Not highly erodible
VALMONT	VaB	Highly erodible
VALMONT	VaC	Highly erodible
VALMONT	VcC	Not highly erodible

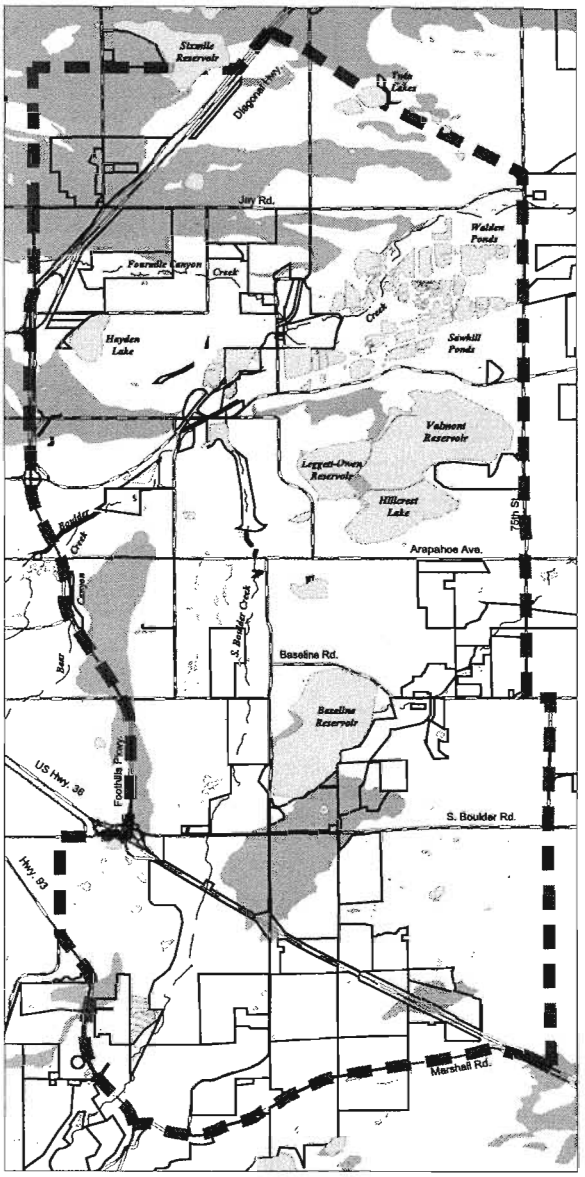


Figure 6.4:
Soils Suceptable to Wind

Soils Susceptible to Wind Erosion
Highly erodible

South Boulder Creek Management Area Extents

City of Boulder Open Space

Roads
Arterial
Highway

Hydrology
Lake
Creek

0 1 Miles

Water Erosion Ratings

There are seventeen soils series and thirty-three soil phases vulnerable to water erosion in the Management Area (Table 6.3 and Figure 6.5). Water erosion is a greater threat to soil conservation in the Management Area because: (1) well-established vegetation does not always protect an area from soil loss due to water erosion, and (2) sedimentation resulting from erosion can have far-reaching adverse impacts on ecological and agricultural function of wetlands, ponds, creeks, and ditches. Further detail of the implications for management of soils prone to water erosion is given in the issues section.

Table 6.3: Soil Susceptibility to Water Erosion
Source: Soil Conservation Service 1987

Soil Series	Phase	Susceptibility to Water Erosion
ASCALON	AcB	Not highly erodible
ASCALON	AcC	Not highly erodible
ASCALON	AcD	Not highly erodible
ASCALON	AoC	Not highly erodible
OTERO	AoC	Not highly erodible
ASCALON	AoD	Not highly erodible
OTERO	AoD	Not highly erodible
ASCALON	AoE	Not highly erodible
OTERO	AoE	Highly erodible
CALKINS	CaA	Not highly erodible
CALKINS	CaB	Not highly erodible
HARGREAVE	HaB	Not highly erodible
HARGREAVE	HaD	Potentially highly erodible
HELDT	HeB	Not highly erodible
HELDT	HeC	Not highly erodible
KUTCH	KuD	Potentially highly erodible
LONGMONT	LoB	Not highly erodible
LOVELAND	Lv	Not highly erodible
MANTER	MdA	Not highly erodible
MANTER	MdB	Not highly erodible
MANTER	MdD	Not highly erodible
NIWOT	Nh	Not highly erodible
NUNN	NnA	Not highly erodible
NUNN	NnB	Not highly erodible
NUNN	NuA	Not highly erodible
NUNN	NuB	Not highly erodible
NUNN	NuC	Not highly erodible
NUNN	NuD	Not highly erodible
RENOHILL	RnB	Not highly erodible
RENOHILL	RnD	Potentially highly erodible
ROCK OUTCROP	Ro	Not highly erodible
SAMSIL	SaD	Potentially highly erodible
SAMSIL	SeE	Highly erodible
SHINGLE	SeE	Highly erodible
TERRACE ESCARPMENTS	Te	Potentially highly erodible
VALMONT	VaB	Not highly erodible
VALMONT	VaC	Not highly erodible
VALMONT	VcC	Not highly erodible

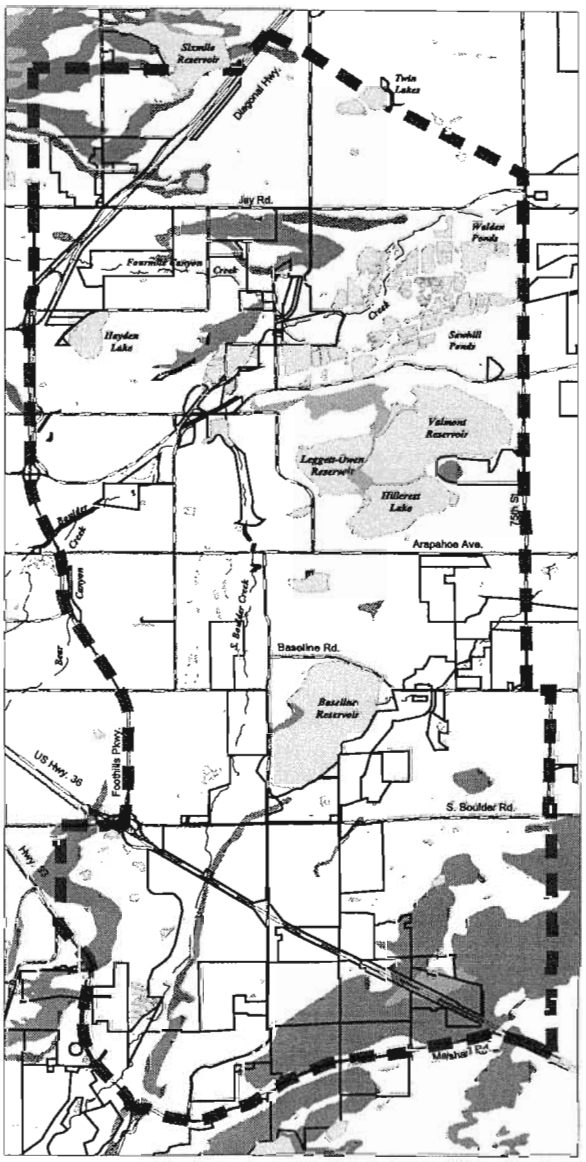


Figure 6.5:
Soils Suceptible to Water Erosion

Soils Susceptible to Water Erosion
Highly erodible
Potentially highly erodible

South Boulder Creek Management Area Extents

City of Boulder Open Space

Hydrology
Lake
Creek

Roads
Arterial
Highway

0 1 Miles

Other Soil Characteristics

Besides the detailed descriptions and mapping of soils, the Boulder County Area Soil Survey (Moreland and Moreland 1975) provides information about agriculture, engineering, and recreational uses (Table 6.4). The uses relevant to management of the Management Area are discussed in greater detail in the issues section.

Table 6.4: Other Soil Characteristics

USE	LIMITATIONS
Agriculture	
• irrigation	application rates for bottomland pastures
• drainage of cropland/pasture	drainage
• crops	salt-tolerant crops
Silviculture	
• native forest management	Changes in soil composition resulting from fire suppression are suspected (citation). Even in 1975, it was noted that most of the woodlands are being used for recreation and homesites rather than wood production.
Recreational Uses	
• picnic areas	• rock outcrop
• paths and trails	• clay
• slow permeability	• slow permeability
	• very gravelly/cobbly
Wildlife	
only general information, not specific to any soil classification unit	• lack of cover/shelter • lack of water
Engineering/Construction	
• pond/reservoir	• depth to bedrock
• embankments/dikes	• slow permeability
• septic tank absorption	• low available water capacity
	• high salinity
	• high alkalinity
	• depth to seasonal high water

6.3 ISSUES

Agricultural Land Uses

Agricultural land uses are controlled by many soil characteristics other than nutrient status and irrigability. For example, historical patterns of livestock grazing have devastated the creek banks and steep slopes in some areas of the Management Area. Prior to Open Space management, the steep, fine-textured creek banks of Dry Creek were severely eroded as a result of trampling by livestock. The Open Space Program removed livestock from the Dry Creek bottomlands soon after acquiring the property. The creek banks are now revegetated and in considerably better condition. Similar impacts from cattle and horses can be noted on steep slopes, ditch banks, and some bottomlands which are susceptible to erosion.

Annual cropping can result in significant amounts of wind and water erosion. The Natural Resource Conservation Service and soil scientists throughout the world have developed many soil conservation practices tailored for annual crops. Opportunities exist for the lease manager of the Baseline 75 property to work with the Natural Resource Conservation Service to ensure minimal soil loss and sedimentation from annual croplands. Presently, about 32 acres are in the process of being converted from crops to grass hay.

Irrigation ditches excavated in the erosion prone, fine-grained soils can also result in long-term management problems as the ditch channels become deeply incised and no longer provide effective water distribution. Eroded ditch channels tend to be replaced by newly excavated parallel trenches with no better engineering. These erode in turn and are replaced by yet other ditches. This loss of soil and damage to the landscape should be minimized in coordination with other management goals (wetlands preservation, cost-effectiveness, conservation of irrigation water, etc.). Soil series in the area that is poorly suited to trenching for irrigation include the sandy loam Ascalons, Manters, and Welds.

Farm roads often widen and deepen as they traverse highly erodible soils. The pattern is similar to what happens with ditches. As the ruts develop, a new two track is established alongside the old road. Often the old road becomes a watercourse and is eroded by water runoff. The newer road eventually deepens and yet another two track is established. Similar patterns develop with pedestrian, bike, and horse trails (see below). Importing a well-drained, coarse-grained (weed-free) road surface is an effective way of maintaining roads in erodible soils.

Trails

The extensive fine-textured and sandy cobbly soils in the Management Area present a significant erosion hazard if not specially engineered as a path or road. Undesignated trails usually lack erosion control treatments such as water bars and specially prepared trail surfaces. These trails tend to become wider and deeper over time as the soil erodes.

In some spots, erosion has exposed the bedrock 10 to 20 inches below the ground surface. Further, once vegetation is killed by trampling, there is little to hold the sandy-textured soil together. Water and wind carry the soil particles downstream and downwind. Unmanaged trails in areas of high erosion hazard result not only in the removal of native vegetation but sedimentation of the creeks, ponds, and wetlands which lie downstream. Native vegetation is also replaced by weedy species. Canada thistle (*Crisium arvense*) is especially prevalent in moist areas along the disturbed edges of trails where sporadic foot or hoof traffic keeps native vegetation from becoming established, but the level of disturbance is not severe enough to exclude this aggressive weed. Knapweed (*Acosta difusa*) is similarly invasive along dry disturbed edges of trails.

Native Vegetation

Native plant communities are, to a great extent, a reflection of the underlying soil structure. Protection of the soil profile from artificial disturbances should be an integral component of a native plant conservation strategy. Where this soil has been disturbed by natural forces (mass movement--landslides, prairie dogs or fire), changes to the vegetation are certain to follow. For

example, ruderals (plants adapted for growth in disturbed or low-nutrient conditions) often dominate landslide areas. The vegetation of prairie dog colonies is affected, in part, by the disturbances to soil caused by prairie dogs (Ingram and Detling 1984; White 1986; Carlson and White 1988). The impacts of fire are more subtle and related to topography, intensity of the fire, regional climate, soil texture, nutrients, organic matter, soil pH, etc. (Kitzberger 1991).

Animals
The Open Space Program has typically not managed any of the invertebrate soil animals which are responsible for fundamental ecosystem processes such as nutrient cycling and which form the basis of energy flow in grasslands, forests, and other habitats. Large burrowing vertebrates, mostly mammals, are somewhat better understood. Black tailed prairie dogs are well studied and clearly have effects upon the chemical and physical characteristics of soils (Ingram and Detling 1984; White 1986; Carlson and White 1988) as well as upon the likelihood of soil erosion--resulting, for example, from removal of grass cover in areas of erodible soils.

Other Engineering Uses
Visitor use facilities such as picnic areas and parking lots need to be constructed with an understanding of the limitations imposed by soil conditions. Erodible soils are unsuitable for heavy uses such as picnic areas unless specifically engineered to improve their resistance to wear and tear. Shallow soils, with outcropping rock or shallow rocky layers, areas with high seasonal water, slow permeability, or high shrink-swell potential are typically unsuitable for the placement of leach fields or septic systems.

6.4 DATA GAPS

- Delineation of finer-scale soil mapping units or an on-site evaluation is needed to plan for intensive localized uses.

- Evaluate erosion potential and possible conservation strategies (best management practices) for agricultural and other uses (trails) in erodible soils (annual crops, grazing, irrigation, farm roads).

- Relate trail condition and maintenance to erodibility of soils throughout the Management Area and identify where trail surfacing should be considered.

- Where should trails be reconstructed along a more gentle grade? Soil characteristics should be included in evaluation and planning process.

- What soils should be avoided because of high construction/maintenance costs? Soils least favorable to trail design should be identified from the engineering specifications in the *Soil Survey of the Boulder Area.* Several of these soils include Heldt clay and Samsil clay.

- Opportunities are available to create a "theme" of unsuitable soils (trails specific) in the Geographic Information System and use it as a guide when creating trail alignments and corridors.

- Some areas within the South Boulder Creek Management Area have been altered and greatly modified since the 1975 *Soil Survey* was printed. These changes are not reflected in the survey and should be recognized as missing information.

7. VEGETATION

7.1 INTRODUCTION

The non-wetland vegetation of the South Boulder Creek Management Area is described, and factors influencing the distribution and condition of plant communities are presented in this chapter. Past and present management goals and activities are outlined. Completed and ongoing research pertaining to native plant community management is described, and gaps in the information required for effective planning are identified. This information has been compiled for use in developing and evaluating resource management alternatives for the Management Area.

Vegetation management goals for the City of Boulder Open Space Program follow the guidance of the *Boulder County Comprehensive Plan*, the *Boulder Valley Comprehensive Plan*, sections of the City of Boulder Charter pertaining to City Open Space, and the *Long Range Management Policies*. General County and City goals for vegetation management include maintaining rural character and preserving and conserving agricultural lands, preserving or restoring natural areas (i.e., native plant communities, rare plant habitat, natural processes), preserving water resources, and preserving land for aesthetic or passive recreational value. The South Boulder Creek management planning process will integrate multiple Program goals including native plant community management with objectives formulated specifically for the Management Area.

Key management themes in the area include monitoring and controlling problem non-native species, managing argicultural activites, maintaining rare species and community habitat, and restoring native plant habitat. The management planning process documents, evaluates, and priortizes specific objectives within these broad themes.

Baseline inventories and experimental and observational studies have been conducted to address information needs in the Management Area and other sections of the Open Space system. Studies of native plant species and communities, exotic species, and agricultural land have included:

- Wetlands inventory and mapping (see Wetlands chapter)
- Survey and mapping of non-wetland vegetation in a portion of the Management Area (ERO 1996)
- Survey and mapping of vegetation of the Open Space system (Bunin 1985)
- Annual weed mapping (Open Space staff)
- Characterization of grassland plant and animal communities (Bock et al. 1995, Bennett et al. 1995)
- Ute ladies'-tresses (*Spiranthes diluvialis*) biology and ecology (Arft 1995),
- Cottonwood regeneration on South Boulder Creek (D'Amico 1996 and 1997)

Vegetation types have been classified and described for wildlife habitat studies conducted on Open Space land (Thompson and Strauch 1987, Keammerer et al. 1990, Bock et al. 1995). The

Open Space Program developed a habitat classification in 1996 and 1997 for use with the Program's wildlife sightings database (City of Boulder 1997). Landsat remote sensing imagery was used by staff and researchers (Bock et al., report in progress) in 1996 and 1997 to develop vegetation maps of the Boulder Valley and vicinity.

7.2 RESOURCE INFORMATION

7.2.1 General Description of Vegetation

The vegetation occurring in the Management Area reflects the topographic, elevational, geologic, hydrologic and climatic diversity that is characteristic of the eastern slope of the Colorado Front Range Foothills. Landscape and biological diversity is high where the Great Plains and Rocky Mountain ecological provinces (Bailey et al. 1994) meet and overlap in the Boulder Valley area. Plant communities in Front Range ecotonal areas contain plains and montane species. Although characteristics of the plains-to-foothills transition are more evident west of the Management Area, the relatively high average rainfall and mild winter weather in the Boulder Valley area strongly influence community composition and patterns in vegetation throughout the Valley. The major native vegetation types in the Management Area are short-, mixed, and tallgrass prairies, plains and foothills shrubland, riparian, wet meadow, and wetland communities (Figure 7.1* and Table 7.1). Some sections of the Management Area are dominated by non-native species where fields are cropped or planted with perennial hay species or where noxious species have invaded. A few agricultural fields have been replanted in native grass species, and other old fields have restoration potential.

Patterns in the vegetation are related to soil types, hydrology and hydrogeology (see Wetland and Natural History chapters), wildlife activity, additional biotic and abiotic processes, and past and present land uses. Grassland communities occur in a mosaic of patches with short- and mixed grass prairie species in dry, upland areas, and mixed and tallgrass species in swales and bottom lands. Shrubland communities follow drainages, mesa escarpments, and north-facing hillsides. Riparian shrubland, woodland, and forest stands occur where water flows perennially or seasonally in streams, draws, and irrigation ditches.

The mosaic of plant communities existing on the landscape today is in part shaped by past and present land use. Livestock grazing, hayfield and cropland cultivation, road and trail construction and use, urban development, water use, fire suppression, and gravel mining have influenced the character of the vegetation in the area for more than a century. Past and present land uses have contributed to the introduction and spread of exotic plant species in most native plant communities and agricultural areas.

The inventory report describes plant communities, land-use history, and other information that is needed for developing management recomendations. Important gaps in information are identified in the report. Missing information will be prioritized in the management plan, and recommendations will be made for filling high priority gaps.

Table 7.1: Ecosystem and Vegetation Types[5]

Ecosystem/Major Cover Type	Vegetation Type
Grassland	Shortgrass prairie
	Mixed grass prairie
	Tallgrass prairie
	Mixed native and non-native
	Forb dominated
Shrubland (upland)	Shrubland
Riparian	Plains riparian forest/woodland
	Plains riparian shrubland
Agricultural lands	Non-native hay/pasture
	Alfalfa/grass
	Annual Crop
Other cover types	Conservation easements, buildings, parking lots
	Open water
	Exposed rock/talus

[5]Please refer to Figure 7.1* and Figure 7.2* which display vegetation by habitat and ecosystem. The vegetation types listed here may include riparian and other wetland communities that are described in the Wetlands chapter.

7.2.2 Ecological Processes and Other Factors Influencing Vegetation Patterns

Many variables and ecological relationships affect vegetation types and patterns. The Natural History chapter provides an overview of the ecological setting for the Management Area. This chapter summarizes factors influencing vegetation and focuses on information needed to develop a resource management plan.

Fire
Native vegetation in the Boulder Valley area is adapted to fire. Example adaptations include:

- The primary growth tissue in prairie grass species is usually below ground level which promotes survival after fire; big bluestem, a tallgrass species, responds favorably to early to mid-spring burns (Towne and Owensby 1984)
- Ponderosa pine seed germination is stimulated by fire, and the thick plates of bark on mature trees are fire resistant

Grassland plant species are also adapted to ungulate grazing, prairie dog herbivory, and small mammal activity. All of these natural disturbance factors should be considered when developing management strategies for grasslands in this area.

Fire is a key ecological process sustaining native ecosystem health and integrity. The biological and structural diversity of native communities is influenced by fire. Examples of the effects of fire on native plant communities include:

- Accumulated dead plant material (litter) is broken down or removed by fire, nutrients are recycled, and seedling growth is stimulated by allowing light and nutrients to reach the soil surface
- Fire can regulate population levels of insect species that affect plant survival
- Catastrophic fires are prevented by relatively frequent fires that remove dead plant material and reduce tree seedling and sapling densities
- The regeneration of many native species is influenced by and sometimes dependent on the disturbance and heat produced by fire (e.g., ponderosa pine)
- Invasive exotic plant species may be negatively or positively affected by fire, depending on the species and the conditions of the fire
- Burned areas green-up faster in the spring than unburned areas and provide an important food source for wildlife

Fire history in the Boulder Valley area has been studied predominantly in montane forest communities (Goldblum and Veblen 1992, Veblen and Lorenz 1986, Laven and Gallup 1995, Veblen et al. 1996). Post-European settlement changes in fire frequencies have caused significant changes in native plant and animal communities. Before European settlement, fires generally occurred frequently and with low intensity. Fire has been suppressed over the last 80-100 years. Without frequent, low intensity fire, dead plant material has accumulated and plant

community composition has changed. The conditions resulting from fire suppression can lead to high intensity wildland fires.

Knowledge of fire history for grasslands in the Boulder Valley is limited. However, there are numerous references to the importance of fire as a natural disturbance in grassland ecosystems of the United States, specifically the Colorado Front Range grasslands (Jackson 1965, Cooper 1961, Baker and Galatowitsch 1985, Colorado Natural Areas Program 1986). The Boulder area grasslands probably burned frequently before European settlement (perhaps every 3-15 years) depending on weather patterns, Native American use of fire, ungulate grazing, and prairie dog activity. Fires may have burned during summer months due to lightening strikes but were also likely to burn from fall through mid-spring when conditions were dry and windy (Baker and Galatowitsch 1985).

The history of fire use in the Management Area is not well documented. Prior to 1985, formal records of fires were not kept; however, some informal records do exist and are based on recollections of area farmers and ranchers (Table 7.2).

Fire suppression and land use changes over the last 150 years have resulted in altered plant community composition and vigor. The introduction and spread of numerous non-native species have contributed to changes in fire behavior and effects. The use of fire as a grassland management tool must incorporate careful timing, intensity, and frequency to discourage problem non-native species and improve conditions for native communities.

Sensitive species and communities in the Boulder Valley area are adapted to pre-European settlement fire ecology. The effects of human-caused changes in fire regime and behavior on rare species are unknown or poorly understood. Plans to restore natural fire regimes in native plant communities through prescribed burning need to address potential effects on sensitive species. In the South Boulder Creek floodplain and upland terraces, the integration of fire management planning for the bobolink, Preble's meadow jumping mouse, the Ute ladies'-tresses orchid, and tallgrass communities is critical in order to sustain these sensitive resources.

Fire can be a valuable resource management tool. Prescribed fire can mimic natural fire and reduce the risk of catastrophic wildfire by decreasing accumulating dead plant material and woody plant densities. The seasonal timing and the weather conditions under which prescribed fire is conducted are important factors to consider in order to ensure ecosystem health and human safety. Examples of goals for a prescribed burning program are:

- Reintroduce fire as a natural process in the prairie ecosystem to maintain a balance of woody and non-woody prairie vegetation
- Evaluate prescribed burning as an integrated weed management tool
- Develop procedures and methods for safe implementation of prescribed burning
- Promote cooperative interagency resource management
- Involve and educate local residents about fire ecology and the role of fire in maintaining healthy ecosystems

Table 7.2: Fire History of the South Boulder Creek Management Area

Property Name Site Name	Date	Size	Objectives
Prescribed Burns			
Yunker, south of U.S. 36 Tallgrass Prairie site #9	Spring 1995	10-15 acres	Reduce thatch buildup, promote native tallgrass species.
Yunker/Short, north of U.S. 36 Tallgrass Prairie site #4	Spring 1993	6 acres	Reduce thatch, control weed species, promote native tallgrass species.
Yunker (east)/Short Tallgrass Prairie site #6	Spring 1993, 1997	20 acres	Reduce thatch buildup, control weed species, promote native tallgrass species.
Yunker (east)/Short Tallgrass Prairie study plots	Spring 1994, 1995, 1996, 1997	1 acre (total)	Study the effects of fire on native tallgrass species.
Church Tallgrass Prairie study plots	Spring 1994, 1995, 1996, 1997	1 acre (total)	Study the effects of fire on native tallgrass species.
Van Vleet (north)	Fall 1996	30 acres	Reduce thatch buildup.
Van Vleet (south) Tallgrass Prairie study plots	Spring 1993, 1994	1 acre (total)	Study the effects of fire on native tallgrass species.
Wildfires			
Hogan Brothers/Damyanovich	1985	10-20 acres	N/A
Andrus	Spring 1988	Unknown	Escaped ag. burn
Burke I/Gebhard	Fall 1989	15 acres	N/A
McKenzie	Summer 1994	5-10 acres (total)	N/A

The use of fire has been prescribed for the Colorado Tallgrass Natural Area as an integral part of the tallgrass community management (Colorado Natural Areas Program 1986). Prescriptions have been developed along with prescriptions for livestock grazing. The Colorado Tallgrass Natural Area management plan will be revisited and revised in conjunction with the Management Plan.

Hydrology and Water Use

- Patterns in vegetation reflect ground water levels, duration of snow cover, and water storage and delivery for agriculture (see Wetland and Agriculture chapters). Microclimates and the mountain rain shadow influence plant community patterns.

- Tallgrass community patches and occurrences of Ute ladies'-tresses orchid (*Spiranthes diluvialis*) in irrigated areas may be sensitive to changes in water availability (i.e., improved structures and lining).

Geology and Soils

- Patterns in vegetation are usually closely correlated with geologic and soil substrate (Bunin 1985, Moreland and Moreland 1975).

- Rare plant species and uncommon plant communities may be associated with specific strata or soil types.

Wildlife

- Wildlife use patterns are reflected in vegetation patterns. Native plant communities are adapted to ecological relationships with animal species. Changes in the presence, distribution and movement of animal species, like black-tailed prairie dogs and mule deer, affect plant community composition and structure. Changes in animal densities due to predator extirpation, fire suppression, and pressures from human land use affect native plant community dynamics.

- The viability of native flowering plant species is dependent on native pollinator species. Knowledge of invertebrate populations and other animal pollinators is important for management of native vegetation.

Biological Invasion

- Non-native plant and animal invasion affects native plant and animal habitat by displacing species through competition and by disrupting pre-exotic invasion population dynamics.

- Control treatments for invasive exotics can impact native plant and animal species.

Land Use and Land Management

- Livestock grazing can influence plant community composition and health. Domestic, grazing animals select some species and avoid others, alter soil nutrient balances, and

disturb the soil surface. Native prairie communities are adapted to native ungulate grazing. Livestock grazing is an important integrated weed management tool in native grassland communities and can be used to remove plant litter build-up.

- Cultivated crops and hayfields can influence native vegetation by introducing non-native species, altering soil nutrient regimes, changing run-off patterns and amounts, re-directing water, and introducing chemicals used for pest control. Smooth brome (*Bromopsis enermis*) is an example of a grass species commonly used in hay production that can invade native plant communities and displace native species.

- The effects of recreational activities on native plant communities vary depending on the type and intensity of recreation, the soil type, and seasonal conditions (i.e., wet, muddy conditions). Trail-building and increasing recreational activity over time can result in cumulative loss of native plant and animal habitat, introduction and spread of noxious species, and conflicts with agricultural practices.

- Urban development has displaced and fragmented native plant and animal habitat in the Boulder Valley area. Non-native species can escape from developed areas into natural areas.

- Much of the western edge of the Management Area is within the City limits of Boulder. Urban development adjacent to Open Space properties has profound impacts and influences management planning.

Restoration and Revegetation

- Plant species introduced through restoration and revegetation projects have the potential to affect natural community dynamics and the genetic integrity of extant native plant populations. Careful planning should guide the selection of species and seed or propagule sources for restoration and revegetation projects. The *Long Range Management Policies* provide general guidance for landscaping, revegetation, and restoration (Section IV.C.5).

Landscape Features

- Landscape diversity in the Boulder Valley area creates habitat diversity for native plant and animal species. The landscape complexity created by the topographical and climatic gradients in the area is reflected in the rich flora. Weber (1995) notes the diverse and unusual flora found in north-facing canyons and outwash mesas, including bryophytes, lichens, disjunct eastern woodland species, and prairie plants.

- Human activity has altered the distribution and patch size of native vegetation types. The effects of these changes on native plant community sustainability and native species viability are largely unknown. The conservation biology concepts of connectivity and fragmentation should be considered and applied in resource management planning.

7.2.3 Detailed Description of Vegetation

Vegetation Mapping Goals and Applications

The vegetation of the Management Area consists of a complex mosaic of plant communities and agricultural fields. Results from surveys and mapping (Figure 7.3*) of the Management Area vegetation (ERO 1996, Bunin 1985, and City of Boulder Open Space 1997) provide both fine- and coarse-level descriptions of the present vegetation cover. The level of detail chosen to describe vegetation depends on the research and management applications for that information. A coarse classification and description of vegetation types are useful for assessing wildlife habitat affinities and the relative abundance of vegetation types (i.e., shortgrass prairie, ponderosa pine forest). Coarse-level vegetation analysis can provide a whole-system or landscape context for use in resource management planning. Finer-scale descriptions of vegetation are used for evaluating plant community health, monitoring sensitive species and communities, identifying micro-scale habitat (i.e., invertebrate habitat), and data sharing.

Vegetation mapping (ERO 1996, Bunin 1985) has focused on characterizing vegetation patterns on the plant community or association level[6]. Where rare species are identified, a finer, species-level analysis is applied. The program goals for vegetation surveying and mapping are to: (1) identify and describe plant communities and wildlife habitat types, and (2) assess the quality and condition of plant communities. Results from mapping can be used to:

- Determine the distribution, frequency, and areal coverage of communities and habitat types
- Determine natural variation within plant communities
- Identify high-quality sites in terms of wildlife habitat and native plant community integrity
- Identify declining (including exotic plant invasion) plant communities and habitat types and potential restoration areas
- Design and facilitate wildlife habitat research
- Refine habitat information for the wildlife habitat (affinity) database
- Develop monitoring and management plans for rare and uncommon species and communities
- Identify important landscape-scale features (i.e., large, unfragmented habitat units, corridors for wildlife movement between habitat units, eastern extensions of the foothills ecotonal types, etc.) for conservation purposes
- Construct an Open Space system-wide context for formulating resource management plans
- Assist in visitor use (recreation) planning

[6]Vegetation mapping methods are presented in Appendix 3.1.2.

Vegetation Classification

Classification systems group discernable patterns in vegetation by using selected attributes (i.e., structure, floristics, landscape patterns, etc.) (Bourgeron and Engelking 1994). The Program uses *A Preliminary Vegetation Classification of the Western United States* (Bourgeron and Engelking 1994) to classify vegetation for management and research purposes. This hierarchical classification is based on international (UNESCO 1973) and national (Driscoll et al. 1984) classification schemes. The widely-used system allows the Program to develop data sets that are compatible with vegetation data across the United States and the world. Use of the Bourgeron and Engelking (1994) vegetation classification creates opportunities for the Program to share information about local vegetation with academic and professional scientific communities. The facilitation of data sharing can provide the Program with valuable local, regional, and global contexts for vegetation management.

The Bourgeron and Engelking (1994) classification hierarchy consists of six levels ranging from coarse- to fine-level characterizations. The broadest classes are based on the physiognomy or characteristic features of the vegetation (i.e., forest, evergreen forest, etc.). Species composition and dominance define the finest levels of the hierarchy. "Plant association" is the most detailed vegetation characterization and is generally defined as a plant community having a characteristic species composition with uniform physiognomy and habitat conditions (Bourgeron and Engelking 1994). Plant communities or associations represent existing vegetation regardless of successional status and are described by two or more dominant species (Bourgeron and Engelking 1994). Other classification schemes have used the plant association concept to describe potential natural or climax vegetation.

A Preliminary Vegetation Classification of the Western United States (Bourgeron and Engelking 1994) provides a technical framework for classifying vegetation that facilitates data sharing. The Program employs separate classifications to describe vegetation in less technical terms and to characterize wildlife habitat. The description of vegetation in the Management Area classifies vegetation coarsely as "vegetation types" and describes the plant communities or associations that occur within each vegetation type. Wildlife "habitats" represent a broad classification of general differences in the structure and composition of vegetation. The utilitarian habitat types are often parallel with vegetation types. Numerous plant communities and associations can be found within each wildlife habitat type.

Vegetation Types and Community Descriptions

The vegetation descriptions in this section are organized hierarchically by: (1) ecosystem type (i.e., grassland, shrubland, etc.), (2) vegetation type (i.e., mixed grass prairie, foothills shrubland, etc.), and (3) community or association (described by several co-occurring species or co-dominant species forming a recurrent pattern). Scientific nomenclature follows *Colorado Flora: Eastern Slope* (Weber and Wittmann1996). The vegetation type descriptions can be applied to vegetation across the greater Boulder Valley area. Table 7.3 lists vegetation types and the communities within each type in the Management Area. Wetlands (including wet meadows) and cropland are described in the Wetland and Agricultural chapters of the inventory report.

Table 7.3: Plant Communities by Vegetation Type

Vegetation Type	Community
Shortgrass prairie	Blue grama/buffalo grass
Mixed grass prairie	Tallgrass/shortgrass mixed prairie
	Prairie dropseed/ little bluestem; Prairie dropseed
	Western wheat/blue grama
	Needle and thread mixed grass prairie (small patches on slopes of Andrus Mesa, unmapped)
	Disturbed mixed grass prairie
Tallgrass prairie	Prairie cordgrass
	Switchgrass
	Bottomland: native tallgrass community
Mixed native/non-native grassland	Native/non-native bottomland grassland
Forb dominated vegetation	Dogbane
Shrubland	Scarp woodland/skunkbrush shrubland mix
	Snowberry
Plains riparian shrubland	Coyote willow
	Plains riparian shrub mix
	Hawthorn floodplain/riparian shrubland
	Alder riparian shrubland
Plains riparian forest/woodland	Plains riparian forest/woodland
Agricultural/non-native	Non-native hay/pasture
	Alfalfa/grass
	Annual crop

***Grassland* [ecosystem type]**

Shortgrass prairie [vegetation type]: Shortgrass prairie is a plains grassland type dominated by blue grama (*Bouteloua gracilis*) and buffalo grass (*Buchloe dactyloides*). Western wheat (*Pascopyrum smithii*) occurs in depressions and where soils are heavier (e.g., clay). Fringed sage (*Artemisia frigida*) is a common forb (a forb is a broad-leaved herbaceous plant). Shortgrass generally occurs in patches with mixed grass or tallgrass in the Management Area. Soil types within the area are not predicted to support shortgrass (Bunin 1985) as a potential natural vegetation type. The presence of shortgrass has been interpreted as a symptom of past heavy livestock use.

[plant communities or associations]
Blue grama/buffalo grass (*Bouteloua gracilis/Buchloe dactyloides*)

Mixed grass prairie: Mixed grass prairie is a plains grassland comprised of a mix of shortgrass, mid-height grass, and tallgrass species. Montane grasses are absent from mixed grass prairie. Common grass species are little bluestem (*Schizachyrium scoparium*), western wheat (*Pascopyrum smithii*), blue grama (*Chondrosum gracile*), needle and thread (*Hesperostipa comata*), Indian rice (*Achnatherum hymenoides*), and side oats grama (*Bouteloua curtipendula*). Mixed grass prairie in the Boulder Valley area typically contains scattered forb and shrub species. A relatively common mixed grass community type found on terraces above the South Boulder Creek floodplain is a tallgrass/shortgrass mixed prairie (ERO 1996, Bunin 1985). The influences of inappropriate domestic livestock grazing, fire suppression, prairie dog presence, and hydrologic changes related to irrigation have contributed to the introduction and spread of non-native species in mixed grass prairie habitat. The term "rangeland" is frequently applied to mixed grassland that is presently or potentially used for livestock grazing (see Agriculture chapter for definitions of related terms).

Tallgrass/shortgrass mixed prairie: Characterized by scattered stands of tallgrass species, primarily big bluestem (*Andropogon gerardii*), with patches dominated by blue grama (*Chondrosum gracile*).

Western wheat (*Pascopyron smithii*)/blue grama (*Chondrosum gracile*): Occurring on south-facing slopes and on some mesa tops (e.g., Andrus Mesa).

Prairie dropseed (*Sporobolus heterolepis*) and little bluestem (*Schizachyrium scoparium*)/prairie dropseed (*Sporobolus heterolepis*): Uncommon and occurring east of the South Boulder Creek floodplain in mesic meadows. Big bluestem and Canada bluegrass are associated with these types. These communities may be in transition from old field composition to a tallgrass community (ERO 1996).

Disturbed mixed grass prairie with native grasses: Western wheat *(Pascopyrum smithii),* blue grama (*Chondrosum gracile*), big bluestem (*Andropogon gerardii*), and little

bluestem (*Schizachyrium scoparium*) and non-native grasses: crested wheat *(Agropyron cristatum*), cheat grass *(Bromus tectorum*), and smooth brome (*Bromopsis inermis*). Two associations of non-native mid-height grass species are described by ERO (1996): (1) crested wheat/Canada bluegrass, (2) cheatgrass/Canada bluegrass. Native species occur in both types but are sub-dominant. In some areas snakeweed (*Gutierrezia sarothrae*), wild rose (*Rosa woodsii*), or non-native forbs like diffuse knapweed (*Acosta diffusa*) are common in disturbed mixed grass prairie habitat.

Tallgrass prairie and mixed native/non-native bottom land grasslands: Tallgrass prairie is dominated by several key grass species, including big bluestem (*Andropogon gerardii*), switchgrass (*Panicum virgatum*), yellow Indian grass (*Sorghastrum nutans*), and prairie cordgrass (*Spartina pectinata*). Sites supporting tallgrass communities are irrigated or sub-irrigated and are generally associated with the South Boulder Creek floodplain. Both xeric tallgrass and mesic tallgrass communities occur in the Management Area. In many of the floodplain grasslands and wet meadows adjacent to South Boulder Creek tallgrass species are co-dominant with introduced perennial grasses. Xeric and mesic tallgrass is described as potential natural vegetation for several soil types occurring across the Management Area (Bunin 1985) (see Native Plant Community Status by Subarea section 7.2.6 for details). The tall grassland types provide important small mammal habitat (ERO 1996).

Prairie cordgrass (*Spartina pectinata*): Prarie cordgrass dominates, or co-dominates with arctic rush (*Juncus arcticus*), wet meadow patches of the historical South Boulder Creek floodplain (ERO 1996). Prairie cordgrass grassland typically occurs where there is a shallow water table, and where irrigation water accumulates. Common associated species are Nebraska sedge (*Carex nebrascensis*), redtop (*Agrostis gigantea*), wild licorice (*Glycyrrhiza lepidota*), arctic rush (*Juncus arcticus*), and Canada thistle (*Breea arvensis*).

Switchgrass (*Panicum virgatum*): Nearly pure stands of switchgrass are reported from the Church property (ERO 1996).

Bottom land: native tallgrass community: Tall grasslands occur commonly in irrigated meadows in the South Boulder Creek flood plain. Native species often dominate these bottomland stands. Typical associates are yellow Indian grass (*Sorghastrum avenaceum*), switchgrass (*Panicum virgatum*), prairie cordgrass (*Spartina pectinata*), arctic rush (*Juncus arcticus*), and big bluestem (*Andropogon gerardii*). Redtop (*Agrostis gigantea*) is a common non-native associate in the floodplain grasslands.

Native/non-native bottomland grassland: Some meadows in the historical South Boulder Creek floodplain have been converted to non-native species. These agricultural fields are either irrigated or not irrigated, and are commonly dominated by non-native grasses (e.g., smooth brome (*Bromus inermis*), meadow fescue (*Festuca pratensis*), Kentucky bluegrass (*Poa pratensis*), and orchard grass (*Dactylis glomerata*) (ERO 1996). Some fields have scattered stands of native species, frequently big bluestem (*Andropogon gerardii*).

Colorado Tallgrass Prairie State Natural Area community types: The Colorado Tallgrass Prairie Mangement Plan (1986) describes a continum of tallgrass communities within the designated State Natural Area patches. Mesic prairie communities in low, moist areas blend into drier, upland tallgrass communities. Mesic community dominates are big bluestem (*Andropogon gerardii*), switchgrass (*Panicum virgatum*), little bluestem (*Schizachyrium scoparium*), and yellow Indian grass (*Sorghastrum avenaceum*). More xeric communities are dominated by big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), and side-oats grama (*Bouteloua curtipendula*). The State Natural Area patches were selected based on information and recommendations contributed by Moir (1969, 1972), and results of a systematic inventory conducted by the Colorado Natural Areas Program during the early 1980's.

Forb dominated vegetation (a forb is a broad-leaved herbaceous plant): This is a broad vegetation type that occurs under variable habitat conditions. Native or non-native forb species may dominate a plant community. Dogbane *(Apocynum sp.)* frequently occurs in small patches that have been mapped as inclusions in grassland community types throughout the South Boulder Creek floodplain and upland terraces.

Shrubland

Shrubland (upland):

Snowberry (*Symphoricarpus occidentalis*): with mixed grass understory

Scarp woodland/skunkbrush shrubland mix: Scarp woodlands are characterized as isolated patches of woodlands on mesa escarpments. Ponderosa pine (*Pinus ponderosa*), skunkbrush (*Rhus aromatica trilobata*), currant (*Ribes cereum*), mountain mahogany (*Cercocarpus montanus*), snowberry (*Symphoricarpus occidentalis*), and other woody species may occur in the escarpment communities. Scarp woodlands represent a small but significant component of the native vegetation types in the Management Area. Woodland patches in a matrix of grassland provide structural diversity which is an important habitat characteristic for many animal species.

Riparian Vegetation Types

Plains riparian shrubland: Riparian shrubland habitat is typically comprised of large shrub thickets associated with streams, creeks, or ditches. Coyote willow (*Salix exigua*) and hawthorn (*Crataegus erythropoda* and *Crataegus macracantha*) are common dominants.

Some shrub species may occur in upland areas or in close association with riparian habitat.
Coyote willow (*Salix exigua*)

Plains riparian shrub mix: skunkbrush (*Rhus aromatica trilobata*), hawthorn (*Crataegus erythropoda and Crataegus macracantha)*, plum (*Prunus americana*), snowberry (*Symphoricarpus occidentalis*), and chokecherry (*Padus virginiana melanocarpa*)

Hawthorn floodplain/riparian shrubland (*Crataegus macracantha*)

Alder riparian shrubland (*Alnus tenuifolia*)

Plains riparian forest/woodland: Forest and woodland riparian habitat is associated with streams, creeks or ditches along the plains. Plains cottonwood (*Populus deltoides*), peach-leaved willow (*Salix amygdaloides*), narrowleaf cottonwood (*Populus angustifolia*), and box elder (*Negundo aceroides*) are important native species along South Boulder Creek upstream of Arapaho Road. Numerous native shrub species are characteristic of plains riparian communities and may co-dominate with tree species. Most riparian reaches in the Management Area are populated by non-native species such as crack willow (*Salix fragilis*), Russian olive (*Eleagnus angustifolia*), green ash (*Fraxinus pensylvanica*) and Chinese elm (*Ulmus pumila*). Riparian forest communities are frequently found along irrigation ditches and laterals.

Agricultural Lands

Alfalfa/grass

Annual crops

Non-native hay/pasture: Hayfields and pasture in this category consist of non-native monocultures or a mix of non-native species. Some hayfields and rangeland in the Open Space system have significant or dominant native grass cover. Native-dominated hayfields and pasture are classified with other native grassland habitat types.

Non-native grass monoculture or mixture of species: may or may not be irrigated
Non-native bottom land grassland

7.2.4 Sensitive Species and Communities

The Management Area supports a diverse native flora including rare species and communities. An important purpose of Open Space is to preserve and restore natural areas supporting "outstanding or rare examples of native species" (City of Boulder Charter). The *Boulder County Comprehensive Plan* sets goals for preserving rare plant habitat, natural communities, and the natural processes that maintain functioning native ecosystems (see Planning Context chapter). Other documents guiding land and resource management in the Boulder Valley area (i.e., *Boulder Valley Comprehensive Plan*; *Long Range Management Policies*) call for the promotion of biological diversity and the protection of sensitive species.

The southern half of the Management Area is designated as a "significant natural ecosystem" on the Boulder Valley Natural Ecosystems Map (City of Boulder 1996a) and an "Environmental Conservation Area" (Boulder County 1995) due in part to the presence of rare species and communities. Two plant species and several communities or associations occurring in the

Management Area are included in the Colorado Natural Heritage Program list of "rare and imperiled animals, plants, and natural communities." Appendix 7.1 summarizes the Colorado Natural Heritage Program information that is pertinent to the Management Area and explains rare plant status rankings. The *Boulder County Comprehensive Plan* uses the Colorado Natural Heritage Program list to identify rare species and "significant natural communities."

Sensitive Species

Ute ladies'-tresses orchid (*Spiranthes diluvialis*): Ute ladies'-tresses orchid is a rare, perennial species belonging to the orchid family. The plant is endemic to the western United States in Colorado, Wyoming, Utah, Montana, Idaho, and historically in eastern Nevada. The U.S. Fish and Wildlife Service assigns threatened status to the orchid. It is the only plant species in the Boulder Valley protected by the Endangered Species Act. The plant is thought to be rare because it occurs in low elevation riparian and wet meadow habitats that have been largely degraded and eliminated by water use, flood control, agricultural practices, and urban development over the last 150 years. The U.S. Fish and Wildlife Draft Recovery Plan (1995) provides a detailed habitat model for the orchid.

Significant occurrences of the orchid are found in the Management Area. Approximately 13,000 plants have been documented over several years of inventory. That number represents about one-forth of the Ute ladies'-tresses orchid plants accounted for across the species' entire range. In 1997 approximately 8,000 previously undocumented individuals were counted in one 40-acre native hayfield. New locations and numbers of the orchid are discovered each year on Open Space.

Most of the orchid habitat on Open Space differs from habitat described in natural areas across the species' range. The habitat is typically the margins of riparian areas, wet meadows, and occasionally lake shores. Flooding and ungulate grazing are natural disturbances that help create and maintain orchid habitat. On Open Space, Ute ladies'-tresses orchid is commonly found in irrigated meadows. Small patches occur in more natural habitat along the South Boulder Creek riparian corridor south of Baseline Road and in small to large patches in wet meadows adjacent to South Boulder Creek. Orchid habitat is actively maintained on Open Space by disturbances such as dormant season livestock grazing, haying, and prescribed burning. These disturbances reduce competition from other species and may influence germination and growth in other ways. Annual snow-melt and high water storm flows combined with direct irrigation of meadows support orchid habitat. Further, ditch and lateral seapage provide surface water and elevated ground water levels that support favorable orchid habitat.

Knowledge of the biology and ecology of Ute ladies'-tresses orchid is limited; however, ongoing research and monitoring continues to add to the knowledge base. Research conducted on Open Space has contributed information that has been applied to management of orchid habitat across its range. Anna Arft, a University of Colorado graduate student, conducted research on Ute ladies'-tresses orchid demography, ecology, and genetics in the Boulder Valley and in populations throughout the species' range (Arft 1995). Experiments studied the effects of management treatments such as haying, livestock grazing, and prescribed fire. The effects of

removing traditional agricultural practices were also studied. Study results indicate that traditional land management treatments support orchid habitat. The study was initiated in 1992, and data collection continued through the 1995 growing season. The Open Space Research Program partially funded the project. Results from ongoing monitoring by Open Space staff can be used to assess the effects of management activities over the long term in Ute ladies'-tresses orchid habitat.

Anecdotal information from the 1997 field season suggests that a specimen of another ladies'-tresses species, *Spiranthes romanzoffiana*, was collected on City of Boulder Open Space in the VanVleet orchid research meadow. This species is known from the upper montane and subalpine zones throughout the Rocky Mountains, and, to our knowledge, has only been noted to occur in the vicinity of *S. diluvialis* in Utah in the northern Uinta Basin at about 7,000 feet. The collection of the *S. romanzoffiana* specimen, and the verification of its identification by botanical authorities has not been officially reported to Open Space. If this close relative does occur side-by-side with Ute ladies'-tresses on Open Space, there may be significant management implications. *S. romanzoffiana* is not protected by the Endangered Species Act. Open Space staff will look for this additional orchid species in the future.

Protection of Ute ladies'-tresses orchid occurrences and habitat is a Program goal. Inventory and monitoring of the orchid have been priorities for Open Space rare plant research and management. Since the mid-1980s, occurrences of Ute ladies'-tresses orchid have been censused and mapped in sections of the South Boulder Creek floodplain. Known occurrences have been inventoried and mapped annually. Mapping and census methods have been standardized. Counts have been conducted by Open Space staff, including numerous volunteers. Based on the available data, it appears that populations in the Management Area have been fairly stable since 1990. Long-term monitoring of population dynamics will be required in order to determine species viability.

An important potential threat to Ute ladies'-tresses orchid within Open Space is hydrologic change. Changes in ground water levels can be caused by the maintenance and alteration of irrigation ditches, structures, and practices. Stream flows and hydrologic patterns along South Boulder Creek create important habitat. Management planning should integrate water use and ditch maintenance planning with orchid habitat protection and management.

Changes in traditional agricultural practices could threaten Ute ladies'-tresses orchid populations in the Management Area. Current agriculture in the South Boulder Creek floodplain and upland terraces is a sustainable, large-scale operation accomplished by one family that leases Open Space land. The long-term viability of Ute ladies'-tresses orchid is apparently dependent on the present agricultural regime, which includes dormant season cattle grazing, irrigation and a single hay-cutting (where hay-cutting takes place). Management planning should consider the need to maintain a large, full-time agricultural operation in order to manage rare species and native plant communities in the Management Area.

The orchid is part of a larger riparian/floodplain and irrigated hay meadow community complex that also supports bobolink, Preble's meadow jumping mouse, tallgrass, riparian forest, and

important agricultural species. The balancing of rare species and community protection and management, agricultural practices, and recreational use in the Management Area is one of the most complex natural area management scenarios in the Boulder Valley. Conflicting needs of many of the sensitive resources create difficult management decisions. For example, hay is cut in mid-summer, ideally after ground-nesting birds have fledged and before orchid flowering stalks are tall enough to be cut. The ideal window of time for hay-cutting is often very short and sometimes doesn't appear. Weather and equipment are also complicating factors. The overall Program goal is to sustain this sensitive, complex system over the long term. There is a critical need for detailed management planning and continual, integrated management in order to accomplish the goal.

Recreational activities, patterns, and intensities have the potential to influence orchid habitat. The displacement of habitat by trails has a cumulative effect as trails are added over time. The timing of trail maintenance (e.g., mowing) can affect orchid fruiting success. Intense use of riparian areas can compact soils and degrade orchid habitat. Recreational planning should consider the numerous sensitive resources in the South Boulder Creek floodplain and vicinity.

In summary, the continued viability of Ute ladies'-tresses orchid in the Management Area hinges on the integration of agricultural practices, water management, wildlife management, prescribed fire, and recreation management. Current land management in the South Boulder Creek floodplain and adjacent uplands supports some of the largest occurrences of the species throughout its range.

American groundnut (*Apios americana*): American groundnut is a Great Plains species that is near the western edge of its range in Colorado. Throughout most of its range the groundnut is infrequent to common (McGregor et al. 1986), and in Colorado the species is considered rare. The habitat includes moist soils in prairie ravines, pond and stream banks, and thickets. In Boulder Valley, American groundnut occurs along fence lines in moist soils in the South Boulder Creek floodplain. Several of the local occurrences are on Open Space in the Management Area.

An inventory and monitoring program has not been developed for this rare species. Occurrences in the Management Area are documented by dot placements on aerial photos and by the completion of Element Occurrence Records (Colorado Natural Heritage Program).

It is important to integrate the protection and management of American groundnut with prescribed fire planning, haying practices, weed control treatments, and ground disturbing activities in the vicinity of fence lines (e.g., fence replacement, road maintenance, ditch maintenance). Fence lines in wet areas of the South Boulder Creek floodplain and adjacent terraces appear to be the best remaining habitat for the species in the Boulder Valley.

Toothcup (*Rotala ramosior*): is a rare species known in Boulder Valley from two ephemeral (seasonal) wetland sites within and near the Management Area. One site is in the South Boulder Creek floodplain near the riparian zone, and the other is near Baseline Lake. In Colorado, the species is at the western edge of its range, and may even be considered non-native by some botanists.

Toothcup habitat is found along stream margins, wet depressions and mudflats. The site where the plant occurs in the Management Area is a wet depression by a gate providing access to an agricultural field. This occurrence was recently discovered and documented. The species appears to exist on the site in spite of light use by vehicles, cattle, and pedestrians.

Planning for recreation, agriculture, and water resources should consider toothcup occurrences and potential habitat. Frequent, repeated trampling of toothcup habitat should be avoided, particularly during the growing season (from approximately June through October). Surveys of likely habitat and monitoring of documented occurrences can add information needed for conserving the species.

Colorado butterfly weed (*Gaura neomexicana* ssp. *coloradensis*): This rare plant is found in a few places on the Rocky Mountain Front Range in Wyoming, Nebraska and Colorado. The only occurrence in the Boulder Valley was documented in 1984 near the base of Lee Hill Rd. Potential habitat exists on Open Space within the Management Area, particularly in the moist, floodplain meadows of South Boulder Creek (south of Arapaho Rd.). General surveys for sensitive plant species on Open Space should include this species, and knowledgable field staff should be watchful for the plant in appropriate habitat.

Showy prairie gentian (*Eustoma grandiflorum*): The prairie gentian is one of the showiest rare plants in Colorado, and was once relatively common across the western Great Plains. Like the Colorado butterfly weed, the gentian grows in moist floodplain meadows. Habitat for both species has been reduced and altered by land use (e.g., gravel mining) over the last 150 years. The prairie gentian is found in eastern reaches of the Boulder Creek floodplain on Open Space, but is not documented in the Management Area. Potential habitat exists in the wet meadows associated with South Boulder Creek upstream from Arapaho Road.

Sensitive Communities

Many native plant communities that are now considered rare were once common in the Boulder Valley vicinity. Some plant associations which were formerly common in the County have been nearly extirpated. The *Boulder Valley Comprehensive Plan* notes: "...natural communities, representative of the pre-settlement landscape, still exist in the County. The preservation of these areas maintains a valuable part of the natural heritage of this region. Natural communities provide living examples of functioning ecosystems, furnishing a baseline against which management actions and other impacts can be compared. Natural communities harbor native plants and typically have greater wildlife habitat value, and thereby enhance and maintain the biodiversity of a region" (Boulder County 1995).

The Colorado Natural Heritage Program maintains a list of rare and imperiled natural communities (Colorado Natural Heritage Program 1996). Several communities listed by the Colorado Natural Heritage Program occur, or are likely to occur in the Management Area (Appendix 7.2). Xeric and mesic tallgrass communities in the southern half of the area are considered some of the best examples in the state (Moir 1972, Baker and Galatowitsch 1984, Colorado Natural Areas Program 1986). In 1984, several high-quality tallgrass community

patches were designated as the Colorado Tallgrass Natural Area by the Colorado Natural Areas Program in cooperation with the Open Space Program (Figure 7.4).

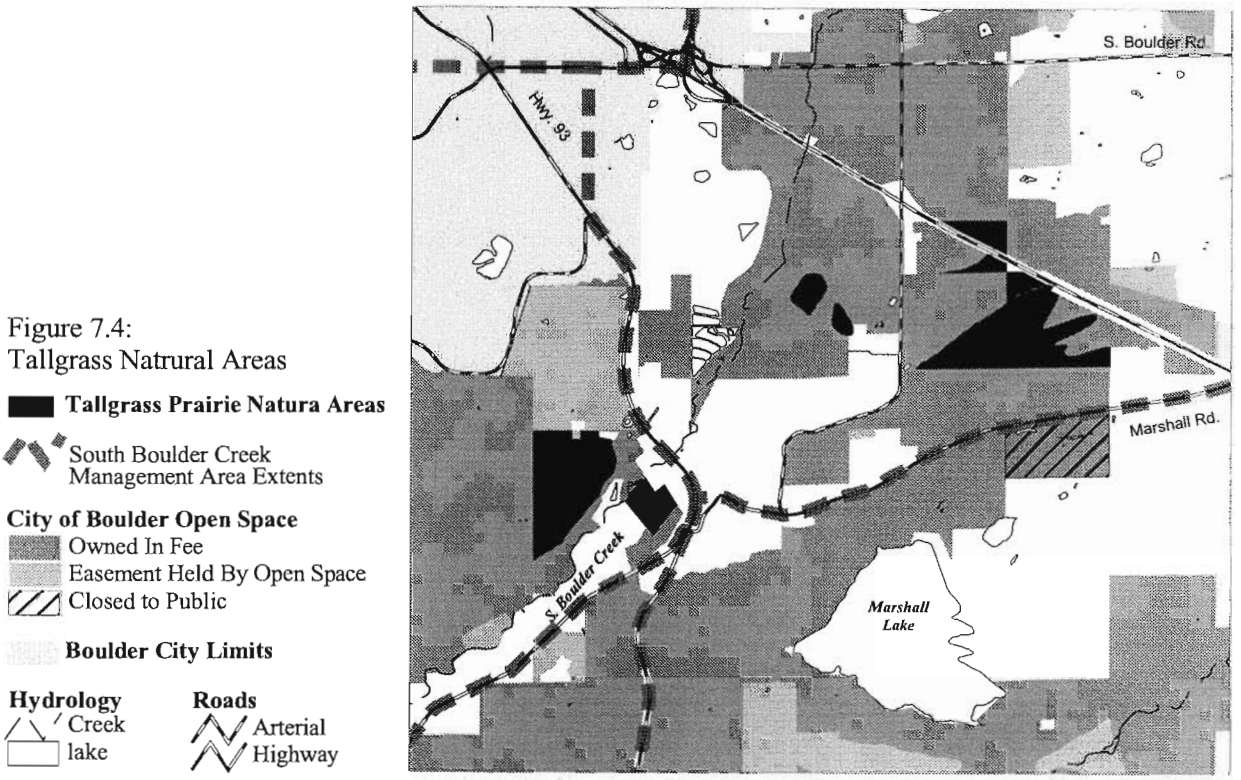


Figure 7.4:
Tallgrass Natrural Areas

Riparian forest communities listed by the Colorado Natural Heritage Program may occur in the Management Area. In addition, the species associated with the Great Plains mixed grass prairie needle and thread communities, and shortgrass prairie are present; however, additional survey work is needed to document these community types within the area. Colorado Natural Heritage Program rare and imperiled communities are evaluated and documented by using set criteria or threshold requirements. Riparian communities in the Management Area have not been evaluated by using the Colorado Natural Heritage criteria, and no records of rare and imperiled riparian communities exist in Boulder County. As suggested in the Wetlands section of this report, Open Space staff should consult with the Colorado Natural Heritage Program to evaluate the status of potential rare communities in the South Boulder Creek riparian corridor.

7.2.5 Exotic Species of Special Concern

Urbanization, agriculture, and other land uses have contributed to important changes in the flora of the Boulder Valley area (Weber 1995). In some natural areas, a significant proportion of the flora is exotic. Exotic plants, also termed aliens, weeds or non-natives, commonly threaten native plant communities by invading and displacing native species. Invasive non-natives reduce

native species diversity, affect natural processes, raise the cost of farming and land management, and diminish the aesthetic and recreational values of natural areas.
Non-native plant species have been introduced to the area through road-building, construction, gardening, landscaping, and agriculture. Some problem species (e.g., cheatgrass (*Anisantha tectorum (Bromus tectorum)*) and leafy spurge (*Tithymalus uralensis* (*Euphorbia esula*)) were brought to this continent unintentionally in contaminated agricultural seed or hay and ship ballast material. Gardening and landscaping plants (e.g., Russian olive (*Eleagnus angustifolia*), tamarisk (*Tamarix ramosissima*), yellow toadflax (*Linaria vulgaris*), dalmatian toadflax (*Linaria genistifolia dalmatica*), myrtle spurge (*Tithymalus myrsinites*), purple loosestrife (*Lythrum salicaria*), Ox-eye daisy (*Leucanthemum vulgare*), etc.) accompanied early settlers or are currently introduced through revegetation and xeriscape plantings (Weber 1995).

The Open Space Program recognizes the invasion of non-native species as a significant threat to natural and agricultural resources. The *Long Range Management Policies* assign high priority to "the management of non-native species that have a substantial negative impact on Open Space resources and that can reasonably be expected to be successfully controlled." Exotic species control is accomplished through Integrated Pest Management. Integrated Pest Management strategies are applied throughout the Open Space system and often include interagency coordination. The policies and law directing the management of non-native species on Open Space land are listed in Section IV.C.9.b. of the *Long Range Management Policies*.
Integrated Pest Management is a decision-making process which selects, integrates, and implements weed control techniques to prevent or manage non-native populations. Integrated Pest Management focuses on long-term prevention or suppression of problem species while reducing the impact that control techniques may have on the environment, human health, and non-target organisms. A whole-systems approach is used, looking at the non-native species as it relates to the entire ecosystem (see *City of Boulder Integrated Pest Management Policy* (City of Boulder 1993)).

Ranking, inventory, mapping, monitoring, and evaluation are the methods used in setting Integrated Pest Management priorities. A ranking system provides an objective, ecologically-based decision-making framework for targeting species and infestations. Weed maps and inventories characterize infestations in terms of size, location, and threat to resources. Monitoring and evaluation track infestations and treatments over time to determine the successes and failures of the program. Mapping and treatment data are stored in the Open Space Program Geographic Information System database.

Prevention, education, cultural control, mechanical control, biological control, and chemical control are the techniques used in Integrated Pest Management. Effective, economical weed management combines several techniques to achieve desired results with the minimum environmental impact.

Problem Species and Control Methods in the South Boulder Creek Management Area
Numerous exotic plant species occur in the Management Area. Most of these problem plants threaten native plant communities by invading aggressively, displacing native species, and in some cases, creating monocultures.

Priority 1: The primary exotic species of special concern in the Management Area are Canada thistle (*Breea arvensis*), purple loosestrife (*Lythrum salicaria*), diffuse knapweed (*Acosta diffusa*), Russian olive (*Elaeagnus angustifolia*), cheatgrass (*Anisantha tectorum*), and musk thistle (*Carduus nutans macrolepis*) (Figure 7.5*). These species are designated as undesirable plants by the Colorado Weed Management Act, Boulder County Undesirable Plant Management Plan and/or Open Space Program. Integrated Pest Management strategies continue to be developed for each target species as more information is acquired. Agricultural pests and program control treatments are presented in the Agriculture chapter of this report. An essential component of a successful Integrated Pest Management program is the coordination and cooperation of all landowners in the vicinity of the Management Area[7].

Canada thistle (*Breea arvensis*): Canada thistle is the most prevalent weed species found in the Management Area. Canada thistle occurs throughout the floodplain areas associated with the various creeks, along ditches, wet meadows, and in other areas with seasonally high soil moistures. Control techniques applied to infestations include: spring grazing, mowing, herbicide treatment, prescribed burning, and the release of beneficial insects. Mechanical treatment (i.e., mowing) and spring grazing are the most common controls used in the Management Area because of the presence of rare plants. Mowing must coincide with the haying operations which makes it a little late for maximum impact on the thistle. Limited use of herbicides occurs in some areas following mechanical treatment. Most ditch infestations have not been treated if spring grazing is not permitted. Prescribed burning in the spring has been used as a control technique in areas where grazing is not permitted (i.e., tallgrass exclosures). Beneficial insects have been released in the riparian corridor of South Boulder Creek.

Purple loosestrife (*Lythrum salicaria*): The South Boulder Creek Management Area is the only management area containing purple loosestrife. The Flatiron Industrial Park property has a 2-acre infestation. Several single plants have been observed on other properties and promptly removed. Control techniques include: hand pulling and cutting followed by herbicide treatment. Hand pulling is effective with young plants if the entire root is removed in the process. More mature plants are cut down to 3 feet when in half-bloom, and herbicide is applied to the cut stem of the remaining plant. Any plant material that is cut or pulled must be bagged and removed from the site. The infestation on the Flatiron Industrial Park property is a continuing management problem. Containment is occurring, but total eradication seems improbable with current controls available. Monitoring is ongoing in areas where purple loosestrife has been found and removed.

[7]Descriptions of the following species can be found in *Weeds of the West* (Whitson 1992).

Diffuse knapweed (*Acosta diffusa*): Diffuse knapweed is relatively new to this area of Boulder. Once contained to roads and isolated areas disturbed by construction, it is now spreading rapidly into adjacent pastures and rangeland. Control methods used throughout the Management Area have included herbicide applications, mowing, hand pulling, flood irrigation, and education. Herbicides continue to be an important control as alternatives are investigated. Mowing is used in some areas to prevent seed formation and may be followed by chemical treatment in the fall. Hand pulling is used frequently on small isolated patches and larger patches adjacent to Ute ladies'-tresses orchid (*Spiranthes diluvialis*) habitat. High soil moistures created by irrigation suppress knapweed and promote competition by other species. Educating landowners about the threat of knapweed and control methods has had limited success. Research on the effects of livestock grazing on knapweed has been initiated (1996). Investigation of the effects of fire on the species is needed.

Russian olive (*Eleagnus angustifolia*): Russian olive infestations in riparian and wet meadow communities are severe in the Management Area. Russian olive threatens native plant and animal diversity as densities gradually increase. Program control techniques include the removal of individuals smaller than 4 inches in diameter by weed wrench and chemical treatment of larger trees. Treated, dead individuals are cut and removed or left standing to provide structural diversity for wildlife.

Cheatgrass (*Anisantha tectorum*): Cheatgrass is present in varying density throughout the Management Area. Infestations in cropland areas are minimal. Spring grazing is used to suppress cheatgrass in rangeland areas. The program plans may include spring or fall prescribed burns in the Integrated Pest Management strategy for controlling this pervasive species.

Musk thistle (*Carduus nutans macrolepis*): Musk thistle often occurs in areas with Canada thistle infestations. Both species have been treated by mowing. Unlike Canada thistle, musk thistle is a biennial and does not spread by the root system (rhizomes). Hand and shovel removal are effective control methods for musk thistle due to these characteristics.

Priority 2: These species are currently on the State Noxious Weed List. They are not on the County Undesirable Plant List.

Species whose presence are mapped and control techniques are implemented in the Management Area.

Dalmatian toadflax (*Linaria genistifolia dalmatica*): This ornamental species has been found in varying densities and acreage. The majority of infestations are hand pulled before full flowering occurs. Chemical control has been used on several large infestations followed by seasonal hand pulling thereafter.

Myrtle spurge (*Tithymalus myrsinites*): Myrtle spurge, an ornamental plant, has been located on Davidson Mesa and along the South Boulder Canyon Ditch. The area is next

to private property and access is difficult. Mechanical control is ongoing when labor is available.

Sulfur cinquefoil (*Potentilla recta*): Sulfur cinquefoil is becoming more evident throughout the southern floodplain area. This species can quickly dominate an area and is a direct threat to rare orchid habitat. Control efforts have been minimal and involve chemical control using hand wick applicators. More effort is needed to gain control of this species before it becomes well established.

Tansy (*Tanacetum vulgare*): Tansy, an escaped ornamental species, is common along the southern part of South Boulder Creek (south of Arapahoe Road). Control efforts have been minimal. Small infestations have been removed by hand. Larger areas will require chemical treatments.

Tamarisk (*Tamarix ramosissima*): One plant has been found in the Management Area and removed. Monitoring for new individuals is ongoing.

Scotch thistle (*Onopordum acanthium*): Scotch thistle, a biennial, is spreading along existing bikepaths and other disturbed areas. Many of these areas have not been controlled and are expanding. Minimal control efforts have occurred on Open Space. These involve mowing where accessible and hand removal in critical areas.

Species whose presence are mapped but controls have not been implemented in the South Boulder Creek Management Area.

Ox-eye daisy (*Leucanthemum vulgare*): An ornamental found in the hayed part of Burke II and the northwest corner of Burke I. This is a serious concern because Burke II is hayed at the time of seed set.

Selfweed or bouncing bet (*Saponaria officinalis*): This ornamental plant is a growing concern in the southern part of the Management Area. It is spreading along roadsides and trail corridors and seems to be moving into most plant communities (i.e., riparian, range, pasture).

Dames rocket (*Hesperis matronalis*): An ornamental plant currently found only in the Cottonwood property.

Perennial pepperweed (*Cardaria latifolia*): Found in scattered pockets of wet areas, along ditches, and roadsides.

Houndstongue (*Cynoglossum officinale*): Occurring in disturbed or degraded areas, often in woodland edges.

Hoary cress (*Cardaria draba*): Becoming established along roadsides and drainages.

Priority 3: These species are currently in the Management Area and are becoming management problems due to their ability to take over natural areas and/or degrade agricultural lands. These are not a mapping priority but have been observed moving onto the Management Area via drainages, bordering pastures, or escaping from cultivated crop situations (i.e., smooth brome) into adjacent natural areas. Most of these species are available as ornamental plants. None of these plants are on the State or County Noxious Weed List.

Winter cress/Yellow rocket (*Barbarea orthoceras*)
Perennial sweet pea (*Lathyrus latifolius*)
Crack willow (*Salix fragilis*)
Smooth brome (*Bromopsis inermis*)
Reed canarygrass (*Phalaroides arundinacea*)
Queen of the meadow (*Filipendula ulmaria denudata*) (infestation localized, but severe)

Exotic Species Monitoring and Data Management
The spread of target species and the effects of control treatments are monitored by the systematic mapping of infested areas. Mapping methods used for weed monitoring are described in Appendix 3.1.2. Weed mapping is conducted on a portion of Open Space land each year so that the entire system is mapped over a 3-4 year period. Annual mapping may occur in rare plant sites, research areas, and intensively managed weed populations. Monitoring data is stored in the Open Space Geographic Information System. Integrated Pest Management strategies are developed and improved as results from monitoring data are evaluated.
Information on the release and monitoring of biological control insects is stored in the Open Space Geographic Information System. Periodic spot checks are conducted to monitor most beneficial insect species. Insects have been released to control Canada thistle and musk thistle in the Management Area.

Exotic Species Research
- The influence of cattle grazing on the population dynamics of diffuse knapweed. George Beck and Larry Rittenhouse, Colorado State University. Research initiated in 1996.
- Effects of diffuse knapweed infestations on the rare plant, *Physaria bellii*: Alan Carpenter, The Nature Conservancy Colorado Program. Research initiated in 1995.
- Dalmatian toadflax (*Linaria genistifolia dalmatica*) encroachment on rangeland. Dr. George Beck and Jim Sebastian. Research initiated in 1992.

7.2.6 Native Plant Community Status by Subarea

The Management Area vegetation varies in quality and condition. The "snapshot" of Open Space natural area condition that is evident today has been influenced by dynamic, natural processes and human land use through time. A program for monitoring and evaluating native plant community health is not in place. Criteria for ecosystem health assessment are being developed as a component of the interagency Ecosystem Plan for the Boulder Valley area. The Ecosystem Plan framework for assessing ecosystem health can guide the development of a

program to monitor and evaluate native plant community health. The ability to assess condition and detect trends in community health is important for resource management planning.

This section compiles information about native communities in the Management Area by dividing the area into three subareas and by describing and assessing conditions in those subareas. The planning subareas are South Boulder Creek/Dry Creek, Boulder Creek, and Fourmile Canyon Creek. The subareas generally follow major drainages and contain Open Space properties with similar management themes. The Wetland chapter also uses subareas to describe wetlands across the Management Area. A more detailed explanation of characteristics used to delineate the subareas appears in Appendix 7.3.

South Boulder Creek/Dry Creek Subarea

***Management themes*:** Present and past agricultural land use in the South Boulder Creek floodplain and surrounding area has been primarily hay production and livestock pasturing. Pasture areas in the South Boulder Creek drainage are often dominated by native species. Most of the land in the Dry Creek section of the subarea is used for hayfields. Natural area features in the subarea include plains riparian forest/woodland, wet meadows and other wetland types, mesic and xeric tallgrass prairie, short- and mixed grass prairie, and riparian and upland shrubland. The Gallucci/Yunker Prairie Dog Viewing and Habitat Conservation Area, and several prairie dog Transitional Areas are located within the subarea.

Management of the South Boulder Creek floodplain and adjacent uplands is probably the most multi-faceted and complex of any area in the Open Space system. A concentration of rare species and rare community habitat is interwoven with productive agricultural land in this area. Additionally, some of the highest quality visitor experiences are available to passive recreationists in the South Boulder Creek natural areas.

The Dry Creek section of the subarea is managed mainly for hay production. Other features of the Dry Creek area include riparian reaches with restoration potential, an old field reclamation project using native prairie species, a prairie dog Transitional Area, and a complex of well-used recreational paths.

***Community composition and structure*:** The patchwork of plant communities across the subarea, some dominated by native and some by non-native species, reflects variation in soil types, water distribution, topography, and land use. Several native tallgrass community patches carry the special designation of "Colorado Tallgrass Prairie Natural Area." Other areas are dominated by non-native pasture grasses and may contain scattered native patches. Both native- and non-native-dominated grassland types and associated riparian areas serve as important grassland bird habitat, Preble's meadow jumping mouse habitat, and agricultural land.

Grassland communities in the Boulder area have been studied and described by various authors throughout the century (Vestal 1914, Hansen and Dahl 1957, Moir 1969, Marr 1964, Bunin 1985, Baker and Galatowitsch 1985, Colorado Natural Areas Program 1986, Santanachote 1992,

Bennett et al. 1997). Species lists for Open Space grasslands in the Management Area have been developed by Bunin (1985), Colorado Natural Areas Program (1986), ESCO Associates Inc. (1991-present), Bennett et al. (1997), Open Space wetlands inventories, Open Space herbarium database, and Open Space prairie dog Habitat Conservation area vegetation monitoring (Open Space and ESCO Associates Inc. 1997). Vegetation mapping and community characterization in grasslands have been carried out by Bunin (1985) and ERO Resources Corporation (1996). Tallgrass prairie communities within the subarea are particularly well studied and documented.

Xeric tallgrass communities occur in patches on the Church, Van Vleet, Gebhard, Yunker, Short, and Gallucci properties. The most well-developed xeric tallgrass within the Management Area is on the northern slopes of Davidson Mesa on the southern Church and Yunker properties. Mesic tallgrass occurs throughout the South Boulder Creek floodplain and adjacent terraces in the Burke II, Burke I, Gebhard, Van Vleet, Church, Yunker, and Short properties.

Short grassland types have been documented on upland areas of Van Vleet (Bunin 1985, ERO 1996), and on Gallucci (ERO 1996). Bunin (1985) attributes the shortgrass types to past heavy livestock use, not to remnant natural vegetation patterns. Shortgrass patches are intermingled with tallgrass and mixed grass throughout much of the Management Area upland terraces and Davison Mesa.

Mixed grass patches were identified by Bunin (1985) on the Gallucci property and Davidson Mesa. One mixed grass prairie type was described by ERO (1996). The ERO mixed grass type is characterized as having a significant non-native component. Upland areas within the Dry Creek drainage, including the Ute Industrial Park and Aweida II properties, have soils that could support native mixed grassland but are presently dominated by non-native species. Aweida II is an old field reclamation area that was recently seeded with native grass species.

Upland shrubland in the subarea consists mainly of skunkbrush-dominated stands on the slopes and rock outcrops of Davidson Mesa. Some skunkbrush (*Rhus aromatica trilobata*) patches contain scattered ponderosa pine (*Pinus ponderosa*) and are characterized as scarp woodlands.

Prairie dogs have a significant influence on community composition. A Habitat Conservation Area is located on the Gallucci parcel, and Transitional Areas have been designated on Klein, Van Vleet, and Rolling Rock. Vegetation monitoring in Habitat Conservation Areas and Transition Areas was established in 1997. The Habitat Conservation Areas and vegetation monitoring program are implementations of the *Black-tailed Prairie Dog Habitat Conservation Plan* (City of Boulder 1996b).

Native riparian communities within the subarea are diverse in composition and structure. South Boulder Creek riparian forest and shrubland communities are the best examples of plains riparian forest and woodland communities in Boulder Valley. Dry Creek riparian communities have a significant non-native component. The Wetlands chapter describes riparian communities in detail. Non-native hayfields and cropland are described in the Agriculture chapter.

***Species diversity*:** Riparian and wet meadow areas that occur along South Boulder Creek are diverse in composition and structure. Dry Creek riparian areas are less diverse, partly due to Russian olive (*Eleagnus angustifolia*) invasion. Grasslands on Gallucci, Davidson Mesa, and small patches on the slopes of Ute Industrial Park butte have a diverse native forb component.

***Rarity*:** Rare species include Ute ladies'-tresses orchid *(Spiranthes diluvialis)*, American groundnut (*Apios americana*), and toothcup (*Rotala ramosior*). Potential habiatat exists for two additional rare species, the Colorado butterfly weed (*Gaura neomexicana* ssp. *coloradensis*) and the showy prairie gentian (*Eustoma grandiflorum*). Tallgrass prairie communities, plains riparian forest and woodland, and high-quality wetlands are rare or uncommon community types that occur in the subarea.

***Relative importance of native and non-native species*:** In South Boulder Creek and the surrounding uplands, many areas have a significant native species component, but several fields are dominated by non-native hay species. Dry Creek area uplands are predominately non-native hayfields. Riparian areas along Dry Creek are invaded by Russian olive (*Eleagnus angustifolia*) and other non-native species of concern. (See Exotic Species of Concern section (7.2.5) for descriptions of problem species and distribution patterns.)

***Potential natural vegetation*:** Soils and hydrology in the subarea would support mesic and xeric tallgrass, mixed grass, riparian forest/woodland, and other wetland community types (Bunin 1985).

***Processes*:** Some of the major processes influencing native vegetation in the subarea are: hydrology (e.g., irrigation, stream flows, flooding), fire, ungulate grazing, and prairie dog activity.

***Land use*:** Traditional agricultural practices are being carried out currently throughout most of the subarea. Common practices are dormant season grazing, irrigation, and a single mid-summer hay cutting (in the South Boulder Creek drainage).

Recreational use is high and steadily increasing in most areas, particularly in the South Boulder Creek floodplain and on the Klein parcel.

Information on past land use is available for some properties. Land use history is compiled in the Colorado Tallgrass Prairie Management Plan (Colorado Natural Areas Program 1986) and in the last section of this chapter. Bunin (1985) and ERO Resources (1996) describe recent plant community composition and how the composition is indicative of past land use practices. The significant cover of snakeweed on the south-facing slopes of Davidson Mesa may be related to heavy livestock use prior to Open Space acquisition.

***Restoration potential*:** Intensively farmed areas with crops or non-native hay species, areas with borrowed topsoil, and abandoned farmland occupied by prairie dogs have a lower restoration potential (e.g., Ute Industrial Park). Potential exists along the Dry Creek riparian corridor to

create and enhance Preble's meadow jumping mouse habitat. The Aweida II oil field is in the first stages of restoration. This upland field was seeded with native, mid-height grass species in the fall of 1996. The Aweida II property was grazed heavily by horses prior to Open Space acquisition.

***Size and shape*:** South Boulder Creek floodplain and upland terraces comprise one of the largest blocks of Open Space. Some of the largest patches of native grassland communities are found in the South Boulder Creek drainage within this subarea. The Dry Creek section of the subarea is a narrow patchwork of agricultural areas. The Ute Industrial Park property is disjunct from the rest of the subarea but is most comparable to the soil types and potential natural vegetation of the Dry Creek drainage.

***Landscape context*:** The South Boulder Creek section of the subarea is surrounded by relatively sparse development except for Burke II and has several major roads crossing the block. Dry Creek is bounded by moderately dense development and is crossed or bordered by several well-used roads.

Threats: The major threats to native communities in the subarea are hydrologic changes, the cumulative effects of trail building and heavy recreational use in riparian and other wetland areas, noxious weed invasion and the spread of existing non-natives, lack of fire, and significant changes in agricultural practices.

***Information gaps*:**

•Vegetation mapping and "ground-truthing" of Landsat imagery

***Major management issues*:**

- Integration of management for agriculture, rare plants and communities, rare animals, recreation.
- Rare species and community protection and management.
- Exotic species management.
- The use of prescribed fire to restore and enhance native communities and agricultural land.

Boulder Creek Subarea

***Management themes*:** Agricultural management is focused on hay production and irrigation systems in this subarea. The riparian areas are important recreational corridors. Some riparian patches serve as good habitat for native plant and animal species or have restoration potential. The main semi-natural areas are found on Short and Milne and the Cottonwood Grove.

***Community composition and structure*:** The majority of the Boulder Creek subarea consists of riparian and other wetland habitat. The Wetland chapter describes this subarea in more detail than will be presented in this chapter. Wetlands in the subarea have been documented through the Open Space wetland delineation, mapping, and inventory project. Several research projects

have been conducted in the Cottonwood Grove property. Non-wetland habitat has not been mapped and inventoried.

Most of the area has been severely disturbed by gravel mining, channelizing for flood control, trash dumping, road building, and road maintenance. A road easement occupies a significant portion of the Boulder Creek riparian corridor in the subarea. The South Boulder Creek corridor on the Flatiron Industrial Park property is highly modified as a result of flood control projects and irrigation infrastructure.

The vegetation reflects the human-caused disturbances. Crack willow (*Salix fragilis*) and other non-native trees are common in the riparian forest, and non-native species usually dominate the understory. Agricultural fields in the Short and Milne property have been planted in non-native hay species.

***Species diversity*:** The Open Space wetland inventory and other observations indicate that native species diversity within the subarea is highest in Short and Milne and the Cottonwood Grove (Scott et al. 1991).

***Rarity*:** Ute ladies'-tresses orchid (*Spiranthes diluvialis*) has been observed on Short and Milne and on private property near the Foothills Highway (47th Street) and Boulder Creek. The patches of native plains riparian forest along Boulder Creek are small remnants of that uncommon community type.

***Relative importance of native and non-native species*:** Non-native species are very common throughout the subarea. Currently, the important noxious species are Canada thistle (*Breea arvensis*), Scotch thistle (*Onopordum acanthium*), and purple loosestrife (*Lythrum salicaria*). Other species posing a significant threat to native plant communities are Russian Olive (*Elaeagnus angustifolia*), crack willow (*Salix fragilis*), and reed canarygrass (*Phalaroides arundinacea*). The Exotic Species of Concern section describes the most problematic species and current management of those invasions.

***Potential natural vegetation*:** Prior to gravel mining and other human-induced changes, the Boulder Creek and South Boulder Creek floodplains could have supported riparian forest and woodland communities, wet meadows, and marshes.

***Processes*:** Significant, human-caused changes in hydrologic regimes have occurred in Boulder Valley over the last 150 years. Reduced spring flooding, narrowing of floodplains, channelization of streams, and water use have contributed to changes in native plant communities. These factors, combined with the introduction of crack willow, Russian olive, and other non-native species, have affected patterns in native riparian vegetation. Research on plains cottonwood regeneration by Scott et al. (1991) in the Cottonwood Grove and D'Amico (1997) in upstream reaches of South Boulder Creek revealed low regeneration rates. Changes in cottonwood regeneration are partly attributed to altered stream flows and degraded habitat. The restoration potential for hydrologic processes in this subarea is probably minimal.

Land use: Historical uses of this section of the Boulder Creek and South Boulder Creek floodplains are described above and in more detail in the Wetland chapter. Currently, the subarea serves as wildlife habitat, a well-used recreational area, and agricultural land. The Wetland chapter describes wetland values.

Restoration potential: Native community restoration potential may be low due to altered natural processes and intensive land use. However, the management of non-native species can enhance native plant community habitat, agricultural land, and recreational experience.

Size and shape: The subarea is made up of small, narrow properties that are mostly non-contiguous. Properties range in size from about 55 acres to less than 5 acres.

Landscape context: This collection of Open Space properties is mostly set in an urban matrix. Short and Milne and Eccher are surrounded by rural development.

Threats: Displacement of native plant species by invasive non-natives; further degradation of habitat due to altered hydrologic processes.

Information gaps:
- Detailed vegetation mapping

Major management issues:
- Control of noxious species and other invasive non-natives
- Recreation management in native plant community habitat

Fourmile Canyon Creek Subarea

Management themes: The major management activities are agricultural. Hay production and livestock grazing are primary. Natural area features include riparian areas and other wetlands, prairie dog habitat (Habitat Conservation Area), and mixed grass prairie patches.

Community composition and structure: Active agricultural areas (Belgrove, Lousberg, Nu-West, McKenzie, portions of Andrus, and the northern pastures on Colorado Open Lands) are composed primarily of non-native grass species with native species concentrated in the riparian and other wetland areas. The Agriculture chapter contains information on the composition of non-native pastures. Pockets of native upland grassland occur on the slopes of Andrus Mesa and on the Lousberg parcel. Non-native, weedy species dominate the Reynolds and Celestial Seasonings properties.

Weed mapping has been completed for portions of the Fourmile Canyon Creek subarea, and wetland mapping has been completed for the entire subarea. Species lists have been generated by Open Space wetlands mapping, the Bock and Bock study (1995, final report in progress), and vegetation monitoring in prairie dog Habitat Conservation Areas and Transition Areas (Open Space and ESCO Associates 1997). Community characterizations for the Fourmile Canyon

Creek subarea, excluding Lousberg, Nu-West, and Colorado Open Lands, are documented in studies by Thompson and Strauch (1985) and Bunin (1985).

Prairie dogs have a significant influence on community composition. Portions of the McKenzie complex and the Andrus Mesa areas are designated as Grassland Ecosystem Habitat Conservation Areas (City of Boulder 1996b). These special designation areas have been chosen as appropriate areas for black-tailed prairie dogs (see Wildlife chapter). Vegetation monitoring in Habitat Conservation Areas and Transition Areas was established in 1997. The Habitat Conservation Areas and vegetation monitoring program are implementations of the *Black-tailed Prairie Dog Habitat Conservation Plan* (City of Boulder 1996b).

***Species diversity*:** Diverse native communities are concentrated in riparian and other wetland areas of the Fourmile Canyon Creek subarea (see Wetland chapter). Small patches of mixed grass prairie on the Andrus Mesa side slopes have a high native species diversity.

***Rarity*:** Rare species (listed by the Colorado Natural Heritage Program) have not been documented within the subarea. Small remnants of native riparian woodland and mixed grass prairie communities occur on Belgrove and Andrus respectively. These small patches need to be further studied in order to determine whether they represent rare community types listed by the Colorado Natural Heritage Program. Alkaline wetlands, which harbor uncommon plant species, are described in the Wetland chapter and by Bunin (1985).

***Relative importance of native and non-native species*:** Many of the Fourmile Canyon Creek subarea properties have a high cover of non-native species. Most semi-native riparian and other wetland communities throughout the subarea are infested by Canada thistle (*Breea arvensis*) and teasel (*Dipsacus fullonum*) (see Wetland chapter). Non-native grass species are dominant in all of the agricultural fields (see Agriculture chapter). Only a few upland areas on the slopes of Andrus Mesa are dominated by native species. Early seral, native and non-native species are common on the Andrus Mesa top. Native species are present in upland areas of Lousberg that are not irrigated or hayed but have been grazed in a rotation during the summer and fall. Blue grama (*Chondrosum gracile*) is a common species. Native vegetation on Lousberg should be surveyed and mapped. Nu-West is dominated by fescues (*Festuca* sp.) and smooth brome (*Bromopsis inermis*).

***Potential natural vegetation*:** Bunin (1985) describes potential natural vegetation for most of the Fourmile Canyon Creek subarea, based on the Boulder County soil survey (Moreland and Moreland 1975). Mid-height grassland is predicted for Andrus Mesa and adjacent uplands, the northern part of McKenzie excluding the playa, and Belgrove north of Fourmile Canyon Creek. Southern McKenzie and Belgrove and Reynolds could support xeric tallgrass. Upland portions of Lousberg and Nu-West may support mid-height grassland and xeric tallgrass (Moreland and Moreland 1975). Mesic tallgrass or wetland may occur in lowland areas of Lousberg, Nu-West, and southern Andrus. Riparian forest is predicted within the Belgrove property.

***Processes*:** Natural disturbances like fire, flooding, herbivory, and prairie dog burrowing are natural processes that influence and sustain the potential natural vegetation types predicted for the subarea. All of these processes have been altered over the last 150 years. The Natural History chapter describes the recent human land use history of the Boulder Valley and impacts on natural disturbance and other processes. Fire suppression, agricultural practices, biological invasion, the redistribution of water, and fragmentation of the landscape by human development have probably had the greatest influence on the subarea native plant communities.

***Land use*:** The dominant land use over the last century in the subarea has been agricultural. Fields have supported livestock grazing, annual crops, and perennial hay species. Pockets of native vegetation typically remain where irrigation is not practical, ploughing or topsoil borrowing have not occurred, or in small areas fenced out of agricultural use that have not been significantly altered by weed invasion.

The Belgrove property has a history of being ploughed, abandoned, and then cropped. Currently, Belgrove is planted in non-native pasture grasses.

Recreational activity in the subarea is focused in the McKenzie parcel. Fourmile Canyon Creek riparian area contains part of the City Greenways trail network.

***Restoration potential*:** Riparian and other wetland areas may have the highest potential for native community restoration. Patches of native species persist in these communities. Non-native invaders like Canada thistle (*Breea arvensis*) and teasel (*Dipsacus fullonum*) present a major obstacle to restoration plans in riparian and wet meadow areas throughout the subarea.

Andrus Mesa top has potential for mixed grass prairie restoration; however, the active prairie dogs in the Habitat Conservation Area on the mesa present a challenge for native plant seedings. Other properties with soils and hydrology that could support mid-height grassland and xeric tall grassland need to be evaluated. The Reynolds property is an extreme case where restoration potential is low due to topsoil borrowing in the past. Weed species dominate the Reynolds property.

***Size, shape, and landscape context*:** Open Space properties in the Fourmile Canyon Creek subarea range in size from 10-150 acres. The main blocks are the McKenzie, Belgrove, Reynolds, Nu-West, Lousberg complex, and the Andrus Mesa block which includes the northern Colorado Open Lands patches. The property named Celestial Seasonings is a small, narrow property that is separated from the main blocks. The two concentrations of Open Space are fragmented by roads but are otherwise contiguous. Adjacent lands are largely residential.

***Potential threats*:**

- Noxious weed species; escaped ornamentals; some agricultural species (e.g., smooth brome (*Bromopsis inermis*)). Canada thistle (*Breea arvensis*), teasel (*Dipsacus fullonum*), diffuse knapweed (*Acosta diffusa*), and crack willow (*Salix fragilis*) pose the most serious problems currently

- Road and trail building, roadside landscaping and reclamation, noxious weeds in adjacent roadside or trailside right-of-ways

***Information gaps*:**
- Mapping and inventory of native plant patches in agricultural fields
- A characterization of Fourmile Canyon Creek riparian plant communities using results from quantitative sampling methods

***Major management issues*:**
- Noxious weed control
- Riparian area management: trails planning, riparian native community restoration, livestock management

7.2.7 Summary of the Influences of Land-use Practices on Open Space Landscapes

Agriculture

Background: Origins of agricultural land use in the Boulder Valley and South Boulder Creek date back to 1859-1860 when the first crops planted included turnips, wheat, onions, and potatoes. In January and February of 1859, farmers "harvested the tall, dried standing, 'natural' grasses of the meadows and sold it to near by mountain communities" (Bixby 1971). Also, cattle, horse, and sheep grazed along creek terraces and in the foothills. The first irrigation ditch was dug in 1860, and others quickly followed, each extending the geographic limits of farming in the Boulder Valley. By 1862, the ditch system was extensive enough to irrigate 1,500 acres (Bixby 1971). Agriculture activities diversified; common crops included vineyards, orchards, berry farms, dairy farms, poultry production, dry-land grain production, haying, and horse boarding. Despite this agricultural diversity, the predominant land uses over the last 130 years have been hay production and livestock grazing.

Land use influences on native plant communities: Over the last 130 years the effects of agricultural management practices (hay production, livestock grazing, irrigation, fire, and weed management) on native plant communities have been mixed. In some instances, agricultural practices have been beneficial, while in others agricultural influences have been detrimental or cannot be determined. Similarly, the intensity of impact or benefit varies by location.

Deliberately introduced changes to native plant communities include conversion of native grasslands to non-native grass pastures or hay fields. Prevalent introduced grass species include smooth brome (*Bromopsis inermis*), orchard grass (*Dactylis glomerata*), timothy (*Phleum pratense*), tall fescue (*Festuca arundinacea*), and meadow fescue (*Festuca pratensis*). Some lands closest to creek bottoms on the lowest terraces were converted from native to introduced grasses. Properties that show evidence of deliberate conversion include Belgrove, Colorado Open Lands, Flatirons Industrial Park, McKenzie, and Eccher.

Where some upper creek terraces, hillsides, and ridgetops were used for livestock grazing, impacts to native plant community composition were a result of grazing practices rather than direct and purposeful vegetation manipulation. Davidson Mesa is an example of this type of agricultural influence. Land use on the south side of the mesa indicates a more intensive grazing history resulting in a change in native plant composition, while on the northeast side of the mesa remnant patches of mid- and tallgrass prairie communities still remain.

Agricultural use of chemicals is in part due to the type of agricultural land use practice (row crops versus hay fields) and in part due to farm traditions. The intensity of agricultural land use (including pesticide and fertilizer applications) varies within the Management Area. For example, some fields in the southern extent of the Management Area had commercial fertilizer applied annually from 1943 through 1964. Other fields had manure applied as fertilizer instead of commercial fertilizer from 1965 through 1985 (information summarized from Jennings 1990).

Applications of commercial fertilizer influence native plant communities. Nutrient loads contained in soil and water are changed by the addition of commercial fertilizers; these changes most frequently benefit non-native plant species.

The addition of irrigation water to the South Boulder Creek landscape has changed some native plant communities. There are 21 ditches that cross the Management Area, and the lessees irrigate about 1,500 acres. Several lessees in the South Boulder Creek Management Area have dramatically improved irrigation to the fields.

Fire is one of several natural processes that have influenced evolutionary adaptions in plant communities in the Boulder Valley. Native plant communities in the Management Area are uniquely adapted to fire; both the biological and structural diversity of native communities are caused by fire. Prior to European settlement, grassland fires were typically low-intensity, fast moving surface fires having a frequency of about 8 to 12 years (Veblin 1996). The suppression of fire has caused significant changes in native plant and animal communities. The beginnings of fire suppression in the Boulder Valley, generally, coincided with European settlement. According to Veblin (1996), the highest reduction in fire frequency occurred in areas near the plains grasslands and foothills ponderosa pine savannah. The history of fire use in the Management Area is not well documented. Prior to 1988, formal records of fires were not kept; however, some informal records do exist and are based on recollections of area farmers and ranchers (Table 7.2).

Non-native species control is an important aspect of agricultural management. It also has a significant impact on the landscape and native and non-native plant communities. The even application of irrigation water, consistent mowing practices, feeding hay that is grown on the same property, and application of manure instead of commercial fertilizer have contributed to the reduction of non-native, undesirable plants.

Large blocks of native plant communities and hay fields dominated by non-native grass species exist in the southern extent of the Management Area. Historic and present agricultural practices contribute to the vigor of these native plant communities. Further, these communities contain

only a minor component of noxious, non-native plants. The aggregate properties of Burke I, Burke II, Van Vleet, parts of Hogan Brothers, Church, and Yunker are an example of well maintained agricultural landscapes in the South Boulder Creek floodplain.

Collectively there are three lessees who farm about 1,750 acres in the southern extent of the Management Area. These 1,750 acres represent an excellent example of agricultural management that incorporates the multiple objectives of agricultural economics, natural area management, and scenic values.

Gravel Mining

Background: Commercial reserves of sand and gravel on the plains surrounding Boulder are generally restricted to the valleys that contained large glaciers during the late Pleistocene time (Madole 1973). Most of the gravel is extracted from the Broadway alluvium; however, Louviers alluvium also contains important deposits but are not as extensive (refer to the geology section), (Madole 1973). Records for gravel mining begin about 1955 and become more extensive with time. In the early 1970s gravel mining in the Boulder Valley extracted about 700,000 tons per year (Madole 1973), of which most was extracted from floodplains.

Gravel mining influences on native plant communities: Removing topsoil, sand, and gravel results in dramatic impacts to landscape characteristics and functions. Significant impacts to native plant communities can result from gravel mining (Law 1984, Smith and Helmund 1994, Reith and Potter 1986). Altered physiographic factors affect plant and animal life indirectly through their effects on light, temperature, moisture, soil, and soil-chemical composition (Law 1984). Vegetation succession processes are impaired or destroyed. Depending on the extent of disturbance, plant communities may revert to primary succession and have less-diverse species composition which are dominated by opportunistic species (Law 1984).

Gravel mining on the Short-Milne property (within the floodplain of Boulder Creek) has resulted in major changes to native plant communities. Canada thistle, diffuse knapweed, teasel, Russian olive, and canary reedgrass have invaded the property following mining activities. In addition to non-native species, Ute ladies'-tresses orchid grows on the property. Weed mapping and insect releases to control Canada thistle have occurred on the property.

Removal of topsoil from Ute Industrial and Reynolds properties (a more dry, upland site) has resulted in non-native and noxious weed species invading the area. Canada thistle, diffuse knapweed, and numerous other invasive species are present on the property. The parcel has been mapped for weed species followed by mowing and chemical control methods.

Major landscape disturbances, such as flood control work that occurred along South Boulder Creek on the Flatirons Industrial property, also create conditions favorable for invasive plant establishment. Purple loosestrife and Russian olive are examples of invasive species that are found on the parcel. Weed species have been mapped over the last six years. In addition, attempts to control purple loosestrife have included persistent hand pulling and removal.

Not only are landscape characteristics and functions dramatically altered by gravel mining, but the entire landscape may be transformed from a terrestrial ecosystem to an aquatic ecosystem. KOA lake, Lake Centre, Cottonwood Pond, and Pit D and C are examples of this complete transformation of landscape. The conversion of landscapes within the Management Area is relatively extensive. For example, wetlands created by gravel mining account for 52 acres, or 13 percent, of all wetlands in the Management Area.

Residential and Commercial Development

Background: During the 100 years between settlement in 1860 and established patterns of urban and suburban development in 1960, the Management Area was characterized by a mix of farms and cattle ranches dependent upon the annual delivery of mountain water to irrigate the former prairies.
Much of the Open Space in South Boulder Creek was purchased from the late 1960s through the late 1970s.

Residential and commercial development influences on native plant communities:
Development impacts to native plant communities include increased landscape fragmentation and loss of high-quality topsoil and productive agricultural land. Non-native plant species are deliberately introduced, or escape and become undesirable species or noxious weeds. Buildings and infrastructure create or become barriers to plant seed dispersal (inhibit direct or indirect dispersal/migration). Plant-pollinator relationships are affected by introduced species. Changes to micro climates (moisture, temperature, sunlight, and wind) influence both native plant communities and their pollinators. Further, increased amount of impervious surfaces lead to increased water runoff. Increased runoff may carry pesticides, fertilizers, and metals (Adams 1994).

Besides the obvious direct influences to native plant communities, there are less obvious indirect influences that result from development. Fire, a naturally-occurring process which is an integral aspect of some native plant communities becomes less frequent on the landscape as development occurs. The risk and potential loss of property has been the driving force behind the elimination of fire on lands with native plant communities.

Open Space is used to create a distinct edge between urban development and rural land uses. One of the purposes for Open Space, as stated in the Charter, is for "utilization of non-urban land for spatial definition of urban areas" (Open Space Charter 1986). Large blocks of open land contribute to this objective. Examples of landscapes that make up this urban definition include Davidson Mesa to the southeast, Marshall Mesa and Flatiron Vista to the south, and Boulder Valley Ranch and Beech properties in the north.

Recreation

Background: The Management Area's topography, streams, and vistas provide an idyllic setting for a variety of recreation activities. Initially, recreational uses in South Boulder Creek were

limited to a system of old cow paths and farm roads to accommodate hikers, horseback riders, dog walkers, and bicyclists. Today, recreation activities in the Management Area account for thirty percent of all recreation use on Open Space. The area serves a variety of recreational uses which are enjoyed by visitors.

Recreation influences on native plant communities: The recreation impacts on vegetation are more obvious to plants than to soil. Obvious visual effects to vegetation include being trampled, crushed, broken, or uprooted. More subtle physiological effects on plants may include reduced vigor (a decline in seed reproduction, leaf area, or stem height) which may, in turn, lead to change in species composition (Smith and Hellmund 1993).

Disturbed areas are particularly prone to the invasion of exotic species which typically out compete native species for moisture and soil nutrients. Non-native species may be introduced either deliberately or accidentally. Revegetation of disturbed areas often includes non-native plant species because they germinate quickly and become established and grow rapidly. Seeds of exotic species may be carried into native plant communities by dogs, horses, and recreationists (Smith and Hellmund 1993). Reduction in vegetative cover may lead to more exposed soil, soil compaction, runoff, and erosion.

Trails often require maintenance activities to control weeds or non-native plant species. Non-native tree removal and mowing are the most frequent maintenance activities. Repeated mowing along trail margins, over the course of a growing season, has a disruptive or detrimental impact to native plant communities. Mowing causes changes in plant physiology, morphology, stress levels, and ultimately reproductive success which, in turn, affects the overall vigor of the plant community.

Prior to 1985, management activities consisted mainly of agriculture, fencing, weed control, and minor trail maintenance. Routine trail maintenance was conducted by Open Space Program Conservation Corp crews on an annual basis. Service roads and trails were maintained by heavy equipment as needed. Subsequent to 1985, management activities focused on trail monitoring and planning efforts to measure and monitor impacts to soil and vegetation along designated and social trails. Presently, routine maintenance continues to include basic services of fencing, weed control, and minor trail maintenance.

Research

Approximately 175 research studies have been conducted on Open Space properties since the beginning of the Open Space program. Of those studies, about 58 involve vegetation and vegetation-related subjects. Broad categories of studies include vegetation-agricultural land use relationships, vegetation-wildlife relationships, fire-vegetation response relationships, vegetation-soil relationships, vegetation-riparian zone relationships, plant community type identification, rare and sensitive species studies, tallgrass vegetation studies, exotic plant species studies, low-elevation riparian forestry studies, and wetland vegetation studies. Many of these studies have been conducted in the South Boulder Creek Management Area. Reports or manuscripts of these studies are located in the Open Space Library.

Future Open Space Management
Present and future vegetation management is based on the principle of adaptive management (a framework that assumes that scientific knowledge is provisional and part of an ongoing learning process (Grumbine 1994)). Management practices will be based on available natural resource information, results of continuing research, and goals and objectives identified in the South Boulder Creek Area Management Plan. In addition, management direction will incorporate the ongoing goals of restoration, conservation, special designations (natural areas), and integrating management activities and resource projects (IPM, wildlife habitat improvement, agricultural land use, education and outreach, recreation planning, and vegetation or habitat improvement).

7.3 ISSUES

Species and communities of special concern
- Lack of information on the biology and ecology of rare species.
- Lack of information on the Open Space system and regional context for sensitive species and communities.
- Exotic plant invasion and spread.
- Recreational use of rare plant and community habitat.
- Need for public education concerning sensitive species and communities.
- Need for long-term monitoring plans for tracking population viability and community condition.

Fire management
- Lack of management planning related to: fire history, natural fire regime for native plant communities, fire as a tool for rangeland and agricultural management, desired condition (seral stage, structural character) of plant communities related to wildlife management, fire as a weed control method, and monitoring of fire effects.
- Fire suppression in native plant communities that are adapted to periodic fire.
- Need for no-impact, interagency pre-planning for prescribed burning and suppression activities in sensitive species habitat.

Grazing management
- Need for riparian fencing in some areas of South Boulder Creek.
- Need for grazing effects monitoring.

Agricultural (crop/hayfield) management
- Crop-types and hayfield species (e.g., smooth brome (*Bromus inermis*)) in proximity to native plant communities.
- Irrigation effects on native plant communities.

Exotic plant management
- Weed infestations in native plant communities.
- Effects of control methods on native species.

- Lack of information on the ecology and biology of native-exotic plant relationships.
- Weed infestations on adjacent land, not managed by Open Space, provide the seed source to re-infest Open Space areas where weed control efforts have been implemented. Adequate and appropriate fencing can provide a short-term solution to this problem by creating a barrier to blowing diffuse knapweed plants. There is not a protective strategy for reducing the spread of purple loosestrife from adjacent land onto Open Space (e.g., purple loosestrife (*Lythrum salicaria*) occurs on the grounds of the East Boulder Community Center, just west of high-quality wetlands and sensitive species habitat on Open Space land). Coordinated weed management involving public and private landowners is an essential step in resolving this critical management issue.
- The spread of non-native ornamental species from urban landscapes and growing facilities onto native plant and animal habitat on Open Space.
- Land over-utilization by livestock can contribute to exotic species invasions by disturbing soils, altering plant species composition, and transporting weed seeds. Important factors to consider when addressing this issue are the timing and duration of grazing, the animal type, the stocking rate, the land use rotation schedule, and the sensitivity or condition of the plant communities involved.

Wildlife and native plant community interactions

- Prairie dog activity can affect native plant community composition and condition. The *Black-tailed Prairie Dog Habitat Conservation Plan* (City of Boulder 1996b) identifies weed mapping in prairie dog Habitat Conservation Areas as a seasonal mapping priority. The Plan directs the Integrated Pest Management coordinator to review monitoring data, and in coordination with the prairie dog interdisciplinary team, develop management recommendations consistent with the goals of the Integrated Pest Management program and the prairie dog plan. Implementation of the Plan will include coordinating management of rare plants, other native vegetation, and prairie dog Habitat Conservation Areas.

Passive recreation

- Use types, patterns, and levels.
- Trails--fragmentation, exotic species spread, dispersed (off-trail) recreation/use, trampling/widening over time (cumulative effects), trail placement in rare or uncommon and high-quality native plant communities.
- Visitor experience and education--maintaining (or restoring) the integrity (functionality of supporting processes, diversity, dynamics) of native plant/animal communities for high-quality visitor experience over the long term.

Hydrology and water quality

- Effects of water manipulation (irrigation equipment/structures, water use patterns) on native plant communities.
- Effects of changes in hydrology related to road and trail construction and maintenance and development adjacent to Open Space.
- Effects of water quality (related to agricultural runoff).

7.4 DATA GAPS

- Systematic inventory of plant species in the Management Area and complete species list.
- Areas not inventoried and mapped in Management Area.
- Rare plant species and community information: biology, ecology.
- Rare plant monitoring plans.
- Exotic plant species information: biology, ecology and control methods.
- Plant community health assessment program.
- System-wide context for evaluating and prioritizing management of vegetation types (a system-wide vegetation map).

8. WETLANDS

8.1 INTRODUCTION

The purpose of this chapter is to describe the wetlands occurring in the South Boulder Creek Management Area. The report focuses upon those wetlands on City of Boulder Open Space and includes information about wetlands on neighboring lands where available and appropriate. The data will be used by the Open Space Program in the development of a management plan for the project area. This identification of wetland areas, functions, and values is intended to protect and balance agricultural land uses, passive recreation, and the conservation of plant and animal habitat, water quality, and other wetland functions in the Management Area[8].

8.1.1 Wetland Policies Relevant to the South Boulder Creek Management Area

A wetland is an area that is inundated (flooded) or saturated by surface or ground water at a frequency and duration sufficient to support, and under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions (Appendix 8.1). This wetland definition is used in the Clean Water Act (33 U.S.C. §1344) and the City of Boulder Wetlands protection ordinance (B.R.C. 1981 §9-12).

The development and management of wetlands are governed by federal, County, and City regulations and policies. Federal policies are mostly part regulatory and are administered jointly by the U.S. Army Corps of Engineers and the Environmental Protection Agency. Boulder County wetlands policies consist of broad direction from the Boulder County Commissioners and the Boulder County Planning Commission. City wetlands policy includes policy direction in the *Boulder Valley Comprehensive Plan*, regulatory provisions of the City's land use code (the wetlands protection ordinance), and City Council direction on wetlands protection and the *Long Range Management Policies*.

8.2 RESOURCE INFORMATION

Wetlands cover approximately 18% of the Open Space within the Management Area and 9% of the Management Area itself (Table 8.1). These values exceed the ratio of wetlands for the entire Open Space system (4.9%) and for the Boulder Valley Comprehensive Planning Area (6%). One would expect the prevalence of wetlands in the Management Area because of its hydrologic relationship with South Boulder Creek, Boulder Creek, and Fourmile Canyon Creek. About 6%

[8]Methods for the collection of wetland information can be found in Appendix 3.1.3.

of the private land in the Management Area is wetland, about the average value in the Boulder Valley.

Table 8.1: South Boulder Creek Management Area Acreage						
	Open Space		*Private*		*Total*	
Wetlands	**Acres**	**No.**	**Acres**	**No.**	**Acres**	**No.**
	667	61	694	58	1,361	119
So. Boulder Creek Management Area	3,733		11,184		14,917	
% Wetland	17.87%		6.21%		9.12%	

Sixty-one wetland complexes have been mapped on Open Space within the Management Area. Individual wetlands on Open Space range in size from 890 square feet to 75 acres. Fifty-eight wetland complexes have been mapped on other lands in the Management Area; these wetlands range in size from 121 square feet to 115 acres. The average size of wetlands in the Management Area is approximately 5 acres.

As shown in Figure 8.1, over half of the wetland area on Open Space is found in fourteen wetlands over 10 acres. A single gravel pond complex along Boulder Creek accounts for 10% of the wetlands in the Management Area.

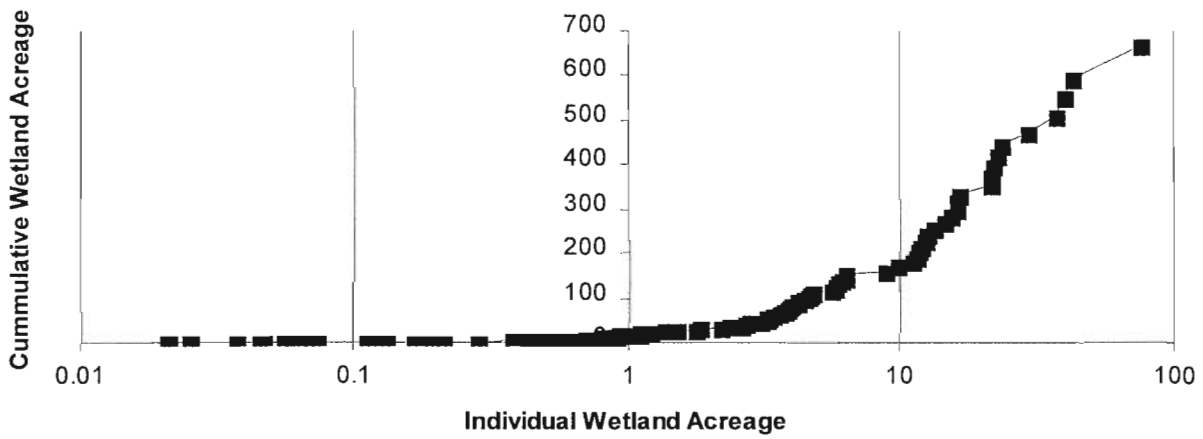


Figure 8.1: Individual Wetland Area, South Boulder Creek Management Area
(note: X axis is logarithmic)

8.2.1 Landscape Context

The Management Area is comprised of Open Space lands in several watersheds of the Boulder Valley. The properties along South Boulder Creek south of Baseline Road and those along Dry Creek dominate the Management Area. The second largest grouping of Open Space lands is found around Jay Road in the Fourmile Canyon Creek watershed. The remaining Open Space lands are clustered around Boulder Creek near its confluence with South Boulder Creek.

Open Space lands within these clusters, or subareas, tend to have more in common with each other than they do with properties elsewhere in the Management Area. The Open Space lands within these areas have similarities in watershed and irrigation hydrology, surrounding land uses, land use history, and their relationship with other management areas. A full description of the justification of these subarea designations may be found in Appendix 7.3.

8.2.2 Geologic Setting

South Boulder Creek/Dry Creek and Boulder Creek Subareas
Much of the Management Area is underlain by alluvial sediments deposited over the last 600,000 years. This material is comprised of clayey silt and sand overlying well-rounded gravel, cobbles, and pebbles. These coarse strata can be up to 30 feet thick, although thicknesses of 15 feet are more typical. The numerous gravel pits along Boulder and South Boulder Creeks have been excavated in these ancient river deposits. The Geology chapter gives a more thorough review of the origin of these deposits. These coarse sediments tend to be very permeable to ground water flow and are an important part of the "plumbing" that brings ground water to the surface in the Management Area.

The soils which have developed atop this alluvial material tend to be shallow and poorly drained. In contrast with the underlying material, these soils have a large component of clay and conduct water poorly. Seasonally high water tables due to snowmelt, runoff, or irrigation result in the saturation of the underlying gravel. Soils may be saturated by high ground water or as water is drawn upward from the coarser material into the clayey silts by capillary action. Floodplains tend naturally to be among the last areas to dry out each spring as elevations of floodplains are relatively low. This prolonged period of saturation can be extended by irrigation. In many years these floodplains do not dry before the snowfall begins, thereby establishing saturated soil or subsoil conditions throughout the growing season.

The regional importance of the floodplain wetlands of South Boulder Creek can be better understood when considering the entire Boulder Valley. Although the Boulder Valley is defined politically, it includes much of the landscape described by Boulder Creek and its tributaries[9] below 8,000 feet. Within the Boulder Valley, Boulder Creek's floodplain has been intensely

[9]Excepting Coal Creek which barely enters the Boulder Valley.

developed with urban land uses ranging from residential and commercial development to City parks and concrete pathways. The channel has been straightened and reinforced with rip-rap ranging from granite boulders to concrete slabs. The flows of Boulder Creek and South Boulder Creek have been significantly diminished by upstream impoundments and diversions for downstream agriculture and municipal water supplies. Flows of some of the smaller tributaries of Boulder Creek such as Bear Creek are similarly diverted. In addition, Bear Creek, Skunk Creek, Bluebell Canyon Creek, Gregory Creek, Goose Creek, Fourmile Canyon Creek, Two Mile Creek, and Elmer's Two Mile Creek have been so significantly modified that their floodplains are relatively concealed within the City, and in places hundreds of feet of the channels have been replaced with culverts and pipes. Remnant portions of the floodplains of Boulder Creek and its tributaries persist amid parking lots, industrial parks, and reclaimed gravel pits.

South Boulder Creek, alone among Boulder Creek's tributaries, maintains a somewhat natural aspect. Abandoned ox-bows, point bars, and meander scrolls have not been obliterated by channelization and mining and are evident in recent aerial photography (notably on the Burke II, Burke I, and Fancher properties within the Management Area). These are really relict land forms because the Creek seldom floods outside of its channel (but in 1995, an extraordinary water year, much of the floodplain was submerged beneath flood water). Patterns of ground water flow and irrigation application have resulted in the perpetuation of a somewhat natural floodplain wetland area. Although diversions and impoundments have had a significant effect upon all aspects of the physical and biotic environment, the manipulations of the landscape have been far less severe than those occurring elsewhere in the Boulder Valley. As Cooper (1988) described the area: "These large wetland areas are the last remnants in good condition of what once were very extensive wetland complexes on this broad floodplain area. Considerable biological diversity occurs." These areas were described as priority wetlands because of the functions that are now valued by human society and because of their importance to the other organisms that are part of the biological community of the Boulder Valley (Cooper 1988).

Fourmile Canyon Creek Subarea

The wetlands of the Gallagher and Lousberg properties include spring-fed wetlands uncommon in the Boulder Valley. These wetlands are supported by rainwater, irrigation ditch seepage, and regional ground water flows that percolate through the gravels overlaying much of the Boulder Valley. Much of this water follows the local topography and flows eastward where springs and seeps form as ground water flow is interrupted by impermeable soils or bedrock.

Water chemistry is also affected by the local geology. The marine sediments which dominate the bedrock of the Boulder Valley are strongly alkaline. Waters flowing over and through these deposits dissolve the calcium, sodium, and magnesium salts. The wetland vegetation of the Boulder Valley is dominated by species adapted for life in alkaline soils.

8.2.3 Soils

Wetlands in the Management Area are found on twelve soil types (Figure 8.2). Areas mapped as NS (non-soil) are mostly ponds, lakes, creeks, and active gravel mines in 1969, when the soil survey aerial photographs were taken. All are open water or creeks in 1997.

The majority of soil survey information provided by the Natural Resource Conservation Service is consistent with the wetlands survey. Hydric soils or open water are mapped for approximately 68% of the wetlands in the Management Area. The remaining soil series underlying wetlands have been identified by the Natural Resource Conservation Service as likely to have inclusions of hydric soils.

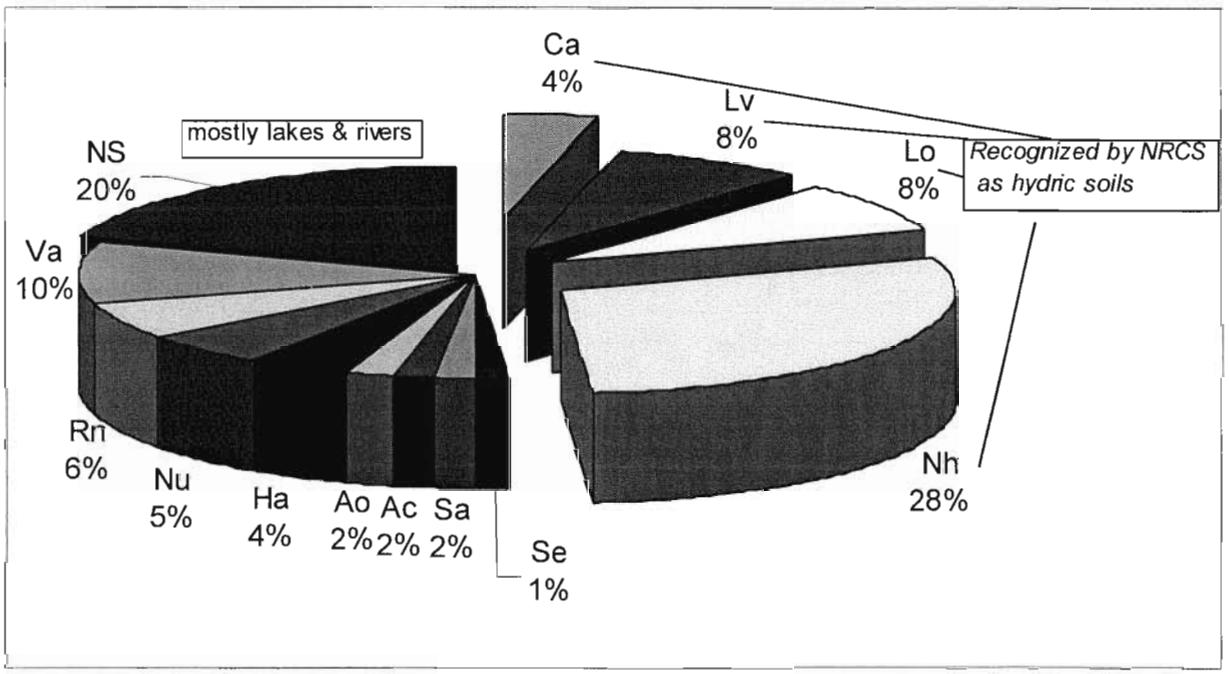


Figure 8.2: Soils of Wetlands in the South Boulder Creek Management Area
Soil types representing less than 6 acres are not shown.

Key to Figure 8.2

Ac	Ascalon sandy loam	NS	Non-Soil
Ao	Ascalon-Otero Complex	Nu	Nunn clay loam
Ca	Calkins sandy loam	Rn	Renohill silty clay loam
Ha	Hargreave fine sandy loam	Sa	Samsil clay
Lo	Longmont clay	Se	Samsil-Shingle complex
Lv	Loveland soils	Va	Valmont clay loam
Nh	Niwot soils		

The soils in the Management Area characterized by a shallow surface layer of silty clay loam or clay loam over deep deposits of gravel. The Geology and Soils chapters provide further detail on the origin and composition of these soils.

Several large reservoirs (Hayden Lake, Baseline, Valmont, Hillcrest, and Leggett) are located on private land within the Management Area. There are also many unnamed small gravel ponds along Boulder Creek (mostly from Colorado Open Lands eastward) and South Boulder Creek (just north of the town of Marshall). Areas mapped as ponds on Open Space are listed in Table 8.2. The Program also manages portions of Sombrero Marsh which are part of the Eason and Lentsch properties.

Table 8.2: Ponds in the South Boulder Creek Management Area

Water Body Name	Origin/Type	Acres
Clough	Conservation Easement	1.29
Cohagen	Conservation Easement	0.40
Reich	Conservation Easement	0.19
Cohagen	Conservation Easement	0.13
Oakley	Conservation Easement	0.01
Pit D (west)	gravel	19.93
KOA Lake	gravel	12.41
LakeCentre I (juts into Colo. Open Lands)	gravel	10.41
Cottonwood Pond	gravel	7.29
Pit D (east)	gravel	1.60
Pit C	gravel	0.51
KOA Lake	gravel	0.02
Suitts (north)	stock	1.93
Church (northwest)	stock	0.59
Church (east)	stock	0.38
McKenzie Pond	stock	0.32
Lousberg Pond	stock	0.29
Church (southwest-2)	stock	0.25
Damyonovich	stock	0.05
Church (southwest-1)	stock	0.04
Short and Milne	temp	0.42
Burke II	temp	0.39
Suitts	temp	0.17
Colorado Open Lands	temp	0.09
Fancher	temp	0.09
Fancher	temp	0.05
Van Vleet	temp	0.03
Rolling Rock Ranch	temp	0.02
Yunker	unknown	0.08
TOTAL		**59.40**

Perennial creeks flow through the Management Area. South Boulder Creek, Boulder Creek, and Fourmile Canyon Creek are dominant parts of the landscape. A perennial spring-fed creek enters the Lousberg property from the west.

The only intermittent creek of note is Dry Creek. Dry Creek, which is also known as the Dry Creek Carrier, flows from Baseline Reservoir northeastward to Boulder Creek. The Dry Creek Carrier has also been deepened and extended to the southwest to intersect with South Boulder Creek so that it can serve as a supply canal to downstream ditches. It is unclear whether Dry is an ancient channel of South Boulder Creek or whether it eroded headward from the vicinity of Baseline Reservoir to its confluence with Boulder Creek.

More information on the creeks of the Management Area can be found in the Water Resources chapter.

8.2.4 Wetland Origin and Water Source: Complexity in an Area of Widespread Irrigation

Wetland origin describes the process by which water is brought into proximity with the ground surface. Water source describes the supply of water by which a wetland is maintained. Field staff tried to determine water source and wetland origin in the field (Figure 8.3). Soil analysis, monitoring wells, irrigation records, and aerial photography helped clarify origin and water sources of wetlands when they could not be established in the field.

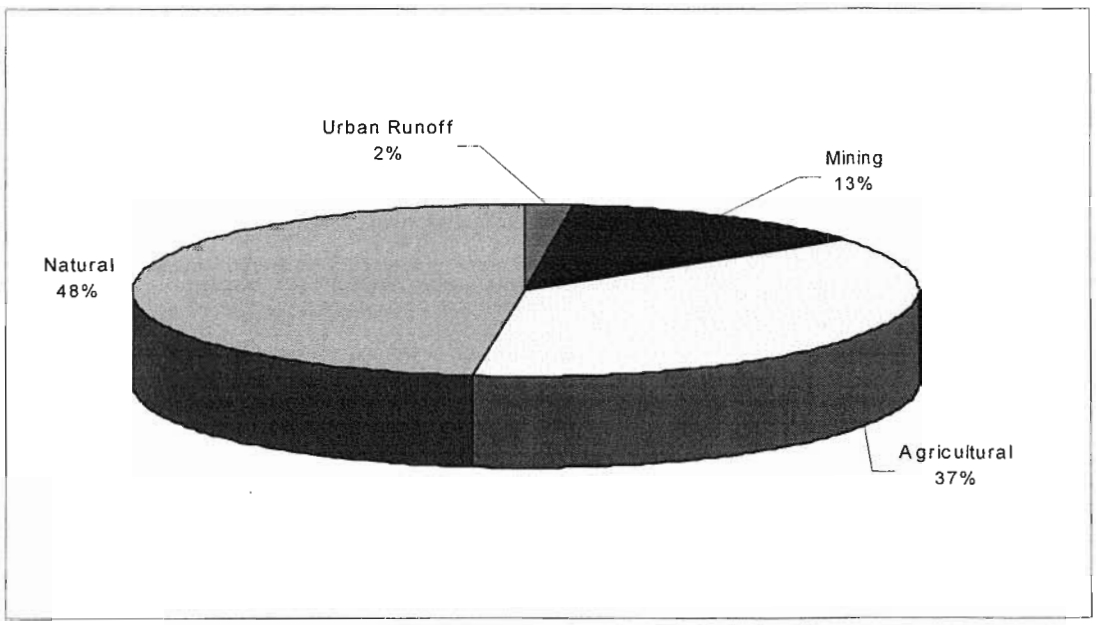


Figure 8.3: Origin of Wetlands of the South Boulder Creek Management Area
(% of wetland acreage on City of Boulder Open Space)

South Boulder Creek/Dry Creek

***Confounding Ground and Surface Water Flow*:** Wetland origin and water source are easily confused in this subarea. The confusion arises from trying to differentiate between those wetlands which are artifacts of irrigation and those which are naturally occurring. One would expect naturally-occurring wetlands throughout the floodplains of South Boulder Creek and Dry Creek because the ground surface is relatively low, and ground water is seasonally elevated. In natural situations without artificial irrigation, there would be wetlands in the floodplains.

Irrigation has been an important process in this subarea for more than 100 years. Irrigation has affected long-term patterns of ground and surface water flow and, consequently, the amount and distribution of wetlands. Irrigation water that is applied in the tributary basins and that does not evaporate or is not used by plants, flows back toward the floodplain. The return flows increase the amount of ground water moving from the mesas and creek terraces back to the creeks. Wetlands have formed where this water is at or near the surface. While some of these wetlands may have formed under natural conditions in extremely wet periods, they are perennial under the irrigation regime of the past century. It is difficult to determine which of these wetlands is the result of natural patterns and which result from the irrigation-augmented flows.

An interesting aspect of irrigation-induced hydrologic change is that differential return rate of ground water may result in a more even distribution of these flows through the year. The process might work something like this: Water is applied at varying distances from the creeks. Because of differences in soil and bedrock, the rate of return flows varies. With a complex variety of distances and rates of return flow, some water is typically moving through an area at any given time. As you approach the point of convergence (the creek) there is a greater likelihood of elevated ground water levels. Perennial ground water at or near the surface creates wetlands.

***Origin, Water Source, and Riparian Structure*:** Another confounding effect of irrigation for defining origin and water source of wetlands is the transfer of water from one creek to another. Dry Creek and South Boulder Creek have an interesting relationship because of such cross-channel transfers. Prior to the development of the Boulder Valley's irrigation system, Dry Creek probably had very low base flows. It was probably a good deal smaller than it is now. Now Dry Creek is used to transfer South Boulder Creek water to farms and ranches in eastern Boulder County. It is now a carrier of South Boulder Creek water which is diverted into the channel from the outlet of Baseline Reservoir. Dry Creek's riparian area, including wetlands, has probably enlarged because of increased flows. It is difficult to determine the origin and water source for such wetlands that are clearly the result of natural processes and agricultural practices.

A similar condition exists on South Boulder Creek where it receives Boulder Creek water from the Wellman Canal just north of the Burke II property. This water is delivered to the Valmont Reservoir complex just south of the Flatiron Industrial Park property.

Boulder Creek

Gravel mining is responsible for most of the wetlands in the Boulder Creek subarea. Most of these wetlands are open bodies of water (Pits C, Pit D, and KOA Lake). Apart from gravel pits,

Boulder Creek is the other major wetland. Despite the dramatic modifications to the channel, Boulder Creek is considered a wetland of natural origin.

Fourmile Canyon Creek
This subarea has similarities with the South Boulder Creek/Dry Creek subarea and the North Boulder Valley Management Area. Like the North Boulder Valley Management Area, naturally-occurring, spring-fed wetlands can be found in the series of unnamed drainages running east west between Fourmile Canyon Creek and Lefthand Creek. These are located on the Nu-West, Lousberg, and Gallagher properties. Like the South Boulder Creek/Dry Creek subarea wetlands can be found in and nearby low lying irrigated pastures and hayfields (Andrus, Belgrove, McKenzie, and Eccher).

No irrigation ditches divert water from Fourmile Canyon Creek for use in the Management Area. These properties are irrigated with water from Boulder Creek through Farmers Ditch and the Jones Donnelly Ditch. (The water resources chapter provides greater detail on the origin of irrigation water in the Management Area.)

8.2.5 Origin Data

Wetland origin is summarized according to the estimated primary origin. About half of the wetlands had a natural "primary" origin compared to 37% considered to be primarily the result of agricultural practices (Figure 8.4). This includes not only irrigation, but the construction of stock tanks and ponds and the storage of water rights for agricultural purposes. However, when considering the *number* rather than extent, there is equal importance of agriculture and natural origin (Figure 8.4). Mining was responsible for creating about 14% of the wetlands in the Management Area. Urban runoff also contributes to the formation of some wetlands in the Management Area.

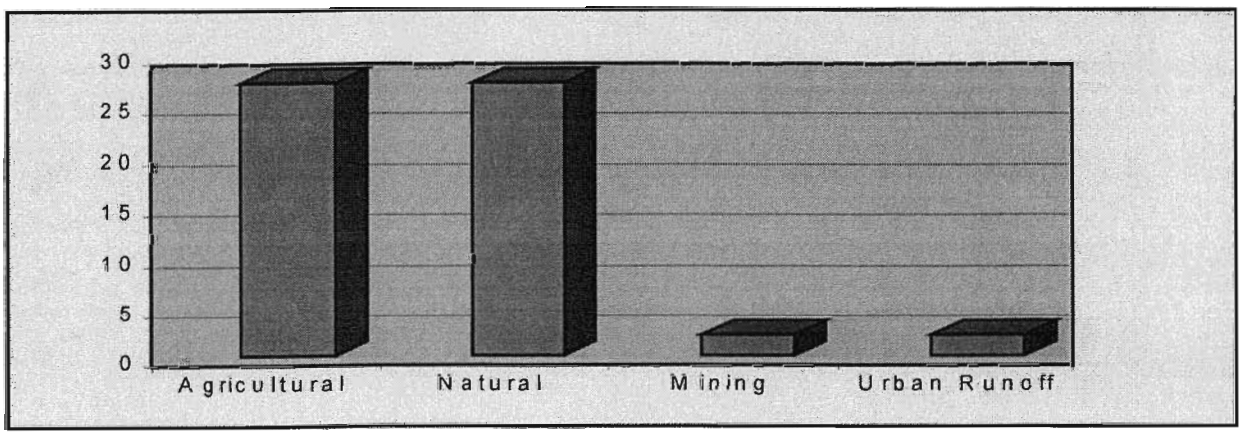


Figure 8.4: Frequency of Origin for Wetland Complexes in the South Boulder Creek Management Area

Water Source Data

Most of the wetland acreage is supported by ground water near (high water table) or at (creeks) the ground surface (Figure 8.5). In places, the high water table and even the creeks are supported by return flows and diversion of irrigation water. In some cases (4% of the wetland acreage) the relationship between a wetland and a ditch was clear enough to relate the water source directly to the ditch. These are typically small wetlands located downslope from ditches in otherwise dry areas.

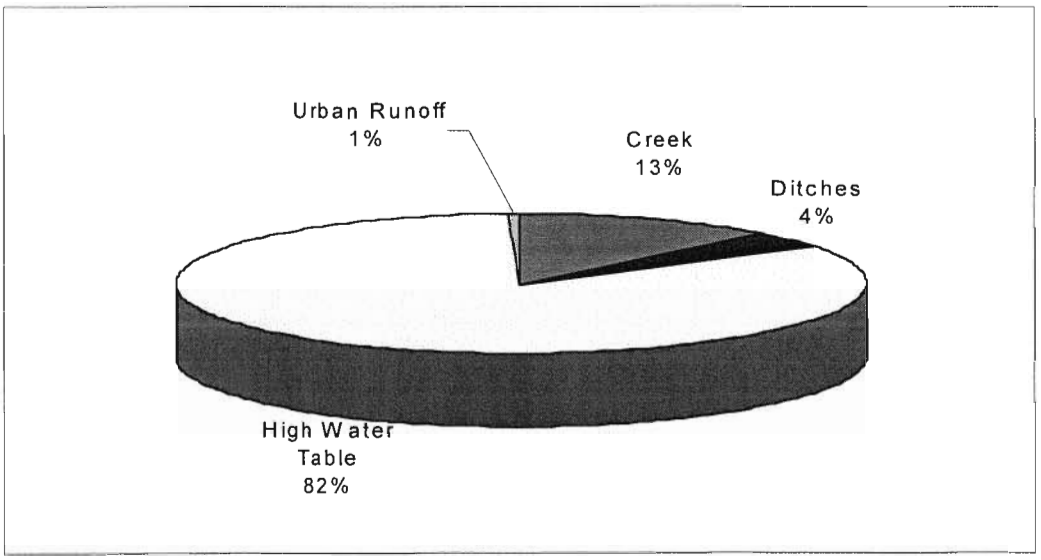


Figure 8.5: Water Source for Wetlands of the South Boulder Creek Management Area
(% of wetland acreage on City of Boulder Open Space)

Agricultural Wetlands *Not* Part of Inventory

Most wetlands occurring in irrigation ditches have not been mapped. The City and the Program usually lack the jurisdiction to prevent these areas from being maintained and modified by the ditch companies. However, the City owns all of Schearer Ditch and miles of laterals; special opportunities exist for maintaining wetlands associated with these features in concert with proper registration and filing with the state for associated water rights.

Information Needs Relevant to Wetland Origin and Water Source

The contribution of irrigation and natural flows for each wetland is difficult to separate. Understanding the long-standing reliance of wetlands upon artificial water sources is critical prior to making alterations in the water delivery systems in the study area. Potential wetland creation opportunities should also be identified and considered as a possible use for the water rights held by the Program.

***Wetland plant communities*:** As part of his 1990 report Cooper described a number of wetland plant communities for the Boulder Valley (Cooper 1990). His classification scheme is useful for deciphering the complex variety of plant associations in wetlands of the Boulder Valley within context of state water law as noted above.

These communities fall into three general groups and several subgroups (Cooper 1990). Those that are recorded from the Management Area are *italicized* and an example is given.

1. **Marshes** or communities in permanent shallow water (water depths over 6.6 feet are not considered wetlands).
   - *Dominated by floating plants*
     Example: pondweed dominated ponds and marshes
   - Dominated by rooted submerged plants
   - *Dominated by rooted emergent plants*
     Example: cattail and bulrush marshes at pond edges

2. **Wet meadows** or communities with seasonal or permanent high water tables but without permanent standing water.
   - *Herbaceous wetlands with organic soils and mineral rich water supplies*
     Example: sedge meadows of open flat areas where ground water seeps near the surface and dense stands of cattails and bulrushes in low areas
   - *Herbaceous wetlands with mineral soils and fresh water*
     Example: fields of wire grass/arctic rush in heavily irrigated and grazed pastures and meadows
   - *Herbaceous wetlands with mineral soils and alkaline water source*
     Example: inland salt marshes as on the Gallagher property

3. **Riparian Wetlands** or communities adjacent to running water.
   - *Herbaceous wetlands*
     Example: wetlands along the banks of Dry Creek
   - *Shrub wetlands*
     Example: willow thickets along South Boulder Creek.
   - *Forested wetlands*
     Example: cottonwood forests of South Boulder Creek

Table 8.3 lists the plant communities recorded for the Management Area. As would be expected in an area dominated by creek floodplains and irrigated agriculture, wet meadows and plains riparian forest dominate the wetlands of the Management Area (Figure 8.6).

Table 8.3: Plant Communities of the South Boulder Creek Management Area Wetlands

Habitat	Community Name	Acres
Plains riparian	*Populus deltoides-Salix amygdaloides-Bromopsis inermis*	93.64
Open water	Open water	77.87
Wet meadow	*Phalaris arundinacea-Cirsium arvense*	59.05
Other	No community type designated	56.95
Wet meadow	*Carex nebrascensis*	47.56
Marsh	*Typha latifolia-T. angustifolia-Schoenoplectus acutus*	46.49
Wet meadow	*Spartina pectinata*	35.75
Plains riparian	*Nasturium officinale-Bacopa rotundifolia-Berula erecta*	32.42
Wet meadow	*Juncus arcticus*	30.23
Wet meadow	*Agrostis gigantea*	25.14
Wet meadow	*Eleocharis macrostachya-Juncus sp.*	24.33
Non-native hay/pasture	*Poa pratensis-Trifolium arvense*	19.95
Marsh	*Schoenoplectus pungens*	16.62
Marsh	*Potomogeton gramineus-Sagittaria cuneata-S.latifolia-Alisima plantago-aquatica-Ceratophyllum demersu*	9.64
Wet meadow	*Carex lanuginosa*	7.10
Wet meadow	*Persicaria lapathifolia-Persicaria maculata*	6.42
Marsh	*Typha latifolia-Breea arvense*	5.90
Wet meadow	*Spartina pectinata-Glyceria maxima*	5.11
Plains riparian	*Salix exigua*	4.43
Marsh	*Bolboschoenus paludosus*	4.26
Open water	*Chara* sp.	4.26
Wet meadow	*Puccinellia distans-Spergularia media*	4.26
Marsh	*Typha latifolia-Lemna minor*	4.06
Marsh	*Scirpus pallidus-Juncus interior*	3.63
Marsh	*Schoenoplectus acutus*	2.92
Plains riparian	*Glyceria maxima-Anemone canadensis*	1.66
Standing water	*Potomogeton pectinatus P. foliosus Elodea canadensis*	1.62
Wet meadow	*Distichilis spicata-Iva axillaris*	0.61
Plains riparian	*Leersia oryzoides-Bidens cernua*	0.32

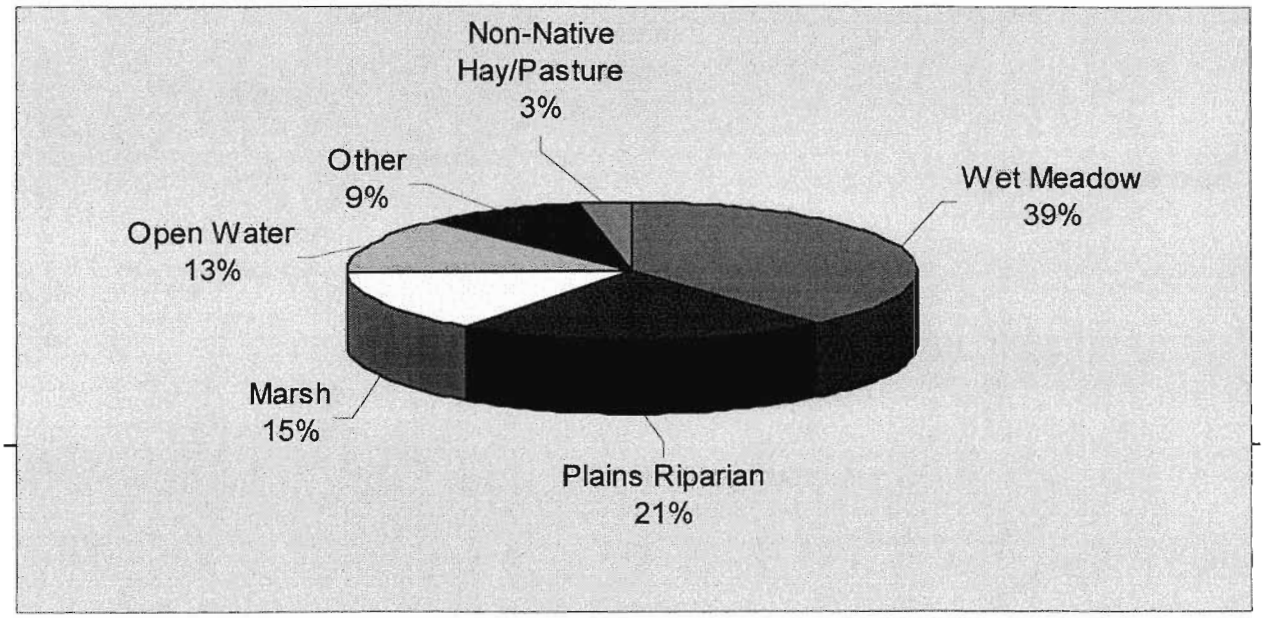


Figure 8.6: Plant Communities of the South Boulder Creek Management Area

A list of wetland plant species recorded for the Management Area is provided in Appendix 8.3. There are three rare or imperiled species (Colorado Natural Heritage Program 1996) recorded from wetlands of the Management Area. These are: *Spiranthes diluvialis, Rotala ramosior*, and *Apios americana.* Invasive non-native plant species are highlighted in Appendix 8.3. These species represent a significant threat to the ecological integrity of the Management Area. More information about both rare and weed species is included in the Vegetation chapter. Wetland indicator status information is provided along with the scientific and common name (if any) for each species. Indicator status is a classification devised by the U.S. Fish and Wildlife Service (Reed 1988) to describe the likelihood that a given plant will be encountered in a wetland. The categories of indicator status are defined in Table 8.4.

Table 8.4: Indicator Status for Wetland Plants (from Reed 1988)

Obligate Wetland (OBL)
Occur almost always (estimated probability > 99%) under natural conditions in wetlands.

Facultative Wetland (FACW)
Usually occur in wetlands (estimated probability 67%-99%) but occasionally found in non-wetlands.

Facultative (FAC)
Equally likely to occur in wetlands or non-wetlands (estimated probability 34%-66%).

Facultative Upland (FACU)
Usually occur in non-wetlands (estimated probability 67%-99%) but occasionally found in wetlands (estimated probability 1%-33%).

Obligate Upland (UPL)
Occur in wetlands in another part of the County but occur almost always (estimated probability >99%) under natural conditions in non-wetlands. Species not listed are considered UPL.

The Colorado Natural Heritage Program (1995) has also identified rare and imperiled natural communities. Included in the list are several types of plains riparian forests. No records exist for these communities in the County. In order for a locale to be considered an occurrence of a rare or imperiled natural community, the area must meet certain threshold requirements. The Management Area certainly has considerable areas which might be considered occurrence of one or more of these natural communities. Open Space staff should consult with staff from the Colorado Natural Heritage Program to determine the best way to evaluate the status of these areas using existing information. If more information is needed, it should be coordinated with the implementation of this plan or the designation of the South Boulder Creek Natural Area. All of these riparian forest types have considerable conservation value.

The following species of vertebrates (Table 8.5) are listed as rare or imperiled (Colorado Natural Heritage Program 1995) plants, animals, and natural communities that have been recorded from the wetlands of the Management Area (see Colorado Natural Heritage Program 1995 for key to rankings). The Open Space Program's invertebrate database was not checked for records of rare or imperiled wetland species in the Management Area.

***Wetland Function and Value*:** Table 8.6 shows the wetland functions provided, on average, by Management Area wetlands to a high (3.5-5), moderate (2.5-3.4), and low degree (1-2.4). The function and value ratings for only thirty-four of the sixty-plus wetlands in the study area have been entered into the database for analysis.

The wetlands providing most functions to a high degree are the creeks which flow through the Management Area. South Boulder, Boulder, and Fourmile Canyon Creeks account for the top 10% of wetlands in the Management Area when ranked by sum of function/value ratings. While these riparian wetlands are valuable and among the most significant in the Management Area, aggregating function ratings can be misleading. Some functions are mutually exclusive and a wetland providing a single function to a high degree may be locally very important. Tables 8.7 and 8.8 provide greater detail on the distribution of wetland function in the Management Area.

Table 8.5: Colorado Natural Heritage Program Ranking of Rare and Imperiled Plants and Vertebrate Species (from Colorado Natural Heritage Program 1995)

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	STATE STATUS
	PLANTS				
Spiranthes diluvialis	Ute ladies'-tresses orchid	G2	S2	LT	
Rotala ramosior	Toothcup	G5	S1?		
Apios americana	American ground nut	G5	S2		
	ANIMALS				
Rana pipiens	Northern leopard frog	G5	S3,S4		SC
Falco peregrinus anatum	Am. peregrine falcon	G3	S2B,SZN	LE	T
Haliaeetus lucocephalus	Bald eagle	G4	S1B,S3N	LT	T
Pandion haliaetus	Osprey	G5	S1B,SZN		
Falco mexicanus	Prairie falcon	G5	S3S4 B,S4N		
Zapus hudsonius preblei	Preble's meadow jumping mouse	G5,T2	S2	P	SC

Table 8.6: Wetland Functions Provided in the South Boulder Creek Management Area

High (rating 3.5-5)	**Moderate** (rating 2.5-3.4)	**Low** (rating 1-2.4)
Wildlife habitat	Shoreline anchoring	Fish habitat
Within basin food chain support	Short-term nutrient storage	
Flood storage	Long-term nutrient storage	
Passive Recreation	Downstream foodchain support	
	Ground water recharge	
	Sediment trapping	

Table 8.7: Number and Percentage of Wetlands in the South Boulder Creek Management Area Performing Each Function to a High Degree

Function	Number	%
Wildlife habitat	26	74.3
Flood storage	21	60.0
Within basin food chain support	21	60.0
Short-term nutrient retention	17	48.6
Passive recreation	16	45.7
Shoreline anchoring	10	28.6
Long-term nutrient retention	10	28.6
Downstream food chain support	8	22.9
Ground water discharge	7	20.0
Fish habitat	7	20.0
Ground water recharge	6	17.1
Sediment trapping	5	14.3

Table 8.8: Wetlands of the South Boulder Creek Management Area Performing Functions to a High Degree

Function	Wetland Numbers
Wildlife habitat	4, 8, 25, 26, 50, 55, 56, 60, 70, 81, 138, 401, 402, 403, 404, 426, 427, 433, 435, 436, 496, 497, 506, 508, 512, 548
Flood storage	4, 26, 50, 53, 55, 60, 70, 81, 138, 402, 404, 423, 427, 433, 436, 496, 497, 506, 508, 512, 548
Within basin food chain support	4, 8, 26, 55, 56, 60, 70, 81, 94, 401, 402, 403, 404, 427, 433, 435, 496, 497, 506, 508, 548
Short-term nutrient retention	4, 26, 50, 55, 56, 60, 94, 401, 404, 405, 427, 433, 435, 497, 506, 508, 512
Passive recreation	8, 70, 81, 548
Shoreline anchoring	8, 50, 55, 70, 401, 402, 433, 435, 496, 548
Long-term nutrient retention	5, 50, 536 508, 548
Downstream food chain support	8, 50, 55, 70, 402, 433, 435, 548
Ground water discharge	26, 56, 70, 81, 403, 548
Fish habitat	8, 81, 402, 433, 435, 496, 548
Ground water recharge	55, 401, 402, 433, 435, 506, 50
Sediment trapping	4, 50, 436, 508, 548

8.2.6 Notes on Individual Wetlands

South Boulder Creek/Dry Creek Subarea

***South Boulder Creek (wetland numbers north to south*: 53, 496, 509, 524, 143, 108)**[10]

- Largest segment of unmined, relatively undeveloped floodplain in the Boulder Valley. The Creek banks are known to be habitat for the Preble's meadow jumping mouse and the Ute ladies'-tresses orchid.
- This wetland was noted by Cooper (1988) as a priority wetland. He stated "it is essential that this be a priority wetland" because it provides a number of wetland functions.
- Opportunities may exist to obtain conservation easements or fee purchase north of Baseline Road. Tributary Greenways Program master plan delineates this as a sensitive environmental area for which no trails are planned. However, proposals have been made by Tributary Greenways Program to obtain trail easements in this area.
- Backyards off of Gapter Road back to the Creek providing individual homeowner access through the riparian area. Property line location is not delineated.
- More information available on South Boulder Creek from Arapahoe Road south to South Boulder Road in the South Boulder Creek Inventory prepared by Open Space staff (City of Boulder 1994).
- Public Service Company maintains the headgate for the East Boulder Ditch. Historically, this maintenance has occurred at irregular intervals (about 3-5 years). Severe impacts to the riparian area have resulted from clearing and dredging impacts to the Creek.
- Modifications to flows in South Boulder Creek are anticipated from the re-licensing of Gross Reservoir by the Federal Energy Regulatory Commission.
- A study about the instream flow of South Boulder Creek was commissioned by the Open Space Program. A review draft was received July 22, 1994 from Hydrosphere Resource Consultants. It identifies the problems, including low winter flows, and includes recommendations on increasing those flows.
- An inventory of fish and aquatic macroinvertebrates in South Boulder Creek was conducted by Dr. Kevin Bestgen of the larval fish laboratory and Dr. Boris Kondratieff at Colorado State University. Dr. Bestgen also noted environmental impacts of low winter flows upon the fish population in South Boulder Creek. He also noted adverse impact associated with sedimentation from storm runoff from Greenbelt Meadows subdivision.
- Trout Unlimited, in cooperation with the Program, conducted a habitat enhancement project from South Boulder Road upstream to just south of the U.S. 36 overpass in 1992 and 1994. Following high water in 1995, these structures were maintained (and partially reconstructed) in 1996.
- The City constructed compensatory mitigation for wetland impacts to South Boulder Creek caused by the re-construction of the Schearer headgate. This project has not been

[10]See Figure 8.7* for location of individual wetlands.

consistently monitored. Monitoring reports as required by the wetlands ordinance need to be prepared or submitted.

- Don D'Amico (1996) has conducted two years of research on the riparian ecosystem of South Boulder Creek concentrating on the restoration opportunities suggested by existing patterns of hydrology and vegetation.
- The South Boulder Creek channel south of the end of the South Boulder Creek Trail is the only section of the creek on Open Space without an adjacent trail. However, a social trail has developed south towards the Fancher property. Riparian canopy and creek channel structure on the Fancher property are highly complex. This area is remote and little used by the public for recreation. The area's value for wildlife is supported by observation of beaver and mountain lions as well as high densities of wintering songbirds. Protection of this area from high levels of visitor use or grazing should be considered to preserve the natural values of this area.
- Grazing is restricted from the South Boulder Creek riparian area in the Management Area north of Baseline Road. However, south of South Boulder Road, grazing is unrestricted. Restricting cattle from the riparian area can improve fish and wildlife habitat, vegetation, and water quality and is a recommendation of the Hydrosphere instream flow draft study referenced above.

South Boulder Creek floodplain and terraces

- An underdrain installed beneath Country Meadows subdivision about 1990 resulted in the de-watering of a portion of the Burke II meadow (Hydrosphere 1992). A series of nine ground water monitoring wells was installed by the department. Because draining wetlands was not regulated at the time of the action, no permit was required and no mitigation was required of the developer. The drain does not appear to have significantly affected the agricultural uses of the property; however, the area affected by the drain dries more quickly between the traditional early summer irrigation and again after the post-harrow floating of the field.
- The "exclosure" area on the east side of the Burke II property is a wetland with a unique assemblage of garden flowers escaped from cultivation. This suggests that the area was part of a garden sometime in the past. These include the large headed yellow loosestrife (*Naumbergia=Lysimachia thrysiflora*), Queen of the meadow (*Filipendula ulmaria*), and tansy aster (*Tanacetum vulgare*). The persistence of these plants suggests that they may have the ability to spread farther in the floodplain.
- The hay-meadows throughout the floodplain have historically been used as nesting habitat for bobolinks and other ground-nesting songbirds. The areas with higher incidental use are typically closed each spring to protect the nesting birds. Nesting success has increased since the closures were started. The closures are voluntary (no summons are issued to people who use the property during the closure), but the pedestrian gates into the areas are locked. The meadow east of the South Boulder Creek Trail has traditionally remained unlocked.
- Extensive stands of an alien sedge *Scirpus linearis* (Weber and Wittmann 1996) can be found from the Burke II property south to U.S. 36. This plant is considered native in eastern grasslands of North America. If not considered native to Boulder County, it is very invasive

and may pose a threat to the biological diversity of the floodplain wet meadows, and some control of this plant may be desirable.

- Ditch clearing activities throughout the floodplain have significant negative visual impact on the wet meadows and may adversely affect plant and animal communities. Such activities may also be prohibited by the City's wetlands protection ordinance.
- The Viele Channel was constructed as a flood water conveyance facility. Since its construction, extensive wetlands have developed in its channel. These wetlands are documented as habitat for the Ute ladies'-tresses orchid and may also be habitat for the Preble's meadow jumping mouse. Recently, attention has been focused upon the flood hazard posed by South Boulder Creek. The absence of maintenance of the Viele Channel was identified by an engineer consulting with the City as a factor contributing to this hazard.

Dry Creek and its floodplain

- The origin of Dry Creek would be an interesting topic of study. At least two models are possible. It may have been an ancient channel of South Boulder Creek. Alternatively, it may have been a drainage which eroded headward to Boulder Creek. A gradient analysis and review of historical aerial photographs could offer a better understanding of the history of this feature. While Dry Creek, which is also known as the Dry Creek Carrier, is a naturally-occurring, intermittent stream channel, it was intentionally extended upstream to intersect South Boulder Creek at South Boulder Road to serve a number of ditches with South Boulder Creek water.
- Shrub wetlands on the Cohagen property are being destroyed by year-round livestock access. It may be appropriate to consider the grazing plan for this property to afford greater protection of these wetlands. Grazing impacts which are not typical of other Open Space lands are also evident on the wetlands of the Lewis and Methvin properties.
- Mitigation for impacts to Dry Creek were constructed on the Lewis property in the winter of 1996-97. The County Transportation Department has the responsibility to monitor these wetlands in accordance with the City wetlands permit.

Boulder Creek Subarea

South Boulder Creek

- Maintenance of the South Boulder Creek channel and reconstruction of the South Boulder Creek Greenways Trail north of the Burlington Northern railroad are scheduled for the fall of 1997. The project will result in the removal of most trees in a corridor in the channel bottom.
- The largest population of purple loosestrife (*Lythrum salicaria*) on Open Space land is located on the Flatiron Industrial Park property just upstream of KOA Lake. The population was identified in 1990-91. Annual control efforts since then have reduced but not eliminated this infestation. Curiously, the population has not spread downstream. KOA Lake may be an effective seed trap preventing downstream transport.
- Mitigation for impacts to South Boulder Creek was constructed adjacent to South Boulder

Creek just north of Valmont Road. The City's Greenways Program has the responsibility for monitoring these wetlands in accordance with the City wetlands permits.

Boulder Creek

- During high flows crack willows (*Salix fragilis S.* X *rubens*) and cottonwoods fall into Boulder Creek. The responsibility for maintenance of the channel and these trees has never been established. Currently the Public Works Department and Open Space Program work together *ad hoc*. A formal maintenance and planting program should be developed through the Tributary Greenways Program to establish a native tree replacement program and facilitate efficient removal of hazard trees from the channel.
- For many years the Open Space Program had an agreement with the University of Colorado to use the Cottonwood Grove, KOA Lake, and other portions of the Colorado Open Lands property as an outdoor laboratory for the study of riparian and creek ecology. That agreement lapsed in the early 1990s.
- While the Cottonwood Grove was a research area, several studies were conducted on the vegetation and vertebrates (small mammals and songbirds). More recently research has focused upon creek geomorphology (Scott et al. 1991) and transport of organic carbon (Barber, in prep).
- As part of the Pearl Parkway project, the County intends to construct a new crossing for Valmont Road at Boulder Creek. This project and later phases of the project will have impacts to wetlands on Open Space. Anticipated impacts from a prior alignment have gained the approval of the U.S. Army Corps of Engineers. Compensatory mitigation for these impacts has been constructed at the Cottonwood Pond and on the western Culver Open Space property. Staff should maintain involvement with this project.
- A restoration plan was prepared for the Tributary Greenways Program for that portion of Boulder Creek downstream of 55th Street (Aquatic Wetland Consultants 1991). The project could be used as the basis for a restoration project but could be improved with greater attention to vegetation, wetlands, and terrestrial vertebrates.
- The wetlands at Short and Milne (427) are documented as habitat for the Ute ladies'-tresses orchid and may be habitat for the Preble's meadow jumping mouse. This is a remote area of high biological diversity. Although once mined for sand and gravel, this area supports a variety of wetland types, each rich in plant species. The understory of the young cottonwood forest is infested with smooth brome (*Bromopsis inermis*) and reed canary grass (*Phalaroides =Phalaris arundinacea*), probably used in post-mining reclamation seed mixes. One of the alternative routes for the Pearl Parkway extension would traverse this property. Open Space staff should work with the County and other agencies to avoid impacts to the remarkable wetlands and riparian areas on this property.
- Wetlands on the southern portion of the Andrus property (423) have historically been drained. The Open Space Program installed a drain sometime in the early 1980s. The drain has been plugged by sediment and the roots of willows. In addition, the wetland, once dominated by cattails (*Typha* sp.), has become infested with teasel (*Dipsacus sylvestris*). Draining often creates conditions right for teasel growth. The failure of the drain may lead to

improved wetland conditions.

- Sombrero Marsh is a significant natural feature and the only remaining naturally-occurring body of Open Water in the Boulder Valley. More information about Sombrero Marsh can be found in a staff (Gershman 1997) research report.

Fourmile Canyon Creek Subarea

- Relatively extensive alkali wetlands on the Gallagher property are of great significance. These areas are not common, have been routinely destroyed, and may be globally imperiled. Historic agricultural practices have changed the hydrology (using the seepage and springs as irrigation water) and vegetation (selective grazing by domestic livestock). However, the result on this property has been a relatively weed free complex of several alkali plant communities. Large stands of alkali bulrush (*Bolboscheonus maritimus*) and bulrush (*Schoenoplectus lacustris*) are unique in the Boulder Valley.
- Similar to the adjacent Gallagher property, the Lousberg property has extensive spring-fed alkali wetlands. These are remarkable not because of their extent but because of the presence of a floating mat of wetland vegetation. This unique wetland feature is probably supported by artesian ground water discharge.
- Previous landowners excavated a small pond on the Lousberg property. This spring-fed pond is unique among all ponds on Open Space because it is crystal clear. It is a spring-fed, cold-water pond which reportedly had been stocked with and can support trout. The floating aquatic vegetation of this pond should be further investigated.
- The irrigated meadows on the Lousberg property support populations of bobolinks. These hayfields may be appropriate habitat for the Ute ladies'-tresses orchid. Preble's meadow jumping mouse could also be found on this property.
- Widening of Jay Road by Boulder County and changes to irrigation structures have re-directed the tail water which supported wetlands (405) on the Belgrove property at the southwest corner of Jay Road and the Boulder-Longmont Diagonal. Management is recommended for this area. The drying wetland should either be reclaimed with native alkali grasses or the water supply returned to restore this area. The project was permitted through the City's wetlands regulatory program, and no adverse impacts were expected for these wetlands.
- The Fourmile Canyon Creek Greenways is scheduled for extension under the Boulder-Longmont Diagonal where it will connect with the Cottonwood Trail on the McKenzie property. There may be impacts to wetlands on Open Space resulting from this trail extension.

8.3 ISSUES

- Coordination of grazing and the conservation of wetland extent, function, and value.
- When are wetland functions most sensitive to grazing impacts?
- When are wetlands of greatest benefit as livestock pasture and forage?

- Coordination with lessees to ensure that pesticide and fertilizer applications are planned and implemented so as to minimize adverse impacts of fertilizer and pesticide use.

- Coordination of Integrated Pest Management techniques (fire, pesticides, mechanical, and grazing) and timing, mostly for Canada thistle control, with the conservation of wetland function and value.

- Coordination of trail and road construction and maintenance with the conservation of wetland function and value (protecting existing hydrology, avoiding fragmentation of habitat blocks, ensuring pre-existing connections are maintained, examining opportunities for increased connectivity of habitat blocks where important).

- Prioritizing environmental education and outreach to increase public awareness of wetland function and value.

- Establishing protocols for long-term monitoring or periodic re-evaluation of wetland function, value, threats, vegetative cover, overall condition, etc.

- Periodic monitoring of wetlands known to support breeding amphibian populations.

- Coordination of irrigation (rates, timing, changes to infrastructure) with the conservation of wetland function and value.

8.4 DATA GAPS

Data Needs Relevant to the Communities, Plants, and Animals of the North Boulder Valley Management Area Wetlands

- The wetlands inventory was not designed to collect information about animal use in wetlands. Instead, incidental sightings of animals were recorded.

- Complete wetland fieldwork and data entry as detailed in Table 8.9.

Table 8.9: Data gaps--Fieldwork and Data Entry for Wetlands Inventory in the South Boulder Creek Management Area

Wetland Number or Property	Mapping	Digitizing	Vegetation Data	Function Summary	Data Entry	Note
70	Yes	Yes	No	Yes	Yes	
81	Yes	Yes	No	Yes	Yes	
93	Yes	Yes	No	Yes	Yes	
94	Yes	Yes	No	Yes	Yes	
102	Yes	Yes	No	Yes	Yes	

Table 8.9: Data gaps--Fieldwork and Data Entry for Wetlands Inventory in the South Boulder Creek Management Area

Wetland Number or Property	Mapping	Digitizing	Vegetation Data	Function Summary	Data Entry	Note
104	Yes	Yes	No	Yes	Yes	
138	Yes	Yes	No	Yes	Yes	
476	Yes	Yes	Yes	No	Yes	Not a wetland, should be deleted from database
498	Yes	Yes	Yes	No	Yes	
499	Yes	Yes	Yes	No	Yes	
500	Yes	Yes	Yes	No	Yes	
501	Yes	Yes	Yes	No	Yes	
502	Yes	Yes	Yes	No	Yes	
506	Yes	Yes	Yes	Yes	Yes	
509	Yes	Yes	Yes	No	Yes	
510	Yes	Yes	Yes	No	Yes	
511	Yes	Yes	Yes	No	Yes	
520	Yes	Yes	Yes	No	Yes	
522	Yes	Yes	Yes	No	Yes	
523	Yes	Yes	Yes	No	Yes	
524	Yes	Yes	Yes	No	Yes	
525	Yes	Yes	Yes	No	Yes	
526	Yes	Yes	Yes	No	Yes	
527	Yes	Yes	Yes	No	Yes	
528	Yes	Yes	Yes	No	Yes	
529	Yes	Yes	Yes	No	Yes	
530	Yes	Yes	Yes	No	Yes	
531	Yes	Yes	Yes	No	Yes	
538	Yes	Yes	Yes	No	Yes	
539	Yes	Yes	Yes	No	Yes	
540	Yes	Yes	Yes	No	Yes	
548	Yes	Yes	Yes	Yes	Yes	
553	Yes	Yes	Yes	Yes	Yes	
559	Yes	Yes	No	Yes	Yes	
593	Yes	Yes	Yes	No	Yes	
Damyanovich	No	No	No	No	No	Not visited
Clough	No	No	No	No	No	
Nu-West	Yes (old aerials)	No	No	No	No	

Table 8.9: Data gaps--Fieldwork and Data Entry for Wetlands Inventory in the South Boulder Creek Management Area						
Wetland Number or Property	**Mapping**	**Digitizing**	**Vegetation Data**	**Function Summary**	**Data Entry**	**Note**
Klein	Yes	No	Yes	Yes	No	
Cohagen					No	
Gallagher	Yes	No	Yes	Yes	No	
Colorado Open Lands	Yes	Yes	No	No	Yes	Needs re-mapping and reevaluation, not complete
Eccher	Yes (old aerials)	No	No	No	No	
Ute Industrial Park	No	No	No	No	No	Small wetland in northeastern portion of property should be mapped
Van Vleet	**see note**					Several new areas were mapped in 1997. Considerable work remains
Church	**see note**					Considerable work remains
Yunker	**see note**					Considerable work remains
Rolling Rock Ranch	**see note**					Room for considerable improvement

- Shallow areas of the ponds should be re-evaluated: few records exist of floating or rooted emergent aquatic communities within the Management Area (more examples of these aquatic communities do exist in the Management Area).

- The flora of the alkali wetlands on the Gallagher and Lousberg properties should be examined several times during the growing season. Many of the wetland plants found in these areas are able to complete their life cycles during the brief periods of inundation. The species list could be significantly lengthened by visiting these areas at intervals through the spring and summer. Much of the inventory work could be completed by volunteers, such as members of the Boulder chapter of the Colorado Native Plant Society or by the herbarium volunteers as part of their summer work program.

Data Needs Relevant to Ownership and Property Information

- Geographic Information System analysis of ponds on Open Space revealed several ponds on what appears to be private property that jut into Open Space land. Are portions of these ponds actually located on Open Space? Are these mapping errors?
- The location of the eastern property boundary of Burke II relative to South Boulder Creek has always been unclear.
- Ownership and management responsibility of the Viele Channel are unclear.
- Are there deed restrictions on the Short and Milne property which would restrict the placement of a roadway through this property?

Data Needs Relevant to Maintaining and Improving Wetland Function and Value

Ground Water Discharge

- The Program should improve its understanding of the ownership of springs, seeps, and ponds supported by ground water discharge within the Management Area..

Natural communities, plant, and wildlife habitat

- Conduct a more thorough investigation of animal use of wetlands in order to improve the Program's understanding of the species of concern and the value of wetlands as wildlife habitat.
- City staff should invite representatives from the Colorado Natural Heritage Program to evaluate the various natural communities of concern found in the Management Area to determine if any of these constitute "occurrences" for the purpose of their conservation database.

Shoreline anchoring

- Wetlands performing this function are widespread in the Management Area. Livestock activity probably represents the most serious threat to the integrity of this function. Livestock access to creeks and ponds should be evaluated to assess impacts to shorelines. Opportunities may exist to improve this wetland function through the management of livestock.
- Review wetland functions and threats to shoreline anchoring by livestock and recommend modifications in agricultural land use practices where appropriate. See especially:
  - Klein
  - Lewis
  - Van Vleet

Food chain support

- Further research should be encouraged to help staff gain a better understanding of the relationship of this ecological function to wildlife habitat value. Such information might suggest alternative management strategies.

Nutrient storage (retention and removal)

- Further research should be encouraged to help staff gain a better understanding of the relationship of this ecological function to wildlife habitat value. Such information might suggest alternative management strategies.
- Cooperate with the Water Quality and Environmental Services staff of the Utilities Division in the Public Works Department on water quality impacts in the Management Area and the role wetlands may play in mitigating the impact of Open Space agricultural practices on water quality in Boulder Reservoir.
- Review collection of literature regarding nutrient retention and storage as well as pertinent management recommendations (good semester-long intern project).

Ground water recharge

Little is known about the movement of surface water back into the ground in the Management Area. The relationship of irrigation tail water to ground water recharge is discussed above. A better understanding of the link between irrigation return flows and wetlands will be important as the Program considers changing irrigation practices. No specific work item has been identified for this wetland function.

Flood storage

The above-average precipitation in 1995 and 1997 provided the Program with an indication of the potential impacts of flooding on the natural systems and infrastructure of the Open Space system. Constructed wetlands may be useful in certain areas to minimize the impacts of flood flows.

- Analyze the locations of flood impacts and potential wetland creation sites to assess the practicality of using wetlands to mitigate soil erosion and flood damage.

Sediment trapping

- Encourage further research to help the Open Space Program gain a better understanding of the relationship of this ecological function to water quality and wildlife habitat value (such as the need of clear water for hunting by herons and other visual predators). Such information will help guide wetlands management.
- Determine the source and outfall locations of sediment into South Boulder Creek. Evaluate the possibility of constructing one or more sedimentation ponds to reduce sediment loading of the Creek.

Fish habitat

- Determine the source and outfall locations of sediment into South Boulder Creek. Evaluate the possibility of constructing one or more sedimentation ponds to reduce sediment loading of the Creek.

9. WILDLIFE

9.1 INTRODUCTION

The principal focus of research for the Wildlife Management Program has been to collect baseline wildlife inventory information. This report presents data from observations, research, and inventory reports for the South Boulder Creek Management Area. A list of research reports containing information about wildlife in the Management Area is compiled in Appendix 9.1. Information is provided on what species are expected in the area, what species are documented in the area, and what historical records of vertebrate species exist. Information on habitat types, surrounding land use, and special wildlife values is noted, along with a discussion of habitat affinities for selected wildlife species. Information gaps and information requirements for management and inventories are presented.

The City of Boulder Open Space Program uses an ecosystem approach to land management. It must be recognized that although the Program attempts to manage on an ecosystem or landscape scale, there are several key species that are particularly sensitive and are known to have specific habitat requirements and needs.

9.1.1 Background

The Management Area is uniquely diverse in comparison to the other six City of Boulder Open Space management areas. This uniqueness is due to the extensive amount of available water. Creeks, reservoirs, lakes, small ponds, and extensive irrigation ditches provide wildlife breeding and foraging habitats. Moving and open water habitats attributed to these water bodies contribute to the diverse wildlife assemblages found in this area.

In addition to providing excellent habitat for wildlife, the Management Area offers the public a variety of recreational activities. These include hiking, biking, fishing, horseback riding, and dog-off-leash activities. These activities may have impacts to the landscape and wildlife habitats. The level of impact to an area varies proportionally with the amount of use an area receives.

Open Space properties in the Management Area are heavily fragmented by urban sprawl and human encroachment associated with the development of the City of Boulder. Trails can increase the impacts from habitat fragmentation. Fragmentation degrades the quality of wildlife habitat. Efforts should be taken to prevent further fragmentation.

Agriculture has been the dominant land use in the Management Area for more than 100 years. This includes primarily irrigated hay fields and late fall and early spring grazing. In addition to recreational impacts and human encroachment, agricultural land uses have contributed significantly to the development of the Management Area's different habitats. The dominant habitat types are grasslands and riparian areas.

Grassland habitats and riparian areas provide critical habitat for sensitive species. Ground-nesting birds rely on the grasslands of the Management Area for breeding areas for their young. Generations will return to the same areas year after year to reproduce. The subtle nuances which make certain fields preferable to others are not fully understood. Mismanagement of these fields could cause long-term damage to local populations. For example, bobolinks (*Dolichonyx oryzivorus*) are at the southwestern extent of their range with isolated and restricted populations in Colorado. Irrigated hay fields in the Management Area are critical for the bobolink population in Boulder County. Bobolink reproductive success, like many ground-nesting birds, requires that fields that serve as breeding grounds not be hayed until the young have completely fledged or are no longer dependent on their parents and are able to fly.

Riparian areas are literally an oases for wildlife. The Management Area has the most concentrated population of Preble's meadow jumping mice (*Zapus hudsonius preblei*) in Boulder County. This mouse was recently proposed for listing under the Endangered Species Act. Its habitat requirements and behavior are not fully understood, but it is thought to be dependent on flowing water between May and November and also to be sensitive to human-associated disturbances. South Boulder Creek is home to two fish species of special concern: the orange-spotted sunfish and the plains topminnow.

In addition to these particularly sensitive species, nearly 240 vertebrate species have been documented in the Management Area, of the 383 that are expected to occur. The list of expected species is based on known habitat affinities and known habitat types in the Management Area and is displayed in Appendix 9.2. Records for this Management Area reveal the presence of sixty-two species of state or federal concern: two fish species, fifty-four bird species, and six mammal species.

The variety of sensitive fauna and flora found in this area makes it challenging to coordinate management activities to benefit all species. It is particularly important to coordinate land management activities in this area between Open Space staff and lessees so that research projects and land management practices do not conflict.

9.1.2 Direction for Wildlife Management in Long Range Management Policies

The *Long Range Management Policies* provide general guidance for wildlife management on Open Space lands. An ecosystem approach to maintaining natural processes and functions to the extent possible will serve as the basis for land management decisions for Open Space. Ensuring that native plants and animals (mammals, birds, reptiles, amphibians, fish, insects, arachnids, molluscs, and crustaceans) have places to live (habitat) is a priority goal of the Open Space Program. Restoration of extirpated species and conservation of threatened or endangered species are management goals in the context of preserving and restoring functional native ecosystems.

9.2 RESOURCE INFORMATION

Wildlife information comes from a variety of sources. These sources include projects conducted as a part of the wildlife program, staff and volunteer sightings, volunteer field projects, research

that is conducted on Open Space, and data shared from other government, private, and non-profit organizations. The majority of these data is best used to get a general idea of wildlife species expected and known to occur in the Management Area.

9.2.1 Wildlife Sightings Database

The Open Space wildlife sightings database was designed to compile this information so that it may be referenced easily. By querying this database, one can get an idea of what species are found on which properties and in what habitat type. These lists can also be compared with the list of species that are expected to occur or have historically occurred in an area (Appendix 9.2). Due to the variable quality of observer accuracy and the loosely structured design of the database, this information is best used to get a general description of an area[11].

Two inventory reports have been completed in the last five years that include areas in the Management Area: "*Long Term Monitoring of Fish Populations and Habitat of South Boulder Creek, Colorado, Within the City of Boulder Open Space Property*" (Bestgen 1996) and the "*City of Boulder 1996 Amphibian and Reptile Survey*" (Livo 1996). A more complete list of reports that include information on the Management Area is presented in Appendix 9.1.

Wildlife program projects include the implementation of the "Black-tailed Prairie Dog Habitat Conservation Plan" (City of Boulder 1996b) (prairie dog town mapping and relocation), grassland bird surveys, small mammal inventories with emphasis on Preble's meadow jumping mouse presence or absence, bat surveys, and winter raptor monitoring at prairie dog towns.

9.2.2 Context of Wildlife Management Program

Land Use Related to Species Composition and Distribution
Vertebrate species found in the Management Area are influenced by the types of land use within and around the Management Area. Livestock grazing, farming, recreation, urban and suburban development, roads, and water management have significant influences on the animals found in the Management Area. Livestock grazing affects the structure and quality of habitat for breeding and foraging animals. Row crop agriculture and water management (irrigation) can benefit or diminish the types of species found in the Management Area. Chemical pesticide use from agricultural operations and surrounding development affects invertebrate populations. Invertebrates provide a key food resource for vertebrates during their breeding seasons. Recreational activities (hiking, biking, dog exercise, horseback riding) can impede the reproductive success and survival of animals in areas of high recreational use (Knight and Miller 1995).

Human Associated Impacts and Disturbance
Constant or repeated disturbance (such as that associated with recreational activities or urban expansion) during critical periods in an animal's life stage (breeding season, high stress periods), can limit breeding potential and cause disturbance-intolerant species to abandon the breeding or

[11] Wildlife research methods are presented in Appendix 3.1.4

foraging area. Disturbance can simply affect an individual or it can affect an entire population or community.

Problem Wildlife Species

Wildlife species whose life history characteristics and actions are inconsistent with wildlife management objectives for native or desirable wildlife are considered problem wildlife species. Urban and suburban developments and trails form edges which provide opportunities for non-native generalist species to negatively impact the reproductive success of native species. Obligate brood parasites, such as brown-headed cowbirds, take advantage of these edges by using them to locate songbird nests which would otherwise be inaccessible to them. The cowbirds use these songbirds as hosts by laying their eggs in these nests and leaving them to be cared for by the much smaller host species. The cowbird young out compete the host species young and directly lower the reproductive success of the host species.

Human-associated predatory species, such as black-billed magpies, great horned owls, skunks, raccoons, and domestic house cats, can limit the reproductive success of birds and mammals. These commensal species benefit from human disturbance and leave humans essentially unaffected. Abundant concentrations of adaptive waterfowl, such as Canada geese, can transmit disease to other water fowl and can also cause significant crop loss. European starlings directly compete for nest locations with native cavity-nesting birds, including northern flickers, Lewis' woodpeckers, American kestrels, and downy and hairy woodpeckers. Starlings concentrate around urban and suburban areas and farm or ranch buildings.

Management strategies that have been employed thus far include the following: (1) removal of non-native trees, such as Russian olives, from grasslands to reduce potential perch sites for brown-headed cowbirds and (2) goose abatement strategies, such as the placement of reflective Mylar or "scary eye balloons" (such as those used in gardens to frighten away hungry wildlife), to prevent geese from concentrating at reclamation sites.

Agriculture

In recent years agricultural management practices on Open Space have incorporated mowing regimes that consider the reproductive cycles of ground-nesting birds. These practices need to continue, and more time needs to be invested each year into determining which fields have the highest concentrations of bird activity. It has been recommended by Thompson and Strach (1987) that hay fields in Boulder County not be mowed until after July 20th to allow young birds to fledge. Mowing dates should be pushed back as late as possible without compromising crop success but must also take into account noxious weed control and rare plant management. Efforts should be taken to ensure that at least the fields with the highest concentration of bird activity are mowed as late as possible. Coordination between Open Space staff and lessees needs to occur annually so that mowing is done responsibly on all Open Space properties. Future research on the effects of grazing, mowing, and irrigation on ground-nesting bird, small mammal, and herpetofauna populations would prove valuable for wildlife management in agricultural areas.

Fire
Prescribed fire can be an important tool for the management of wildlife habitats. The potential to use fire as a management tool in the Open Space system is not completely understood at this time, and further investigation and experimentation are necessary. Catastrophic wildfires that impact the entire landscape can result in some habitats becoming unsuitable for certain species; however, managed prescribed burns and prescribed natural fires are important for maintaining habitat quality for some species. Future research projects which would assist in wildlife management include the effects of fire on ground-nesting bird, small mammal, and herpetile populations. Pre-burn and post-burn surveys need to be conducted, in conjunction with subsequent annual surveys.

9.2.3 Highlights from Existing Information

The majority of the following information was derived from research projects funded by the Open Space Program. This information is highlighted due to its high level of reliability and the guarantee of quality due to Program sponsorship. Criteria for federal, state, and local species of concern are found in Appendix 7.1

Birds
There are 238 avian species expected to occur in the Management Area. Out of these, 80% (191) have been documented in the Management Area. More than 80% of avifauna in the western United States rely on riparian areas for food, shelter, or breeding habitat during some point of their lives (Knopf 1985). Lowland plains riparian forests that are unimpacted by trails or other human development are critical nesting and foraging areas for many neotropical migratory birds. Many of these neotropical migrants are experiencing dramatic population declines similar to grassland nesting birds (Martin and Finch 1995). Preservation of undisturbed and structurally diverse riparian vegetation is critical.

The grassland and riparian areas of the Management Area contain unique and diverse assemblages of birds. Bobolinks and savannah and grasshopper sparrows nest within the floodplain grasslands, tallgrass, and irrigated wet meadows of the Management Area. These populations represent the western extent of the range of these species. Grassland avifauna has declined more rapidly than any other group of birds in the past thirty years (Knopf 1996). Preservation of grasslands that are protected from human disturbance, human commensal predators, and destructive agricultural practices is vital for the survival of these species.

Bobolink habitat and diet requirements are similar to those of grasshopper and savannah sparrows. By protecting known bobolink habitat, it is hoped that potential habitat for other ground-nesting birds will be provided.

***Bobolinks*:** Bobolinks rely on tallgrass, flooded meadows, prairies, and dense grain fields for nesting and foraging habitats. Their diet consists mainly of grass and forb seeds and some spiders. Bobolinks have disappeared from their breeding range in the north and southeast United States probably due to the early cutting of hay fields (Ehrlich et al. 1988).

The floodplain grasslands of South Boulder Creek, particularly in the Burke II, Burke I, and Gebhard properties, contain a unique population of ground-nesting bobolinks (*Dolichonyx oryzivorus*). Known bobolink habitat is displayed in Figure 9.1*. This population of bobolinks is disjunct from the main population which lies in the tallgrass prairie of the eastern and midwestern United States. The Open Space Program has been monitoring population levels of bobolinks in the Boulder area periodically for the past eleven years. Numbers of bobolinks have been stable or steadily increasing in the critical habitat adjacent to the South Boulder Creek Trail. A voluntary seasonal closure (May 15-July 15) was established in 1993 for the Burke I and Burke II properties to reduce impacts from human disturbance, dogs, and horses. Numbers of bobolinks have increased in those areas over the past few years. This could be the result of the closure or it could be a natural trend. The birds appear to do best with irrigation occurring in early May and haying after July 20th (Thompson and Strauch 1987). Haying schedules are pushed back as close to the 20th as is possible without compromising the crop. It is important, however, that this population be maintained over time because of its unique spatial status in proximity to the main population to the north. Peripheral populations are critical to maintaining genetic diversity in the population as a whole (Lesica and Allendorf 1995).

To effectively manage grassland bird populations, surveys should include more properties and information about fledging behavior. This should give staff an idea of the status of local populations of various species and if current management practices are effective to protect ground-nesting birds. Coordination between Open Space staff and lessees needs to occur annually so that mowing is done responsibly on all Open Space properties.

Owls: Lowland riparian forest along the four creeks in the Management Area provides potential nest sites for small owls, such as eastern and western screech owls. Historic barns and silos that are no longer used, such as those on the Suitts property, can provide nesting habitat for barn owls. Artificial nest platforms can be placed to encourage barn owl use. An inventory of owls in the riparian areas of the Management Area would prove valuable for future owl management.

Species of concern: The bald eagle is listed as threatened by the U.S. Fish & Wildlife Service. It has been observed in seven out of twelve habitat types in the South Boulder Creek Management Area. Historic winter habitat, including perch sites, exist around Baseline Reservoir. Presence and use of the area is well documented in Audubon Christmas bird counts. Christmas bird count data indicate generally a stable population of raptors in the area around Baseline Reservoir. Besides bald eagles, golden eagles, ferruginous hawks, red-tailed, and rough-legged hawks are common in the winter months. The area is used by osprey and Swainson's hawks in the spring, summer, and early fall.

Management issues and concerns: The area around Baseline Reservoir and South Boulder Creek is an important winter habitat for bald eagles and summer habitat for osprey and Swainson's hawks. Prairie dog colonies exist on Suits, Klein, and Rolling Rock properties and are important winter food sources for the bald eagles. Maintaining viable prairie dog populations and grassland habitats for other small mammals and avoiding disturbance of hunting raptors by humans will be important to protect this area.

Fish

There are fifty fish species known to occur in the Management Area. Out of these, only 32% (sixteen) have been documented. South Boulder Creek was sampled during 1994-1996 (Bestgen 1996). Nine native species and seven non-native species were sampled. The native species consisting of mostly minnows and suckers were more widespread and numerically dominant over the non-natives. The non-native species were trout and sunfishes. The non-natives occurred sporadically and were overall relatively uncommon.

***Species of concern*:** The orange-spotted sunfish is considered a rare fish in Boulder County. A single specimen was captured during Bestgen's three-year study. The plains topminnow is an uncommon fish in Boulder County and is considered imperiled in the state. In South Boulder Creek, Bestgen describes its presence as abundant but restricted in distribution. This fish is often used for mosquito control. Establishing a source population in coordination with the Colorado Division of Wildlife that could be used to reintroduce this fish to different areas may benefit mosquito control efforts in the future.

***Management issues and concerns*:** Non-native fish species continue to be introduced or dispersed from reservoirs into South Boulder Creek. At least three, and perhaps up to nine, native fishes have been extirpated from South Boulder Creek. The extirpated species were habitat specialists while the others were generalists that can tolerate degradation. Siltation, low flows (especially during winter), channelization, and diversion dams at South Boulder Road may be blocking dispersal because species richness drops dramatically upstream of South Boulder Road.

Macro Invertebrates

Ninety-six macro invertebrate taxa were identified within three orders: *Ephemeroptera, Plecoptera, Trichoptera. Ephemeroptera* and *Trichoptera* were the most abundant groups. Diversity in macro invertebrate communities was greater upstream of South Boulder Road.

***Management issues and concerns*:** Siltation, low flows, and high water temperatures may limit species richness. Allowing higher flows may improve species richness. Species richness is lower downstream of South Boulder Road, probably due to siltation.

Amphibians

There are seven amphibian species known to occur in the Management Area. Out of these, five (71%) have been documented. Lauren Livo from the University of Colorado at Boulder conducted the most recent extensive herpetological inventory of Boulder County in 1997 (Livo 1997). Five native species and one introduced species were captured. The introduced bullfrog made up 84% of captures with the western chorus frog a distant second with only 6.3% of captures. The following information was taken from their final report.

***Tiger salamander*:** Expected to occur on most or all of Open Space lands. In the South Boulder Creek area, these salamanders have been documented on the Short and Milne property. No breeding sites in the Management Area have been documented.

***Woodhouse's toad*:** Records show this toad has been found on the following properties: Gebhard, Burke I, Richardson (widespread and common on this property).

***Western chorus frog*:** Breeding sites include Van Vleet and Church. Current records show its presence on Richardson, Hogan Brothers, Church, Van Vleet, Suitts, Burke I, Colorado Open Lands. It is considered widely distributed in the Boulder area.

***Bullfrog*:** An introduced species. No records from the Management Area.

***Northern leopard frog*:** Populations are showing declines due primarily to competition from bullfrogs. Recent captures show this frog on the Richardson and McKenzie properties. Historically, it was also found on Gallucci and Klein.

***Plains spadefoot*:** This species has a limited distribution along the eastern margins of Boulder County. No individuals were captured in the Management Area.

Amphibian populations are declining on the six continents on which they occur (Vial and Saylor 1993). Boulder County herpetofauna is relatively well known compared with the rest of Colorado (Livo 1997). Despite the availability of information, detailed knowledge of distribution and abundance of amphibians and reptiles in Boulder County is crude. Long-term surveys should be conducted to get an understanding of population trends and distribution of amphibians and reptiles.

Reptiles

There are twenty-one reptile species known to occur in the Management Area. Out of these, seven (41%) have been documented. Two native turtle species, the painted turtle and the snapping turtle, were found in Livo's 1997 study. The painted turtle represented 98% of all turtle captures. Three native species of lizards and skinks were captured. The six-lined race runner was the most common. Nine native snakes were captured, with the plains garter snake being the most common.

***Snapping turtle*:** Only current record from Colorado Open Lands.

***Painted turtle*:** Current records include Van Vleet and Colorado Open Lands. Historically, an individual was captured on the Reynolds property.

***Racer*:** The McKenzie property is a known breeding site. There are current and historic captures documented on this property.

***Northern water snake*:** Historic captures occurred on Burke I and Colorado Open Lands properties. It is considered common along Boulder Creek.

***Bull snake*:** Recent captures include the McKenzie property. Historically, they have been captured on the Reynolds property.

***Western terrestrial garter snake*:** The McKenzie property is a breeding site and an area of recent capture. Historically, this species was known to occur in the Cottonwood Grove.

***Plains garter snake*:** This species is the most commonly occurring reptile in Boulder County. Historically, it has been captured on the Burke I, Klein, and Short and Milne properties.

***Common garter snake*:** Historically captured on the McKenzie property.

Mammals

Sixty-seven mammal species are expected in the Management Area with only 30% (twenty) of them documented. The Management Area is not an area of concentrated mountain lion or black bear activity. Between 1987 and 1996, there have been three lion sightings in the area and no bear sightings. The lions were most likely using the creeks as travel routes.

***Preble's meadow jumping mouse (Zapus hudsonius preblei)*:** The Preble's meadow jumping mouse is a subspecies of the meadow jumping mouse whose known range extends only from southeastern Wyoming through eastern Colorado. The U.S. Fish and Wildlife Service has recently proposed, under the Endangered Species Act, to add the Preble's meadow jumping mouse to the list of Federal endangered species. Preble's are nocturnal and feed primarily on seeds and insects. These mice are true hibernators that sleep underground in a burrow from September through May. The Management Area is known to support the largest population of Preble's meadow jumping mice in Boulder County.

Presence/absence surveys have been most extensive in this Management Area. The mouse has been found on Gebhard, Suitts, Fancher, and Van Vleet properties. Figure 9.1* displays known Preble's habitat. Several remaining areas in the Management Area appear to have suitable habitat and warrant surveys. The Short and Milne property appears to have excellent habitat and is adjacent to historical capture sites. These sites have since been mined for gravel and leave Short and Milne as an island of undisturbed habitat. Small mammal inventories should not only look for presence or absence of Preble's meadow jumping mice, but also how the mice are affected by management strategies such as grazing, fire, haying, and irrigation. Until the implications of these management practices are understood, it will not be possible to manage this species appropriately. Management implications for land use and recreation will not be determined until the U.S. Fish and Wildlife Service has decided whether to list the mouse as an endangered or threatened species.

***Black-tailed prairie dog (Cynomys ludovicianus)*:** There are 88.29 acres of active prairie dogs in the Management Area. The Open Space Program drafted a management plan for short-and mixed grass prairies that is intended to conserve populations of black-tailed prairie dogs. This plan was approved by the Open Space Board of Trustees in 1996. In the Management Area, 189.36 acres have been designated as Habitat Conservation Areas for black-tailed prairie dogs, approximately 33 acres are transition areas awaiting designation, and only 6.12 acres have been declared unsuitable habitat and are removal areas.

The Klein property is a Habitat Conservation Area in the Management Area that is bisected by the Dry Creek Trail where dogs are allowed off leash. This is a potential public health risk as prairie dogs can harbor fleas that carry the Sylvatic plague and can transfer this to dogs and, in turn, to humans. Redesignation of leash laws on this property should be considered to only allow dogs on leash.

Burrowing owls are dependent on prairie dog towns for nesting habitat. They have not been documented nesting in Boulder County since 1993. Several have been seen migrating through. Many other species are dependent on prairie dogs for either food or nesting habitat. A study of small mammal use of prairie dog towns in the future would prove valuable in fully understanding the effects of prairie dog extermination and prairie dog relocation.

***Bats*:** Bats are a vital component to any ecosystem. They are highly beneficial to humans for several reasons. Bats are insectivorous and consume large numbers of insects that are commonly considered pests. They also play a key role in seed dispersal. The most common bats in Boulder County are the little brown myotis and the big brown bat. A single little brown myotis can capture and eat 600 mosquitoes in just one hour. A colony of 150 big brown bats can protect farmers from up to 18 million or more rootworms each summer (Bat Conservation International 1993).

Bats are exceptionally vulnerable to extinction because they are the world's slowest reproducing mammal. Most bat species produce only one pup per year (Bat Conservation International 1993). The majority of Colorado bats are colonial and therefore hundreds can be killed by the destruction or disturbance of only one roost site. Nearly 40% of American bats are in severe decline or are already listed as endangered species. Worldwide losses are occurring at alarming rates. The loss of bats increases the demand for chemical pesticides, can jeopardize entire ecosystems of other animals and plants, and can also harm human economies (Bat Conservation International 1993).

Research of bat populations in the Management Area is still in the rudimentary stages. Eighteen bat boxes were placed in cottonwoods along South Boulder Creek (between South Boulder Road and the golf course) during the fall of 1994 and the spring of 1995. These boxes were checked in the summer of 1996 and 1997 for activity. No activity was recorded. Improved placement or design of these boxes should be considered. Understanding the status of bat populations and the location of roost sites in the Management Area is vital to bat conservation.

Wildlife and Ranger Services

Open Space Rangers are responsible for patrolling City Open Space properties, and their presence on the land provides an important contribution to resource protection. In addition to law enforcement and emergency response, Open Space Rangers routinely patrol the 3,500 acres of the South Boulder Creek Management Area to monitor resource impacts, inspect wildlife habitats (riparian areas and trails, agricultural fields, endangered species perch sites, and others), monitor wildlife populations, enforce state hunting and fishing regulations, provide information to the public, and monitor stream, lake and ditch levels. While the Open Space Department

contains an Education and Outreach Division, rangers are an integral part of educating Open Space visitors on a daily basis. Rangers are in the field 362 days a year educating visitors about every aspect of Open Space, informing them of upcoming events, leading Nature Trail Programs, and assisting visitors in many other areas. While assisting the Education and Outreach Division, rangers also use education to protect natural resources and proactively decrease the need for future enforcement of regulations.

9.3 ISSUES

Managing wildlife populations

- Maintain animal diversity and critical habitats by balancing potentially conflicting management objectives.

Maintaining, restoring, and protecting wildlife habitats and habitat quality

- Restore or protect natural ecosystem functions and habitat quality.
- Improve data collection techniques to be simple, sound, and efficient so that data can be consistent and long-term trends can be understood.
- Determine role of natural ecosystems in the South Boulder Creek Management Area for maintaining species diversity and natural functions in the Boulder Valley.
- Determine impact of non-native plant and animal species on native species diversity and habitat function.
- Determine impacts of recreational uses and levels of use on native species diversity and habitat quality.
- Define Open Space priorities for fish and water management.
- Protect riparian areas that are valuable nesting habitat for neotropical migrants from cattle grazing by installing fences that exclude cows from riparian areas.

9.4 DATA GAPS

- Effects of the presence of non-native fish species on native fish species.
- Effects of grazing, mowing, and irrigation on declining ground-nesting birds, small mammals (specifically Preble's meadow jumping mouse), and herpetile populations.
- Fire effects on declining ground-nesting bird species, small mammals (specifically Preble's meadow jumping mouse), and herpetile populations.

- Ecological condition of Open Space macro invertebrate populations.
- Status of bat populations in the Management Area, critical roost sites and foraging locations, and means for improving bat box placement and design.
- Use patterns of prairie dog towns by raptors.
- Status of declining ground-nesting bird populations.

10. CULTURAL RESOURCES

10.1 INTRODUCTION

City of Boulder Open Space lands play a significant role in preserving the cultural heritage of the Boulder Valley. Cultural resources may include buildings, structures, sites, districts, or objects having scientific, historic, archaeologic, or social values. Only cultural resources more than fifty years old will be considered in this chapter. Many of these resources are irreplaceable, and reasonable efforts will be made to preserve and protect significant cultural resources when possible.

The City of Boulder Open Space Program has these goals for cultural resources (City of Boulder 1990):

1. Recognize cultural resource values and integrate them into the management of Open Space lands
2. Establish procedures for identification, documentation, evaluation, recovery, and curation of cultural resources
3. Protect and preserve significant cultural resources
4. Interpret, educate, and train visitors and staff about cultural resources

This chapter will discuss the cultural background of the South Boulder Creek Management Area and review resource inventories, data gaps, and issues related to cultural resources.

10.2 RESOURCE INFORMATION

10.2.1 Cultural Resource Inventory Methods

A cultural resource inventory of the Management Area was completed in 1997 as part of a survey of about 1,411 acres for the Open Space Program; 319 acres of conservation easement were not surveyed (Gleichman and Phillips 1997). The other 1,400 acres in the Management Area were surveyed previously and are summarized in the report. Work was conducted by Native Cultural Services, a local consulting firm. Inventory work included a detailed literature search, interviews with long-term residents, and an intensive field survey of the area.

The inventory was performed to locate, record, and evaluate all visible cultural resources within the Management Area and to provide the City of Boulder with recommendations concerning these resources.[12] These inventories increased the Program's cultural resource database and facilitated management decisions regarding cultural resources. All cultural resources were evaluated for their significance in terms of eligibility for inclusion on both the State Register of Historic Properties and the National Register of Historic Places (Appendix 3.1.5). Cultural

[12]See Appendix 3.1.5 for further information on cultural resource inventory methods.

resources which do not meet the criteria for inclusion on the State or National Registers may still be locally significant and eligible for local landmarking.

The cultural resource inventory provides recommendations for protection of cultural resources from adverse impacts (recreational use, agricultural practices, etc.) and assesses other threats to these resources. A set of expectations based on findings during previous investigations in the vicinity has been developed to help understand the prehistory and history of the area.

10.2.2 Cultural Resource Inventory Results

The cultural resource inventory recorded nine new historic sites and one historic isolated feature. Previous investigations had recorded forty-seven sites and ten isolated finds in the Management Area. A total of fifty-six sites and eleven isolated finds has been documented in the area. The cultural properties documented within the Management Area were evaluated for their significance and eligibility for the National Register of Historic Places, the State Register of Historic Properties, and local landmarking.

The Fox Mine Office (5BL460) and the Fox/Hogan Stone Barn (5BL4125) have been listed on the National Register of Historic Places. A 19th century stone building (5BL7012) is eligible for the State Register of Historic Properties as an example of early stone construction in Colorado. The Viele Farm (5BL5036) is a City of Boulder Historic Landmark. Lewis/Stengel Farm (5BL4228) and Hogan Farm (5BL5038) may be eligible for County landmarking.

Several sites need additional data to evaluate their eligibility for the National Register of Historic Places for their archaeological potential. Determination of the presence and quantity of buried cultural material through test excavations is recommended for several historic stone foundations, piles, alignments, and dugouts (5BL5024, 5BL5027, 5BL5028, 5BL5029, 5BL5030, and 5BL7013).

Several irrigation ditches crossing Open Space are pioneer ditches and key to the early and sustained agricultural success of the area. The Davidson Ditch (5BL453), Boulder and White Rock Ditch (5BL1636), segments of the Howard Ditch (5BL1986.2), East Boulder Ditch (5BL4163.2), Enterprise Ditch (5BL4164.1), McGinn Ditch (5BL4165.1), and the New Dry Creek Carrier Ditch (5BL4166.1) are considered eligible because of their association with the development of water storage and irrigation in Boulder County. The Bear Creek Ditch (5BL3870), Cottonwood No. 2 Ditch (5BL4488.1), Dry Creek Davidson Ditch (5BL4489.1), North Boulder Farmer's Ditch (5BL6879), Green Ditch (5BL7037), and the Boulder and Left Hand Ditch (5BL6880) may also be eligible for their associational values. The ditches are active and should not be affected by recreational use of the area. The ditches are owned by ditch companies comprised of individual, corporate, and government owners. Most are not owned by Open Space. These ditches are adjudicated and carry their own legal protections regarding third parties (i.e., ditch companies protect function but not necessarily historic integrity of ditches).

None of the other cultural properties are considered eligible for nomination to either the National Register of Historic Places or the State Register of Historic Properties, nor are they

recommended for local landmarking.

10.2.3 Background

The cultural history of this area spans over 11,500 years from the Paleo-Indian Period to the present day. The Paleo-Indian Period existed from about 9500 to 5500 B.C., and subsistence practices at this time included both hunting and gathering of natural resources. Most known Paleo-Indian sites are big game kill sites where large and occasionally fluted lanceolate projectile points are associated with animal remains (Gleichman and Gleichman 1989).

The period from about 5500 B.C. to 1 A.D. in northeastern Colorado is known as the Plains Archaic Period and coincides with a significant change in subsistence to a more generalized broad-spectrum hunting-gathering strategy (Frison 1978). The foothills and mountains of Colorado may have been occupied during the Early Archaic Period and may have provided food and shelter from a severe warming and drying climatic episode on the plains (Benedict and Olson 1978).

The Plains Archaic is followed by the Ceramic Period (1-1550 A.D.), also known as the Late Prehistoric Period. In this area a hunting-gathering lifestyle was retained, with seasonal movements of people into the Front Range. Sites relating to this period are known to be present in eastern Boulder County, including a site along Rock Creek which has been partially excavated (Gleichman et al. 1995).

The Protohistoric Period refers to the era after European contact and before widespread Euro-American settlement, about 1600-1800 A.D. European trade items began to be used by indigenous peoples, and horses became available. Colorado was occupied during the 18th century by the Comanche in the plains and the Ute in the foothills and mountains. By the early 19th century, the Cheyenne and Arapaho began to occupy most of the plains of eastern Colorado (Buckles 1968). The Native Americans were forced out of the area by the late 1860s.

Although fur trappers were attracted to Boulder County in the early 1800s, their numbers were limited. It was not until the discovery of gold in California in 1849 that large numbers of Euro-Americans began to migrate to the west. The first encampment of Euro-American settlers in Boulder County was in 1858; a small group in search of gold camped at the mouth of Boulder Canyon. In 1859, the first major discovery of gold in Boulder County was made, and soon hundreds of prospectors rushed into the area. At that time, Arapaho Indians inhabited much of the Boulder area. Irrigated agriculture and ranching were beginning to occur by 1860 (Fetter 1983).

The productive soils of eastern Boulder County were well suited to agriculture. By the 1860s, scattered farms appeared on the plains east of Boulder City and human-made lakes and ditches were constructed to improve the agricultural productivity of the land. The need for hay and produce in the gold camps west of Boulder further stimulated agriculture (Dyni 1989). Agriculture is still practiced in the Management Area. The northern portion of the Management Area also experienced an "oil boom"--extensive exploration and production of oil, beginning in

the early 1900s. The southern portion of the Management Area, on Davidson Mesa, was part of the Marshall coal fields and has been extensively mined for coal since the Euro-American settlement of the area.

Archaeological finds in this part of eastern Colorado are variable. Previous cultural resource inventories in the immediate area have identified historic resources (generally associated with irrigation and agriculture), a few prehistoric sites, and isolated artifacts. The low number of aboriginal sites known for this area may in part be due to heavy vegetation growth resulting in poor ground visibility. Low site numbers may reflect the intensive historic use of the Management Area and the proximity of urban and suburban development, with prehistoric material being lost to collection and otherwise obliterated by plowing and other development. Prehistoric camps tend to be located near water sources in areas with gently sloping terraces or ridge tops. Areas immediately adjacent to the Management Area creeks were expected to contain little surface evidence of prehistoric occupation or use due to the number of floods which have occurred and to problems of surface visibility.

Historic Euro-American remains were known to be present in the Management Area and are more common than prehistoric sites. A rich history of farming, ranching, mining, and recreation has resulted in numerous sites related to these activities, such as house foundations, animal enclosures, irrigation ditches, farm machinery, and trash deposits.

Additional information about the cultural history of the northeastern plains/foothills of Colorado, including the Management Area, is summarized in several documents: plains prehistory in Eighmy's (1984) *Colorado Plains Prehistoric Context,* plains history in Mehls' *Colorado Plains Historic Context* (1984a) and *The New Empire of the Rockies* (Mehls 1984b), and montane region history in Guthrie et al. (1984) *Colorado Mountains Prehistoric Context* and Mehls' (1984c) *Colorado Mountains Historic Context.*

10.2.4 Cultural Resource Themes

The Boulder Historic Context Project (Friedman 1989) established cultural resource themes. The Management Area themes include: agriculture, mining and extractive industries, water resources, and transportation. A description of these themes, including site information, follows.

Aboriginal Prehistory (about 12,000 B.C. to A.D. 1880)
Because of the intensity of agricultural cultivation and development over the last century, few aboriginal cultural resources were expected (no sites were documented), but isolated prehistoric artifacts were found in the area. Aboriginal sites undoubtedly existed in the Management Area, and buried prehistoric cultural material may be present in the area.

Agriculture (about 1859 to present)
The theme of agriculture covers a broad expanse of activity within the Boulder Valley. Agricultural property types may include farms, flour and grist mills, gardens, orchards, livestock ranches, dairy industries, and fisheries (Friedman 1989). There are three intact farm complexes and portions of other farms in the Management Area which relate to this theme.

Farming and ranching in the area began shortly after Euro-American settlement in the 1860s and has been continually engaged in since. The demand for fresh produce to supply, first, the miners, and later, the growing towns, stimulated agricultural growth throughout the Boulder Valley, including the Management Area.

A notable characteristic of the agricultural development in this area is the long-term continuity of the evolving, intermarrying families that homesteaded and farmed the region. In several cases, the descendants of families that originally appeared in the South Boulder area among the earliest Euro-American settlers (in the 1860s to 1880s) maintained and operated the family farms to and beyond World War II. The Viele, Kohler, Stengel, DeBacker, Clyncke, Hogan, and Spicer families are among those in the area of this study and in nearby areas who have continued agricultural activities for a century or more.

Of particular note is the presence of several families originating in Belgium and Alsace-Lorraine and immigrating over a twenty-year period. Original-source documents speak to the influence on prospective immigrants of the good reports that came back to their European relatives and neighbors from the early arrivals. Members of these Belgian and Alsatian families intermarried, both in Europe and in Boulder County, and it was common for the older male immigrants to return to bring younger siblings and other relatives back to Colorado.

Much of the land in the Management Area was owned by the Viele family who established several farms. James Boyd Viele (1810-1895) and his wife, Lucinda Emerson Viele (1816-1867), were New Yorkers who came to Colorado from Illinois in 1864 for Lucinda's health. They brought with them their six children: Jefferson; Catherine; Rossetta "Rose" (1845-1919); James B. Jr.; Edward; and Albert (1860-1960).

The Viele Homestead consists of an intact complex of buildings constructed between 1884 and 1905. The Viele farm, a.k.a. Meadow Brook Farm, was a dairy farm established by Albert Viele and his wife, Abbie Lucinda Spicer Viele (1861-1942). (See below for more information on the Spicer family.) They married in 1881; she had come to Boulder with her family from Illinois. She attended teacher's college to become a schoolteacher and taught at the Dry Creek School after it was first constructed in 1887.

Albert and Abbie Viele began obtaining land in the mid-1880s from his father James. The Meadow Brook Farm eventually covered 637 acres and was operated by them until 1942 (with the exception of a period from about 1905 to 1910). They delivered 200-250 pounds of butter per week to Boulder markets. In 1942 the farm was sold to L.W. Van Vleet who raised Arabian horses. The complex consists of a very large two-story stone house, a large barn, tool shed, garage, granary, several stock sheds, chicken coop, well, and outhouse.

An adjacent site, the Harf Farm, now consists of a barn and other outbuildings. Owned and constructed by the Viele family to be leased to a tenant family as a farm complex, the buildings date to the turn of the century. This property was included in L.W. Van Vleet's acquisition from the Viele family. Farther south on South Boulder Creek, the Abernathy Farm, now a ruin, was also developed by the Viele family to be leased out. The agricultural subdivision of these

properties represents the period from the turn of the century until about World War II, when the family farm was the primary source of foodstuffs for the rapidly growing cities before corporate farming developed in a significant way.

Van Vleet also bought the Doran Farm, west of the Viele properties across South Boulder Creek. The major remaining structure there is a barn also built around 1900. On both the Harf and Doran sites, Van Vleet had the original houses demolished around 1970 so as to avoid having to continue paying property taxes on vacant residences. The land, barns, and outbuildings continued in agricultural use for Van Vleet's Arabian horse farm, but they no longer functioned as family farms after World War II.

James Viele's daughter, Rossetta (1845-1919), inherited the Gebhard Farm, consisting of a barn, silo, and associated structures, when he died in 1895. She married one of Boulder County's earliest Euro-American immigrants, Frederick William Kohler Jr. (1832-1904), in 1868. Frederick Kohler emigrated to the United States from Saxony in 1849. He did farmwork in Pennsylvania and California and came to Colorado in 1862. A successful farmer on this site and others, Kohler later was elected a County commissioner and was one of the founders of Boulder National Bank where he served as president. One of Frederick and Rosseta Kohler's sons, Frederick William III, sold this property to Joseph F. Stengel in 1921. It is currently unknown whether the Kohlers or Stengels built the farmstead. The barn was built about 1920, and the silo was either contemporaneous or added later. The farm was sold to the Gebhard family in 1943, who moved the house to a nearby hilltop.

The Stengel family in Boulder County originally consisted of three brothers, Louis (1863-1946), Joseph (1868-1932), and Andrew (1874-1956); they emigrated from Alsace-Lorraine in 1882, 1885, and 1891, respectively. A sister, Josephine, also came to Colorado.

Joseph and Louis married sisters, Maria and Barbara Dornberger, also Alsatian; Maria anglicized her name to Mary when she came to the United States. Mary and Joseph Stengel always emphasized to their children that they were neither French nor German but Alsatian. Together, the three brothers fathered twenty-three children and owned most of the farmland along 75th Street between Arapahoe and Baseline Roads.

An intact farm complex, the Lewis/Stengel Farm, was developed and occupied by three generations of the Stengel family over ninety-two years. Purchased by Andrew Stengel in 1900 from George K. Autry, the farm complex consists of a dozen buildings, with miscellaneous other features and a segment of the Dry Creek Davidson Ditch. The oldest portions of the farmhouse itself are believed to have been constructed by Autry who had acquired the property from the original homesteader, James C. Stuart, in 1889. A wooden barn or grain crib, about 900 square feet in size, also appears to predate 1900.

Andrew Stengel relocated the original Autry farm house using the services of another early resident, Poliete Clyncke. Andrew and his wife Josephine (1875-1917), who married in 1902, added on to the original house and raised three sons, Frederick F., Eugene, and John. Andrew Stengel built a hay barn and an adjacent silo in about 1927; the wooden-floored barn was used

for public square dances for many years. A wooden privy in the complex is concrete-floored and marked "Ideal Portland Cement laid by WPA" (Works Project Administration).

Fred Stengel and his wife Francis stayed on the farm and acquired it in 1953. One of their three children, Jodell Josephine, married Tom Lewis and took ownership of the farm in 1981. The Lewis family raised hay, oats, and barley and maintained a herd of twenty-four dairy cows.

In 1992 the Lewis/Stengel Farm Complex was acquired by the Boulder Municipal Property Authority.

Another parcel originally owned by the Vieles contains the Spicer Farm. The site includes a small stone house and four outbuildings and associated structures. The main farm house burned down in the 1970s. The stone building has mud mortar and originally had a sod roof and dates to the 1860s-1880s. It may have originally served as a stage stop. A larger house on the site reputedly burned down. The wooden privy at this site also has a concrete floor laid by the Works Projects administration during the depression. This land was owned by the eldest son of James Boyd Viele Sr., James B. Viele Jr., from 1879 until 1923, when he sold it to Martha I. (DeBacker) Spicer.

The Spicer family apparently consisted of David Scudder Spicer (1830-1894), his wife Mary Smith, and four children who relocated to Boulder County from Illinois: Abbie Lucinda (1861-1942), who married Albert Viele; Alonzo (1865-1935); William A. (1870-?); and Robert (1879-?). Martha DeBacker married Alonzo F. "Lon" Spicer (1865-1935) in 1890. Lon Spicer was a homesteader southeast of Superior. At some point the Spicers moved to South Boulder Road. Members of the Spicer family lived and farmed here until the early 1970s.

The DeBackers, Spicers, and others were also involved in another agricultural site, a homesite ruin, of which the ownership history shows the interaction of mining, water resource development, and farming in the lives of its owners.

The lands containing the area of the site were first held by Levi Hake (1840-?). An Ohio native, Hake came to Colorado, took part in the 1859 Pike's Peak gold rush, and ended up mining in Four Mile Canyon and then in various parts of the region. From 1861-1868 he operated a freight business between Boulder and Empire and between Denver and the Missouri River. In addition, he farmed and raised stock and served on the school board (Chapman 1898). In 1875 Hake sold the property of concern to John T. Mitchell who apparently farmed it for fifteen years; in 1890 Mitchell sold the land to John DeBacker.

John DeBacker (1827-1907) was a Belgian millwright who moved to New York in 1855 to install his family's flour mill machinery there. He married Marie Fouse (1830-1865) in New York, an immigrant from Alsace-Lorraine, and later set off for the California gold fields. In Fort Laramie, Wyoming, DeBacker heard Horace Greeley recommend Colorado instead and followed that advice, arriving July 11, 1859. DeBacker first held a profitable placer claim in Gold Hill and built the first ore mill in Boulder County (albeit unsuccessfully). He then homesteaded along South Boulder Creek, west of Marshall, developing a stock and dairy farm.

In 1866 DeBacker moved just east of Valmont while evidently maintaining ownership of his South Boulder Valley farm. There DeBacker partnered with Judge Peter M. Housel. Together they built and operated the Butte Mill (also known as the Housel Mill), a large waterwheel flour mill, and built the Butte Mill Ditch to serve it.

In 1868 DeBacker sold out to his partner and relocated to Denver to run a feed, grain, and freight business.

In 1869 the family moved back to the South Boulder Valley, returning to the cattle business and running 800 to 1,500 head on the open range to the south of the ranch.

In 1881 DeBacker's son, Frank (1863-1944), took over the family farm in the Baseline Lake district. John DeBacker stayed in agriculture, purchasing the land containing this site from John T. Mitchell in 1890. When John DeBacker died in 1907, this land went to his daughter, Martha Spicer (1871-1938), and this property remained with the Spicers until 1974.

One building, a granary from the Eberharter Farm, is in the Management Area. The rest of the farm complex is outside the area. Louis and Philiomena Eberharter emigrated from Austria in 1881 and homesteaded the farm on 75th Street. It is currently the Isenhart Farm.

The Hogan Farm, south of the Viele-Van Vleet area and a little north of the edge of Davidson Mesa, is a farm/ranch complex that also incorporated several coal mining related structures. The complex was originally owned by the Fox family who owned and operated the Fox Coal Mine. The Fox Mine Building is within this complex, and the Fox Mine itself was just to the south. The ruins of the Fox residence are present, as are the Hogan/Smith house, a granary, barn, silo, several sheds, and corrals. The Hogan/Smith house is a frame house built in Marshall by Edward Smith, a coal miner, before the turn of the century. It was moved to its present site by Poliete Clyncke in the 1920s. The Hogan family has lived at and operated the farm for many years. The Fox/Hogan Stone Barn is slightly north of the farm complex. It has served as both a domicile for Fox Mine employees and as a livery or livestock shelter. The intersection of agriculture and mining is common in the region beginning on the south edge of the Management Area.

The use of much of the Management Area for pasture and crops continues into modern times. The Open Space Program leases portions of the land to ranchers and farmers. The sites that are associated with water resources are also associated with agriculture in the area and are discussed below.

Water Resources (about 1859 to present)
Excavation of irrigation ditches began soon after Euro-American settlement; ditch construction was vital to successful agricultural production because of the unpredictable rainfall patterns in this semi-arid climate.

Ditches were built across the Boulder Valley in rapid succession. The Management Area either contains or is traversed by twenty historic ditches; fourteen of these tapped South Boulder Creek, and the other six were built to use Boulder Creek. All nineteen had received their first

appropriations by the end of 1873, only a decade and a half after the first Euro-Americans arrived in the Boulder Valley. Several ditches were later enlarged, and the technology of gates, gauging stations, and ditch linings has been adapted ever since. This early development demonstrates the high priority applied to agricultural irrigation by the earliest settlers and homesteaders.

The first ditch to enter the Management Area--and the first ditch to tap South Boulder Creek--was the Howard Ditch, with an appropriation date of April 1, 1860, for 1,000 acre feet. The other thirteen Management Area ditches off South Boulder Creek (listed chronologically by date of fee appropriation) are McGinn Ditch--also called McGinn Ditch No. 2, Schearer Ditch, East Boulder Ditch, South Boulder Bear Creek Ditch, Marshallville Ditch, Cottonwood No. 2 Ditch, Dry Creek Davidson Ditch, Dry Creek No. 2 Ditch, Enterprise Ditch, South Boulder Canyon Ditch, New Dry Creek Carrier Ditch, Davidson Ditch, and Goodhue Ditch.

The five ditches that utilized Boulder Creek are the Anderson Ditch, North Boulder Farmer's Ditch, Green Ditch, Butte Mill Ditch, Boulder and White Rock Ditch, and Boulder and Left Hand Ditch. Among these, the Butte Mill Ditch is distinctive because it was originally built by Judge Peter M. Housel and John DeBacker to power a grist mill rather than for direct agricultural irrigation. However, as the technology of flour milling was converted with the spread of electricity and the original Butte Mill itself became obsolete, the Butte Mill Ditch was adapted into an irrigation ditch.

There is no doubt that these ditches were critical to the extent and durability of agriculture in the area. The agricultural families described above depended on these ditches to funnel reliable water out of the mountain-fed creeks into their fields, and the century-long duration of their agricultural success shows the importance of these ditches.

A few small ponds are also found in the area, and several large reservoirs are adjacent to the area. Management and control of water continues as a consistent theme in the Euro-American development of the region.

Mining, Minerals, and Extractive Industries (about 1858 to present)

Coal Mining: Much of the early history of settlement in the Boulder Valley is connected with mineral extraction. Boulder was originally settled by gold seekers in 1858. While precious metal mining took place in the mountains, coal mining was a major endeavor in the Boulder-Weld Coal Field, portions of which comprise the southern part of the Management Area.

While the majority of coal mines and related sites were on Marshall Mesa, south of the Management Area, several mine adits from unnamed or unknown mines are on Davidson Mesa, as is a portion of the New Ross Mine. The Fox Mine building is also on Open Space, north of Davidson Mesa, although the Fox Mine itself is on private land. Also present are the Marshall Caves and several habitation ruins associated with mining, including the Gorham/Spangler house (E.V. Miller cabin).

The first coal mines in operation in the state of Colorado were at Marshall. The time period in which the Marshall mines were active spans the years between 1859 and shortly after the end of World War II. The initial impetus for mining coal in the Marshall area was to provide a source of steam power for early industries and for domestic use, both in gold mining towns and in Denver and surrounding plains towns. Since coal was available in natural outcrops around Marshall, the town grew up as a center of coal mining activities in the Northern Coal Fields (Boulder-Weld Coal Fields).

In 1859 William A. Kitchen began mining coal near what became Marshall. In 1866 William Kitchen sold his claim to Joseph Marshall who increased his land holdings and established the Marshall Coal Mining Company, devoting himself to the development of the Marshall and Black Diamond Mines. Coal mining operations in Marshall began on a large-scale basis following the influx of Welsh and English miners in the 1860s. These experienced workers brought with them a knowledge of how to open mines, how to lay rails for the coal cars used in underground transportation, how to handle explosives, and the working knowledge of how to operate a coal mine successfully. These miners used a coal-extracting technique called the room and pillar method, leaving unmined, supporting pillars of coal between mine rooms and passageways in order to support the overlying bedrock.

By 1870 the mining camp had grown into a community that supported a school and three saloons, a butcher, a company store, powder houses, mining offices, and workers dwellings. In 1877 the mining settlement at Marshall was surveyed and platted as a town.

Prior to the coming of the railroad, wagons were used to transport coal to local residents and to Denver. In 1878 the first carloads of coal from the Marshall mines were hauled along the tracks of the Golden, Boulder, and Caribou Railroad into Boulder. The railroad had an immediate and consequential impact on mining operations at Marshall. Coal production increased dramatically, doubling between 1878 and 1879.

In 1885 the Denver, Marshall, and Boulder Railroad was organized by the Union Pacific. In 1886 track was extended to Marshall and Boulder. The Colorado and Southern took over the line in 1901, and coal was transported on this line to the smelter at Argo Junction until 1932. Spurs from the main line serviced the coal mines.

Late in 1879 Joseph Marshall leased his 1,480 acres of coal fields in the Marshall area to a partner, Augustine Langford. By 1882 Langford had assumed the general management of the Marshall mines, and his brother, Nathaniel Langford, became president of the Marshall Coal Mining Company. From this time on, the settlement was known by at least the names Gorham, Langford, Marshall, and Foxtown.

By the turn of the century, some of the buildings in the town included a town hall, a meat market, two boarding houses, saloons, mine superintendent's housing, and a number of other small, mining-related buildings. There were company houses and, of course, a number of outhouses as well. Miners also lived in ephemeral shacks and dugouts. There was a train depot and a section

house for the railworkers that attended the railroad lines. There was a number of barns and corrals used to house and feed the mules and horses that worked in and around the mines.

In the late nineteenth century the mine operations at Marshall were dependent on a multi-ethnic work force made up of immigrants from different countries in Europe and Latin America. Foreign workers were often brought into the mines to replace striking mine workers. These "scabs" were from a wide variety of countries. Miners were perpetually suspicious of other "foreigners" in the camps.

The perceived need for more workers in the mines led the owners to actively seek out laborers from various ethnic groups who would work for less money. By the early 1900s, there were more foreign-born workers in the western states than in the east due to the special recruiting efforts of mine owners. The influx of miners from different countries effectively altered the character of the population at Marshall and that of a certain portion of the Colorado Front Range.

A long history of labor organization and labor problems spans the period of coal mining. Labor protests and strikes were common for the miners of the Northern Coal Fields, and sometimes they were fairly violent in nature. The Marshall miners took part in larger mining strikes that were called statewide, as well as in strikes that were called in response to local grievances.

Strikes in the Marshall coal mines took place for a number of reasons. Dangerous working conditions, pay guidelines (including rates, method and times of payment, and jobs that constituted paid work), and the need for fair and honest assessments of coal that was produced were among the major issues that concerned the miners. Mining labor problems were precipitated by, as well as helped to initiate, the tremendous growth of ethnic populations in the area.

By the turn of the century coal mining in the Northern Coal Fields was interrupted more and more often by labor disputes between workers and mine management. At the heart of these disputes were poor working and living conditions that at times were intolerable to mine workers. In 1910 the longest coal strike in Colorado history began, a state-wide mine strike that lasted four years and eight months, although in the Northern Coal Fields miners were out of work for nearly five years. It ended with the famous Ludlow Massacre in April 1914.

Mine operations intensified at Marshall during the World War I years when the demand for the energy that coal produced was fueled by the needs of the U.S. Government. Coal production records indicate that the years around World War I witnessed the greatest overall production of coal from the Marshall mines collectively.

Following World War I, coal production decreased but remained, for the most part, fairly steady through the 1920s up until the Great Depression. It was during the years of the Depression that some of the so-called "dog holes," which were informal mines excavated by small groups of individuals who were looking for coal for their own needs, may have begun to appear.

Problems between mine workers and mine operators still contributed to the decline of the coal mining industry at Marshall. Sources of strife between management and miners were wage decreases and the dropping value of coal itself. While there were certainly a host of factors at work, the underground coalfires had been a problem for years. Some mines had problems with flooding. Much of the readily obtainable coal had already been mined out of the Marshall coal fields by the late 1930s. A number of mines were still in operation, of course, and the World War II years saw an increase in mining production compared to previous years. However, the number of active mines at Marshall was much smaller than it had been earlier in the century, and production rates dropped precipitously, as they had immediately following World War I.

The advent of new fuels, such as natural gas, also contributed to the decline of the coal mining industry at Marshall in the late 1940s. By the middle of the 1950s, coal mining was no longer a part of the Marshall landscape.

***Oil Extraction*:** Much of the northern portion of the Management Area is part of the Boulder Oil Field, and oil exploration and extraction did take place in the Management Area. The Boulder Oil Field, a.k.a the Haystack Field, is about six by two miles, extending northeast along the present Boulder-Longmont Diagonal. According to Smith (1981), the "Old Whiterock" well was sunk at the top of Gunbarrel Hill in 1892. Ferdinand V. Hayden, after surveying the area for the U.S. Geological Survey in 1901, referred to Boulder County as lying over "a veritable sea of oil" (Smith 1981:139). Isaac Canfield hit oil in an exploratory well in January 1902, and by April of that same year 117 oil companies were operating in the area of the Boulder-Longmont Diagonal. In the peak year, 1909, over 85,000 barrels of oil were produced. This boom was short-lived however, with production falling to 7,000 barrels in 1914, and by 1923, only twelve wells were operating in the County. Of the 183 wells that were drilled during this period, 102 were dry, seventy-six produced oil, and five produced gas. By 1953, just 2,500 barrels of oil were produced (Jenson 1954).

While the boom was short-lived, oil exploration and drilling continued into the 1950s and indeed continues to a limited extent today. After the turn of the century, large areas of oil lands tended to be owned by a few companies, including Inland Oil and Refining Co., United Oil Co., and Continental Oil Co.

Transportation (about 1540 to present)
Aboriginal and pioneer transportation routes undoubtedly passed through this portion of Boulder County, though no specific routes have been reported within the Management Area. Historic transportation in the area was principally on wagon roads, which often became automobile roads, and via the railroad.

Stagecoach routes may well have crossed the Management Area connecting Boulder to outlying communities such as the coal towns. Current main roads such as South Boulder Road and Cherryvale Road were likely important routes historically. No attempt had been made to document the history of current roads, as none are owned by or wholly contained within Open Space.

The bridge over Dry Creek Ditch that provides access to the homesite ruins at 5BL7013 must have been part of a wagon track and perhaps later an auto road. An access road leads from the bridge to the homesite. No definitive road cut (leading to the bridge) is currently visible.

The Union Pacific Railroad, formerly the Denver and Boulder Valley Railroad, extended its tracks west to Boulder from Erie in 1881. The Boulder Depot was constructed in 1890. The Union Pacific line traversing the Management Area functioned for about 100 years.

10.3 ISSUES

- Resolve potential conflicts with other resource management goals.
- Identify "best management practices" to protect and preserve significant cultural resource sites.
- Identify sites eligible for national and local landmarking.
- Determine appropriate uses of significant historical structures within the Management Area.
- Determine interpretation potential of sites.
- Determine if test excavations should be conducted at certain sites. These sites may contain archaeological information which could provide additional knowledge on the prehistory of the area.

10.4 DATA GAPS

- Because of poor ground visibility and the floodplain nature of the area, undetected prehistoric sites or historic archaeology sites may be located within the South Boulder Creek Management Area. If any prehistoric artifacts or features are uncovered during management activities or practices, all work should be temporarily stopped until these resources are evaluated. This policy is more fully outlined in the *Long Range Management Policies* and *Cultural Resource Guidelines*.

- Several documented sites may contain buried cultural material, and test excavations are needed to fully evaluate the sites. Some of the prehistoric sites in the Management Area and one historic habitation may contain potential archaeological information. Only testing within the bounds of specific research inquiries may determine the information potential of these sites.

- Specific recommendations concerning local landmarking have not been completed and will need to be evaluated on a case-by-case basis. The Boulder County Historic Preservation Advisory Board, the City of Boulder Landmarks Advisory Board, and the Open Space Board of Trustees should be consulted prior to any management action concerning these historic structures.

11. PROPERTY INFORMATION

11.1 INTRODUCTION

The South Boulder Creek Management Area encompasses 3,502 acres of Open Space, about 14% of Open Space land ownership. Ninety-six different Open Space properties are included in the Management Area. Most properties are owned in fee. Several properties have conservation easements owned by the City.

This property information chapter is divided into three sections: Resource Information, Issues, and Data Gaps. These three sections provide an inventory of the properties and their real estate characteristics. The sections also identify follow-up items and list the data that was not available and, therefore, is not included in this chapter.

The Resource Information section resulted from the review of the real estate file of each property and was supplemented by information from additional sources. The information is organized by a table with columns for each aspect of property ownership such as acreage and water rights. The table intends to identify salient real estate characteristics of each property. In the "Other" column, the table goes beyond the presentation of data to include items of special interest about each property.

The Issues section identifies the follow-up items that became apparent as a result of producing the inventory and table. It also includes follow-up items identified by users of the Property Information section of the inventory. To further define the property information presented, the Data Gaps section lists the real estate data that were unavailable. Generally, the same set of data was available for each property, but some properties were missing certain information. The missing items are listed in Data Gaps.

11.2 RESOURCE INFORMATION

11.2.1 Open Space Properties[13]

Table 11.1 details the real estate information on each Open Space property within the Management Area. The categories of information for each property are listed and defined in the remainder of this section.

Property
The property's official name, typically the family or corporate name of seller, sometimes a feature such as Cottonwood Grove.

[13] Figure 11.1* illustrates the location of the properties in the South Boulder Creek Management Area.

Acquired
The closing date for the City's acquisition of the property. When the property acquisition called for a series of parcels to be acquired over several years (i.e., rolling options), the date shown is the date of the closing of the first parcel in the series.

S/T/R
The Section / Township / Range West of the 6th Principal Meridian; real estate acquisitions and related files maintained by the department are organized by property name within a particular Section - Township - Range (S/T/R).

Acres
Nearly all reported acreage comes from field surveys by licensed land surveyors.

Ownership
The City of Boulder does not own the full and complete title to every Open Space property in the Management Area. When the City does own the complete title, subject to some limitations such as easements, mineral exceptions, rights of way or other restrictions, the ownership is labeled *fee purchase*. Other times the City purchased the property owner's *development rights* only. In these cases the property owner still owns all the rights associated with property ownership except the right to develop the property. Sometimes the City purchased a *conservation easement* or *scenic easement*. In these cases the property owner still owns the land itself but is restricted to certain uses of the land and has certain performance obligations. The restrictions and obligations are negotiated with each owner and therefore vary considerably among the Open Space properties marked *conservation easement* or *scenic easement*. Other times the City acquired a specific right to use a property owner's land for a certain purpose. These cases are indicated by *access easement or trail easement,* depending on which right was acquired. Finally, the ownership types of two particular properties are *air space agreement* and *management agreement*. These indicate no ownership of land by the City but do indicate a legal agreement that obligates the property owner to certain conditions.

Public Easement
Public or quasi-public entities, such as Boulder County, U.S. West, and Public Service Company often have legal rights to use an Open Space property for certain purposes. Their rights are usually in the form of an easement that identifies specifically the use(s) allowed and the geographical location and dimensions where the rights can be used--the easement boundary. Also listed in this area for a public right of way are roads, utilities, etc. which have specific boundaries and purposes. The rights of public and quasi-public entities to use Open Space are listed here.

"Right-of-Way"
Public and private entities, such as the federal government or a ditch company, sometimes have a right to use Open Space properties for a specific purpose where that right does not have a specific geographic location or specific dimension. For example, most irrigation ditches that occur on Open Space properties do not have described geographic boundary lines. Their rights are not

limited to a certain area of the land by a specific legal description but are limited, generally, by practicality--what area of the land has historically been used to operate and maintain the ditch. These rights are sometimes called "prescriptive easements." Rights of others that do not have specific geographic boundaries are under this heading. While these interests may be described as "right-of-way" (ROW), they are typically not acquired for public roads, utilities, etc., which are listed under the heading of Public Easement.

Private Easement
Private parties, such as individual and corporate property owners, may have legal rights to use an Open Space property for certain purposes. Their rights consist of an easement that identifies specifically the use(s) allowed and the geographical location where the rights can be used--the easement boundary. Typically, these are interests which predated Open Space purchase or were retained by the seller with retained land or other retained property interests. For example, the McKenzie family retained an easement across Open Space for vehicular access to the real property they retained. The rights of private parties to use Open Space properties are identified by this category.

Conservation Easement
Similar to public and private parties having rights to sometimes use land owned by the City, a conservation easement gives the City specifically defined rights to control land owned by others.

Scenic Easement
Similar to a Conservation Easement, a scenic easement is also listed in this category. The rights held by the City to control and sometimes use the land owned by others for the general purpose of conserving land are identified in this category.

Water Rights
Listings are typically rights to use water which generally are owned either as shares/stock in an incorporated ditch or reservoir company or are Decrees from the State water court. Often the City also acquires "all water rights owned by Seller" which could include wells, seeps, springs, and other resources not necessarily separately decreed or deeded. The water rights acquired by the City for Open Space use are listed in this category.

Mineral Rights
The right to extract minerals, such as gravel, coal or oil and gas, is part of the rights of property ownership. All mineral rights owned by the City for Open Space purposes are listed here. Sometimes the mineral rights were sold off before Open Space acquired the property; in those cases, acquisition of the property did not include acquisition of the mineral rights. When severed mineral rights are available for purchase, the City may buy these at a later date if funds are available. When known, the other parties owning mineral rights on Open Space properties are identified in this category.

Other
Information that does not conform to the other categories is listed here.

Table 11.1: South Boulder Creek Property Inventory

PROPERTY	ACQUIRED	S/T/R	ACRES	OWNERSHIP	PUBLIC EASEMENT	"RIGHT-OF-WAY"*	PRIVATE EASEMENT
ANDRUS	31-Dec-77	15, 22-1N-70W	118.554	Fee Purchase	200-sq. ft. easement for guy wires and anchors to Boulder County	- One 25 feet wide sanitary sewer line easement. - ROW's for the North Boulder Farmers Ditch & Boulder and Left Hand Ditch.	None
ARNOLD, WILLIAM	01-Jan-77	28-1N-70W	4.424	Fee Purchase (Donation)	Two 30-foot easements across Open Space for drainage and utilities to be located by Wm Arnold.	None	- A ROW and easement over the Northerly 110 feet reserved by Wm. Arnold
AWEIDA II	01-Sep-93	35-1N-70W	56.146	Fee Purchase	None	-ROW for ditches or canals constructed by authority of the U S gov. -ROW for pole line for electric power and telephone facilities.	None
BASELINE / 75	17-Apr-92	36-1N-70W	67.781	Fee Purchase	- Permanent easement to the County for purpose of providing & maintaining improvements for public roadway and attendant facilities for maintenance of 2 access points to Baseline 75 property. - County agrees to submit new easement request to OSBT in event any open space lands are required for Phase II activity, including design & construction of trail crossings on 75th & 76th Streets at locations to be determined by OS staff. - An easement 6 ft. wide for maintenance, operation and use of an irrigation lateral along westerly line of County Rd No. 25	- Easement and right of way for Boulder Co. Rd No. 56 (Baseline Road) & Co. Rd No. 25 (N 75th St.)	- Easement & ROW for the Boulder Res. Ditch & pipeline including any rights, interest or easements in and over the waters and present and past bed and banks of Dry Creek.
BELGROVE	13-Jun-80	16,21-1N-70W	92.34	Fee Purchase		None	None

PROPERTY	CONSERVATION EASEMENT	MINERAL RIGHTS	OTHER	ID #
ANDRUS	None		Owners agree not to construct a fence of the type known as chain-link or Real Lock along the boundary except along the country roads. *Valmont Connection Issues.*	65.00
ARNOLD, WILLIAM	None		Vacation of easements requested during Eastpark III, Replat B not accomplished. Bike path lines up w/Reynolds bike path easement. Applicant has entered joint fence maintenance agreement with City for existing boundary fence along Open Space. Council accepted a gift of greenbelt land from William Arnold, Jr. that lies north of & parallel to Boulder Creek. Greenbelt land extends along S.E. boundary of Eastpark III development, 100 ft wide.	59.10
AWEIDA II	None		Transferred from Parks Department. Access issues related to Crestmoor subdivision and other subdivisions to the south.	260.00
BASELINE/75	None			235.00
BELGROVE	None		Easements through FourMile Creek Subdivision bring water to property. The new roadway improvements recently built on 47th Street south of Jay Road may be illegally encroaching onto Open Space property.	79.00

PROPERTY	ACQUIRED	S/T/R	ACRES	OWNERSHIP	PUBLIC EASEMENT	"RIGHT-OF-WAY"*	PRIVATE EASEMENT
BIDDLE	21-Sept-79	24-1N-70W	67.011	Fee Purchase	None	None	None
BOULDER CONSERVATIVE SYNAGOGUE	01-Jan-87	34-1N-70W	1.076	Scenic Easement (Dedication)	Scenic Easement 50' west & 25' east of the centerline of South Boulder Creek. Grantor may landscape the area, install playground equipment and maintain any improvements. Grantor shall not remove any live trees. Maintenance of the scenic area is not the responsibility of the grantee.	None	None
BURKE I	01-Jan-73	03-1S-70W	87.198	Fee Purchase	None	None	None
BURKE II	31-Dec-74	34-1N-70W	68.068	Fee Purchase	None	- ROW for ditch purposes granted to PSCo of Colorado. - ROW for gas line granted to Colorado-Wyoming Gas Co. subsequently assigned to PSCO - ROW for sewer line granted to City of Boulder.	None

PROPERTY	CONSERVATION EASEMENT	MINERAL RIGHTS	OTHER	ID #
BIDDLE	None		Owned by utilities, managed by Open Space.	700
BOULDER CONSERVATIVE SYNAGOGUE	None			178.10
BURKE I	None		- Prebles have been trapped nearby the constructed trail. - Seasonal closure of the west portions Burke I & Burke II from May 15th to July 15th or until Bobolinks are not using areas. - Greenway path constructed in Burke I and Gebhard in 1997.	31.00
BURKE II	None		- License agreement with the County on the development and maintenance on the trail system on the Burke II. Who is liable in the event of injury to persons using bridge which crosses Empson Ditch from Old Tale Rd to Centennial Trail? The bridge has been erected, maintained and re-erected by various persons in the neighborhood, most recently by John Mackinko, an adjacent property owner. - Seasonal closure on western portion of I & II from May 15 - July 15 or until bobolinks not nesting.	47.00

PROPERTY	ACQUIRED	S/T/R	ACRES	OWNERSHIP	PUBLIC EASEMENT	"RIGHT-OF-WAY"*	PRIVATE EASEMENT
CELESTIAL SEASONINGS	01-Jan-82	10-1N-70W	9.741	Conservation Easement (Donation)	None	None	None
CENTER GREEN HEIGHTS	15-Aug-83	21-1N-70W	.235	Pedestrian-Bicycle Access Easement (Dedication)	15' easement for hiking and bicycle trail south of Boulder White Rocks Ditch.	None	None
CHURCH	15-Nov-77	15-1S-70W	272.435	Fee Purchase	- A 16 ft. wide ROW to lay, construct, maintain and repair a water pipeline.	- ROW for the Goodhue Ditch and Davidson Ditch.	Road easement across certain portion of SE1/4 Sec 15-1S-70 (hogan) for common use of a road.
CHURCH OF CHRIST	01-Jul-91	11-1S-70W	42.881	Fee Purchase	None	A right of way for Goodhue ditch, for road purposes over and across the Easterly 15 ft. of that part of the East ½ of the SW quarter of Section 11, that lies Southerly of the center line of the Goodhue ditch and across the Southerly portion of said land for Davidson Ditch.	None

PROPERTY	CONSERVATION EASEMENT	MINERAL RIGHTS	OTHER	ID #
CELESTIAL SEASONINGS	- Subdivider provided the City with a conservation easement that is south of the ROW for the Gunbarrel Avenue extension for a bike path and pedestrian way that is to be constructed as part of phase III of the development of the subdivision. - Grantor may construct and maintain on the scenic area a pond, herb garden and a jogging course with exercise stations and bicycle paths. - Grantor has right to have a railroad spur pass through the area and railroad facilities and road access to such facilities. Any disturbance to this area must be restored by the grantor.		Subdivider shall provide for the following private improvements: a bike path and pedestrian way located in the portion of the pedestrian and bike trail easement, as shown on the final plat, that is south of the right-of-way for the Gunbarrel Ave. Extension, the path (s) shall be constructed as part of the phase III development of the subdivision through the conservation easement.	100.20
CENTER GREEN HEIGHTS	None		Bike paths to be maintained by developer until responsibility assumed by Kings Ridge Homeowners Assoc.	234.11 234.12
CHURCH	None		Possible remote control glider issues.	64.00 64.01 64.02
CHURCH OF CHRIST	None		Has an inholding. Access point shown on 1991 Open Space Trails map.	238.00

PROPERTY	ACQUIRED	S/T/R	ACRES	OWNERSHIP	PUBLIC EASEMENT	"RIGHT-OF-WAY"*	PRIVATE EASEMENT
CITY ON THE HILL	01-Jan-87	14-1S-70W	12.578	Fee Purchase	None	None	None
CLOUGH	15-May-96	02-1S-70W	19.952	Fee Purchase	None	None	Clurman has 30' wide access & utility easement.
CLYNCKE, MARY	28-May-93	03,04-1S-70W	6.322	Fee Purchase	- 150 ft. wide easement & ROW for installation, construction, repair, maintenance and reconstruction of channel and other improvements for flood control and drainage purposes, - 10 ft. wide easement for installation, construction, repair, maintenance and reconstruction of an 8-in water main. - Quit Claim Deed from County to City for a 60 ft to 90 ft wide road ROW running generally North -South.	- ROW for Hogan's lateral over and across the south portion. - ROW for Anderson Ditch over and across the south portion. - ROW for South Boulder Road over and across the south portion, - ROW as conveyed by Mary Hogan Clyncke.	- Easement and ROW to new Dry Creek Ditch Co.
COHAGEN	05-Aug-92	36-1N-70W	13.146	Fee Purchase	None	ROW's for Cottonwood Ditch No. 2, Cottonwood Ditch No. 1 & Dry Creek.	None

PROPERTY	CONSERVATION EASEMENT	MINERAL RIGHTS	OTHER	ID #
CITY ON THE HILL	None		Access point shown on 1991 Open Space Trails map.	175.00
CLOUGH	None		Purpose of the acquisition is to connect Klein Open Space to other Open Space properties on South Boulder Road for a possible trail route. Protective covenants did not jeopardized open space purposes. City Council approved acquisition by condemnation. refer to conditions in access file. City shall retain a one-sixth (1/6) interest in the road and City to contribute their share of expenses related to maintenance of road. City agrees that the access road from point 150 feet south of its juncture with Baseline Road shall not be utilized by members of the public for access to the City Property. *Special concern for trail use & neighbors. Refer to Klein property.*	283.00
CLYNCKE, MARY	None		$15,000 budgeted for fencing and a habitat overlook to create an orchid viewing area. Mapped as Wetland #138, *Spiranthes diluvialis* present	257.00 257.01 257.02 257.11 257.12
COHAGEN	None		- Subdivision Agreement developer's obligations: private road to serve development, maintained by the HOA of Mallard Pond Estates. - Grantor shall be responsible for construction & maintenance of fences & gates on Property except fence between Parcels 1 & 2, constructed by Grantee & jointly maintained by parties. - Property is strategic for eastern buffer & proposed trail system thru Dry Creek area. City will designate certain portion of 17 acres purchase as trail corridor & will construct a fence between 17 acre City ownership & 20 acre Con. Ease.	222.00

PROPERTY	ACQUIRED	S/T/R	ACRES	OWNERSHIP	PUBLIC EASEMENT	"RIGHT-OF-WAY"*	PRIVATE EASEMENT
COHAGEN, CONSERVATION EASEMENT	05-Aug-92	C - 3 6 - 1N-70W	22.167	Conservation Easement	None	None	None
COLORADO OPEN LANDS I, Parcels A, B & F	A- 11-July-84 B- 11-July-84 F- 20-Nov-84	22-1N-70W	A=1.97 B=.875 F=29.149 Total= 31.993	Fee Purchase	- Easement for Fourmile Creek and for water and sewer utility lines.	ROW for the Erving Pipeline No. 1	- Access road being a 30 feet wide strip of land. -Temporary ingress/egress easements for the Flatiron Paving Co. In full force and effect until such time as the road know as Pearl Street Parkway is completely constructed and usable between Vlmont Road and 63rd. Street north of Andrus Road.
COLORADO OPEN LANDS II, Parcels 57 & 58	13-Nov-85	28-1N-70W	32.339	Fee Purchase	None	None	None

PROPERTY	CONSERVATION EASEMENT	MINERAL RIGHTS	OTHER	ID #
COHAGEN, CONSERVATION EASEMENT	- Uses restricted to agricultural, wildlife habitat & open space purposes. Use of the Property for business purposes of any kind other than farming is expressly prohibited. - Grantor shall be responsible for the construction and maintenance of all fences and gates on the Property, except that the fence between Parcel 1 & Parcel 2 which shall be constructed by Grantee and jointly maintained by the parties. - Grantee recognizes the right of the Grantor to utilize or rent the Property as a tree farm, for grazing animals, raising crops & nursery stock.			222.01 222.21
COLORADO OPEN LANDS I, Parcels A, B & F	None		- Property to be used solely for "open space" purposes. - Flood Control improvements to be done to enhance Open Space. Any improvement reasonably necessary for flood control purposes that is a permitted use may be constructed on the Property - possible trail corridors to connect to Pearl St. bike trail and the Boulder Creek trail, to downtown - A roadway, parking areas and restroom facilities may be constructed within the right-of-way. - Flatiron Co. has a permanent ROW from the access road to the Pearl Street Parkway. *Complex restrictions exist, access point issues exist.*	136.01 136.02 137.02 137.03
COLORADO OPEN LANDS II, Parcels 57 & 58	None		Reclamation Agreement with Flatiron Co. to reclaim Parcels 57 & 58.	145.02 145.03 145.04 145.05

PROPERTY	ACQUIRED	S/T/R	ACRES	OWNERSHIP	PUBLIC EASEMENT	"RIGHT-OF-WAY"*	PRIVATE EASEMENT
COLORADO OPEN LANDS, KOA LAKE	13-Nov-85	27-1N-70W	17.120	Fee Purchase	- Water Storage Contract between City of Boulder, Colorado and Flatiron Pre-mix Concrete Co. for Water Storage Space in KOA Lake.	None	- a non-exclusive perpetual easement to Flatiron for an enlargement to the Reservoir and for Reservoir outlet works. - Flatiron has the right to utilize 18 acre-feet of storage space in the Reservoir. Contract shall continue in full force and effect for 30 years. - Flatiron Pre-mix Concrete Co. to use the upper one foot of the KOA Lake for storage of water and to build, operate & maintain dike. Flatiron may use improvements for Butte Mill water stored in KOA Lake; for Behrman Ditch Reservoirs & Slough & Dry Creek; for Butte & Ellen & Hixon Irrigation ditches. - for ingress and egress, as granted to Pollie R. Addison by Kenneth G. Hendrick; for water and sewer utility line. - to survey, construct, operate, maintain, control, repair, replace utility lines, sanitary sewer line, for the Dry Creek and Dry Creek No. 2 drainage & irrigation facilities, road and utility purposes, easement for uninterrupted flow of South Boulder Creek and the Jones & Donnelly Ditch & Leggett Outlet Ditch.

PROPERTY	CONSERVATION EASEMENT	MINERAL RIGHTS	OTHER	ID #
COLORADO OPEN LANDS, KOA LAKE	None		- O'Neal is interested in correcting the water situation by getting an out-of-city tap or by annexing. - Open Space and Transpo. propose routing of "Valmont Connector" within the 57th St. road easement. - OSBT recommended construction of Phase I of South Boulder Creek Trail proposed from Boulder Creek Trail to Flatiron Industrial Park. - Agreement with CU, whereas the parties are interested in preserving and managing riparian habitats and are interested in the creation, development and management of a pond on City owned land. *Possible hazardous materials issue*	145.01

PROPERTY	ACQUIRED	S/T/R	ACRES	OWNERSHIP	PUBLIC EASEMENT	"RIGHT-OF-WAY"*	PRIVATE EASEMENT
COLORADO OPEN LANDS I, Parcels C & E	20-Nov-84	28-1N-70W	C=4.409 E=8.883 Total= 13.292	Fee Purchase	None	None	- for the Butte Irrigating Ditch - to construct, reconstruct, operate, maintain and repair its lines of telephone & telegraph as granted to the Mountain States Telephone & Telegraph Co
COLORADO OPEN LANDS I, PARCEL D COTTONWOOD POND	20-Nov-84	28-1N-70W	19.818	Fee Purchase	None	None	- for PSCo steel tower electric transmission line - for constructing, installing, operating, maintaining, inspecting, repairing, relocating and replacing all or any part of sanitary sewer, effluent, out-fall line.
COPPER DOOR	31-Mar-82	27-1N-70W	1.7	Scenic Easement (Dedication)	- Grantor shall not construct any structure of any kind, dump garbage, change the general topography or remove trees. - Grantor may construct two-lane bridges across South Boulder Creek. - Subdivision Agreement for a bicycle and pedestrian trail from Arapahoe Avenue to the northwesterly corner of the property. - An easement for the installation, construction, repair, maintenance and reconstruction of a public bicycle and pedestrian/equestrian trail along the creek.	None	None
CORZINE (CENTENNIAL TRAIL)	01-Jun-83	33-1N-70W	0.486	Scenic Easement (dedication)	- Grantor shall not construct any structure of any kind, dump garbage, change the general topography or remove trees. - Maintenance is the responsibility of the grantor. - Annexation Agreement states applicant must construct at no cost to the City, a bikeway along the southern property line of the property.	None	None
COTTONWOOD FARMS	18-Dec-90	22-1N-70W	22.529	Fee Purchase (Donation)	None	None	None

PROPERTY	CONSERVATION EASEMENT	MINERAL RIGHTS	OTHER	ID #
COLORADO OPEN LANDS I, Parcels C & E	None		- Agreement that Flatiron perform reclamation work on the Reclamation Parcels in accordance with the reclamation plan. - A roadway may be constructed within the ROW area which shall be exempt from the restrictive covenants.	137.04 137.06
COLORADO OPEN LANDS I, PARCEL D COTTONWOOD POND	None		- Syntex requested an access right for a pipeline which is needed to remedy off-site groundwater contamination. - Agreement that Flatiron perform reclamation work on the Reclamation Parcels to seed reshaped area. Flatiron will guarantee the survival of the revegetation for a period of twenty four months.	137.01
COPPER DOOR	None			98.11 98.12
CORZINE (CENTENNIAL TRAIL)	None		Neighborhood does not want trail linked to anything nor a 10' wide concrete bikeway	116.10
COTTONWOOD FARMS	None			190.00 190.11 190.12

PROPERTY	ACQUIRED	S/T/R	ACRES	OWNERSHIP	PUBLIC EASEMENT	"RIGHT-OF-WAY"*	PRIVATE EASEMENT
COTTONWOOD GROVE	01-Jun-83	28-1N-70W	28.567	Fee Purchase	None	None	None
COUNTRY MEADOWS SUBDIVISION	11-July-88	30-34-1N-70W	.628	Scenic and Trail Easement (Dedication)	- A scenic and trail easement, maintenance of the scenic area shall be the sole responsibility of the Grantor, except for the trail, which will be maintained by Grantee. - Estate of Louise Viele shall dedicate to the City an open space, scenic and trail easement along the Wellman Canal extending 100 feet in a southerly direction starting at the north property line.	Revocable license for trail corridor on southerly portion of property.	None
DAMYANOVICH	09-Sep-95	14-1S-70W	78.771	Fee Purchase	None		- 20 ft. wide for a water pipeline. - An easement 50 ft wide for gas pipeline.
EASON	04-Oct-97	34-1N-70W	1.388	Fee Purchase	None	None	None
ECCHER	01-Jan-73	24-1N-70W	7.989	Fee Purchase	None	ROW as granted to the Leggett Ditch and Reservoir Co.	None
FANCHER	06-Oct-89	16-1S-70W	17.607	Fee Purchase (Donation)	None	None	

PROPERTY	CONSERVATION EASEMENT	MINERAL RIGHTS	OTHER	ID #
COTTONWOOD GROVE	None		- The Cottonwood Grove is accessible to the public only by special permit and then only for research purposes. - OSBT approved an agreement with CU to provide research facilities and a management plan for the Cottonwood Grove. - Syntex Chemical granted easement for ingress and egress by City for maintenance, patrol and emergency access to property.	103.20
COUNTRY MEADOWS SUBDIVISION	None		- Will need to coordinate configuration of park site with approved wetland mitigation plan. Wetlands will need to be protected with conservation easement to City with maintenance to remain with owners of fee interest. - Storm sewer must not be located on City of Boulder property line.	300.10
DAMYANOVICH	None		This parcel is in two management areas. Only the portion north of Hwy. 170 is applicable to the South Boulder Creek Management Area.	276.01 276.21
EASON	None		1.388 acres of property in fee plus a non-exclusive 10ft. wide access easement to be acquired.	288.00
ECCHER	None			33.00
FANCHER	None		- Lafayette water line runs through it near east boundary.	216.00 216.10

PROPERTY	ACQUIRED	S/T/R	ACRES	OWNERSHIP	PUBLIC EASEMENT	"RIGHT-OF-WAY"*	PRIVATE EASEMENT
FLATIRON INDUSTRIAL PARK	01-Jan-73	27-1N-70W	30.414	Fee Purchase (Donation)	None	Easement and ROW for Jones and Donnelly ditch & for Leggett Outlet Canal.	- For electric transmission line as granted to PSCo. - Easement for electric transmission lines, water line purposes & sewer line purposes.
FOOTHILLS PARKWAY INDUSTRIAL PARK	01-Jan-84	28-1N-70W	0.394	Scenic Easement	15' on either side of North Boulders Farmers Ditch.	None	None
FORSBERG	14-Nov-97	25-1N-70W	2.316	Fee Purchase	None	None	None
GALLUCCI	15-Sep-68	14-1S-70W	49.555	Fee Purchase	City approval to Convey to the County a 10-ft. strip of land which lies immediately to the N of HWY 36 and parallel & adjacent to the Gallucci and Salaman properties.	None	-Easement for poles, wires and incidental purposes, as granted to the PSCo. - 20 feet wide easement for water pipe lines.
GATEWAY (UNIVERSITY OF COLORADO)	17-Sept-97	16-1S-70W	.518	University ownership	N/A	N/A	N/A

PROPERTY	CONSERVATION EASEMENT	MINERAL RIGHTS	OTHER	ID #
FLATIRON INDUSTRIAL PARK	None		- Purpose of gift to City included flood control and City agreed to maintain for such. Public Works recommended the proposed composite channel design be constructed by the Urban Drainage and Flood Control District. - The City and the Flatiron Companies have agreed to maintain a 75-foot wide corridor. - The City has agreed to modify the flood channel of South Boulder Creek on the Flatirons Industrial Park. - OSBT approved delivery of subsurface water from US West for beneficial use on Open Space wetlands. US West has agreed to monitor the water quality for the City 2 times per year and provide results.	35.10
FOOTHILLS PARKWAY INDUSTRIAL PARK	None			121.10
FORSBERG	None		This purchase removes a significant inholding, protects the shoreline and wildlife area near the Valmont Power Plant and would allow land management staff to move from the inadequate space and nonconforming use at the South Foothills location and to move other staff as needed.	289.00
GALLUCCI	None		Next to scenic overlook. Access from Louisville may become an issue.	4.00
GATEWAY (UNIVERSITY OF COLORADO)	N/A		- The University granted to the City a non-exclusive, revocable license for the construction, repair, maintenance and reconstruction of a public gravel pathway. - The City shall be responsible for the construction and subsequent maintenance of the trail corridor. - The City and the University shall design and prepare educational and interpretive signs and materials describing the importance of the South Boulder Creek floodplain.	298.1

PROPERTY	ACQUIRED	S/T/R	ACRES	OWNERSHIP	PUBLIC EASEMENT	"RIGHT-OF-WAY"*	PRIVATE EASEMENT
GEBHARD	01-Jan-71	03-1S-70W	104.33	Fee Purchase	- Easement to the City of Lafayette for a period of 20 years, for the installation, construction, reconstruction, repair and maintenance of a water diversion facility. - 15 ft wide easement agreement between Greenbelt Associates and the City of Louisville for measurement and recording devices for purposes of maintaining and otherwise visiting the devices. - Grant of Easement to the City of Louisville for a underground pipeline. Louisville agrees that in the event it does not use the easements it is granted for the purpose for which they were requested within two years or if abandoned, they will revert to Boulder. - Grant of Easement to the City of Lafayette and the Baseline Land and Reservoir Co. for the purpose of constructing, maintaining, operating, repairing and reconstructing an access road turnaround and small parking area.	- A 40 ft wide ROW for the Enterprise Ditch. - a 45 ft wide ROW for the new Dry Creek ditch. - an undefined ROW for the McGinn Ditch	A 25 ft. wide sanitary sewer easement across the Westerly portion. Staff has negotiated with the owners to quit claim deed an area of land along the fence line to open space in exchange for the sewer easement. - Temporary utility easement was granted to PSCo for $10.00 for 18 months to relocate the power pole and guy wires. - Easement and ROW to Baseline Land and Reservoir Co. for the purpose of constructing, maintaining, operating, repairing and reconstructing an irrigation ditch, together with the right of ingress and egress.
GREENBELT MEADOWS SUBDIVISION	01-Jan-84	03-1S-70W	0.272	Access Easement (Dedication)	The developer has made dedications within the subdivision for access to open space, including pedestrian access to West. The maintenance of these easements, except along the Viele channel is to be the responsibility of the homeowners.	None	None
HARRINGTON	01-Mar-95	16-1N-70W	7.191	Fee Purchase	None	None	None
HATCH-QUINBY-PHIPPS	31-Dec-85	33-1N-70W	7.90	Fee Purchase (Donation)	Permanent easement as granted to State Department of Highways	None	None

PROPERTY	CONSERVATION EASEMENT	MINERAL RIGHTS	OTHER	ID #
GEBHARD	None		- Gate with Greenbelt Meadows Subdivision agreement, no trail. - Received Quit Claim Deed to 15' along the boundary w/Greenbelt Meadows. *Spiranthes Diluvialis present, Prebles Jumping Mouse likely present.*	13.00
GREENBELT MEADOWS SUBDIVISION	None		- Annexation agreement, applicant will provide public access to Open Space. - Received Quit Claim Deed to 15' along boundary w/Gebhard.	128.10
HARRINGTON	None		$6,000 was authorized for fencing and removal and replanting trees.	271.00
HATCH-QUINBY-PHIPPS	None	None	- City accepts gift from Hatch / Quinby / Phipps for Open Space. Staff to construct a bench on property with plaque indicating name of parcel and that it was donated to City by the owners. - City approves non-exclusive, revocable license issued to the Utilities Division for the construction of a 12-inch water line.	164.10

PROPERTY	ACQUIRED	S/T/R	ACRES	OWNERSHIP	PUBLIC EASEMENT	"RIGHT-OF-WAY"*	PRIVATE EASEMENT
HOGAN BROTHERS	02-Apr-86	15-1S-70W	106.8	Fee Purchase	Easement Agreement recorded January 23, 1969.	- ROW's for Co. Rd. No. 109 (Cherryvale Drive) and for Co. Rd. No. 107 (Marshall Drive) which is also known as State HWY No. 170. - ROW for the Davidson Ditch.	Road easement across certain portion of SE1/4 Sec 15-15-70W for common use of road by Church.
HOOVER HILL	20-Aug-77	02-1S-70W	2.314	Fee Purchase	None	None	None
JAMES, ACCESS EASEMENT	12-Nov-81	15-1N-70W	.317	Access Easement	Access Agreement to the City in perpetuity for the purposes of installation, construction, public use, repair, maintenance and reconstruction of a 9' wide pedestrian and equestrian trail with fencing required.	None	None
JAMES, AIR SPACE (RIGHTS) RESTRICTION	12-Nov-81	15-1N-70W	15.833	Air Rights Agreement	Air Rights Agreement in perpetuity for the purposes of preserving, controlling and protecting for scenic and open space purposes all of the area over and above an elevation of 5265.8 feet.	None	None
JAMES DEVELOP-MENT RIGHTS	12-Nov-81	15-1N-70W	4.424	Development Rights	Access Agreement with the City in perpetuity for the purposes of installation, construction, public use, repair, maintenance and reconstruction of a 9' wide pedestrian and equestrian trail. Fence required.	- For North 57th Street. - ROW for a lateral ditch as constructed.	
JIRKOVSKY	06-Feb-95	14-1S-70W	10.1	Fee Purchase	None	None	None

PROPERTY	CONSERVATION EASEMENT	MINERAL RIGHTS	OTHER	ID #
HOGAN BROTHERS	None	Seller reserved all minerals and such surface rights.	20-year grazing lease with Albert and Leo Hogan.	165.00
HOOVER HILL	None		Included: buildings, fences, roads, pumps, machinery, and other improvements thereon.	62.00
JAMES, ACCESS EASEMENT	None		*Access Issues Exist.*	91.01 91.21
JAMES, AIR SPACE (RIGHTS) RESTRICTION	None			91.22
JAMES, DEVELOPMENT RIGHTS	None			91.00
JIRKOVSKY	None		Survey shows that we legally own the property on which Maumquist had the dirt deposited and that we did not trespass onto such land when we removed the dirt.	286.00

PROPERTY	ACQUIRED	S/T/R	ACRES	OWNERSHIP	PUBLIC EASEMENT	"RIGHT-OF-WAY"*	PRIVATE EASEMENT
KLEIN	01-Jan-74	02-1S-70W	74.802	Fee Purchase	None	None	- Klein reserved a utility easement for water, sewer & gas pipes, electrical cables & phone & television cables. Klein will restore disturbed areas by smoothing the area and planting native grasses or other acceptable plantings. - Klein reserved an easement 20 ft. wide along S. border of Western Tract to construct, install & maintain an irrigation ditch lateral from McGinn Ditch. - Easement Agreement for installation, construction, reconstruction, repair & maintenance of a subsurface water pipeline.
LAKECENTRE, LTD. I	17-Apr-92	22-1N-70W	5.675	Fee Purchase (Donation)	- A permanent easement and ROW for the installation, construction, repair, maintenance and reconstruction of sanitary sewer line and appurtenances. - Easement and ROW for 1)pump house and water supply pond, 2)pipeline easement from trailer court site to pump house, 3)sewer treatment plant site & 4)pipeline from trailer court site to sewer line plant site. - Encroachment of fence along E line of subject property. - A non-exclusive right to use any & and all easements & ROW as they may exist on the ground pertaining to access for ingress, egress & maintenance purposes for water and sewer purposes servicing San Lazaro Mobile Home Court. - Easement and ROW for raceways	None	- Grantor reserved all historical rights for the drainage and discharge of storm water or other surface water. - Utility easement as reserved to the Mountain States Telephone & Telegraph Co. - Easements pertaining to both real estate and water & ditch rights, lateral ditches.
LAKECENTRE, LTD. II	17-Apr-92	22-1N-70W	1.36	Fee Purchase (Donation)	- Utility easement as reserved to the Mountain States Telephone & Telegraph Co. - Access agreement to Lakecentre Ltd.,	- Easement and ROW for Co. Rd. No. 10.	None

PROPERTY	CONSERVATION EASEMENT	MINERAL RIGHTS	OTHER	ID #
KLEIN	None		- City agrees that it will not contest, protest or object to any application by Klein for rights to construct domestic wells to serve houses located on the land now owned by Klein contiguous to the Western Tract being retained by Klein. - City has entered into an agreement with Kleins regarding the location of any trail construction west of the Clurman house. Refer to agreement dated 5-12-97	42.00 42.01 42.02
LAKECENTRE, LTD. I	None		Agreement with Lake Center Partnership regarding acquisition of the ROW, Open Space, and buffer areas for Pearl Parkway. The deed contains a reverter clause which says that if the City has not commenced construction of Pearl Parkway Extension on this parcel by Sept. 12, 2001, then the parcel ownership goes back to Lakecentre Ltd.	214.10
LAKECENTRE, LTD. II	None		- Part of "Straty Property". Terms, agreements, provisions, conditions and obligations concerning Open Space, flood control & bike trail are contained in warranty deed from Lakecentre Ltd. - Lakecentre granted sufficient land not to exceed 68 ft wide for a connector road over and across the "Straty Property" as generally depicted on Exhibit A, to connect 61St. N. of Pearl St. to the Airport Blvd. Extension.	223.10

PROPERTY	ACQUIRED	S/T/R	ACRES	OWNERSHIP	PUBLIC EASEMENT	"RIGHT-OF-WAY"*	PRIVATE EASEMENT
LAUFFEN-BERGER TRAIL	31-Dec-85	15-1S-70W	0.587	Fee Purchase (Donation)	None	None	None
LENTSCH	12-Oct-95	34-1N-70W	1.899	Fee Purchase	Seller shall grant easements to the City of Boulder for the existing water and gas lines and grant a right of way across their remaining parcel for the re-located drive and bridge if the City's survey indicates that the drive and bridge would be an encroachment on the Seller's remaining parcel.	None	None
LEWIS	28-Oct-92	36-1N-70W	57.657	Fee Purchase	Boulder Co. Transportation easements for a road widening project on the Swartz & Lewis Open Space properties on the 75th/76th St. corridor between Arlington Dr. and the Union Pacific Railroad.	A ROW granted to the Colorado Central Railway Co.	- An easement 10 ft. wide for communication systems, as granted to The Mountain States Telephone & Telegraph Co. - Easement for Railroad ROW over the Northeast corner.
LOUSBERG	30-May-96	16-1N-70W	90.299	Fee Purchase	A permanent easement for 51st Street for roadway purposes.	- A permanent right of way 4 ft. in width for ditch purposes. - A ROW for Jay Road & for Co. Rd. No. 51	An easement for water pipeline granted to Boulder Valley Water Users Association
MARSHALL	07-Sept-97	02-1S-70W	60.05	Fee Purchase	None	None	None

PROPERTY	CONSERVATION EASEMENT	MINERAL RIGHTS	OTHER	ID #
LAUFFEN-BERGER TRAIL	None		A fence agreement was proposed but may not have been executed. Acquired through County and NUPUD & subdivision process. *Trail that dead ends.*	122.00 122.10
LENTSCH	None		- Access to the property is from 63rd Street. - $12,775 is allocated for the removal of the building and debris & reclamation of the site. - Board of County Commissioners approved Sombrero Marsh community Facility Lot Split subject to the following conditions: A management plan addressing future uses and maintenance of the property, mosquito control, weed control, and ditch maintenance shall be submitted to Co. staff. - Keep the 6 ft. chain link fencing south of the ditch. - Lentsch's have the right, under the contract, to remove the existing chain link fencing and use it elsewhere.	278.00
LEWIS	None		Maintenance and use of house and barn need to be addressed.	250.00
LOUSBERG	None		- Building in the SE corner of property to be removed pursuant to OSBT direction. Removal planned for 1998. - Left Hand Water District requested a 10 ft. wide easement on a portion of property abutting existing ROW - Seller reserved right & ability to rebuild fence separating backyard from land the City of Boulder Open Space acquired. This does not give permission to access through fence to the Open Space or to build a gate in new fence giving private access to Open Space.	284.00
MARSHALL	None		- A 20 foot wide corridor along the east side of the conservation easement will be purchased in fee to provide a trail connection from Baseline Road to South Boulder Road. - City has leased back the property to the Marshalls for agricultural purposes for a period of five years beginning 09-17-97.	294.00

PROPERTY	ACQUIRED	S/T/R	ACRES	OWNERSHIP	PUBLIC EASEMENT	"RIGHT-OF-WAY"*	PRIVATE EASEMENT
MARSHALL, CONSERVATION EASEMENT	07-Sept-97	02-1S-70W	17.00	Conservation Easement	None	None	None
MATHESON	11-Jul-88	15-1S-70W	3.254	Conservation Easement	None	None	Grant of Limited Access Easement for the purpose of ingress and egress for maintaining and re-drilling the domestic well. Grantee agrees to give Grantor (City) 24 hours notice when easement will be used.
McKENZIE	12-Aug-74	16,21-1N-70W	230.25	Fee Purchase	None	- A ROW over property to be acquired from the City in order to allow access & free passage to Grantors' property. - ROW for Boulder & White Rock Ditch	- Easement to be used only for the purpose of constructing and maintaining a natural gas line. - McKenzie has right of access to existing irrigation facilities on adjacent property acquired by City from Grantor ("Open Space"), to allow exercise of Grantor's water rights necessary to serve Property.

PROPERTY	CONSERVATION EASEMENT	MINERAL RIGHTS	OTHER	ID #
MARSHALL CONSERVATION EASEMENT	- The conservation easement restricts future development to a single family residential use. - Grantee has the right to enter the property after prior notice to Grantor. - No public access is granted. - Grantor is responsible for all fences and gates on the property.			294.20 294.50
MATHESON	- OSBT recommended that an access easement be granted in exchange for a conservation easement. - This easement does not include the right of public access. - 24 hour advance notification is required by City to enter easement. - Grantee agrees to restore any area grantee disturbs within the conservation easement.		No public access	183.00 183.20
McKENZIE	None			38.00

PROPERTY	ACQUIRED	S/T/R	ACRES	OWNERSHIP	PUBLIC EASEMENT	"RIGHT-OF-WAY"*	PRIVATE EASEMENT
McKENZIE, DEVELOPMENT RIGHTS	12-Aug-74	16,21-1N-70W	80.00	Development Rights	Scenic & Planting Easement to the City for purpose of protecting and enhancing Fourmile Canyon Creek's scenic attractiveness.	ROW for Boulder & White Rock Ditch & ROW for Four Mile Creek	None
MERLE-SMITH	09-Aug-91	35,36-1N-70W	24.441	Fee Purchase	Planting easement as granted to the State Dept. of Highway for road purposes.	None	
METHVIN	02-Oct-84	35-1N-70W	36.148	Fee Purchase	Slope Easement is for the purpose of providing and maintaining lateral support & a proper drainage grade.	- ROW for Cottonwood Ditch & Dry Creek. - ROW 30 ft wide along the southerly property line for Co. Rd. No. 56	-Seller reserved an access easement to a house and outbuildings located at 6801 Baseline Road. - Easement 75 ft. wide granted to PSCo for electric transmission and distribution lines.
MOAD/ CILLESSEN	18-May-92	16-1S-70W	0.22	Fee Purchase Moad = 1/3 Cillessen = 2/3	None	None	- Easement for ingress & egress and to construct, reconstruct, repair, replace or maintain and operate the irrigation ditch and appurtenant facilities. - 16 ft. access easement for access to other portions of the property. - In addition to the gates listed in the original Agreement, Reg Howard may install four additional gates, each approximately 8 ft. in length. (May have been extinguished by purchase of Rolling Rock)

PROPERTY	CONSERVATION EASEMENT	MINERAL RIGHTS	OTHER	ID #
McKENZIE, DEVELOPMENT RIGHTS	None		- Deed of Development Rights to construct up to five additional detached dwelling units restricted to living Grantors or living children of Grantors including the living children of Cynthia M. Webber. - City will maintain Open Space reasonably free from noxious or proliferating weeds and will reasonably prevent such weeds from spreading. - City will establish a formal program for the maintenance and improvement of the existing trees, bushes, shrubs and grass along the Boulder and White Rock Ditch and along Fourmile Canyon Creek.	39.20
MERLE-SMITH	None		- All other improvements not included in the sale shall become the property of the Purchaser if not removed by the expiration of the one year period. - Public access to leased site shall be discouraged to the extent consistent with Open Space Dept. policies.	229.00
METHVIN	None		The property could be an important trail linkage in the area of Dry Creek leading toward 75th & Teller Farm area. An old trails plan map showed a proposed trail along the Enterprise Ditch.	134.00
MOAD/ CILLESSEN	None		Moad Estate re: Road on Rolling Rock Ranch Property.	215.00 215.01

PROPERTY	ACQUIRED	S/T/R	ACRES	OWNERSHIP	PUBLIC EASEMENT	"RIGHT-OF-WAY"*	PRIVATE EASEMENT
N.B.I.	17-Feb-82	21-1N-70W	0.723	Access Easement (Dedication)	- Grant of Easement for the installation, construction, repair, maintenance & reconstruction of a bike path. - Easement Agreement for 30 ft wide pedestrian, equestrian & bicycle easement for public ingress & egress over & across the NBI site.	None	None
NOBLE PARK	12-May-92	21-1N-70W	.59	Scenic Easement	- Scenic and trail easement along Boulder and Left Hand Ditch, 60' in width centered on the center line of the ditch. The subdivider shall provide improvements as shown on the engineering plans.	None	None
NORTHCREEK	13-July-88	16-1N-70W	.371	Scenic Easement	- City may not have received intended scenic easement along Boulder and White Rocks Ditch through the northcreek subdivision in Outlot "K". - A 15' wide bike and pedestrian easement is located in Outlot "D". - A 50' wide scenic easement located in Outlot "D" and in Outlot "H".	None	None
NU-WEST	28-Sep-84	16-1N-70W	73.853	Fee Purchase	- Permanent easement as granted to the Department of Highways - Easement & ROW for uninterrupted flow of Boulder Whiterock Ditch.	ROW for Co. Rd. 51 (n. 51st St.)	None
OAKLEY	07-Jun-95	11-1S-70W	93.7	Conservation Easement	None	None	None

PROPERTY	CONSERVATION EASEMENT	MINERAL RIGHTS	OTHER	ID #
N.B.I.	None		Easement Agreement, NBI shall construct gates across the fire access road at Independence Road and at the north line of the NBI property to Fire Dept. standards & such gates shall be locked at all times. Owners constructed bridge across ditch to COB side.	95.10
NOBLE PARK	None			152.10
NORTHCREEK	None			232.10
NU-WEST	None			135.00
OAKLEY	- The Grantors shall not erect any buildings, barns, or other permanent structures except livestock storm shelters, upon that portion of the Property outside of the building envelopes. - The Grantors shall have the right to construct two additional residential dwellings and attendant outbuildings on the Property within the building envelopes. Dwellings not to exceed 5,000 s.f. each. - Grantors may restrict public access to the property. - Grantors shall be responsible for all fences and gates.	None - covenant not to develop	Future development on the property will be limited to two new single-family income homes not to exceed 5,000 sq. ft. each.	274.00 274.20

PROPERTY	ACQUIRED	S/T/R	ACRES	OWNERSHIP	PUBLIC EASEMENT	"RIGHT-OF-WAY"*	PRIVATE EASEMENT
PADDOCK	29-Dec-95	22-1N-70W	17.893	Conservation Easement (Donation)	25' wide sewer easement to the City	None	Telephone easement over easterly portion.
PARKSIDE VILLAGE	10-Apr-94	21-1N-70W	.47	Scenic Easement (Dedication)	- Scenic and trail easement 60' in width from the center line of Boulder Left Hand Ditch. -Subdivision agreement states the developer to construct a bike path and pedestrian way located within the Scenic Easement running from Airport Road to the west property line of Lot 1. As of Jan. 98' no action has been taken.	None	None
PEARL STREET INDUSTRIAL PARK	01-Jan-83	28-1N-70W	0.325	Public Use Easement (Dedication)	Grant of Easement for Public Use for the installation, construction, repair, maintenance and reconstruction of a 15 ft. wide bicycle & pedestrian path.	None	None
PLUM CREEK	19-July-85	21-1N-70	.51	Scenic Easement (Dedication)	Scenic & Trail Easement 60' wide located within the Plum Creek Subdivision. Grantor assumes maintenance responsibility.	None	None
POSTLE	21-Jun-83	21-1N-70W	0.312	Scenic Easement (Dedication)	None	None	None
REICH	01-Jan-72	14-1S-70W	25.021	Development Rights	None	None	- Grantors shall have the right to build a storage barn, guest house and covered riding ring on the property. - Grantors shall have the right to construct recreational facilities.

PROPERTY	CONSERVATION EASEMENT	MINERAL RIGHTS	OTHER	ID #
PADDOCK	- Easement prohibits public access and trails on property. - Grantor is responsible for all maintenance. - Grantor reserves the right to use the property.			280.20
PARKSIDE VILLAGE	None			242.10
PEARL STREET INDUSTRIAL PARK	None			102.10
PLUM CREEK	None		Existing trail. Issue involving house encroachment onto easement.	101.11 101.12
POSTLE	None		Bike path that was required through Woodridge PUD has never been built.	109.10
REICH	- Development rights agreement conveyed to the City included the right to erect any structure, to park portable living quarters. - Grantor has right to exclude public from entering property. - Grantor has right to construct structures pursuant to agreement dated 9/14/72		No public access is granted. May be trail access issues to Gallucci.	21.20

PROPERTY	ACQUIRED	S/T/R	ACRES	OWNERSHIP	PUBLIC EASEMENT	"RIGHT-OF-WAY"*	PRIVATE EASEMENT
REYNOLDS	01-Mar-77	21-1N-70W	18.482	Fee Purchase	- Easement for sanitary sewer and storm sewer lines. - Clear zone easement over Hayden Lake acquired by Rule & Order of the District Court.	- Easements & ROW for Boulder & White Rock Ditch. - Easement & ROW for Co. Rd. No. 18.	- Easement & ROW for Hayden Reservoir. - Easement & ROW to operate, maintain, replace & remove communications systems as granted to Mountain States Telephone & Telegraph Co. - NBI has a non-exclusive easement for secondary fire access. City Council is very specific in that access to Independence Rd. be limited strictly to an emergency access 12 ft. wide and that easement will never be used for secondary access to the NBI property.
RICHARDSON I	01-Jan-71	15,16-1S-70W	66.007	Fee Purchase	None	ROW for Boulder Co. Rd. No. 39, ROW for Davidson Ditch	None
ROBINSON DONATION	25-Nov-85	21-1N-70W	.163	Fee Purchase	None	None	None
ROLLING ROCK RANCH	23-May-92	16-1S-70W	58.567	Fee Purchase	None	60 ft. wide ROW for ingress & egress.	An easement and ROW for access and utility lines.

PROPERTY	CONSERVATION EASEMENT	MINERAL RIGHTS	OTHER	ID #
REYNOLDS	None		Lease Agreement, to Celestial Seasonings. Upon termination of Lease Lessee will plow under the herbs and plant the described property with a suitable grass seed so that the property will be secured by a grass cover. Celestial Seasonings' weeds may have contributed to weed patch.	61.01 61.11 61.12
RICHARDSON I	None	Existing mine shafts and subsidence.	- The Bureau of Mines has offered to attempt to extinguish a mineral fire on the Richardson I Property for either 46% of the cost or exchange of mineral rights. The Concrete and metal flume lining previously installed over this burning coal mine has deteriorated and needs to be replaced. The State Mined Land Reclamation Division has identified this as a feature meriting restoration with State funds earmarked for this purpose. - Site of "Ev Miller" house.	15.00
ROBINSON DONATION	None		Maintenance of this parcel will be combined with that of the adjacent Open Space land.	N/A
ROLLING ROCK RANCH	None	½ of all mineral rights, other ½ owned by Reg Howard (may be other ½ of Moad.)	- South Boulder and Bear Creek Ditch runs thru, connected to Tantra Park w/out a recorded easement. - A parking area will be provided along the southern edge of the Van Vleet Ranch upon the acquisition of the trail easement across the Rolling Rock Ranch property.	243.00

PROPERTY	ACQUIRED	S/T/R	ACRES	OWNERSHIP	PUBLIC EASEMENT	"RIGHT-OF-WAY"*	PRIVATE EASEMENT
SALAMAN	22-Sep-95	13-1S-70W	1.40	Conservation Easement	City approval to convey to the County a 10-ft. strip of land which lies immediately to the N of HWY 36 between Louisville & Cherryvale Rd., related to annexation through Open Space.	None	- Sellers reserved an ingress/egress access easement over the Property. - Purchaser shall re-fence the Property on its eastern boundary contiguous to City of Louisville within 2 years of date of closing. - Easement and ROW for electric transmission line as granted to PSCo. - An Easement for ingress & egress over the W 30 ft. of the property.
SHORT	24-Oct-80	11-1S-70W	50.147	Fee Purchase	- City approved sale to the County of a 10-ft. strip of land which lies immediately to the N of Hwy. 36 between Louisville & Cherryvale Road, related to annexation through Open Space. - The easement extension of Whaley Drive can be used by the City for ingress & egress & parking purposes.	A ROW for ditches & canals.	An easement for the existing Davidson Ditch, together with an easement 20 ft. wide, for ingress & egress for the maintenance of ditch lateral.
SHORT AND MILNE	01-Dec-71	22,23-1N-70W	55.34	Fee Purchase (Donation)	None	Easement & ROW for the W.W. Ferris Ditch.	- Easement and ROW for the Erving Pipeline No. 1.
SHORT AND MILNE-FREY LAND EXCHANGE	25-Nov-85	21-1N-70W	.451	Fee Purchase	none	None	Vacated ROW to be retained as a utility easement for all utilities.
SISK	01-Jan-83	28-1N-70W	0.763	Scenic Easement (Dedication)	Scenic easement 30' wide on each side of the center line of the Boulder and Left Hand Ditch.	None	None
ST. WALBURGA, CONSERVATION EASEMENT	11-July-96	02-1S-70W	30.00	Conservation Easement	Mutual Access Agreement across the property owned by Houck and across the property owned by the City. The parties are jointly responsible for the maintenance of a vehicle bridge over and across the McGinn Ditch.	ROW for the McGinn Ditch.	- Access Easement & Road Maintenance Agreement. - Easement for gas pipe lines & incidental purposes granted to PSCo. - Seller reserved a 25 ft. wide easement for utility purposes.

PROPERTY	CONSERVATION EASEMENT	MINERAL RIGHTS	OTHER	ID #
SALAMAN	None		Louisville Trail dead ends here.	277.20
SHORT	None		- The City has constructed and will maintain a fence between parcel "B" and Parcel "C". - The City will not construct sanitation facilities or picnic facilities on that portion of the land described in Exhibit 'B' which lies within a radius of 300 ft. from the Sellers' house. - The City has constructed and will maintain a fence on the northerly property line. *Trail by pad?* Trail access constructed at end of lane.	76.00
SHORT AND MILNE	None		Related to Valmont Connector issues. Last island of wildlife values.	19.10
SHORT AND MILNE-FREY LAND EXCHANGE	None		Vacation of the unused portions of 61st/63rd Streets & Andrus & a subdivision exemption on property located adjacent to 61st/63rd St. & Andrus Road.	19.11
SISK	None			114
ST. WALBURGA, CONSERVATION EASEMENT	- Houck agrees not to cultivate or sell plant species on the Property that are listed as noxious weeds by the State of Colorado. - Grantor further agrees to be responsible for the control of any plant cultivated or sold on the property. - Grantor may restrict public access to the property.		Boulder County Zoning Administrator has conditionally approved the Site Plan for Houck Residence/Barn/Barn addition/Greenhouses.	287.21 287.50 287.60

PROPERTY	ACQUIRED	S/T/R	ACRES	OWNERSHIP	PUBLIC EASEMENT	"RIGHT-OF-WAY"*	PRIVATE EASEMENT
ST. WALBURGA	11-Jul-96	02-1S-70W	20.036	Fee Purchase	- The City & Houck has executed a joint easement for ingress & egress in such a way as to avoid the wetlands and any populations of spiranthes diluvialis. - Houck has installed barrier fencing to protect the ladies' tresses orchid population along the access road from the construction activities.	The ROW for the McGinn Ditch	- Easement, for water pipeline for irrigation purposes. - Seller shall reserved a 25 ft. wide easement for utility purposes - Grant of Easement for purposes of a soil absorption system.
SUITTS	07-Jan-91	03-1S-70W	76.952	Fee Purchase	None	A ROW over said land to construct and maintain a ditch, as conveyed to the Base Line Land & Reservoir Co.	An Easement for construction of a domestic water well and with an easement for ingress & egress to the water well and waterline easements.
SUITTS, DEVELOPMENT RIGHTS	07-Jan-91	03-1S-70W	6.271	Development Rights	None	None	None
SUNRISE CENTER I, WEST	14-Sep-90	21-1N-70W	2.248	Scenic and Trail Easement (Dedication)	- A Scenic and Trail Easement 30' from either side of the centerline of North Boulder Farmers and Boulder and Left Hand Ditches. - The Subdivider shall provide a 10' wide bike path and pedestrian way within the easement as it abuts the North Boulder Farmers and Left Hand Ditches. Maintenance of the easement shall be the responsibility of the grantee. - 25' utility drainage easement along North boundary. - A 100' wide utility, drainage & future road easement along easterly portion of property.	None	- Grantor reserves the right to install a public road at grade and utilities and drainage facilities in the scenic area that will not unreasonable interfere with the trail. - Grantor must contact the Open Space Department prior to any construction.
SUNRISE CENTER II, EAST	05-Jan-90	22-1N-70W	2.251	Scenic and Trail Easement (Dedication)	- A Scenic and Trail Easement 30' from either side of the centerline of North Boulder Farmers and Boulder and Left Hand Ditches. - The Subdivider shall provide a 10' wide bike path and pedestrian way within the easement as it abuts the North Boulder Farmers and Left Hand Ditches.	None	None

PROPERTY	CONSERVATION EASEMENT	MINERAL RIGHTS	OTHER	ID #
ST. WALBURGA	None		- The parties acknowledge that Spiranthes diluvialis exist on the property and agree not to engage in any activity that would threaten damage or destroy the plant or its habitat. The parties agree to manage the property in ways which will enhance the habitat including, but not limited to, grazing. - The City shall not permit any public trail in the 200' corridor.	287.01
SUITTS	None		- The USFWS is concerned that a proposed trail will cause the eagles to abandon the area. - Fencing around the plantings, ponds and the house have not been completed as agreed upon. - Cultural resources should be addressed regarding historic structures.	203.00 203.01 203.02
SUITTS, DEVELOPMENT RIGHTS	None			203.21
SUNRISE CENTER I, WEST	None		None	205.10
SUNRISE CENTER II, EAST	None			213.11 213.12

PROPERTY	ACQUIRED	S/T/R	ACRES	OWNERSHIP	PUBLIC EASEMENT	"RIGHT-OF-WAY"*	PRIVATE EASEMENT
SYNTEX	01-Jan-86	28-1N-70W	0.558	Fee Purchase (Dedication)	None	None	None
UNION PACIFIC RAILROAD	10-Dec-85	22-1N-70W	4.498	Fee Purchase	None	None	None
UTE INDUSTRIAL PARK	16-Mar-95	25-1N-70W	76.331	Fee Purchase	None	None	- Utility, drainage & ditch easements for the Cottonwood No. 2 Ditch. - Easement & ROW of way for a water well, water line and water rights located on Lot 21.
VALMONT INDUSTRIAL PARK	31-Mar-80	22-1N-70W	7.608	Fee Purchase	An easement for a sewer main line 25 ft. wide.	Subject to a 30 ft. ROW along the South and Southeasterly lines for Valmont Road.	

PROPERTY	CONSERVATION EASEMENT	MINERAL RIGHTS	OTHER	ID #
SYNTEX	None		- Parcel is recognized by Parks Dept. as Open Space and their only interest may be use for future trails system. Arapahoe Chemicals quit-claimed for park for recreation and related purposes. - The applicant agrees to dedicate the land on the north side of Boulder Creek and permit access on the south side of the Creek across their property if it becomes necessary to the location of the Boulder Creek pathway system.	169.00
UNION PACIFIC RAILROAD	None	None	- Acquisition of approximately 5 acres of railroad ROW. - A section between 47th St. & 59th St. will be used for City projects, including the North Goose Creek Channel, Pearl Street & the Yards Master Plan. - A portion located between 55th & Valmont, will be for Open Space. - Seller agrees that all track & track material will be removed from the Sale Parcel prior to closing.	154.00 154.01 154.02
UTE INDUSTRIAL PARK	None		- A subdivision referral from the County mentions a trail across the property. While the subdivision was approved by the County, except for two buildings, it was never built. - A conceptual trail corridor in the area was removed from both the Boulder Valley and Boulder County Comprehensive Plans. The property was purchased in 1994 by City Open Space primarily for wildlife purposes and trails were not listed as a reason for purchase. - Valmont Reservoir is designated a wildlife sanctuary by the Colorado Division of Wildlife. - The Public Service Company is concerned about safety issues from currents created in the reservoir from the water used for power production.	268.00
VALMONT INDUSTRIAL PARK	None		OSBT recommend approval of the Valmont Connector Project.	78.20

PROPERTY	ACQUIRED	S/T/R	ACRES	OWNERSHIP	PUBLIC EASEMENT	"RIGHT-OF-WAY"*	PRIVATE EASEMENT
VAN VLEET	01-Jan-78	09,10, 16-1S-70W	780.81	Fee Purchase	- Easement & ROW for ditch & flood control purposes as granted by Wayne Van Vleet to City. - Easement & ROW for Co. Rds #60 & 39. - Easement & ROW for water and sewer purposes to City of Boulder. - Agreement with Boulder Co. Public Works Dept. by which the County will construct a 3/4 mile long off-street trail facility 10 ft. wide in exchange for a 5.8 acre easement. - Easement to County for the purposes of reconstruction of a public road and reconstruction of public utility lines by PSCo. - Approval to convey to the County a 10-ft. strip of land which lies immediately to the N of Hwy. 36 between Louisville & Cherryvale Rd. Related to annexation through Open Space.	- Easement & ROW for uninterrupted flow of South Boulder Creek. - Easement & ROW for the following ditches: South Boulder Canyon Ditch, Shearer Ditch, Marshallville Ditch, Goodhue Ditch, Enterprise Ditch, Deepe Ditch, Dry Creek Ditch #2 & McGinn Ditch.	- Drainage and flood easement burdens the property as a result of a retaining the berm. - Easement to Short & Milne to divert and discharge floodwater and other surface flows of water from the grantees' parcel onto the Van Vleet parcel, by means of levees, dikes, berms & other barriers. - Easement to the Mountain States Telephone & Telegraph Co., 16-1/2 ft. wide construction easement & a 10 ft. wide permanent easement. - Easement & ROW for Communication System purposes.
WILLE	14-May-92	16-1S-70W	0.631	Fee Purchase	None	None	None
YUNKER	01-Jan-77	14-1S-70W	190.593	Fee Purchase	Approval to convey to the County a 10-ft. strip of land which lies immediately to the N of Hwy. 36 between Louisville & Cherryvale Rd. Related to annexation through Open Space.	None	Easement unto the Mountain States Telephone & Telegraph Co

PROPERTY	CONSERVATION EASEMENT	MINERAL RIGHTS	OTHER	ID #
VAN VLEET	None		- State Highway Dept. in holding. - Fenced wrong along Etter subdivision line. - Tallgrass prairie on State Highway Dept. piece. - Colorado Highway Dept. will ensure access for the farm personnel and machinery under U.S. Highway 36.	67.00 67.01 67.02 67.03
WILLE	None			244.00
YUNKER	None		A ROW for water pipe line.	63.01 63.02 63.03 63.04

11.2.2 Adjacent Lands Affecting the South Boulder Creek Management Area

Surrounding Public and Private Land Uses/Zoning[14]

Deepe Farm (CU/Gateway property, previously called Flatiron): Three hundred-eight acres in Area IIA and IIB and currently designated Open Space (70%) and residential (30%) in the *Boulder Valley Comprehensive Plan.* It is the site of several gravel extraction plans since the 1950s, now in final stages of reclamation. There is over one mile of contiguity with Van Vleet ranch along the floodplain of South Boulder Creek. Land exchanges between the Carl Deepe farm and Van Vleet ranch prior to City purchase resulted in preservation of over .05 mile of South Boulder Creek riparian area. The land was purchased by the University of Colorado in late 1996 for long-term future University purposes which are yet undefined. It is anticipated that these purposes may require City services. At such time as these are proposed by the University, it will include negotiations and agreements with the City regarding such services. NOTE: The southerly 30 feet are planned for donation by the University to the City through a license agreement in late 1997 for Open Space trail purposes.

This property, City Open Space, and other land in the South Boulder Creek watershed are included in a floodplain study sponsored by the Urban Drainage and Flood Control District, which should be completed in 1998.

Baseline Reservoir: Potential changes of use due to change of ownership and operational plans by the City of Lafayette for municipal water supply. Watch for potential impacts to wildlife, particularly bald eagle roost, on or near the Klein Property.

Valmont Connector, Pearl Parkway trail, and road route alternatives: Long-term uses along a corridor extending from 55th and Boulder Creek to the northeast continue to be studied and discussed by a number of agencies participating: City and County Public Works, Transportation, Greenways, and Open Space.

Valmont Reservoirs/Public Service Company: Management of plant and site important to Open Space interests in the area. Public Service Company currently may have an agreement with the Colorado Division of Wildlife regarding wildlife management on the site, and details of this agreement, if any, should be considered in management decisions in this area.

[14] Figure 11.2* "County Land Use Classes", Figure 11.3* "Boulder County Zoning", and Figure 11.4* Utility Map illustrate surrounding land uses and zoning in the Management Area.

11.3 ISSUES

General

- Monitor the development of lands adjacent to Open Space for the following management needs: requested access to Open Space, encroachment on Open Space, drainage impacts, impacts on native animals and plants and their habitats, and increased recreational interest.

- Determine properties that need to be acquired to accommodate issues raised through the South Boulder Creek Area Management Plan subject to available funds.

- Further research property issues raised through the South Boulder Creek Area Management Plan.

- Locate all public utility easements so that access issues can be resolved with utility companies.

- Prioritize minerals for possible purchase.

- Map the existing easements on the Geographic Information System interactive property map and connect the map to the Property Information table and database.

- Review the property acquisitions that required subsequent transaction(s) to be completed, determine their status, and monitor to conclusion.

- Review the inventory of water rights acquired and confirm long-term needs for our beneficial use of all our water rights on Open Space properties.

- Inventory and determine the condition of the irrigation ditch water delivery system components we are responsible for maintaining, including rights of way for those systems when they are off site of Open Space.

- The City has existing transportation corridors, easements, and rights-of way. These either cross or parallel South Boulder Creek in several locations.

- The City has existing public utility corridors, easements, and rights-of-way. The major inteceptor sewer serving South Boulder parallels South Boulder Creek for several miles and includes minor collector sewers, storm drains, and water mains. This sewer systerm is currently in operation and will eventually require maintenance.

Property Specific

- Andrus-Valmont Connector Bikeway: monitor alignment considerations; see Valmont Connector above.

- Colorado Open Lands/Short and Milne/LakeCentre II: deed states in part that the City's Pearl Parkway right-of-way ownership reverts to the original owner (LakeCenter Partnership) if the City fails to commence construction of the street or road improvements intended to be constructed thereon within 10 years from the date of agreement (September 12, 2001).

- Burke II: Centennial Trail, monitor possible trails through property.

- Damyanovich: on- and off-site contamination management issues. Contact City of Boulder Public Works regarding any management issues about the Marshall Landfill cleanup managed by City under multi-party agreement.

- Church: concern about remote control gliders.

- Colorado Open Lands: access point issues at gravel pit near Pearl Street.

- Greenbelt Meadows subdivision: gate and public access approved with plat map and/or Subdivision Agreement.

- James, access easement: access issues.

- Lauffenberger Trail: trail easement that dead ends.

- LakeCenter I and II: Pearl Parkway right-of-way reversion.

- Reynolds: monitor for any spread of exotics from temporary herb garden use approved for Celestial Seasonings in the 1970s.

- Salaman: Louisville's trail dead ends here.

- Short and Milne: Valmont Connector, evaluate possible trail alignments.

- Future uses of railroad rights-of-way particularly in vicinity of Valmont townsite and Public Service Company plant.

- Long-term use of Western Mobile asphalt plant near Valmont townsite.

11.4 DATA GAPS

All easements that affect City-owned Open Space need to be located, described, and documented for recording. Once these easements are determined, easement owners need to be contacted to clarify access points. Old easements that are not being used should be abandoned.

Agreement, if any, between Public Service Company and Colorado Division of Wildlife on management of wildlife on Valmont site.

Title policies are needed for the following properties:

Andrus: Parcel 5, Parcel 6, Parcel 7
Belgrove
Biddle (utilities)
Cohagen, conservation easement
Cottonwood Farms
Cottonwood Grove
Fancher
Hoover Hill
Klein
Lauffenberger Trail
Lentsch
Matheson
Moad/Cillessen: both transactions
Oakley
Orchard Creek
Reich
Robinson donation
St. Walburga Abbey
Short&Milne-Frey land exchange
Suitts, development rights
Syntex
Union Pacific Railroad: Parcel B, Parcel C
Ute Industrial Park: Lots 18-21
Wille
Yunker

12. FACILITIES INVENTORY

12.1 INTRODUCTION

For the purposes of this inventory, facilities are considered to be structures or buildings which serve residential, office, or agricultural functions (see the Passive Recreation chapter for further information on other types of Open Space facilities). Several existing buildings and structures, including barns, silos, corrals, and residences have been purchased incidental to land acquisition. Facilities on Open Space may be preserved and used for the implementation of Open Space Program goals. Uses may include, but are not limited to (City of Boulder 1995):

- Maintenance and management of structures for public Open Space use and education
- Leasing for uses and occupancies related to Open Space Program needs
- Securing and maintaining the structures for future Open Space needs, including Open Space office and management needs
- Removal of structures that do not serve any Open Space purpose

The goal of facility management is to ensure safe, responsible, and efficient use and maintenance of all structures or buildings owned by the City of Boulder Open Space Program. For facilities with local, state, or national historical significance reasonable efforts will be made to preserve and protect significant cultural resources when possible.

12.2 RESOURCE INFORMATION

The resource information section will briefly describe facilities located within the South Boulder Creek Management Area. Historical significance has been covered in the Cultural Resources chapter. See Figure 12.1* for specific locations of each facility.

12.2.1 Open Space Operations Center Complex

Open Space Operations Center
Located at 66 South Cherryvale Road, the Open Space Operations Center is a remodeled and expanded (originally residential) ranch style home, which houses most of the field staff personnel.

Rocky Mountain Riding for the Disabled -- Horse Facility
A large horse stable barn, including tack room, handicapped accessible restrooms, and resident manager apartment, together with a fenced riding arena south of the Operations Center, currently leased to Rocky Mountain Riding for the Disabled.

Parking Barn
A rectangular shelter building north of the Operations Center that was remodeled (including the construction of secured storage rooms) for use as a parking facility for Open Space vehicles.

Hay Barn
A large rectangular shelter southwest of the Operations Center that is currently being utilized for hay and other storage by the current lessee--Rocky Mountain Riding for the Disabled.

Feed Barn
A rectangular horse stable/shelter building, east of the Operations Center, currently being utilized for Open Space tools and supplies.

Cherryvale Pump House
A large cinder block structure with asphalt roofing located off an access road at the southeast corner of the Operations Center public parking area. It is secured and in good structural condition.

Sam's Lane Pump House
A fenced in, aluminum-sided, pump house on the access road known as "Sam's Lane" west off Cherryvale Road directly across from 790 Cherryvale Road. It is currently utilized by the tenants of the Van Vleet Ranch for cattle watering, etc.

Hawkins House
A contemporary ranch style home located at 5990 South Boulder Road and occupied by an Open Space employee/caretaker.

12.2.2 Viele Farm Complex

Viele Farm House
A historically significant farm house at the southwest corner of South Boulder and Cherryvale Roads. The exterior was recently restored to historically correct standards, as the Viele Farmstead is a City of Boulder Historic Landmark. The exterior restoration included stabilization of the foundation and replacement of the roof. The interior walls are in disrepair and are not structurally sound. Several suggestions on repair techniques have been submitted, but thus far no action has been taken by the Open Space Program.

Viele Barn
A large, red, historically significant (and recently restored) barn standing on the Van Vleet property, at the corner of South Boulder and Cherryvale Roads. It is used daily by the lessee as a storage area for hay, large farm equipment, etc.

Viele Machine Shed
A stone and wood structure standing at the northeast corner of the Viele barn (north of the access drive). This structure is historically significant and currently in use as a machine and tool shop by the lessee.

Viele Silo
A large concrete silo standing on the southeast corner of the Viele barn.

Viele Sheds
A series of structures in the Viele barn complex including: two chicken coops, an abandoned outhouse, a stone storage shed, a granary, four loafing sheds (one with a complete stable complex), a "cat house," and a small garage.

Lower Meadow Calf and Loafing Sheds
A small wood calf shed, located in the Van Vleet property on the east side of South Boulder Creek, is in disrepair but structurally sound. Slightly southwest (on the east bank of the creek) stands an "L" shaped loafing shed of wood and metal siding construction and adjacent corral. This structure appears to be in very good condition.

12.2.3 Harf Complex

Harf Historic Barn
A large aesthetically significant barn with surrounding structures located at the Schearer Ditch on the east side of Cherryvale Road on the Van Vleet property, which was restored to historically correct standards in the spring of 1991. It is currently vacant but has the potential for storage of large agricultural equipment.

Harf Farm Buildings
Include a corral and livestock shelter (utilized by the lessee's cattle) located west of the barn and a "chicken coop" structure northwest of the barn. All of these buildings were included in the historical restoration of 1991. An entire corral and stable complex stands north of the Schearer Ditch. This area was not included in the historical restoration but has potential for such a project in the future.

Harf Pump Houses
Two small secured pump houses used by the lessee for irrigation and livestock watering, just southeast of the main barn and corral area.

12.2.4 Doran Complex

Doran Barn
A large, aesthetically significant barn and corral located south of South Boulder Road on the Van

Vleet property, which was the focus of a contracted historical restoration in the spring of 1991. It is currently utilized by the lessee for agricultural equipment storage.

Doran Chicken Coop Foundation
All that remains is a simple concrete foundation, just north of the Doran barn.

Doran Milk Shed
A small milk storage structure located at the northwest corner of the barn, which was re-roofed and restored in 1991 as well.

12.2.5 Suitts Complex

Suitts Barn and Silo
A combination wood and brick structure which stands on the east edge of Cherryvale Road on the Suitts property. Currently abandoned, it is in poor condition.

Suitts Outbuildings
Seven weathered outbuildings in various stages of deterioration but all structurally sound. The Suitts milk shed stands in front of the barn and silo on Cherryvale Road. Six scattered buildings on the north side of South Boulder Road (through an access gate) include a wooden shed, stone shed, outhouse, a second (red) shed, a small tin silo, and a power shed (standing on the southwest side of the Suitts pond). All are abandoned.

12.2.6 Lewis/Stengel Farm Complex

Lewis/Stengel Farm House
An aging and somewhat deteriorated farm house located at 1195 75th Street. It is currently vacant and would need significant upgrades prior to occupancy. The entire farm complex may be eligible for County landmarking.

Lewis Garage
A large vacant equipment garage at the southwest corner of the Lewis house.

Lewis Barn and Grain Silos
A large agricultural barn and twin silo structure south of the garage area, including a relatively new and structurally sound shelter which is currently being utilized by the lessee for hay storage.

Lewis Feed Shed
A livestock feed shed located directly west of the barn.

Lewis Loafing/Storage Sheds
Two vacant farm structures west of the barn.

12.2.7 Hogan Farm Complex

Hogan House
A small, two-story farmhouse located at 1226 South Cherryvale Road on the Church property and currently occupied by the Van Vleet lessee. The Hogan Farm may be eligible for County historic landmarking.

Hogan Outbuildings
A medium-sized horse barn in advanced deterioration directly west of the Hogan house. There are six various sized storage sheds between the house and barn.

Fox/Hogan Stone Barn ("Jack's Pen")
A square stone structure standing directly on the west shoulder of Cherryvale Road, just northeast of the Hogan house. On the National Register of Historic Places, it was slated for contract restoration in 1994. Due to funding, the project was put on hold. It is currently used for hay storage by the Van Vleet lessee.

Hogan Storage Barn
The largest of the Hogan outbuildings, this wood structure is in sound condition and used for farm storage.

Fox Mine Office
A small, structurally sound, square stone structure, also on the National Register of Historic Places, which stands just southwest of the Hogan house.

Hogan Stone Ruins
A completely run down foundation and collapsed stone walls located just east of the Fox Mine office.

12.2.8 Individual Facilities

Abernathy Homestead
An abandoned stone farm structure in deteriorating condition, on the east bank of South Boulder Creek at the end of "Sam's Lane" on the Van Vleet property. It was chosen for historical restoration in 1990, and an architectural upgrade description was produced, but the actual work was never contracted because of cost considerations.

Ute Industrial Complex
A large, abandoned industrial cinder block structure on Red Deer Drive west of 75th Street, between Arapaho and Valmont Roads. It is currently suitable for storage of materials in concert with use of the "Forsberg Building," also on Red Deer Drive.

The "Forsberg Building" is scheduled to house the Land Management Division, together with other Open Space uses after possession is received in November 1997.

Lentsch Garage
Located off 63rd Street, just south of Arapahoe Road, on the Lentsch property. It is a relatively modern cinder block, metal sided, two-bay garage with an asphalt T-lock shingle roof that is currently vacant and is secured. The Open Space Board has recommended demolition of this building as part of reclamation of land at Sombrero Marsh.

Merle-Smith Box Cars
Located just west of an access gate/road off the north side of Arapahoe Road are three weathered railroad box cars used as housing at one time. They are structurally sound and secured but present a lure for transient occupancy. Staff recommendation is to remove the box cars when funds are available.

Klein Shed
A small, secured, wooden shed located on the south side of Dry Creek on the Klein property, which has been utilized for storage of old Open Space fence materials for the last fifteen years.

Lousberg Garage
A large, six-bay, aluminum-sided garage/pole barn located at the northwest corner of Jay Road and North 51st Street. Currently abandoned, it is secured and in good structural condition. The Open Space Board has recommended demolition of this building in order to improve the scenic corridor along the Diagonal Highway.

12.3 ISSUES

Appropriate use of facilities and associated outbuildings

- There are two habitable residential structures located within the South Boulder Creek Management Area. One residence is leased to a City employee/caretaker, and one residence is leased to agricultural lessees. An assessment of the potential uses and habitability of the Lewis property and costs for improvement and stabilization should be made.

- There are numerous outbuildings located within the Management Area. Some of these outbuildings are used for agricultural purposes, and others are currently not in use.

- There is a need to develop acceptable standards and inspection schedules for all (occupied) buildings on Open Space.

- When new properties are acquired, associated facilities should be assessed for usefulness, condition, cost of repair, and maintenance for their intended use.

- There is a need to develop acceptable standards and inspection schedules for exterior condition, size, and location of all improvements on Open Space easements.

12.4 DATA GAPS

- Cost estimates are needed for various repairs, including Lewis.
- Cost estimates for demolition or removal of box cars on Merle-Smith; Lentsch garage; Suitts outbuildings, barn and silo; and the Lousberg building are needed.
- Revised and implemented policies on facilities and caretakers are needed.

13. AGRICULTURAL RESOURCES

13.1 INTRODUCTION

Agricultural resources described in this inventory pertain to properties that are currently under agricultural management and properties that may be managed for agriculture. Administration of agricultural operations in the Management Area is consistent with policy direction as stated in the City of Boulder Charter, Boulder Valley Comprehensive Plan, and Long Range Management Policies.

Responsible management of agricultural lands has been a priority for the Open Space Program, and there was an early recognition that the farms and ranches being purchased had special needs. In 1975, a consulting firm completed an agricultural management plan for the then current Open space system. This plan included specific analysis and recommendations for eight of the properties in the South Boulder Creek Management Area. The plan recognized that "in harmonizing the possible agricultural uses of the various parcels with the Purposes and Functions of Open Space it is readily apparent that the most desirable use of a given tract is not necessarily the most profitable economic use" and made recommendations for specific parcels that were "aimed at stabilizing and then improving each tract's ecosystem" (Nortrust 1975). A self-admitted shortcoming of the plan was that its expertise and scope were limited to making recommendations for parcels "designed to increase their carrying capacity for domestic animals." While it recommended agricultural uses "oriented to the minimization of conflicts with wildlife," it also recommended that competent advice should be obtained from wildlife specialists regarding enhancement of the wildlife values on Open Space. The plan recommended adopting basic agricultural management principles: having written leases and annual plans (including budgets), inspections, and documentation. Weed management needs included addressing weed infestations arising from farm management practices of previous owners. Water rights management was also considered key.

13.1.1 Historic Relevance

Origins of agricultural land use in the Boulder Valley in the Management Area date back to 1859-1860 when the landscape was first plowed and planted in turnips, wheat, onions, and potatoes. Agriculture was not limited to planted crops; in January and February of 1859, farmers "harvested the tall, dried standing, 'natural' grasses of the meadows and sold it to nearby mountain communities" (Bixby 1971). At the same time, cattle, horses, and sheep grazed along creek terraces and in the foothills. While the initial crops relied on seasonal rains, the need for additional moisture became obvious--irrigation soon followed agriculture. The first ditch was dug in 1860, and others quickly followed, each extending the geographic limits of farming in the Boulder Valley. In fact, by 1862, the ditch system was extensive enough to irrigate 1,500 acres (Bixby 1971). Agriculture activities diversified; common crops included vineyards, orchards, berry farms, dairy farms, poultry production, dry-land grain production, haying, and horse

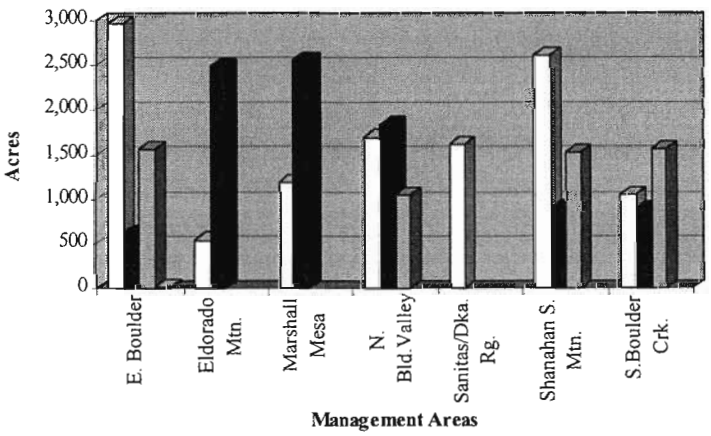
boarding. Despite this agricultural diversity, the predominant land uses over the last 130 years have been hay production and livestock grazing.

13.1.2 Management Context and Objectives

The Management Area encompasses 3,502 acres, which is about 14% of Open Space land ownership. Currently, 1,565 acres of irrigated pasture--predominately hay/forage crops--1,041 acres of transitional land, and 895 acres of native grasslands--primarily used as range--are in agricultural production. Leases (contracts) cover 2,460 acres of agricultural property within the Management Area. Five different lessees irrigate 1,515 acres--or 43% of the Management Area.

Application of sustainable agriculture principles and practices to provide natural resource protection, economic viability (to the lessee), and agricultural cultural diversity, as an element of the quality of life in the City of Boulder and Boulder County, is the objective of agricultural management in the Management Area. This objective is dynamic and is grounded in the principle of adaptive management (a framework that assumes that scientific knowledge is provisional and part of an ongoing learning process (Grumbine 1994)). Agricultural management practices are based on available natural resources, use of adjudicate/irrigation water resources, historic agricultural uses/practices, long-term lease agreements, and specific land use goals (Fig. 13.1). These goals include land reclamation, conversion of one vegetation cover to another, or integrated pest management. Further, agricultural objectives incorporate other land use and management activities/goals such as maintaining prairie dog preserves, native grasslands, wildlife habitats, and sensitive or threatened and endangered species. Finally, recreation and cultural resources are incorporated into the adaptive management framework.

Figure 13.1:Land use by management area



13.1.3 Agricultural Land Uses

Agricultural lands are defined as places used for crop, animal production, or silviculture. However, Open Space agricultural land use practices are presently limited to transitional agricultural lands, grasslands (range), cropland, pasture, and miscellaneous uses (Figure 13.2*). Each is described as follows:

Transitional Agricultural Lands
Lands not presently being used but have been used or are suitable for agriculture uses. These lands may be parcels in transition, restoration, or lack a particular resource to support an agricultural practice--for example, a lack of water for grazing. The existence or condition of irrigation structures and an ability to irrigate, soil, and topography are also considerations used to determine typical agricultural land status.

Grasslands (Range)
Lands used for grazing, predominately uplands with a native forb/shrub component. Grasslands are typically not irrigated. These lands also contribute to wildlife habitat, recreation activities, and wetland protection.

Croplands
Lands often used for intensive agricultural production with a principal focus on economic return. Typically, land uses include short- or long-term crop rotation.

Pasture
Lands used for grazing that may be irrigated and are frequently dominated by non-native grasses. The lands may have native vegetation component grasses. These lands often balance multiple objectives of agricultural economics, natural area management, and scenic values.

Miscellaneous
Lands that are fragments and typically small, non-contiguous properties. These lands may include dedications; their values contribute more to buffer areas, watershed protection, or scenic easements than to agricultural or landscape-scale resources.

13.1.4 Current Agricultural Practices

Cow/calf operations combined with hay and pasture production are the most common agricultural activities within the Management Area. Typically, Management Area native grasslands are not pure stands of a single species, but are rather made up of individual communities comprised of many grassland species. The distinction between grassland communities is based primarily on plant species composition. Each community evolved with natural disturbances: fire, flooding, and grazing. Phenological characteristics of each species determine the ability of the individual plant to regrow and regenerate after disturbance events.

Several grazing schemes are designed to achieve management objectives. Modifications have been made to accommodate the size of livestock operations, economics of moving livestock, and available resources. The modified schemes are defined as follows:

Deferred Rotation Grazing
Any grazing system that provides for a systematic rotation among pastures. Grazing is postponed for a prescribed period, usually until the maturity or seed set of target group plant species.

Rest Rotation
Use of systematically recurring periods (year-long rest) of grazing and rest for two or more pastures or management units.

Aftermath Grazing
Fields that are grazed after the main crop (typically grass/alfalfa) has been harvested. Grazing occurs during the dormant season (usually between October and May).

13.2 RESOURCE INFORMATION

13.2.1 Soil

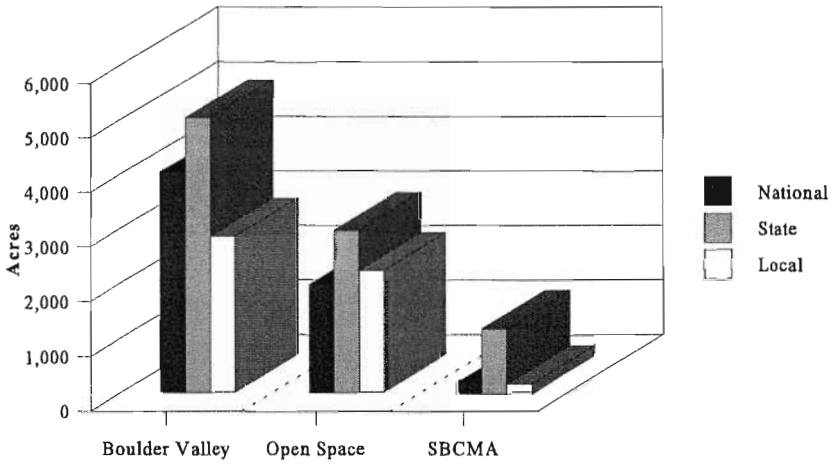
An investigation of soils in the Management Area is significant because it helps natural resource managers identify land use suitability that influence agriculture productivity and practices. Several soil characteristics are described. They include lands of federal, state, or local significance and soil capability.

Three classifications are used to identify significant agricultural lands: agricultural lands of national importance, agricultural lands of statewide importance, and agricultural lands of local importance. These classifications are based upon the *Colorado Important Farmland Inventory* (Soil Conservation Service 1982).

The Boulder Valley contains approximately 4,000 acres of land that qualifies as nationally significant, 5,000 acres that are classified as state significant, and 2,800 acres that are locally significant agricultural lands. Of this total, the Open Space Program owns 1,970 acres (49%) of the nationally significant lands, 2,962 acres (59%) of the state significant lands, and 2,227 acres (78%) of the locally significant lands contained in the Boulder Valley. Further, the Management Area contains 196 acres of nationally significant land, 1,117 acres of state significant land, and 117 acres of locally significant agricultural land (Figure 13.3).

Nationally significant farmland is divided into two categories: "prime" and "unique" farmland. Prime agricultural land is determined when the best and most significant use is production of common food and fiber crops. Less than 200 acres of agricultural land in the Management Area is classified as agricultural land of national importance.

Figure 13.3: Significant Agricultural Lands



The Boulder County office of the Natural Resource Conservation Service has identified three categories for agricultural lands of statewide importance: (1) irrigated lands (not "prime") that are important to the state's agricultural economy but do not meet the "prime" criteria for one or more reasons, (2) irrigated lands (water supply inadequate) that are limited by water supply, not meeting the "prime" criteria for soil moisture, and (3) high potential dry cropland.

Identification of the three categories of agricultural land of local importance is based on criteria devised by the Longmont office of the Soil Conservation Service (now the Natural Resource Conservation Service) and the Boulder County Extension Office. Based on the work of the Conservation Service and Extension Office with farmers (county-wide) over many years, irrigated cropland, dry cropland, and rangeland are those agricultural lands of key importance to the local agricultural economy. A technical description of significant agricultural land is found in Appendix 13.1.

A knowledge of local soil types and their capability is essential for agricultural land management. Capability classification is the grouping of soils to show, in a general way, their suitability for most types of farming (Figure 13.4*). Soil capability is heavily influenced by the availability of irrigation water. Classifications used for the Management Area are those used for irrigated soils.

Based on criteria developed by the Natural Resource Conservation Service, irrigable land is defined as land that does not have restrictions for hay production relative to soil or topography and occurs under the existing irrigation system. Historically, irrigated soils that are not rated as irrigable may be suitable for irrigated pasture. Limitations for these "non-irrigable" lands may include shallow depth to bedrock, slopes too steep for efficient irrigation, poor natural drainage, and excessive salinity and sodicity.

Soils of the Management Area are primarily of the Mollisol order. They are typically shallow and are sandy loam containing varying amounts of cobble with a thin, poorly developed "A" horizon. The irrigable sandy-clay loam soils of the Nederland, Niwot, and Nunn series are best suited to agricultural uses such as pastures and irrigated crops when they occur along floodplains and terraces. In contrast, the shallow, stony-cobbly loams of the Nederland series, when located on rocky knolls and side slopes, are best suited to native grass pastures and range agriculture use. A more detailed discussion of soil, its applicable use, and working constraints is presented in the Soils chapter of this inventory.

13.2.2 Water

Water--its acquisition, delivery, and application--is an essential component of many agricultural operations. Agricultural operations in the Management Area depend entirely on surface irrigation. An extensive system of twenty-one ditches and laterals provides water to the Management Area; more than 1,533 acres, or 43% of the area, are irrigated. Flood irrigation is used exclusively; wells, pumps, and sprinkler systems are not used in the Management Area. A detailed characterization of the irrigation network and its underpinnings is presented in the Water Resources chapter of this inventory.

Water availability is an essential component of a cow-calf operation. Water sources include wells, lakes, streams, stock ponds, irrigation ditches, and seeps. The size, condition, and location of these sources also influences the effectiveness of the operation as well as the ecological condition of the landscape. An inventory of water sources is in progress, as is a management strategy. Both the water resources inventory and the management strategy are necessary to provide direction and guide field activities. Such activities include development of hay and forage crop production (most suitable), and grazing management schemes (time, duration, intensity, and location).

The network of irrigation ditches (water availability) is considered to be responsible for tailwater wetlands and populations of *Spiranthes diluvialis* that lie within the historic South Boulder Creek floodplain. However, there are two isolated populations (properties) that lie outside the historic floodplain whose existence is directly attributable to the water provided by irrigation ditches. More specific information about sensitive plants in the Management Area is described in the Vegetation chapter of this inventory.

13.2.3 Wetlands

Extensive wetlands exist in the Management Area. Prescriptive grazing in some wetlands may be used as a tool for noxious weed control. Canada thistle is the most common weed in wetlands in the Management Area. Early spring grazing (using specific intensities and durations) is an effective method to stress or stunt the growth of thistle while not producing a negative impact on native wetland vegetation. However, grazing prescriptions that identify timing, duration, intensity, and location are essential. These prescriptions have yet to be developed, and further study is necessary. Areas for further study include (1) the location of existing fencing and needs

for additional fencing, (2) identifying and ranking of problem areas within wetlands, and (3) an economic analysis for the practicality of intensive management (moving or transporting) of livestock to and from numerous small areas. A more detailed discussion of wetlands--their functions and values--is presented in the Wetland chapter of this inventory.

13.2.4 Vegetation

The vegetation composition of hayfields, non-native pastures, and some grasslands is made up of monocultures (or co-dominates) of non-native species--smooth brome, timothy, orchard grass, and others. However, some hayfields and rangelands in the Management Area have important or dominant native grass cover (big bluestem, blue grama, buffalo grass, western wheat grass, and numerous others). Most fields of the Management Area are a mosaic of cool and warm season grasses (shortgrasses, midgrasses, and tallgrasses). Since both cool and warm season grasses have different phenological responses to disturbance (ability to recover, regrow, and regenerate), a definitive characterization of vegetation communities is required before site specific grazing prescriptions are further developed.

Grazing of non-native vegetation occurs in pastures and as aftermath grazing of hay fields. Vegetation composition of pastures is generally smooth brome, while vegetation composition of hay fields is fescue, smooth brome, timothy, orchard grass, and alfalfa. Aftermath grazing amounts to thatch removal and utilization of late season growth, which does not affect plant physiology.

The vegetative status of each parcel is evaluated based on historic use level, recent use level, management objectives, and desired condition. To date, a formal procedure and criteria used to evaluate properties have not been developed.

Prescriptive grazing is used to help manage for the native Ute ladies'-tresses orchid, *Spiranthes diluvialus*. *Spiranthes* is designated by the U.S. Fish and Wildlife Service as a threatened species and a facultative wetland species. It is nationally rare but locally common in the South Boulder Creek floodplains. Typically, it is found in seasonally moist, bottom land grasslands. Using spring/early summer grazing to remove thatch or cropping overstory vegetation benefits growing conditions for the orchid. Aftermath grazing is also used to remove thatch in bottom land fields where the orchids grow. The Vegetation chapter of this inventory describes the detailed habitat requirements and ecology of *Spiranthes*.

Remnant Tallgrass Prairie

Boulder Valley contains one of the most extensive networks of high-quality remnant tallgrass prairie in Colorado (Colorado Natural Areas Program, 1986). There are 251 acres of tallgrass prairie growing on nine non-contiguous Open Space parcels. Tallgrass prairie occurs in the Shanahan-South Mesa Management Area and in the Management Area. There are six parcels totaling about 121 acres of tallgrass prairie in the Management Area (Figure 7.4 in Chapter 7). Tallgrass prairie communities are identified as being either mesic prairie or xeric prairie. Mesic communities are found in low-lying (bottom land) areas and are dominated by big bluestem, little

bluestem, switch grass, and Indiangrass. Xeric communities are more commonly found in dryer locations (uplands) and are dominated by big bluestem, little bluestem, and side-oats grama grasses.

Grazing, mowing, and prescribed fire are used to maintain or enhance tallgrass prairies. Specific grazing recommendations include fall/winter utilization as well as the number of animal unit months each parcel can support. Haying is also advised for one 6-acre parcel (#6) in the Management Area; further, it recommends that mowing occurs on this parcel in July rather than August or September. Justification for mowing in July rather than August or September is that later mowing is more likely to negatively impact the tallgrass species and provide competitive advantage to shortgrass species, creating a potential conversion of species composition from tallgrasses to shortgrasses.

Incorporating fire, grazing, and mowing in an integrated approach to manage the tallgrass prairies is proposed. The fire section (see below and the Vegetation chapter) describes fire management for the tallgrass prairie parcels.

13.2.5 Cropland

The traditional crop sequence used in the Boulder Valley is a rotation based on small grain (corn, barley, wheat, etc.) and hay production. Small grains are grown for 2-4 years and then alfalfa or grass/legume hay crops are grown for 6-10 years. However, in the Management Area the predominant long-term use of croplands has been hay production. The soils in the Management Area are well suited to hay production because the presence of cobbles makes tillage impractical. In addition, many of the soils have poor drainage characteristics and are saturated during some portion of the growing season.

Grass hay mixtures (usually smooth brome, orchard grass, or tall fescue with a legume) are only harvested once during the growing season. If alfalfa or clover is included in the mixture, the hay crop may be harvested twice throughout the growing season. Single-harvest hay crops are generally irrigated once before the crop is harvested and again after the crop is harvested. Hay crops that are harvested twice a year are irrigated three times throughout the growing season. Hay crops that are predominantly alfalfa are usually harvested three times throughout the growing season.

Irrigation usually occurs before the first harvest and again after each cutting. In addition to irrigation management, insect and weed pests are also managed in crops. Alfalfa weevils and aphids can cause economic damage to alfalfa crops. Treatment for these crop pests usually occurs before the first harvest and lasts throughout the growing season. The Vegetation chapter of this inventory contains more specific information about management issues and strategies.

Approximately thirty-two acres of tilled, irrigated cropland exist in the Management Area on the Baseline 75 property. The predominant crop is alfalfa, with corn and small grain used as rotational crops.

A 150-foot buffer of grass and alfalfa/grass hay was planted in 1994 and 1995 adjacent to the grade school which serves as a "no spray" area. Winter aftermath grazing occurs on the whole property.

13.2.6 Integrated Pest Management

In an agricultural context, even a native plant or animal may be viewed as a "pest." Undesirable species are those that threaten the desired plant community (the crop). By competing with or parasitizing the desirable plant community, weeds and pests threaten the: (1) general health and integrity of the plant community and (2) efficiency of agricultural operations, thus raising the cost of farming. The impacts to land containing extensive infestations include reduced forage productivity, reduced crop yields and/or a product less palatable to livestock, and reduced market prices for the product. This section will discuss management of weed and pest species in a cropland situation, meaning those lands where intensive agricultural production occurs and the principal focus is economic return. Grassland and pasture weed management will be reviewed in the Vegetation chapter of this document.

Alfalfa is the dominant crop in the Management Area; corn and other small grains are rotational crops. These intensively managed monocultures are prone to weed and insect infestations. The economic value of the crop must be considered when deciding if control is necessary. Inventory and evaluation of economic threshold levels for different weed and pest populations are performed on a yearly basis for agricultural fields. Control techniques are recorded by the Integrated Pest Management coordinator.

The weed species most frequently found in the cropland are cheatgrass, Canada thistle, hoary cress, foxtail, kochia, flixweed, bindweed, and several others. Common insect pests include the alfalfa weevil in alfalfa, Russian wheat aphid and mites (two kinds) in small grains, and corn borer and rootworm in corn. Control techniques depend on many factors such as weed/insect species and density, crop species, growth stage and health, age of stand, dryland or irrigated cropland, and equipment available for the control techniques desired. Control techniques include mowing, tillage, crop rotation, irrigation, ditch maintenance, grazing, burning, chemical control, and planting resistant varieties. Many of these are cultural and preventative techniques that are day-to-day agricultural practices.

13.2.7 Wildlife

Unique wildlife habitat management needs, sensitive vegetation, irrigation practices, and historic agricultural practices combine in the Management Area to create a landscape requiring a variety of management techniques. *Spiranthes diluvialis* (a federally threatened orchid) and several species of ground-nesting birds (showing the most rapid population declines of any North American avifauna group) are examples of these management requirements.

Several bottom land hay fields within the Management Area are used for nesting by ground-nesting bobolinks. This population of bobolinks is unique because it is disjunct from the main

bobolink population located in the Midwest. Populations of the birds return year after year to nest in the same field. Haying in these fields has been pushed back several weeks from late June to mid-July to protect fledgling birds.

Bottom land hay fields are also important as habitat for the Preble's meadow jumping mouse. The Preble's meadow jumping mouse is being considered for listing under the Endangered Species Act by the U.S. Fish and Wildlife Service because of its limited range and special habitat requirements. The geographic range of the jumping mouse is limited to disjunct island habitats in southeastern Wyoming and eastern Colorado. The preferred habitat of the Preble's meadow jumping mouse is believed to be moist meadows with flowing water. The moist bottom lands of the Management Area are known Preble's meadow jumping mouse habitat. Multiple capture sites within the area have been recorded by the U.S. Fish and Wildlife Service. Grazing and mowing of moist bottom land hay meadows have occurred for more than 100 years. The effects of present and historic agricultural practices on the Preble's meadow jumping mouse are presently (1997) not well understood.

Other important wildlife populations in the Management Area include prairie dog colonies. The *Black-tailed Prairie Dog Habitat Conservation Plan* (City of Boulder 1996b) describes four conservation sites within the Management Area. About 190 acres are designated conservation areas; 33 acres are transition areas, and 6 acres are not suitable for prairie dogs. Vegetation composition within conservation areas may be manipulated/improved by using grazing, mowing, or prescribed fire to stimulate vegetation growth in prairie dog towns/habitat. Currently, a detailed inventory of the vegetation in the conservation areas is being conducted. The results of the inventory analysis will assist in developing grazing strategies for the conservation areas. A detailed characterization of wildlife species and habitats is presented in the Wildlife chapter of this inventory.

13.2.8 Fire

Native vegetation communities of the Management Area have evolved with frequent, low-intensity fires. Historically, natural grassland fires burned every three to ten years (Veblen et al. 1996). Generally, fire regimes in the prairie grasslands are less well-known and documented than those of the forest ecosystems--particularly within the ponderosa pine ecosystem. While less is known about shortgrass and mixed grass prairie fires, it is generally recognized that fire is an important ecological process that contributes to the health and integrity of the grasslands.

The history of fire use in the Management Area is not well documented. Prior to 1988, formal records of fires were never kept; however, some informal records do exist and are based on recollections of area farmers and ranchers. A detailed inventory of burn locations and dates is underway and partially complete, but the remainder of the inventory is a data gap and an opportunity for additional research. Further, an explicit burn schedule has not been developed. Presently, burning ditches or fields occurs on a year-by-year basis and is completed as opportunities arise (when conditions are appropriate, when resource constraints can be mitigated, and when Open Space staff is available). Occasionally, burns are conducted to meet the needs of

a research project. The Vegetation chapter contains a brief history and use of fire in the South Boulder Creek Management Area (Table 7.2).

Based on present information, there is a need to finish the inventory to: (1) establish a ratings process (with criteria based on fire history, vegetation types, grazing, mowing, and goals for the landscape), (2) identify priority sites, and (3) prepare a 5-10 year prescribed burn plan according to the process outcomes.

Currently, fire as an agricultural management tool is used for two purposes--clearing irrigation ditches of thatch, brush, or weed infestations and removing thatch from irrigated fields or native grasslands. Burning ditches helps maintain the function and efficiency of water delivery, while burning fields or native grasslands stimulates regeneration, reduces non-native weedy species, and facilitates nutrient recycling. Fire is used in conjunction with grazing and mowing to control Canada thistle. Burning annually or semi-annually provides some level of thistle control. Burning for thistle control is effective in spring, fall, or winter depending on objectives and associated control techniques.

13.2.9 Agricultural Leases

The Open Space Program leases properties to local farmers and ranchers to maintain or improve native grasslands and to help maintain viable agricultural operations in the Boulder Valley. Lease agreements for Open Space properties outline the duties of the City and the lessee to accomplish Open Space goals for the particular property. General covenants for the lessees include the diligent application of irrigation water, protection of wildlife and wildlife habitat, protection of wetlands, protection of native grasslands and tallgrass prairies, limitations of specific grazing, and identification and protection of cultural resources.

The Open Space Program currently manages nine lease areas in the Management Area: Burke I/Burke II/Gebhard/Rolling Rock Ranch (318 acres), Baseline 75/Clough/Lewis/Methvin (277 acres), Biddle/Fell/Andrus/Colorado Open Lands (with McKenzie) (344 acres), Ditzel (57 acres), Eccher (8 acres), Hogan Brothers (769 acres), Belgrove (92 acres), HN (81 acres), and Van Vleet leases (657 acres), (Figure 13.5*). A standard agricultural lease is presented in Appendix 13.2.

Present lease areas are delineated by historical or present land ownership boundaries rather than ecological criteria and agricultural infrastructure requirements. While some lease areas have been combined to create a more economic or spatially effective management unit, the opportunity exists to review vegetation communities, soils, water, and agricultural infrastructures to develop less fragmented, agriculturally useable, and economically viable lease boundaries that are consistent with other Open Space objectives. Prior to modifying present boundaries, several infrastructure improvements need to be inventoried and analyzed.

13.2.10 Agricultural Improvements

Agricultural improvements are natural or human-made structures that benefit a farming or ranching operation. They include fences, livestock barns, corrals, hay storage areas, and housing as facilities. Similar improvements include irrigation infrastructure and livestock watering sources.

Fence inventory information is a requisite for management decisions--estimating economic costs, determining appropriate locations for agricultural operations, and determining the effectiveness of present or potential fence locations. A partial fence inventory (Figure 13.6*), was completed in 1997. Approximately one-half of the Management Area (northern half) was field inspected and the data entered into the Open Space Geographical Information System. The southern half of the area remains to be inventoried. In addition to type and condition of fencing, the approximate age of the fences is included in the inventory.

A complete inventory of existing and potential water sources--wells, lakes, streams, stock ponds, and seeps--is needed. An inventory is in progress but remains unfinished to date (1997).

Open Space rangers routinely patrol the 3,500 acres (more than 100 properties) of the South Boulder Creek Management Area to monitor resource impacts, inspect agricultural facilities (barns, hay sheds, historic home sites, and others), enforce agricultural land regulations, and respond to law enforcement and medical emergencies.

13.3 ISSUES

Irrigation Water, Wildlife, and Vegetation
Irrigated wet meadows are known to support populations of *Spiranthes diluvialus*. The application and duration rate of irrigation water can improve the growing conditions of the threatened orchid. It also affects ground-nesting neotropical migrant birds such as the bobolink. Timing of irrigation water (application in early May) is more important than duration for successful bobolink nesting. Further, the timing and duration of water use and efficiency of delivery structures contribute to tailwater wetland creation or maintenance.

Water application rates and duration may create standing water or tailwater ponds that are favorable locations for mosquito reproduction.

Recreation Activities Adjacent to Agriculture Lands
Private landowners with horses and stables next to Open Space agriculture fields are using the agricultural lands and creating horse paths in hay fields. The paths reduce the crop yield and economic return as well as cause direct loss of individual threatened plants and plant habitat.

Adjacent Landowners and Agricultural Practices
Farm operations create noise and occasional delays on roads for adjacent landowners.

Weed Control on Open Space Lands
Pesticide spraying on Open Space and ditches or buffers near subdivisions may occur. Some properties are farmed for alfalfa hay and small grains, and pesticides may be used to control insects or weeds. Some fertilizer is also applied, both chemical and manure.

Improvements to Agricultural Structures
Several houses, barns, hay sheds, and outbuildings may require repair or maintenance. The improved structures would contribute to a more viable agricultural operation as well as add to the attractiveness of the lease.

Balancing Resource Protection, Recreation, and Agricultural Operations
A balance between natural resource protection, recreation, and maintenance of viable agricultural operations in the Management Area is important.

13.4 DATA GAPS

Irrigation Infrastructure Condition
An inventory of existing conditions of irrigation ditches and laterals is incomplete. The inventory should include the condition of each ditch or lateral (must also establish criteria for condition) and type of ditch/lateral (i.e., concrete, corrugated metal pipe, dirt, clay, steel or plastic pipe). Additionally, the locations of locked gates (access to ditches) should be included in the inventory. An initial draft identifying the criteria for irrigation infrastructure condition is complete. However, a review of field data collected by the Water Resources Specialists is necessary to determine additional information needs.

Water Availability for Livestock
A complete inventory of existing and potential water sources--wells, lakes, streams, stock ponds, irrigation ditches, and seeps--is needed. The water availability inventory should include development of a field inspection check sheet, followed by field inspections of the management parcels and creek corridors. The data should then be analyzed and recommendations developed. Completing the water availability inventory requires that the fence inventory be finished. Identifying fence locations will assist with the development of criteria and locations for watering needs.

Fence Infrastructure
A fence inventory of the north half of the Management Area (northern half) was completed. The southern half of the area remains to be inventoried. In addition to type and condition of fencing, the approximate age of the fences should be included in the inventory. Completing the inventory will require about two months for one individual. The task includes using the established field worksheet, field inspection, and data entry into the Geographical Information System.

Landscape Evaluation/Monitoring Procedure (Parcel Condition)
A comprehensive landscape evaluation/monitoring procedure is being developed. Resource

Managers are drafting criteria for evaluation standards that will produce results that can be integrated into county or regional monitoring programs. This integration will help to produce some insight into regional landscape-scale vegetation health.

Integrate Land Use Management Tools
Presently, a plan for the coordinated use of grazing/burning/mowing/fire prescriptions for native grasslands (shortgrass, midgrass, and tallgrass) vegetation communities has not been developed.

Low Elevation Riparian Forest/Shrub Inventory
Identify forest/shrub communities in riparian areas and develop grazing prescriptions to protect them. Background information about riparian forest along the creeks in the Management Area is available. Completing the inventory will require a literature review, preliminary field investigations/inventory, and detailed inventory. Analysis of inventory data should lead to management recommendations and policy direction.

Prescribed Fire
Use of fire for restoring native grasslands and for agricultural management purposes is essential. A fire plan for the area needs to be completed.

Grazing Prescriptions in Wetlands
Prescriptions that identify timing, duration, intensity, and location are essential for proper grazing in wetland areas. These prescriptions have yet to be developed, and further study is necessary. Areas for further study include the location of existing fencing as well as the needs for additional fencing.

Agricultural Practices and the Preble's Meadow Jumping Mouse
The effects of present and historic agricultural practices on the Preble's meadow jumping mouse are not well known. Further research is necessary to improve management decisions and protect important habitat.

14. PASSIVE RECREATION

14.1 INTRODUCTION

More than 720,000 visits occur annually in the South Boulder Creek Management Area. Visitors have easy access to approximately six miles of designated trails and four trailheads that are managed and maintained by Open Space. Common activities include jogging, bicycling, exercising pets, and hiking. Other activities include outdoor education classes, horseback riding, photography, model glider flying, and wildlife viewing. In addition to the trails managed by Open Space, more than four miles of paved trails pass through the Management Area and are maintained by the City of Boulder Greenways Program. Activities on the Greenways trails include commuting, rollerblading, bicycling, jogging, and walking. Open Space trails and trails constructed by the Greenways Program are extremely popular recreation areas.

In addition to providing passive recreation opportunities, the Open Space lands located within the Management Area serve as an important aesthetic resource. The rolling grasslands provide excellent views for residents and visitors and serve as a natural visual buffer between Boulder and nearby communities. The Management Area is a particularly important visual resource, serving as a natural visual corridor as people enter Boulder along U.S. 36 from Denver. This unique buffer provides Boulder its own distinct identity clearly delineating it from other communities.

The *Long Range Management Policies* state "Open Space will be managed in a way that provides for aesthetic enjoyment, minimizes cumulative impacts to the natural ecosystems and conflicts between users, considers user safety, preserves responsible agricultural use, provides for a quality recreational experience, and protects natural areas" (City of Boulder 1995).

In the City of Boulder Charter, passive recreation is listed as one of the purposes of Open Space, and certain activities are listed: hiking, photography or nature studies, and, if specifically designated, bicycling, horseback riding or fishing. "Recreation" is often defined as activities that offer a contrast to work-related activities and that offer the possibility of constructive, restorative, and pleasurable benefits (Hammitt and Cole 1987). "Passive recreation" is generally considered to be activities that occur in natural settings which require minimal development or facilities and where the importance of the environment or the setting for the activities is greater than in developed or active recreation situations.

14.2 RESOURCE INFORMATION

This section will summarize previous passive recreation management, visitation characteristics and trends, passive recreation facilities (trails, access points, and structures), visitor services, issues, and information gaps.

14.2.1 Previous Passive Recreation Management

Although the Open Space Program began acquiring properties in the Management Area in the late 1960s, these lands did not become well known or heavily visited until the mid 1980s. The principal focus of passive recreation management in past years has been to inventory and maintain designated trails and access points. "Many trails in the Management Area developed from informal use patterns and were never properly designed or constructed as trails." Many of the trails in the Management Area were never formally designed or constructed as trails. "In some cases, extensive reconstruction has occurred because these trails were not properly located, designed, or constructed."

Management activities consisted mainly of agriculture, fencing, weed control, and minor trail maintenance prior to 1985. Routine trail maintenance is conducted by Open Space Conservation Corp crews on an annual basis. Service roads and trails are maintained by heavy equipment as needed. Appendix 14.1 contains specific information on past management of various trails and trailheads.

14.2.2 Visitation Characteristics and Trends

City of Boulder Open Space lands, including this Management Area, are popular for recreation. More than two million visits occurred on all of the City of Boulder Open Space lands in 1996. Recreational use, while providing for individual enjoyment and an opportunity to enjoy the undeveloped character of Open Space. Heavy and increasing visitation can create conflicts between visitors, safety concerns, trail widening, proliferation of undesignated trails, increased trail maintenance, conflicts with agricultural operations, impacts to natural resources and wildlife, and increased management needs. Future growth in the Boulder Valley will certainly influence visitation patterns, potentially affecting the quality of outdoor recreation experiences and the natural resources of the Management Area.

Estimates derived from a system-wide visitation study (Zeller et al. 1993) indicate that approximately 1.6 million visits occurred system-wide on Open Space lands from June 1, 1992-May 31, 1993. During this same time period, approximately 451,555 visits (approximately 30% of the system-wide visits) occurred within the Management Area (this estimate does not include visits on the Boulder Creek Greenway trail; see estimates provided by the City of Boulder Parks and Recreation Department below). Estimates of visits within the Management Area include a small portion of land south and east of 75th Street (the O'Connor-Hagman, Steinbach, and O'Connor Family properties located just outside the Management Area).

Estimates provided by the City of Boulder Parks and Recreation Department indicate that approximately 269,714 visits occurred during 1992 on the Greenways trail west of Foothills Parkway. This is nearly the amount of visitation that occurs on Open Space managed land in the entire Management Area. Off-street connections from the end of the Greenways trail at Arapahoe to the bridge at the East Boulder Community Center affect the level of use

significantly in the Management Area. The results of these studies indicate that this Management Area receives higher levels of visitation than any other area of Open Space lands.

System-wide information on seasons of use indicates the majority of use occurs during the spring season (38%), followed by fall (28%), summer (24%), and winter (10%) (Table 14.1). System-wide information also indicates an average party size of 1.4 persons, with 70% of these visits being single visits. Ninety percent of all parties consisted of one or two persons. The average length of visits was 53 minutes system-wide, while length of visits in the Management Area averaged approximately 33 minutes.

Table 14.1: Amount of Use by Seasons System-wide on Open Space

Spring	Summer	Fall	Winter
38%	24%	28%	10%

Although jogging is the most common activity throughout the Management Area and system-wide on Open Space, activity choices do vary within the Management Area (Tables 14.2 and 14.3). The Open Space land between Baseline and South Boulder Road shows some differences in activity choice compared to the remainder of the Management Area. Analysis of the individual access point information and staff observations indicate that exercising pets is the most popular activity in this subarea. The next most popular activities in this area are hiking, jogging, wildlife viewing, and bicycling.

Table 14.2: Four Most Popular Activities System-wide on Open Space

Jogging	Hiking	Exercising pets	Bicycling
39%	29%	21%	17%

Table 14.3: Four Most Popular Activities in the South Boulder Creek Management Area

Jogging	Hiking	Exercising pets	Bicycling
47.5%	10.6%	15.9%	22.6%

"Dog restrictions and lack of trail connections to the south result in less use for this subarea." Individual access point information indicates that jogging is the most popular activity choice, followed by bicycling, hiking, and wildlife viewing. Although the South Boulder Creek Trail currently dead-ends south of U.S. 36, Open Space has reached an agreement with the University

of Colorado to provide for a connection of the trail to Highway 93. As future trailheads and trail connections develop in this area, use levels are expected to be similar to those north of South Boulder Road.

The area north of Baseline is characterized by small isolated parcels of Open Space, and most visitation occurs along the Greenways trails. Estimates in this area indicate that bicycling is the most popular activity, followed by hiking, jogging, and exercising pets. This area receives the highest levels of use, followed by the area between Baseline and South Boulder Road. The area south of South Boulder Road receives significantly less use. The specific area or access point information provided above is based only on visitors who completed the exit registration cards, which is not everyone who visits the area. Use information provided for the Open Space system and the entire Management Area is based on visitor registration and on-site observation, providing more accurate results.

The place of residence of visitors using Open Space also varies between different areas. System-wide, 90.9% of the visitors reside in Boulder County compared to 95.5% within the Management Area (Tables 14.4 and 14.5). Visitors who come from outside Boulder County tend to use areas which have specific attractions and larger, well-known trailheads such as the South Mesa Trailhead. Currently, the Management Area only has four small parking areas and is not well known by out-of-County visitors.

Table 14.4: Place of Residence of Visitors System-wide on Open Space

City of Boulder	Boulder County	Denver Metro	Other Colorado	Out of state
74.6%	16.3%	1.7%	4.8%	3.3%

Table 14.5: Place of Residence of Visitors to the South Boulder Creek Management Area

City of Boulder	Boulder County	Denver Metro	Other Colorado	Out of state
88.6%	6.9%	0.8%	0.5%	3.3%

14.2.3 Passive Recreation Facilities

Passive recreation facilities in the Management Area include designated access areas such as trailheads, designated trails (trails which are signed, shown on public trail maps, and maintained by Open Space staff), and structures. Undesignated access points and undesignated trails are areas where informal use patterns have created obvious physical disturbances on the natural landscape. The Open Space Program discourages use of undesignated access points and

undesignated trails and encourages visitors to use designated trails in order to minimize impacts to natural resources by erosion and disturbance, to minimize fragmentation of wildlife habitat, to reduce resources needed to effectively maintain these areas, and to reduce trespass problems on adjacent private property.

Designated Access Areas

Designated access areas (Figure 14.1*) include access points and trailheads. Access points provide access to designated trails but do not provide vehicle parking. Trailheads provide vehicle parking and access to designated trails. Four designated trailheads are located within the Management Area. These trailheads generally provide parking, trash cans, information on local regulations and trails, and convenient access to trails. Random pedestrian access is discouraged but basically unrestricted along the entire perimeter of the area, with exterior fences being the only control of access.

It is essential to plan appropriate public access points to Open Space. In the past, pedestrian gates were placed to provide unplanned public access to various properties without taking other factors, such as access to designated trails or other facilities, into consideration. These gates did not connect to designated trails and have resulted in the creation of numerous undesignated trails. Undesignated trails are not maintained and are difficult to eliminate once use patterns become established.

Carefully planned access points connecting designated and maintained trails will enable the Open Space Program to focus management and use into appropriate areas, while discouraging use in sensitive or fragile areas. Open Space trailheads have become increasingly popular. Many of these trailheads are at or near parking capacity every weekend and often on weekdays. Encouraging use of alternate transportation modes will be an important consideration. More attention should be placed on providing access points which connect to existing Regional Transportation District bus routes and bicycle routes.

Trailheads

***Bobolink Trailhead*:** Located on the south side of Baseline Road just west of the intersection with Cherryvale Road. Parking for approximately nineteen vehicles, two designated handicap parking spaces, limited horse trailer parking, two bike racks, two trash cans, a new corral fence around the parking area, a dog excrement station, an information board, a trailhead sign, a welcome sign, a self-guided interpretive trail with seven stations, one picnic table, two access points to South Boulder Creek, and access to East Boulder Community Center and the Greenways trails are provided.

> **Assessment:** The trailhead was reconstructed during the fall of 1996 and is in good condition. The trailhead generally fills up with cars during the busy portions of the weekdays (between 7 a.m.-11 a.m. and 4 p.m.-7 p.m.) and on weekends, but parking problems have not been observed on adjacent areas.

***Dry Creek Trailhead*:** Located along the south side of Baseline Road just east of Baseline Reservoir. Parking for approximately twenty vehicles, two designated handicap parking spaces, limited horse trailer parking, a bike rack, a trash can, a new corral fence around the parking area, a dog excrement station, an information board, a trailhead sign, one picnic table, and access to Dry Creek Trail are provided.

Assessment: The trailhead is in good condition and generally provides adequate visitor parking (except during brief peak periods). A well established network of undeveloped trails has formed in recent years (see the section below on undesignated trails). A pedestrian underpass or marked pedestrian crossing may be needed at Baseline Road if trail connections are completed to the East Boulder trail system.

***Cherryvale Trailhead*:** Located on the west side of Cherryvale Road just south of South Boulder Road. Parking for approximately twenty vehicles, two designated handicap parking spaces, ten horse trailers, a bike rack, a trash can, an information board, a trailhead sign, a welcome sign, and access to South Boulder Creek Trail are provided.

Assessment: This trailhead was constructed during the fall of 1996 and is in good condition. Although this trailhead currently receives little use, it provides overflow parking for events held at the nearby Rocky Mountain Riding for the Disabled facility, located at the Open Space Cherryvale Operations Center. Future trail connections and increased public awareness of this trailhead will result in increased use levels in the near future. Policies regarding dog use in this area need to be clearly posted for visitors.

***Cottonwood Trailhead*:** Located on the south side of Independence Road just east of the Boulder-Longmont Diagonal Highway. Parking for approximately fifteen vehicles, limited horse trailer parking, a bike rack, a trash can, an information board, a trailhead sign, and access to Cottonwood Trail are provided.

Assessment: This trailhead is in good condition and generally accommodates parking needs for this area. The square shape of the parking lot and the narrow entry make it difficult to fully utilize the parking capacity.

Access Points

***Jay Road*:** Small access point located along Jay Road just east of the Boulder-Longmont Diagonal Highway. An information board and access to Cottonwood Trail are available.

Assessment: This access point is used mostly by commuters coming into Boulder and accessing other bike paths in the area. Occasionally, visitors park along the shoulder of Jay Road and this use should be monitored and discouraged.

***East Boulder Community Center*:** A large parking lot at the community center, managed by the Parks and Recreation Department and located along 55th Street between South Boulder Road and Baseline. A welcome sign, trash can, and dog excrement station are located at this access

point. The trash can and dog excrement station are located on Parks and Recreation land (for easy access to maintain the facilities), but are maintained by the Open Space Program.

Assessment: This parking lot is heavily used. The majority of visitors who use this access point appear to come from the community center and surrounding neighborhoods.

***Greenbelt Meadows subdivision*:** A small neighborhood access located south and west of 55th Street and South Boulder Road. According to the Planned Unit Development agreement this is a designated public access but no formal trail connections exist. There are several undesignated trails on the west side of South Boulder Creek in this area. Limited on-street parking is available along the entrance to this subdivision on 55th Street.

Assessment: Undesignated trails are prominent in this area, despite several attempts to discourage use of these trails. Closure of these undesignated trails will continue to be difficult until formal access to the designated trails is established. Long term, a pedestrian bridge and related improvements may be needed to connect this access to South Boulder Creek Trail.

***South Boulder Road*:** One access point located along the north side of the underpass at South Boulder Road and another located along the south side of South Boulder Road just west of South Boulder Creek. No parking is available, an information board is located at the access point south of South Boulder Road, and trash cans and welcome signs are available at both accesses.

Assessment: Many visitors access South Boulder Creek Trail from the west end of South Boulder Road, and these access points provide an important connection to designated trails in this area. The Regional Transportation District also has scheduled stops just east and west of these access points, and they provide convenient access for people using alternative modes of transportation. Parking problems frequently occur along South Boulder Road and the access trails which parallel the road to the south. Some parking patterns have also developed along both sides of 55th Street near its intersection with South Boulder Road. Because of safety consideration, parking in these areas should be discouraged and carefully monitored in the future. The trash can north of South Boulder Road receives little use and is difficult to access for maintenance. The underpass at South Boulder Road has water on the trail surface throughout much of the year, and numerous complaints have been voiced by citizens. Swallows often build their nests in the underpass and sometimes surprise visitors as they pass through the tunnel. Further, there is a need to correct drainage problems on the trail and advise people that swallows nest in the underpass.

***KOA Lake*:** This access point is located on the east side of 57th Street just south of Valmont Road. Limited on-street parking, an information board, two trash cans, and access to KOA Lake and the Boulder Creek Greenways Trail are available.

Assessment: This access point primarily provides access for fishermen at KOA Lake and some visitors using the Greenways trail which goes through this Open Space area. Parking

problems could develop and should be monitored.

***Cottonwood Pond*:** This access point is located along the south side of Pearl Street between 47th and 55th Streets (across from the City Yards and Rental City). Extensive informal parking has developed along the shoulder of Pearl Street. No Open Space signs or facilities are located at this access point.

Assessment: This access point primarily provides access for visitors using the Greenways trail which goes through this Open Space area. The parking area which has developed along the shoulder of the road on road right-of-way is heavily used but is relatively confined by Open Space boundary fences. The Open Space and Greenways Programs will work together to determine long-term parking needs and management actions for this area.

Designated Trails

Designated trails (Figure 14.1*) are considered to be official trails within the Open Space system which are signed and maintained by Open Space staff and appear on public trail maps. There are approximately 75 miles of designated trails within the entire Open Space system and approximately six miles located within the Management Area. Cottonwood, Dry Creek, and South Boulder Creek Trails are the three designated Open Space trails located within the Management Area. An additional four miles of Greenways trails are located on the Open Space land within the Management Area. The Greenways trails are constructed and maintained by the City of Boulder Transportation Department.

All of the trails within the Management Area are open to hikers, joggers, and people exercising pets. Bicyclists are allowed only on trails designated with the international bicycle symbol (approximately 4.7 miles are open to bicycle use in the Management Area and 32 miles in the entire Open Space system). A short section of trail (0.23 miles) is specifically designated for equestrian use. Many of the trails in the Management Area consist of 8-10-foot-wide gravel surfaced trails and are well suited for the multiple uses they provide. "The majority of the designated trails within the Management Area are located in flat terrain and are in good condition."

***Cottonwood Trail*:** Primarily a 10-foot-wide gravel trail which starts just east of the Boulder-Longmont Diagonal Highway on Jay Road and travels south to Independence Road. At Independence Road, the trail becomes an 8-foot concrete trail and continues south, eventually connecting to other bike paths in the area. The Greenways Program manages and maintains the concrete portion of the trail which is south of Independence Road. Many people continue along the roads and bike routes to connect to the Boulder Creek Greenways Trail.

Designated access areas: Cottonwood Trailhead and Jay Road access point.

Assessment: The Cottonwood Trail receives a high amount of use with few apparent problems. This trail is heavily visited by joggers and bicyclists commuting to and from

Boulder. Visitor use of this area could increase substantially with potential connections to Fourmile Canyon Creek Trail and other multi-use trails to the north and east which are managed by Boulder County.

***South Boulder Creek Trail*:** Begins at Baseline Road and currently continues south to the dead end of the trail near the gravel ponds on private property. Another section of the South Boulder Creek Trail is located west of Highway 93. A trails connection will be completed in the fall of 1997. The section of the trail included in this Management Area only includes the portions east of Highway 93. The trail is approximately 3 miles in length and is a combination of 5- to 6-foot-wide trail with crusher fines surface and a 10-foot-wide gravel service road. The entire trail is open to hikers and joggers. Equestrians and bicyclists are allowed on the majority of the South Boulder Creek Trail except for a short section of trail just south of the Bobolink Trailhead. A separate equestrian trail is provided in this short section and bicyclists are allowed on the newly constructed Greenways trail.

Designated access areas: Bobolink Trailhead, Cherryvale Trailhead, Greenbelt Meadows subdivision, East Boulder Community Center, and South Boulder Road.

Assessment: South Boulder Creek Trail is in good condition throughout most of its length. During irrigation season (spring and summer), sections of the trail surface on the Gebhard property become muddy, resulting in trail widening. Some areas of the creek bank are eroding and high water during the spring runoff has flooded the trail in recent years (1996 and 1997). Visitor use conflicts, connecting the trail to Marshall Road and Dry Creek Trail, and informal development of undesignated trails are the primary passive recreation issues for this section of the South Boulder Creek Trail. Several undesignated trails lead off the main trail and wander through both sides of the riparian corridor. The underpass at South Boulder Road has water on the trail surface throughout much of the year, and some visitors have expressed concerns about swallows nesting in the underpass.

***Dry Creek Trail*:** Begins at Dry Creek Trailhead, located off Baseline Road just east of Baseline Reservoir. The designated trail is a 10-foot-wide service road and is approximately a quarter mile in length. The trail is open for hiking and equestrian use and is extremely popular with people exercising pets.

Designated access areas: Dry Creek Trailhead

Assessment: This trailhead has become very popular in recent years, and an extensive network of undesignated trails has developed along Dry Creek and the Open Space lands directly east of Baseline Reservoir. The extensive network of undesignated trails will be evaluated, and additional designated trails could be considered. This trail is centrally located between the Management Area and the East Boulder Trail area.

Undesignated trails

Although the majority of use occurs on the designated trail system of the Management Area, an

extensive network of undesignated trails (Figure 14.1*) is developing. These informal undesignated trails fragment plant and animal communities and create corridors for the invasion of non-native plants. Undesignated trails have developed primarily in areas where no designated trails or access points have been established. There are approximately sixteen miles of undesignated trails and nine miles of old road grades (most of which receive some informal use) located within the boundaries of the Management Area. Undesignated trails were also classified into categories to assist with analyzing future trends. Of the sixteen miles of undesignated trails, approximately five miles were considered low use, four miles were considered moderate use, and seven miles were considered high use. Future connections may lessen use of these undesignated trails, but careful management will be required to eliminate use of these undesignated trails. Issues to consider in managing undesignated trails include:

1. Reducing visitor use conflicts (widening of the trail, possibly separating or regulating certain uses, eliminating blind spots by removal of surrounding vegetation or rerouting the trail)
2. Connections with other existing trails
3. Loop trails to discourage use of undesignated trails
4. Trail maintenance (wet areas, obstacles, building up the trail surface to allow adequate drainage, etc.)
5. Educational efforts and signs to discourage use of existing undesignated trails and creation of new undesignated trails
6. Conflicts with private landowners

Undesignated trails associated with South Boulder Creek Trail: Although the majority of use occurs along the South Boulder Creek Trail, undesignated trails have developed in some areas. The majority of the undesignated trails are concentrated between Baseline and South Boulder Roads. North of South Boulder Road undesignated trails have formed along the east and west side of South Boulder Creek. Use of the undesignated trails on the west side of the creek is associated with the East Boulder Community Center and the Greenbelt Meadows subdivision to the south. Some of these trails are along the banks of South Boulder Creek and seem to be spots where people go to get off the main trail to relax or enjoy the creek. The current creation of the creek access points and trail improvements on the Burke I property have drastically reduced the overall amount of undesignated trails in this area and have provided for continued enjoyment of the area by people with lessened environmental impact.

A prominent undesignated trail exists along the west side of South Boulder Creek and goes from the bridge at the East Boulder Community Center south to the Greenbelt Meadows subdivision. Most use of this trail comes from residents of the Greenbelt Meadows subdivision. A neighborhood access has been designated on the east side of this subdivision, but no formal trails connect this access with the South Boulder Creek Trail.

Another prominent undesignated trail has developed in the fields east of South Boulder Creek. The trail begins at the junction of South Boulder Creek Trail, the Greenways trail, and the Enterprise Ditch, and travels southeasterly to a pedestrian gate on the south end of the Gebhard

property. The trail initially developed primarily from equestrian use, but recently other types of activities occur in this area.

South of South Boulder Road, the designated trail becomes a 10-foot-wide combination service road/trail. Most visitors tend to remain on the designated trail south of this point. Occasionally, visitors wander off the trail to fish, check out the *Spiranthes diluvialis* research plots, or take a closer look at some of the historic buildings located in this area. Dogs are prohibited on the Open Space land south of South Boulder Road. This restriction and restricted access reduce the overall use of this area compared to other sections of the trail to the north. The connection with Marshall Road and the Open Space trail system west of Highway 93 will dramatically increase use of this section of trail.

***Undesignated trails in the Dry Creek area*:** An extensive network of trails has developed in this area in recent years. A very prominent loop has formed along the south side of Dry Creek which starts at the trailhead and joins with the designated trail near the bridge crossing for the Enterprise Ditch. At the bridge, the designated trail ends and several undesignated trails travel south and west in the field just west of Baseline Reservoir. No attempts have been made to close these trails, and most people assume that they are part of the designated trail system. Developing a loop trail, potential connections to South Boulder Creek Trail, and the East Boulder Trail will be evaluated before final trail locations are determined.

***Undesignated trails associated with Boulder Creek Greenways Trail*:** A well-developed, undesignated trail parallels the Boulder Creek Greenways Trail through the William Arnold and Cottonwood Grove properties. These trails seem to be used primarily by pedestrians and joggers attempting to get away from the heavily used Greenways trail. A large loop has formed around the pond just north of the Cottonwood Grove, and many people park along Pearl Street (across from Rental City) to access the trails in this area.

***Isolated undesignated trails*:** A number of small, undesignated trails have formed on some of the isolated parcels of Open Space. These include undesignated trails on the Hatch-Quinby-Phipps, Colorado Open Lands, Andrus, and Ute Industrial Park properties. Most of the use in these areas occurs from residents of surrounding neighborhoods and people exercising their pets. These trails are in urban areas which are greatly influenced by the surrounding development. Access and trails from several adjacent subdivisions have developed and will be evaluated in the future.

Passive Recreation Structures

***Rocky Mountain Riding for the Disabled*:** A therapeutic riding center for people with mental and physical disabilities is located at the Open Space Operations Center at 66 South Cherryvale Road. This eighteen-horse facility has covered horse stalls, fenced turn-out areas, a large barn for hay storage, parking for approximately thirty vehicles, handicap-accessible restrooms, and a large riding arena. The riding arena is generally used by Rocky Mountain Riding for the Disabled but can be scheduled for public use by contacting Rocky Mountain Riding for the Disabled.

14.2.4 Planned Passive Recreation Facilities

The Open Space Program has negotiated an easement to connect South Boulder Creek Trail to Marshall Road. Connections with the East Boulder trail system beginning at Arapahoe Road, approximately 1.5 miles east of 75th Street, will be evaluated. Use of the trails and surrounding Open Space lands is expected to increase as a result of these connections and developments.

The *Boulder County Comprehensive Plan* and the *Boulder Valley Comprehensive Plan* have identified trail connections within the Management Area (Figure 14.2). The trail connections which could occur on or influence use of Open Space lands include: (1) a conceptual trail corridor along the Boulder-Longmont Diagonal Highway that would connect Gunbarrel to north Boulder, (2) a Greenways multi-use trail connection from Fourmile Canyon Creek at the Boulder-Longmont Diagonal Highway east to the Cottonwood Trail, (3) continuation of the Boulder Creek Greenways Trail from its current dead end at Valmont and 57th Street north and east to 61st/ 63rd Street, (4) a conceptual trail corridor along the Union Pacific Railroad right of way from Boulder (in the vicinity of Valmont and 55th Street) east to 75th Street, (5) an Open Space trail corridor from the Dry Creek Trail north and east to the East Boulder Trail and south and west to the South Boulder Creek Trail, (6) a Greenways trail corridor along U.S. 36 from Boulder to Louisville, and (7) an Open Space trail corridor from the current dead end on South Boulder Creek Trail to Marshall Road. These connections will be addressed over the next several years through a public process and based upon staff and financial resources available.

14.2.5 Visitor Services

As more and more visitors enjoy Open Space areas such as this Management Area, additional resources and staff time are needed to provide an enjoyable and safe recreational experience. Trails and trailheads must be built, signs must be installed to direct visitors to appropriate areas and to interpret the natural resources, and staff must inspect and maintain the facilities and amenities that are provided. Visitor services include education and outreach, facility development and maintenance, patrol, law enforcement, and emergency response.

Passive recreation facilities require extensive staff efforts and financial resources to construct and maintain. Trailheads and major access areas are maintained on a regular basis and are monitored and maintained once or twice a week depending on the time of the year. Maintenance includes general trash cleanup, emptying trash cans, restocking brochures and dog excrement bags, and routine repairs.

Open Space rangers routinely patrol Open Space lands to monitor visitor use and potential resource impacts, educate and inform visitors, inspect recreational facilities (trails, trailheads, structures, etc.), encourage visitor safety (wildlife interactions, natural hazards), enforce regulations, and respond to emergencies. High use areas are checked several times a week, and remote or seldom used areas are checked on a monthly basis. There are numerous farm buildings

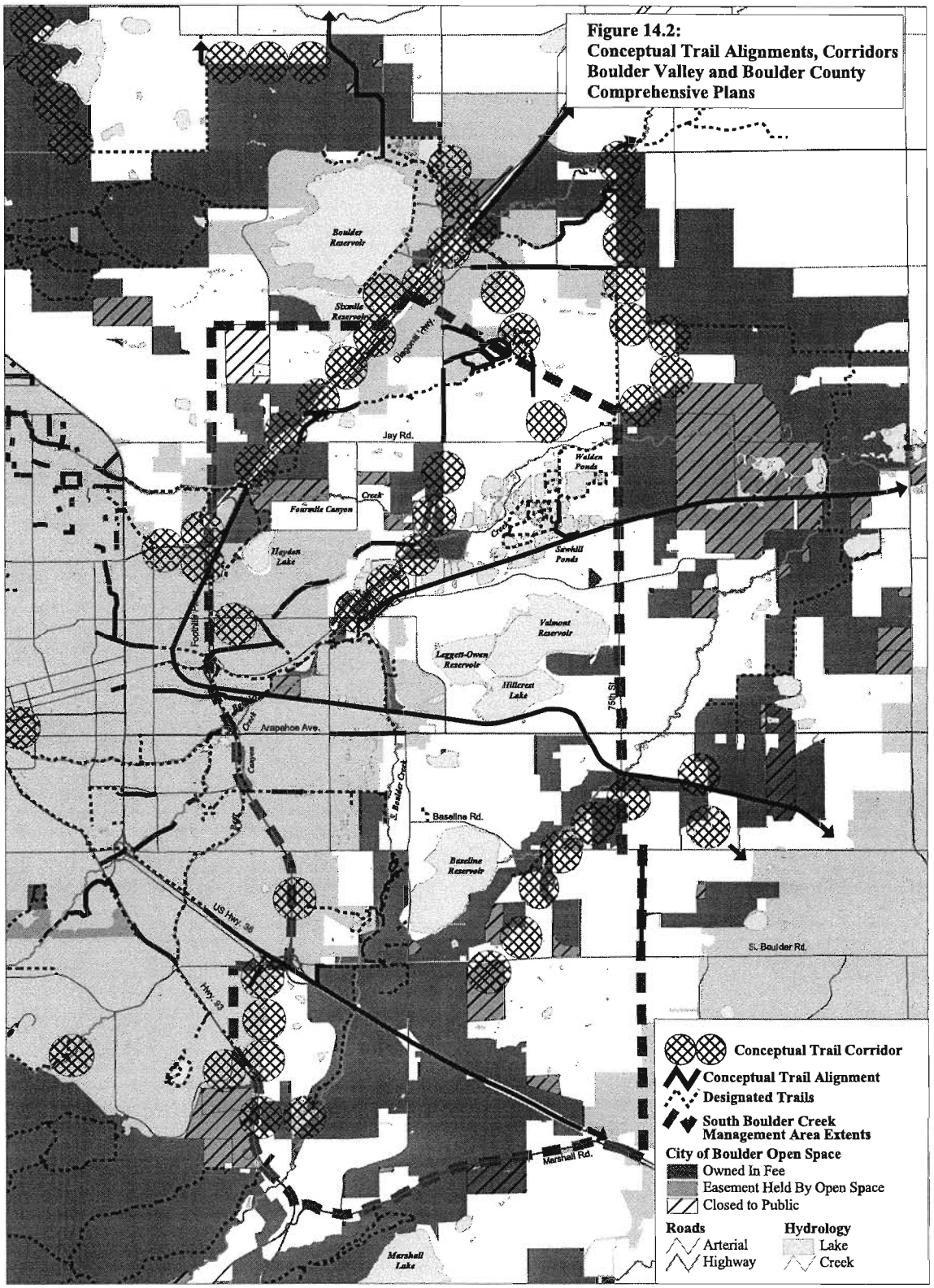


Figure 14.2:
Conceptual Trail Alignments, Corridors
Boulder Valley and Boulder County
Comprehensive Plans
Boulder Reservoir
Stazzilo Reservoir
Diagonal Hwy.
Jay Rd.
Walden Ponds
Fourmile Canyon Creek
Hayden Lake
Sawhill Ponds
Foothills Pkwy
Valmont Reservoir
Leggett-Owen Reservoir
Hillcrest Lake
75th St.
Arapahoe Ave.
Boulder Creek
Canyon
S. Boulder Creek
Baseline Rd.
Baseline Reservoir
US Hwy. 36
Hwy. 93
St. Boulder Rd.
Marshall Rd.
Marshall Lake
Conceptual Trail Corridor
Conceptual Trail Alignment
Designated Trails
South Boulder Creek Management Area Extents
City of Boulder Open Space
Owned In Fee
Easement Held By Open Space
Closed to Public
Roads
Arterial
Highway
Hydrology
Lake
Creek

and historic structures located in the Management Area which must be monitored, maintained, and inspected. These structures often attract illegal activities such as vandalism and illegal camping, drinking, and fires.

Rangers are responsible for law enforcement and emergency response on Open Space lands and assist other agencies in these areas as needed. Appendix 14.2 contains a copy of the regulations for the Management Area. Common violations in the Management Area include trespassing within the Cottonwood Grove (a restricted access Open Space parcel along Boulder Creek), vandalism to barns and structures, illegal camping, dogs at large, dogs where prohibited on the Van Vleet property, and failure to remove animal excrement. New dog regulations are in effect in many areas of Open Space, requiring extensive staff time to educate and promote compliance. Figure 14.3* depicts the various dog regulations for the Management Area.

Rangers receive backup and assistance from the Boulder Police Department and Boulder County Sheriff's officers as available. Boulder police officers assist rangers inside the City limits of Boulder, and Boulder County Sheriff's officers assist outside the City limits. This situation often leads to confusion as to who has the appropriate jurisdiction, and neither agency is typically familiar with Open Space lands.

Emergency response involves many different activities. These activities include firefighting and responding to medical emergencies, natural disasters (flooding, tornados, etc.), and search and rescue requests. These services are provided year-round and twenty-four hours a day.

14.3 ISSUES

Trails

Potential connections to trails in surrounding areas:

- Dry Creek Trail south to trails around Marshall Mesa
- Dry Creek Trail east and north to trails around Louisville
- Cottonwood Trail north and west to trails around North Boulder Valley
- South Boulder Creek Trail to Marshall Road and South Mesa/Shanahan
- South Boulder Creek Trail to Marshall Mesa
- Dry Creek Trail to East Boulder
- Greenways trails (Fourmile Canyon Creek and City of Louisville along U.S. 36)
- Boulder-Longmont Diagonal Highway

- Potential connections to trails within the Management Area:
- Dry Creek Trail to South Boulder Creek Trail
- Continued use and creation of undesignated trails (particularly in areas to the east and in small parcels close to Boulder).
- Complaints about water on the trail surface at the South Boulder Creek underpass and swallows nesting in the underpass.

Access
- Pedestrian gates that have been placed which do not connect with existing designated trails.
- Access to Open Space from private subdivisions (Wildflower Ranch, Greenbelt Meadows).
- Access and increased use which could result from residential development to the east and development of areas which are adjacent to Open Space lands.

Structures, amenities, and visitor services
- Appropriate level of services, facilities, and amenities provided at trailheads and access points.
- Staffing levels needed to provide adequate visitor services.

Types of uses
- Use of Church property by model glider pilots.
- Increased visitation levels and multiple uses in some areas could result in visitor conflicts and impacts to natural resources.
- Adjacent landowner uses (land practices, development) and potential influences to surrounding Open Space areas.
- Use of area by domestic pets and associated impacts (dog management issues related to impacts to visitors, livestock, and wildlife).
- Appropriate dog regulations for the Management Area (determining the status of dog regulations on the planned extension of South Boulder Creek Trail, inconsistency of regulations along and on the both sides of South Boulder Road and Cherryvale Trail, and inconsistency of regulations along the Boulder Creek Greenways Trail).

Enforcement issues
- Enactment of new dog regulations.
- Mediation of user conflicts.
- Appropriate ranger staff levels and adequate training.

Safety concerns
- Coal mine subsidence problems around the Richardson and Church properties.
- Safe trail crossings for any future trail connections (crossings for the South Boulder Creek Trail at Baseline Road and Highway 93, extension of Dry Creek Trail to the northeast and southwest).

Natural resources and recreational uses
- Educational and interpretive activities and signs to enhance visitor appreciation and understanding of natural resources within the Management Area.
- Potential impacts from recreational use (Preble's meadow jumping mouse, Ute ladies'-tresses orchid, ground-nesting birds, tallgrass prairie areas, riparian areas).

14.4 DATA GAPS

Updated Information Regarding Visitation
Predictive model updates have not been completed for 1995/1996 and 1996/1997. No studies have been conducted to determine the distribution of visitor use within the Management Area. Current estimates of use along the Greenways trails would be helpful to better understand how these trails influence visitation patterns on Open Space lands.

Impacts From Passive Recreation
"Additional research is needed to evaluate the potential impacts of passive recreation on natural resources (fragmentation of sensitive plant and animal communities, effects of various recreational activities such as dogs off leash, and visitor experiences (crowding, visitor conflicts). Studies are being developed and conducted which will evaluate recreational impacts and visitor use needs. Results from these studies should be incorporated into the future management of this area.

Future Development of Adjacent Lands
Appropriate location and management of public access to Open Space must be incorporated into the management of the area as adjacent lands are developed.

Passive Recreation Needs Assessment
No studies have been formally conducted to determine the passive recreation needs of Boulder citizens who support the acquisition of Open Space lands through their tax dollars. Studies of past visitor use activities have been conducted (Zeller et al. 1993). Public meetings will be conducted throughout the area management planning process, and staff will incorporate this public comment and input into the planning effort. Open Space is also working with various user groups to determine passive recreational needs for this Management Area.

City Ecosystem and Trail Plans
Resource plans -- Ecosystem Plan, Visitor Use Plan, and Forest Ecosystem Plan -- that provide a comprehensive analysis of the City's natural resources are being developed and will have to be incorporated into the management of recreational amenities in the area. Periodic updates to the *Boulder Valley Comprehensive Plan* and the *Boulder County Comprehensive Plan* must be incorporated into current trails plans.

Compliance With Dog Regulations
Revised dog regulations are in effect in many areas of Open Space. Monitoring and further analysis are needed to determine visitor compliance and the effectiveness of these regulations.

15. EDUCATION AND OUTREACH

15.1 INTRODUCTION

The Open Space Program has the responsibility to manage its resources in a sound, proactive way. Successful Open Space management requires a combination of education and management actions. These actions must be timely and designed to meet specific management challenges. Heavy visitation to Open Space emphasizes the "first line" importance of education in accomplishing management.

The goal of the education and outreach program and management and planning programs is to:

- Establish education and management measures in a reasonable, responsible, timely way to ensure that the Open Space system remains ecologically, agriculturally, and recreationally viable

Objectives to accomplish this goal are to:

- Conduct first-rate education and outreach activities for the general public and ensure that decision makers are aware of these efforts

- Proactively provide education and public participation opportunities on management decisions by responsibly incorporating citizen ideas into recommendations

- Provide opportunities for the public to assist in management activities which accomplish program goals.

To achieve these goals and objectives, education and outreach efforts are focused on three audiences:

- General public: citizens as a whole and people who pay sales taxes that support the Program
- Frequent Open Space visitors: people who visit Open Space at least once a week comprising 85% of Open Space visits
- Opinion leaders: members of the community that have an active interest in influencing Open Space decision making, including elected and appointed officials

The Program's education and outreach goals are met through the following general activities:

- Conducting projects and programs that provide opportunities for people to establish a relationship with the Open Space Program and land system

- Engaging in public processes which provide opportunities for public input, discussion, and involvement in Open Space planning and decision making
- Using media opportunities to communicate Open Space activities, achievements, issues, management challenges, and messages

15.2 RESOURCE INFORMATION

15.2.1 Facilities

The Management Area has four trailheads, six designated access points, and three trails with a total of approximately six miles of designated and maintained trails on Open Space. Trailheads include parking lots, information boards, and, in some cases, welcome signs. Accesses may include information boards and welcome signs.

Information boards are located at four trailheads and four designated access points in this Management Area. The information board at Bobolink Trailhead contains a brochure dispenser. These boards display an area map with trail information, rules and regulations (including international symbols), Nature Trails program notices, and timely notices of importance (i.e., wildlife warnings, emergency trail closures, public meetings, etc.).

A series of seven interpretive signs was installed in 1996 along the South Boulder Creek Trail near the Bobolink Trailhead. Other informational signs such as boundary markers and "please stay on trail" are posted in selected locations. See the Passive Recreation chapter of this report for further information on amenities.

15.2.2 Current Activities

Educational programming in the Management Area has not used a central theme; a wide variety of programming has been opportunistic, taking advantage of education resources, citizen interest, and staff availability. The Nature Trails program series has conducted an average of eleven educational activities in the Management Area annually, reaching about 250 people.

Education and outreach activities combine to form a comprehensive approach to disseminating and receiving information. Education activities generally involve more formal presentations and one-way communication, while outreach includes more dialogue with the public and decision makers on management proposals.

Education activities conducted in 1996 by the Open Space Program include:

- In-field interpretive programs
- Presentations and discussions at the request of civic groups, neighborhood organizations, schools, and other groups

- Information and interpretive signs
- Trailhead information boards

Outreach activities conducted by the Open Space Program include:

- Quarterly newsletter--*Open Space...Naturally!*
- News releases to the media
- Internet/world wide web site on the Boulder Community Network (http://bcn.boulder.co.us) to educate, and respond to requests and comments from citizens
- Contacts by Open Space staff and volunteers in the field
- Public meetings including in-field meetings, field trips, open houses, forums, and City Council and Open Space Board of Trustees meetings
- Individual meetings and phone conversations
- Quantitative surveys and focus groups
- Effectiveness assessments to assure that Program goals are being achieved and that the public is being effectively served--these evaluations include internal and external evaluation forms, activity debriefings, and staff assessments

15.2.3 Resource Topics

Resource topics used to advance the Program's education and outreach goals and objectives are natural, recreational, agricultural, or cultural features. Past program topics include: raptors and birds of prey, mountain lion ecology, bats, wildlife, insects, grasslands, rare plants, wetland ecology, astronomy, nocturnal wildlife, responsible visitor use, and mining history.

Primary education themes for the Management Area include attributes associated with floodplains, wetlands influences of the developed environment on natural resources, endangered tallgrass prairies, the complexity of managing multiple rare species, how to enjoy and reduce impacts to Open Space, and mining and agricultural histories.

A more extensive list of education and outreach resource topics includes (rare species or prime examples follow dashes):

- Wildlife: ground-nesting birds--bobolink, wildlife closures, raptors, Preble's meadow jumping mouse, bats, coyotes, foxes, snakes, frogs, fish--plains topminnow and orange spotted sunfish, aquatic invertebrates, etc.
- Plants: cottonwoods, native mixed-and tall-grasslands, noxious weeds, wildflowers--Ute ladies' tresses orchid, American groundnut
- Cultural: prehistoric sites, Native American history, ranching history, coal mining areas, historic barns and structures--Viele house and associated buildings, ditches--Howard Ditch (April 1860), Davidson Ditch (May 1860), McGinn Ditch (May 1860)
- Geologic: Valmont Dike, fossils
- Agricultural: cattle, farming, ditches

- Wetlands: ponds, ditches, wetlands, South Boulder Creek floodplain and morphology
- Conservation biology concepts: habitat fragmentation, connectivity, edge effects, fire ecology
- Other: adjacent development

15.2.4 Volunteer Programs and Projects

Volunteers are a valuable resource to the Open Space staff and to the public. The public is encouraged to participate in accomplishing Open Space goals. Open Space volunteers supplement staff efforts, contributing their professional, technical, or avocational skills. Staff commits significant time to the training of volunteers to provide them with the information and resources necessary to be successful. Many volunteer projects and activities have been conducted in the Management Area. See Appendix 15.1 for an inventory of volunteer programs and projects.

- Volunteers with extensive professional and avocational skills conducted inventories and assessments of cultural and natural resources. Ongoing research and monitoring projects include endangered plant, raptor, predator, avian, and bat studies.
- Students earned internship credit for completing service learning and research projects.
- Court ordered community service has allowed citizens to make restitution on cleanups, weeding, and maintenance work.
- Community corrections crews contributed labor-intensive service in this Management Area. Activities included trash pick up, fence construction, reclamation work, integrated pest management, and irrigation work.
- Neighborhoods and groups helped with habitat plantings, revegetation, and trail building and maintenance.
- A Stewardship Program for this Management Area was initiated in 1992, allowing interested citizens to agree to learn about and care for the area through time.
- Open Space Trail Guides walk trails and serve at trailheads, providing information to the public, gathering information for staff, and providing education.
- Youth Service Learning groups and organizations carry out maintenance and restoration projects in this area, including reclamation work and trailhead work.

15.2.5 Education and Outreach Activities of Adjacent Agencies and Land Owners

Other agencies and individuals are involved with education, outreach, and volunteering in the Management Area. Open Space education and outreach activities will coordinate with and complement other educational programs, when possible. A partial inventory of these agencies and individuals follows:

- Thorne Ecological Institute: nonprofit environmental education organization providing classes and bird banding

- Boulder Audubon Society: hikes, annual bird count
- Numerous day care and private preschools
- Boulder County Parks and Open Space, Walden Ponds: numerous environmental education programs focusing on riparian ecology
- City of Boulder Mountain Parks: numerous environmental education programs on a variety of topics focusing on riparian ecology

15.3 ISSUES

Issues are areas of concern in which Open Space should evaluate education and outreach activities. Education and outreach opportunities may arise from public interest in a particular topic or project or from Open Space needs to resolve a particular issue or emergency. Among the important issues are:

- Conflicts between various types of uses
- Protection of sensitive species
- Protection of fragile riparian corridors
- Protection of sensitive geologic, historic, and prehistoric sites
- Use and creation of undesignated trails
- Environmental impacts from increased visitor use
- Vandalism to Open Space property and facilities
- Impacts from housing, commercial, and industrial developments adjacent or near to Open Space and the associated impacts
- Protection of livestock and croplands on Open Space properties
- Priorities for educational and outreach efforts for area management
- Anticipate and proactively educate about area management issues

15.4 DATA GAPS

- Provide evaluative standards and measures to assess the quality and effectiveness of the Program's education and outreach activities.

- Identify education and outreach needs for each Open Space division or specialty to develop appropriate programs and service levels.

- Engage in public process to determine citizens' needs for and expectation of education and outreach in the Management Area.

REPORT CONTRIBUTORS

SOUTH BOULDER CREEK MANAGEMENT AREA INTERDISCIPLINARY TEAM MEMBERS

Bob Crafaci (Water Resources Specialist) - water resource inventory and analysis

Mark Gershman (Natural Resource Planner) - wetlands inventory and analysis; coordination of wetland issues

Mark Grundy (Resource Specialist) - agricultural resources and reclamation

Cindy Hansen (Education/Outreach Specialist) - community outreach; inventory of potential outreach/education opportunities; overall coordination with the Education Outreach Division

Dave Kuntz (Planning Supervisor) - planning context; coordination with administrative staff and Open Space Board of Trustees; integrating project into Open Space Program's work program

John Leither (Trails Coordinator) - trail inventories; trail construction and maintenance issues; facilities; overall coordination with Land Management staff

Sean Metrick (Technical Research Assistant) - cartography and Geographic Information System analysis

Doug Newcomb (Property Agent) - real estate/property/easement information and related issues

Lynn Riedel (Plant Ecologist) - vegetation inventory and analysis; coordination of integrated pest management and fire management

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Jean Koszalka (Ranger II) - emergency activities; patrol activities; public contact

Michael Warren (Project Facilitator) - coordination and edited natural resources chapters; natural history inventory; assisted with project management

Matt Jones (Open Space Planner) - project manager; cultural resources inventory; bon vivant

Other Inventory Report Contributors

Many other staff members, surrounding agencies, consultants, and volunteers were involved in collecting information and completing inventory reports. Other significant contributors include:

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John D'Amico (Property Administrative Aid) - real estate/property/easement information and related issues

Clint Miller (Wildlife Biologist) - wildlife inventory and analysis

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Laurie Deiter (Natural Resource Specialist) - integrated pest management

Ann FitzSimmons (Administrative Assistant) - inventory report editing

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Pete Gleichman (Archaeologist with Native Cultural Services) - cultural resource inventories

Bill Grabow (Construction Carpenter) - facility information

Hydrosphere (water resource consulting firm) - water resource analysis

Mary Lovrien (Support staff) - inventory report editing

Ben MacDougall (Facilities Person) - facility information

Rich Smith (Education and Outreach Coordinator) - education and outreach information

Delani Wheeler (Deputy Director) - historical perspectives on Open Space acquisition and management

Bryan Pritchett (Natural Resources Manager) - coordination with natural resources and administrative staff and integrating project into work programs

Nancy Neupert (Assistant Plant Ecologist) - vegetation research and inventory

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APPENDICES

APPENDIX 2.1 PLANNING CONTEXT

2.1.1 Boulder Valley Comprehensive Plan Policies

Community Design

Community Identify/Land Use Pattern

2.05 Open Space Preservation.
The City and the County will preserve lands with unique natural features and characteristics as permanent open space by purchase of development rights, fee simple gifts or purchases, and other measures as appropriate and financially feasible.

Community Conservation

2.25 Community Sustainability.
Within the resource limits and the population carrying capacity of the Boulder Valley, the City and the County seek to maintain and enhance the liveability, health, and vitality of the Boulder Valley and its bioregion now and in the long-term future. Maintaining the long-term health of the natural environment and the economy and community liveability in the Boulder Valley and beyond are inextricably linked. The City and the County seek to preserve choices for future generations and to anticipate and adapt to changing community needs and external influences.

2.27 Historic and Cultural Preservation Plan.
The City and the County shall develop a Boulder Valley-wide preservation plan in order to integrate historic preservation issues into the Comprehensive Plan, to ensure coordination between preservation goals and zoning, land use, growth management, transportation, and housing goals, and to ensure consistency among governmental policies that affect the community's historic and archaeological resources.

Environment

Protect Natural Resources: Lands

4.06 Natural Ecosystems.
The City and the County shall protect and restore significant ecosystems and habitats for native plant and animal species on public and private lands through acquisition, land use planning, development review, and public land management practices. Promotion of biological diversity and protection of endangered species and their associated habitats will be emphasized. Degraded habitat may be restored, and selected extirpated species may be reintroduced as a means of enhancing native flora and fauna in the Boulder Valley. Natural areas (as designated in the Boulder County Comprehensive Plan) that are within the Boulder Valley shall be managed in a manner that is consistent with the Natural Area Goals and Policies of the Boulder County Comprehensive Plan.

4.07 Ecosystem Connections and Buffers.
The City and the County recognize the biological importance of preserving large areas of unfragmented habitat. The City and County will work together to preserve, enhance, and restore undeveloped lands critical for providing ecosystem connections and buffers for joining significant ecosystems. These areas are important for sustaining biological diversity and viable habitats for native species and for minimizing impacts from developed lands.

4.08 Maintain and Restore Ecological Processes.
Recognizing that ecological change is an integral part of the functioning of natural systems, the City and the County shall work to ensure that, when appropriate precautions have been taken for human safety and welfare, natural processes will be utilized or mimicked to sustain, protect, and enhance native ecosystems.

4.09 Wetland Protection.
Natural and human-made wetlands are valuable for their ecological and, where appropriate, their recreational functions, including their ability to enhance water and air quality. Wetlands also function as important wildlife habitat, especially for rare, threatened, and endangered plants and wildlife. The City and the County will continue to develop programs to protect and enhance wetlands in the Boulder Valley. The City shall discourage the destruction of wetlands, but in the rare cases when development is permitted and the filling of wetlands cannot be avoided, they shall be restored or replaced.

4.10 Public Access to Public Lands.
Certain City- and County-owned or managed lands provide a means for educating citizens on the importance of the natural environment. Public lands may include areas for recreation, preservation of agricultural use, unique natural features, and wildlife and plant habitat. Public access to public lands shall be provided for except where necessary to protect such areas from unacceptable degradation, unacceptable impacts to habitat and wildlife, or for public safety.

4.12 Agricultural Land.
The City and the County shall encourage the preservation of agricultural lands as a current and future source of both food and fuel and for their contribution to cultural, environmental, and economic diversity. Agricultural lands with national, state, and local significance have been identified. The City and the County will encourage the protection of significant agricultural areas and related water supplies and facilities, including the historic and existing ditch systems, through a variety of means, which may include public acquisition, land use planning, and sale or lease of water for agricultural use.

4.13 Unique Geological Features.
Due to its location at the foot of the Rocky Mountains, the Boulder Valley has a number of significant or unique geological features which have been identified. The City and the County shall attempt to protect these features from alteration or destruction through a variety of means, such as public acquisition, land use planning and regulation, and density transfer within a particular site.

4.18 Wildfire Protection and Management.
The City and the County will require on-site and off-site measures to guard against the danger of fire in developments adjacent to forests of grasslands. Recognizing that fire is a widely accepted means of managing ecosystems, the City and the County will integrate ecosystem management principles with wildfire hazard mitigation planning and urban design.

Protect Natural Resources: Water

4.19 Protection of Water Quality.
The City and the County shall protect, maintain, and improve water quality within the Boulder Creek basin and Boulder Valley watersheds, as a necessary component of existing ecosystems and as a critical resource for the human community. Efforts will be made to protect the quality of ground water, surface water, and storm water, and to plan for future needs.

4.22 Minimum Flow Program.
The City shall pursue expansion of the existing instream minimum flow program to protect aquatic ecosystems within the Boulder Creek watershed.

4.23 Protection of Aquifer and Ground Water Recharge Areas.
The City and County shall continue to evaluate aquifers, ground water recharge areas, and sources of ground water pollution within the Boulder Creek watersheds and formulate appropriate protection programs.

4.26 Flood Management.
The functional and aesthetic qualities of drainage courses and waterways shall be preserved and enhanced. A noncontainment approach to flood management shall be used on Boulder Creek. A generally non-structural approach to flood control that emphasizes a natural appearance shall be used on all major water courses and drainageways. In some cases a structural solution may be used, consistent with adopted master plans.

Protect Natural Resources: Resource Conservation

4.33 Resource Planning.
The City and the County shall seek to incorporate short- and long-term environmental costs into resource planning decisions, to maximize the efficiency of resource use in the Boulder Valley and to encourage the use of renewable resources.

4.43 Integrated Pest Management.
The City and the County shall encourage efforts, both public and private, to reduce the use of chemical herbicides, pesticides, and fungicides. In its own practices, the City commits to use of integrated pest management, which emphasizes the selection of the most environmentally-sound approach to pest management, with the overall goal of reducing and, where possible, eliminating the dependence on chemical pest control strategies.

2.1.2 Boulder County Comprehensive Plan Goals and Policies

Goals

Design of the Region

A.1 Future urban development should be located within or adjacent to existing urban areas in order to eliminate sprawl and strip development, to assure the provision of adequate urban services, to preserve agriculture, forestry, and Open Space land uses, and to maximize the utility of funds invested in public facilities and services.

Environmental Management

B.1 Unique or distinctive natural features and ecosystems and cultural features and sites should be conserved and preserved in recognition of the irreplaceable character of such resources and their importance to the quality of life in Boulder County. Natural resources should be managed in a manner which is consistent with sound conservation practices and ecological principles.

B.3 Critical wildlife habitats should be conserved and preserved in order to avoid the depletion of wildlife and to perpetuate and encourage a diversity of species in the County.

B.4 Significant natural communities, including significant riparian communities and rare plant sites, should be conserved and preserved to retain living examples of natural ecosystems, furnish a baseline of ecological processes and function, and enhance and maintain the biodiversity of the region.

B.5 Wetlands, which are important to maintaining the overall balance of ecological systems, should be conserved.

B.6 Unique or critical environmental resources identified pursuant to Goals B.1, B.3, B.4 and B.5 shall be conserved and preserved in a manner which assures their protection from adverse impacts, with the private sector, non-County agencies, and other governmental jurisdictions being encouraged to participate.

B.7 Productive agricultural land is a limited resource of both environmental and economic value and should be conserved and preserved.

B.8 Environmental Conservation Areas (ECAs) should be conserved and preserved in order to perpetuate those species, biological communities, and ecological processes that function over large geographic areas and require a high degree of naturalness.

B.9 Riparian ecosystems, which are important plant communities, wildlife habitat, and movement corridors, shall be protected.

Parks and Open Space

C.1 Provision should be made for Open Space to protect and enhance the quality of life and enjoyment of the environment.

C.2 Parks, Open Space, and recreation facilities should be encouraged throughout the County and should be integrated whenever suitable with public facilities. The County will assume only those financial responsibilities for public development as provided under Open Space Policy OS 4.02.

C.3 Open Space shall be used as a means of preserving the rural character of the unincorporated County and as a means of protecting from development those areas which have significant environmental, scenic, or cultural value.

C.4 A County-wide trail system shall be promoted to serve transportation and recreation purposes.

C.5 The private sector, non-County agencies, and other governmental jurisdictions should be encouraged to participate in Open Space preservation and trails development in Boulder County.

Cultural Resources

K.1 Every effort shall be made to identify and protect historic sites which meet national, state, or local criteria for historic designation from destruction or harmful alteration.

Policies

Environmental Resources

Natural Areas

ER 2.02 Natural Areas shall be preserved through the planning of compatible surrounding land uses. Land use proposals which may have potential adverse impacts to Natural Areas shall be dealt with on a case-by-case basis. Depending on the scale and location of the proposal and the scope of the adverse impacts, the County may determine that a site specific evaluation of the impacts is warranted and will be required of the applicant.

ER 2.06 Designated Natural Areas or natural landmarks which also have other environmental designations (e.g., critical wildlife habitats, wetlands, rare plant sites, environmental conservation areas) will be dealt with according to all appropriate policies and regulations.

ER 2.07 The County shall identify and work to assure the preservation of critical wildlife habitats, Natural Areas, natural landmarks, environmental conservation areas, and significant agricultural land.

Wildlife Habitat

ER 4.03 The Boulder County Comprehensive Plan and attendant regulations shall be formulated to ensure that proposed land uses, including structures, shall be compatible with the ecosystem of critical wildlife habitats and not pose immediate and potential detrimental impacts to such habitats.

ER 4.11 Where critical plant associations or rare plant sites exist within Community Service Areas or are controlled by municipalities, Boulder County shall offer assistance to municipalities for the establishment of management plans.

ER 4.12 Land use proposals which could have potential adverse impacts on critical plant associations or rare plant sites shall be dealt with on a case-by-case basis in order to eliminate or adequately mitigate such adverse impacts: Depending on the scale of the project and the degree to which the proposal will alter the natural successional patterns of the area, the applicant may be required to complete a report addressing the proposal's impacts on the identified associations or species, and shall include recommendations for elimination or mitigation of such adverse impacts.

Rare Plants and Natural Communities

ER 5.03 The County shall cooperate and participate with other governmental agencies and other public and private organizations to develop regional approaches to natural community and rare plant protection: Where significant natural communities or rare plant sites have been identified on public land, the County will pursue intergovernmental agreements to ensure the specific protection of these resources: Where significant communities or rare plant sites exist within Community Service Areas, Boulder County shall provide assistance to municipalities for the establishment of management plans to avoid the degradation or loss of such resources.

ER 5.04 The County will encourage applicants of land use proposals to avoid damaging, disturbing, or disrupting any natural communities: The County will review proposals which could potentially disturb or alter significant natural communities or rare plant sites: If adverse impacts to the vegetation are unavoidable, the County shall request a report addressing the proposal's impacts on the identified community or site and any appropriate mitigation measures (including site restoration). The report shall detail the implementation of a site specific management and monitoring plan designed to minimize impacts to the community or site.

Wetlands

ER 6.01 Landowners of existing significant wetlands will be encouraged to seek assistance from Soil Conservation Services or the Parks and Open Space Department for the purpose of formulating management plans.

ER 6.02 The County will encourage applicants of land use proposals to avoid damaging, disturbing, or disrupting any significant wetlands: Where impacts to significant wetlands are unavoidable, the County shall request appropriate mitigation, including restoration, enhancement, and/or creation of wetlands along with the implementation of a management and monitoring plan. Although requested protection measures for locally significant wetlands may exceed the requirements of other governmental agencies, the practices are intended to complement, and not negate, any other wetland requirements.

ER 6.03 Boulder County shall cooperate with the Soil Conservation Service's policy of providing no financial or technical assistance for the conversion of significant wetlands to other uses.

ER 6.04 The County shall cooperate and participate with other governmental agencies and other public and private organizations to develop regional approaches to wetlands protection. Where significant wetlands have been identified on public land, the County will pursue intergovernmental agreements to ensure the specific protection of these resources: Where significant wetlands exist within Community Service Areas, Boulder County shall provide assistance to municipalities for the establishment of wetland management plans to avoid the degradation of such wetlands.

ER 6.05 Significant wetlands, which in addition have been identified as critical wildlife habitats or critical plant associations or rare plant sites, should conform with the applicable goals and policies of the Boulder County Comprehensive Plan.

ER 6.06 Development proposals affecting wetlands other than those identified as significant, particularly those with high functional ratings, a large size, hydrologic connections, wildlife habitat value, or human interest, should also be evaluated for potential impacts and mitigation measures.

Cooperative Preservation

ER 7.01 In addition to the policy provisions related to specific environmental resources, the County shall utilize the following criteria in protecting identified resources.

ER 7.01.01 The County shall work with landowners and other entities to promote sound conservation practices and, where appropriate, to establish cooperative management plans.

Environmental Conservation Areas

ER 8.01 The County shall encourage the removal of development rights from Environmental Conservation Areas through transfer, donation, acquisition, or trade.

ER 8.02 Development within Environmental Conservation Areas shall be located and designed to minimize impacts on the flora and fauna of the area.

ER 8.03 Development outside of Environmental Conservation Areas shall be located and designed to minimize impacts on Environmental Conservation Areas and connectivity between Environmental Conservation Areas.

ER 8.04 The County will encourage and participate with the various public and private owners in the development of coordinated management plans to conserve, protect, or restore the values of Environmental Conservation Areas.

ER 8.05 Management of Environmental Conservation Areas shall encourage use or mimicry of natural processes, maintenance or reintroduction of native species, restoration of degraded plant communities, elimination of undesirable exotic species, minimization of human impacts, and development of long-term ecological monitoring programs.

ER 8.06 The County will work towards protecting critical elk range and migration routes through reducing development potential and by working with landowners and management agencies to minimize human disturbance and provide seasonal habitat needs.

ER 8.07 The County will work with appropriate management agencies and property owners to protect or restore riparian areas.

ER 8.08 The County shall work toward minimizing human impacts to riparian ecosystems from development, roads, and trails.

ER 8.09 The County will work with appropriate entities to ensure suitable minimum and maximum stream flows that maintain channel morphology, support hydrologically connected wetlands, and perpetuate species, both plant and animal, dependent on riparian ecosystems.

ER 8.10 Land use proposals which could have adverse impacts to riparian ecosystems must submit a report and site plan detailing such impacts. Although examined on a case-by-case basis, the County will encourage avoidance of riparian ecosystems. Where impacts are unavoidable, the County shall require appropriate mitigation.

ER 8.11 Management of riparian areas shall encourage use or mimicry of natural processes, maintenance or reintroduction of native species, restoration of degraded plant communities, elimination of undesirable exotic species, minimizing human impacts, and development of long-term ecological monitoring programs.

Agricultural

ER 9.03 The County shall actively participate in State, Federal, and local programs directed toward the identification and preservation of agricultural land. This shall include investigation of proposed Federal legislation to establish pilot projects to research and implement methods for preserving agricultural land.

ER 9.03.01 Implementation programs directed toward the preservation of agricultural land should give priority to those lands identified in the Environmental Resources Element as "lands of National and Statewide importance and lands of local importance."

ER 9.04 With assistance provided by the Parks and Open Space Department, the County shall identify significant native short grass prairie ecosystems and encourage the development of management plans on such prairie ecosystems where they are endangered by over-grazing.

Open Space Policies

Resource Management

OS 2.01 The County shall identify and work to assure the preservation of Environmental Conservation Areas, critical wildlife habitats and corridors, Natural Areas, Natural Landmarks, significant areas identified in the Boulder Valley Natural Ecosystems Map, historic and archaeological sites, and significant agricultural land.

OS 2.02 Significant Natural Communities, rare plant sites, wetlands, and other important stands of vegetation, such as willow carrs, should be conserved and preserved.

OS 2.05 The County, through its Weed Management Program, shall discourage the introduction of exotic or undesirable plants and shall work to eradicate existing infestations though the use of Integrated Weed Management throughout the County on private and public lands.

Scenic Area and Open Corridor Protection

OS 3.04 Areas that are considered as valuable scenic vistas and Natural Landmarks shall be preserved as much as possible in their natural state.

Trails

OS 6.01 Trails and trailheads shall be planned, designed, and constructed to avoid or minimize the degradation of natural and cultural resources, especially riparian areas and associated wildlife habitats: Riparian areas proposed for preservation but for which trail development is inappropriate include: 1) Boulder Creek between 55th Street and U.S. Highway 287, 2) St. Vrain Creek west of Airport Road, 3) Left Hand Creek west of State Highway 119, and 4) Rock Creek west of McCaslin Boulevard.

Cultural Resources Policies

K 1.01 Boulder County, utilizing staff, volunteers, and professionals, shall continue researching County historic structures, sites, and districts and archaeologically sensitive areas.

K 1.01.1 A comprehensive historic sites survey shall be conducted which identifies the resources of historic significance within the County: This survey shall be updated as necessary to include those sites which, though not presently over 50 years of age, become so as time goes on.

K 1.03 The Boulder County Land Use Code and attendant regulations shall ensure that historic and archaeological resources are protected.

K 1.04 Boulder County shall encourage interjurisdictional cooperation to further the goals of historic and archaeological preservation.

K 1.04.5 The City of Boulder Landmarks Board shall be a referral agency for proposals affecting cultural resources within the Boulder Valley: Examples of such proposals include nomination of historic landmarks and the demolition or alteration of historic properties owned by the City of Boulder.

APPENDIX 3.1 METHODS

3.1.1 Geographic Information Systems Methods

Geographic Information System data development and support for the *South Boulder Creek Inventory Report* was provided by the City of Boulder Open Space Geographic Information System Lab.

Data was digitized and converted from the U.S. Department of Agriculture Natural Resource Conservation Service and Boulder County sources. Most of the information represented was developed in-house, using 1993 orthographic 1" = 100' and 1" = 200' (digital) aerial photos as a field and map base. Additional planimetric line-work, developed for the City of Boulder by Merrick Aerial Photography (Denver), was used for building footprints and contours.

In-house fieldwork and mapping were digitized primarily in AutoCAD, using a CalComp Drawing Board 2 (9200) tablet. Attribution, analysis, and data assembly were performed in AutoCAD, ArcCAD, and ArcInfo.

The Lab consists of six PCS and one Sun Sparc 20 Unix machine operating CorelDRAW, Microsoft Word, Excel, Access, AutoCAD, ArcCAD, ArcView, and ArcInfo software on a multi-platform integrated network (Windows 95, Windows NT, Novell, and Unix). Graphic output is produced on Hewlett Packard printers and plotters.

All non-Open Space data sources retain copyrights and restrictions on their respective digital data. The City of Boulder's Electronic Data Dissemination Policies are available from the Public Works Department (441-3200). The maps in this report may not be reproduced without consent from the Open Space Department (441-3440).

3.1.2 Vegetation Mapping Methods

The vegetation mapping projects conducted on City of Boulder Open Space lands have used qualitative methods to classify and describe vegetation. Open Space Program methods establish a minimum mapping unit of ½ acre. Mapping is initiated in the office or computer lab by identifying distinct vegetation types on orthophotographs (April 1993, scale: 1" = 100' and 1" = 200') and drawing boundaries to delineate the types. Boundaries can be drawn directly on aerial photographs or on digital (computerized) versions of aerial photographs. This preliminary vegetation analysis can distinguish coarse level vegetation types such as forest, shrubland, and grassland.

Field checking of the initial map allows for boundary adjustments and the identification of plant communities. Fine level vegetation types are delineated based on plant species composition and frequency, soil types, geology, and geomorphology. Species dominance is determined from ocular estimates of frequency and cover within a square meter frame placed randomly, two to three times within a vegetation type. Field notes for each community polygon include lists or descriptions of

dominant, common, uncommon and rare species, variation within the community, site condition, land use information, signs of wildlife use, and other site characteristics.

Field data are entered into a Geographic Information System where they can be manipulated to produce a computer generated display of the vegetation. The Geographic Information System software used presently by the Program includes AutoCAD GSX Overlay, ArcCAD, and ArcView. A Geographic Information System database stores descriptive information (i.e., name of vegetation type) and numerical data (i.e., area of polygons, frequency of polygons, etc.). A classification hierarchy used to describe vegetation can be stored in the database. The South Boulder Creek Management Area vegetation types have been assigned community, habitat and ecosystem classes. The Management Area vegetation can be displayed with varying levels of detail by manipulating the database information.

Weed Mapping Methods

Weed infestations on Open Space are mapped onto aerial photographs and then entered into the Open Space Geographical Information System. The spread of weeds and the effects of various control methods on individual infestations can then be monitored over time. This data also helps prioritize and schedule treatment areas.

Individual infestations are mapped on 1"=200' or 1"=100' blue line or black line ortho photos using colored pencils. Each species of weed is mapped using a different color:

SPECIES	COLOR	SPECIES	COLOR
Canada thistle	yellow	purple loosestrife	orange
musk thistle	red	toadflax (Dalm. or yellow)	purple
diffuse knapweed	light blue	Russian olive	brown
leafy spurge	light green	*other (Med. sage, myrtle	black
whitetop/hoary cress	pink	spurge, cinquefoil, tamarisk, etc.)	

*When mapping with black, the species it represents should be noted on the map.

The density of each infestation is determined according to the table below, and the appropriate symbol is drawn within the boundaries of the infestation. A 1 meter diameter hoop is used for the first few days of mapping to allow mappers to get a feeling for what different densities look like. After that densities are estimated.

CATEGORY	SYMBOL	PARAMETERS
Scattered	S	>2 plants/ 50 sq .feet but <2 plants/ sq. meter
Light	L	2-5 plants/ sq. meter
Moderate	M	6-9 plants/ sq. meter
Heavy	H	10 or more plants/ sq. meter

A minimum mapping area has been set at 50 square feet or 1/16th of an acre. This means that infestations smaller than this size must be mapped as 1/16 acre. This equals a one half inch square on 1"=100' maps and a 1/4 inch square on 1"=200'. This does not mean that they must be mapped as squares and many times will follow soils or land types. Fifty feet is also the minimum distance

between two infestations of the same species. If weed infestations having the same density are closer than 50 feet, they become one infestation. All infestations should be mapped as closed polygons. If an infestation continues off of the property being mapped, a dotted line along the property boundary can denote this.

Densities are also "blended" together in certain situations. This helps streamline data and makes it easier to digitize. For example, Canada thistle spreads vegetatively so a map could look like a "bulls eye" of three or four different densities in one area. These densities should be blended to favor the two most distinctive densities. Infestations containing two densities that were similar in plants per meter (5 plants/meter and 7 plants/meter on average) are blended. In this situation, choose the density that covers the most area.

Mapping technique can vary depending on the number of mappers. A solitary mapper covers ground methodically until a weed is found and then circles it to determine if another weed of the same species is within 50 feet of it. If so, the infestation is mappable and the location is plotted on the aerial photograph. The mapper then follows the infestation until it ends (i.e., goes 50 feet without finding a weed) in all directions, plotting the boundary as she goes. Two mappers can follow the boundary in opposite directions until they meet and then draw the boundary on the map. Three or more mappers may operate independently (if enough copies of the map are available) or cover the property in swaths, walking 20 to 50 feet apart (depending on terrain, vegetation, and weed density) and telling the designated mapper (walking in the middle of the swath) what they see. The most efficient method depends on the size and shape of the property, the availability of landmarks, and the vegetation density.

3.1.3 Wetlands Research Methods

The first comprehensive wetland mapping project that included the Boulder Valley was undertaken by the U.S. Fish and Wildlife Service as part of the National Wetland Inventory. For the Boulder Valley wetlands coverage, National Wetland Inventory mapping was published in 1983 and is based upon 1976 aerial photography. National Wetland Inventory mapping was published at a scale of 1:24,000 and produced as an overlay to existing U.S. Geological Survey 7.5 minute topographical maps. The Boulder and Niwot, Colorado quadrangles contain the National Wetland Inventory information relevant to the South Boulder Creek Management Area. Wetlands are classified on National Wetland Inventory maps in accordance with Cowardin et al. (1979).

In the Management Area the National Wetland Inventory mapping provides good, general information about the location of wetlands. However, because of the methods used and the time lapse since the mapping, the current extent of wetlands differs dramatically from the National Wetland Inventory information.

The U.S. Environmental Protection Agency and the City of Boulder co-sponsored a wetland mapping and evaluation project during the summers of 1987, 1988, and 1990 in anticipation of a local wetlands protection program (Cooper 1988). Subsequent work beginning in the summer of 1992 resulted in compatible mapping and evaluation of wetlands on other Open Space property

within the study area. The full details of the methodology are given in Cooper (1988) and Gershman (1991) and are summarized here.

A set of 1"=400' aerial photographs and National Wetland Inventory maps for the Open Space system were used to approximate the locations of wetlands. A field data sheet was prepared for each wetland. The evaluation included a floristic inventory and rough estimates of plant cover for plant species encountered. Each wetland was rated with regard to the following ecological functions and social values shown in the table below.

Wetland Functions and Values Ranked in City of Boulder Wetlands Identification Project

Ground water Recharge	Ground water Discharge	Flood Storage	Fish Habitat
Passive Recreation	Wildlife Habitat	Shoreline Anchoring	
Active Recreation (not used for Open Space wetlands)	Nutrient Retention long term short term	Food Chain Support within basin downstream	

The ranking system provided a scale to measure the degree to which each function is performed. Each wetland was given a single rating.

A rating of "1" indicates that a function was not being performed and could not be performed by that particular wetland. A ranking of "2" indicates that the function was performed to a low degree. A ranking of "3" indicates that the function was performed to a medium or average degree. A ranking of "4" indicates that the function was performed to a high degree. A ranking of "5" indicates a function was performed to an extremely high degree. Further description of these functions and values may be found in Cooper (1988).

The approximate boundaries of each wetland were drawn on field copies of aerial photographs. Each wetland outline was numbered; numbers were the same on the aerial photographs and the data sheet. Information from the data sheets was then recorded in a computerized database. Wetland boundaries were transferred to mylar base maps and digitized for use with a Geographic Information System. Beginning in 1991, wetland boundaries were digitized directly from aerial photographs and no mylars were prepared. The wetland boundaries are approximate and do not represent delineations for legal purposes. It is also possible that some wetlands were not mapped.

The South Boulder Creek study area was revisited several times in the summer and fall of 1995 to reassess conditions, map wetlands on properties acquired since the initial mapping effort, and look for wetlands that may have been missed during the earlier surveys.

3.1.4 Wildlife Research Methods

Information Sources
Information for the South Boulder Creek Management Area wildlife report was gathered from a variety of sources: (1) research projects done in the Management Area (Bock and Bock 1994, 1995; Blumestien 1986; Dawson 1989; Knight and Miller 1995; Sandy 1989; Scott 1995), (2) consultant reports done for the Open Space Program (BCNA 1990, Thompson and Strauch 1987), (3) Open Space Program survey and monitoring work and associated databases (e.g., Wildlife Sightings Database, Avian Transects, Deer Survey, Predator Sightings Database), and (4) staff and volunteer knowledge of the Management Area and information from local organizations and agencies with particular knowledge of the Management Area (i.e., Boulder County Nature Association, City of Boulder Mountain Parks, Boulder County Parks and Open Space).

Information on habitat affinities of various vertebrate species was developed to compare documented reports of animals with species expected to occur in the Management Area. The Open Space Program maintains a Wildlife Sightings Database that contains location-specific reports of a variety of wildlife species. This database has more than 14,000 sightings for the entire Open Space system (from 1987-present). Records cataloged in the database include location-specific data from research and consultant reports as well as incidental sightings and wildlife monitoring results.

Management recommendations and background information contained in various consultant reports, research reports, unpublished Program reports, and historic studies that pertain to the Management Area were incorporated into databases. Historic studies (Alexander 1937, Betts 1913, Henderson 1909) and other databases (Audubon Christmas Bird Count , Boulder County Nature Association Winter Raptor Survey) or information (Fitzgerald et al. 1995) that focus on vertebrates throughout the Boulder Valley and Colorado were used to ensure thorough analyses of wildlife in the Management Area.

Avian Transects
Three avian (formerly "wildlife") survey routes (nineteen system-wide) are located in the Management Area--one on the Church property, one on the Gebhard property, and one on the Van Vleet property. Each route contains a series of 100 meter fixed radius circular plots (point counts). Transects are sampled by trained volunteers in January, April, July, and October (one sample per sampling period). Information from these surveys has been incorporated into the wildlife species database, since it is not realistic to analyze information from individual routes or individual points along the routes.

Predator Tracking Transect
A predator tracking transect was located on the Parsons property; this was discontinued in 1995 (see Miller 1995). No information from this transect was available for this report.

Herpetofauna Survey
A comprehensive survey of amphibians and reptiles was conducted throughout the Boulder Valley, including walking and driving transects the South Boulder Creek Management Area (Livo 1997). General visual reconnaissance, walking transects, night driving, and turtle trapping were used in a

variety of habitats and areas. A total of 2,058 amphibians were recorded during the 1996 survey. Most specimens (1,895) were observed during visual encounters; one specie was documented by turning rocks or other surface objects; one specie was recorded during 174 miles of night driving; and 44.5 hours of turtle trapping produced only observations of snapping turtles.

Winter Raptor and Bird Surveys

Winter Raptor Survey routes are run once each month from November-March each year by volunteers from the Boulder County Nature Association. Designated routes are driven at a constant speed and raptors seen from the survey route are recorded to species on a map. A relative abundance (raptors/km) is obtained to provide information on determining population trends. The Boulder Reservoir winter raptor survey route (which includes City and private land) has been sampled since 1984.

The Audubon Christmas Bird Count has been run since 1909 in Boulder County (annually since 1950). A 12-kilometer radius circle centered on 19th and Alpine Streets in Boulder is surveyed for one day by volunteer bird watchers annually in December. Relative numbers of birds (birds/count with party hours controlled) are obtained. Although the Christmas Bird Count data are not specific to the Management Area, the trends in bird numbers for the Boulder Valley are pertinent for comparison.

Christmas Bird Count results can be compared to Winter Raptor Survey results by reformatting the Christmas Bird Count data using the number of each species divided by the total number of hours observers spent in the field to control for effort bias between years (observations/party hours). The result is normalized (0-1) by dividing the observations/party hours by the largest value.

3.1.5 Cultural Resource Inventory Methods

The South Boulder Creek Management Area was inventoried by a crew of three to four archaeologists walking a series of parallel, adjacent transects at intervals of 30 meters or less. In relatively flat areas, transects could be oriented along compass bearings. In steeper areas, transects followed contours of the slopes where possible. Road and drainage cuts, tracks and trails, eroded surfaces, anthills, and rodent backdirt piles were closely inspected for evidence of buried cultural material. Vegetative cover throughout the project area was generally heavy, consisting of thick grasses in open meadows. Ground visibility was generally poor, averaging about 20-40% visibility.

Evidence of cultural resources was sought in the form of material debris, structural remains or any other unusual surface anomaly. *Isolated finds* were defined as no more than four artifacts in the space of 100 by 100 meters, or solitary features without associated artifacts. *Sites* were minimally defined by the presence of five or more artifacts, two or more features, or a feature with artifacts or structural remains. The appropriate Colorado Office of Archaeology and Historic Preservation forms were completed for each site or find. Black-and-white photographs were taken and a sketch map drawn of each site. Artifacts were described in the field. No testing was conducted, nor were any artifact collections made.

Significance and Eligibility Assessments
The sites and isolated finds newly documented within the project area were evaluated for their significance and eligibility to the National Register of Historic Places, the State Register of Historic Properties and the Boulder County Register of Historic Places. Specific management recommendations regarding treatment of the cultural resources follow the eligibility assessments.

National Register of Historic Places eligibility is judged according to the criteria set forth in 36CFR 60.4 below:

> "National Register Criteria" means the following criteria established by the Secretary of the Interior for the use in evaluating and determining the eligibility of properties for listing in the National Register: The quality of significance in American history, architecture, archaeology, engineering and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and:
>
> (A) That are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> (B) That are associated with the lives of persons significant in our past; or
>
> (C) That embody the distinctive characteristics of a type, period or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> (D) That have yielded, or may be likely to yield, information important in prehistory of history.

The State Register of Historic Properties uses essentially the same criteria as above, with the addition of a fifth criterion, that being "geographical importance." The Boulder County Register is designed to recognize cultural properties of local significance.

3.1.6 Property Information Inventory Methods

Two main sources were used to collect the information on the individual Open Space properties: the property database, located in the Program's Geographic Information System and the property inventory files, located in the Program's administrative office. The property inventory files are the end product of a research effort undertaken to assist with the area management planning process. The property inventory files contain any information relevant to a property's purchase and management, as it relates to public or private access to the property. Information in the property inventory files was gleaned from the Program's extensive inventory of files compiled for each Open Space property purchase. Additional files from the City's Central Records were also used.

APPENDIX 5.1 SUMMARY OF DITCHES WITHIN THE SOUTH BOULDER CREEK MANAGEMENT AREA

Arnold-Harrop Ditch

Arnold-Harrop Ditch is technically a seepage right that diverts water from an unnamed drainage into a small ditch on the Lousberg property. The ditch was originally appropriated in 1911 for 6 cubic feet/second. The physical capacity is 3 cubic feet/second. The source of water is seepage from the Farmers Ditch. Open Space owns all of the ditch. Water from the ditch serves the Nu-West and Harrington properties.

Boulder and Left Hand Ditch

Boulder and Left Hand Ditch diverts from Boulder Creek in Central Park in downtown Boulder. Boulder and Left Hand Ditch shares a headgate on Boulder Creek with the North Boulder Farmer's Ditch and the Boulder and White Rock Ditch. Boulder and Left Hand Ditch was originally appropriated in 1873 for 82.8 cubic feet/second and had a subsequent appropriation of 81 cubic feet/second in 1876. The physical capacity of the ditch is 35 cubic feet/second. Open Space holds .5 of the 130 shares (0.38%) outstanding in the company. This ditch does not serve water to any Open Space properties within the South Boulder Creek Management Area.

Boulder and White Rock Ditch

Boulder and White Rock Ditch diverts water from Boulder Creek in City Park in Downtown Boulder. Boulder and White Rock Ditch shares a headgate on Boulder Creek with the North Boulder Farmer's Ditch and the Boulder and Left Hand Ditch. Boulder and White Rock Ditch has two direct flow decrees. The first direct flow appropriation was on November 1, 1873, for 135 cubic feet/second on Boulder Creek and the second is for 26 cubic feet/second with an appropriation date of December 1, 1873, on Goose Creek. The physical capacity of the ditch is 100 cubic feet/second. The City of Boulder holds 214.25 shares total, of which Open Space holds 178.25 shares. There are 5,500 shares outstanding in the company. This ditch serves the McKenzie property.

Butte Mill Ditch

Butte Mill Ditch diverts water from Boulder Creek just upstream from the confluence of Boulder and South Boulder Creeks. Butte Mill Ditch was originally appropriated on March 1, 1865, 110.86 cubic feet/second. The physical capacity of the ditch is 50 cubic feet/second. The City of Boulder holds 11.1 shares (26.4%) of the 42 shares outstanding in the company. Of the City of Boulder shares, 9.75 shares (23.2%) are held by Open Space.

The Eccher property is served with water from the Butte Mill Ditch. No transfers of water form the Butte Mill Ditch have occurred.

Church Mine Ditch No. 1 and No. 2

The Church Mine Ditch No. 1 and No. 2 is located on the Church property. This water right is technically a spring that has been decreed and diverted into a small unincorporated ditch that serves the Church property. The water right is a "ditch" here because that is how it is referred to in the State Engineer's Office water rights listing. The source of the water from the ditch is the shafts of the abandoned Church Mine. Water from the mine is either pumped or flows by gravity into the ditch. Church Mine Spring No. 1, which feeds the ditch, was appropriated in 1942 for 1 cubic feet/second and Church Mine Spring No. 2, which also feeds the ditch, was appropriated in 1952 for 2 cubic feet/second.

Cottonwood No. 2 Ditch

Cottonwood No. 2 Ditch is also known as the Original Cottonwood Ditch. Cottonwood No. 2 Ditch diverts water from Dry Creek on the Klein property. Cottonwood No. 2 Ditch was originally appropriated on April 15, 1863, for 33.7 cubic feet/second. The physical capacity of the ditch is 30 cubic feet/second. The City of Boulder holds 3.67 shares (18.35%) of the 20 shares outstanding in the company. All of the City of Boulder shares are held by Open Space. The Lewis and Methvin properties are presently irrigated with water from the Cottonwood No. 2 Ditch. The agricultural lease for the Lewis property indicates that 0.67 share of Cottonwood No. 2 Ditch water is assigned for use on that property, while the Methvin agricultural lease indicates that 1.0 share of Cottonwood No. 2 Ditch water is assigned for use there. The remaining two shares are used on Open Space properties outside of the Management Area.

Two water rights transfer cases (W 9193 and 82 CW 311) are believed to involve the Cottonwood No. 2 Ditch. However, these water court cases have not yet been examined and remain a data gap that will need to be resolved before the operation of this ditch is fully understood.

Davidson Ditch and Reservoir Company

Although the corporate name is the Davidson Ditch and Reservoir Company, everyone associated with the ditch simply calls it the Davidson Ditch. The Davidson Ditch diverts water from South Boulder Creek on the Dunn II property, just west of the Mesa Trail parking lot. Davidson Ditch was originally appropriated on April 15, 1872, for 116.3 cubic feet/second, and had a subsequent appropriation on May 10, 1875, for 8.75 cubic feet/second. The physical capacity of the ditch is 100 cubic feet/second. The City of Boulder holds 549.5 shares (17.7 %) of the 3,103 shares outstanding in the company. All of the City of Boulder shares are held by Open Space. Within the Management Area, the Church, Short, and Yunker properties are presently irrigated with water from the Davidson Ditch. In addition, part of the Church of Christ property could possibly be irrigated using Davidson Ditch water. Furthermore, other properties outside of the Management Area are currently irrigated using Davidson Ditch water but were not examined as part of this inventory.

The agricultural lease for the Church property indicates that 13.5 shares of the Davidson Ditch water is assigned for use on that property, while the Short agricultural lease indicates that 45 shares are

used there, and the Yunker property is irrigated with 30 shares of Davidson Ditch water.

Four water rights transfer cases (W 8348, 80 CW 469, 83 CW 319, and 85 CW 119) involve the Davidson Ditch. However, these water court cases have not yet been examined and remain a data gap that will need to be resolved before the operation of this ditch is fully understood.

Dry Creek Davidson Ditch

Dry Creek Davidson Ditch diverts water from Dry Creek on the Lewis property. Dry Creek Davidson Ditch was originally appropriated on May 1, 1863, for 29.95 cubic feet/second. The physical capacity of the ditch is 20 cubic feet/second. The City of Boulder holds 172 shares (27.7%) of the 620 shares outstanding in the company. All of the City of Boulder shares are held by Open Space. No Open Space properties within the Management Area are irrigated with water from the ditch.

The Dry Creek Davidson Ditch is also commonly referred to as the Little Dry Creek Ditch.

Three water rights transfer cases (6517, 10000, and 79 CW 017) involve the Dry Creek Davidson Ditch. However, these water court cases have not yet been examined and remain a data gap that will need to be resolved before the operation of this ditch is fully understood.

Dry Creek No. 2 Ditch

Dry Creek No. 2 Ditch diverts water from South Boulder Creek on the Neuhauser property. Dry Creek No. 2 Ditch was originally appropriated on May 1, 1864, for 69 cubic feet/second. The physical capacity of the ditch is 20 cubic feet/second. The City of Boulder holds 97.06 shares (32.35%) of the 300 shares outstanding in the company. Of the City of Boulder shares, Open Space holds 77.2 shares (25.73%).

Open Space properties irrigated with water from the ditch include Burke I and II, Gebhard, Rolling Rock Ranch, and Van Vleet. No Open Space properties outside of the Management Area are irrigated with Dry Creek No. 2 Ditch water. The Burke I and II properties are assigned 6.6 shares, while 8 shares are assigned to the Gebhard property, 5.6 shares are assigned to the Rolling Rock Ranch property, and 20.4 shares to the Van Vleet property. In addition, part of the Mary Clyncke and Fancher properties could possibly be irrigated using Dry Creek No. 2 Ditch water.

Four water rights transfer cases (21299, W 8346, W 8500, and 85 CW 133) involve the Dry Creek No. 2 Ditch. However, these water court cases have not yet been examined and remain a data gap that will need to be resolved before the operation of this ditch is fully understood.

East Boulder Ditch

East Boulder Ditch diverts water from South Boulder Creek on the Burke I property. East Boulder Ditch was originally appropriated on April 1, 1862, for 102.3 cubic feet/second and had a

subsequent appropriation on June 1, 1872, for 24.9 cubic feet/second. The physical capacity of the ditch is 24 cubic feet/second. The City of Boulder holds .1751 shares (1.46%) of the 12 shares outstanding in the company. All of the City of Boulder shares are held by Open Space.

No Open Space properties are presently irrigated with water from East Boulder Ditch. A headgate exists in the East Boulder Ditch that can be used to divert water into Sombrero Marsh, and was used to do this, but it is uncertain when this headgate was used for this purpose. No Open Space properties outside of the Management Area are irrigated with water from East Boulder Ditch. Since the East Boulder Ditch flows across the Burke I property, it may be possible to irrigate a portion of it by gravity or by pump. In addition, a lateral extending from the East Boulder Ditch to a private parcel west of the Lentsch property could potentially be used to irrigate or reclaim the Lentsch property if permission of the lateral owners could be secured.

Two water rights transfer cases (82 CW 305 and 85 CW 276) involve the East Boulder Ditch. Case 82 CW 305 is a transfer of water out of the East Boulder Ditch by Lafayette involving 0.3125 shares. The other case, 85 CW 276 is a transfer by the Public Service Company of Colorado and primarily allows Public Service Company to transport additional water through the East Boulder Ditch from the Dry Creek No. 2, Jones and Donnelly, and Enterprise Ditch. However, these water court cases have not yet been fully examined and remain a data gap that will need to be resolved before the operation of this ditch is fully understood.

Enterprise Ditch

Enterprise Ditch diverts water from South Boulder Creek on the Gebhard property just north of South Boulder Road. Enterprise Ditch was originally appropriated on February 1, 1865, for 34.08 cubic feet/second. Subsequent appropriations occurred on May 1, 1866, for 6.68 cubic feet/second and June 1, 1881, for 13.49 cubic feet/second. The physical capacity of the ditch is 35 cubic feet/second. The City of Boulder holds 4.6 shares (9.6%) of the 44.195 shares outstanding in the company. All of the City of Boulder shares are held by Open Space.

Open Space properties irrigated with water from the Enterprise Ditch include Lewis (.75 share) and Methvin (1.35 share) properties. No Open Space properties outside of the Management Area are currently irrigated with Enterprise Ditch water. The agricultural lease for the Lewis property indicates that .75 shares of Enterprise Ditch water is assigned for use on that property, while the Methvin agricultural lease indicates that 1.35 shares are used there.

Parts of the Gebhard, Burke I, Klein, Aweida II, Merle-Smith, and Ute Industrial Park properties, as well as properties outside of the Management Area could be irrigated using Enterprise Ditch water. Open Space presently holds enough shares of the Enterprise Ditch to irrigate at least some of these properties. However, additional shares of Enterprise Ditch would be necessary to irrigate all of the irrigable land on these properties. The number of acres of land that can potentially be irrigated via the Enterprise Ditch and the number of additional shares of the Enterprise Ditch that could be purchased to fully irrigate these lands is a data gap that needs to be closed.

A portion of the Burke I property, lying west of the Enterprise Ditch and East of the East Boulder Ditch, could potentially be irrigated with the installation of a new headgate and field lateral near the point where Cherryvale Road crosses the Enterprise Ditch. A portion of the Klein property lying between the Enterprise Ditch and Dry Creek could be irrigated if a new headgate and lateral were installed. Portions of the Aweida II and Merle-Smith properties were formerly irrigated via the Enterprise Ditch, and irrigation could be reestablished if the original ditch alignment, which has fallen into disrepair, were to be reexcavated.

The northwest portion of the Ute Industrial Park was formerly irrigated via the Enterprise Ditch, but the headgate has been removed. However, the original field laterals are still in existence. If a new headgate is installed, irrigation could be reestablished at the Ute Industrial Park. Furthermore, the Enterprise Ditch could be utilized for the reclamation of the east portion of the Ute Industrial Park if a temporary pump were installed in the ditch at the location of the old headgate. In addition, a decree and augmentation plan involving the Enterprise Ditch shares purchased with the Ute Industrial property need to be examined and a conditional water right associated with the development needs to be reviewed to determine how the right should be developed, if at all.

Five water rights transfer cases (10000, 21299, W 8652, 82 CW 305, and 85 CW 277) involve the Enterprise Ditch. Jay Neibur, president of the ditch, reports that with these transfers 20.36 cubic feet/second remain in the ditch. However, these water court cases have not yet been examined and remain a data gap that will need to be resolved before the operation of this ditch is fully understood.

Farmers Ditch

Farmers Ditch diverts water from Boulder Creek near the mouth of Boulder Canyon. Farmers Ditch was originally appropriated on October 1, 1862, for 73.29 cubic feet/second. The physical capacity of the ditch is 55 cubic feet/second. The City of Boulder holds 67.59 shares of the 100 shares outstanding in the company. Of the City of Boulder shares, Open Space holds 21.9607 shares.

Open Space properties irrigated with water from the ditch within the Management Area include the Belgrove (1.625 share), Harrington, Lousberg (1.25 shares), McKenzie (2 shares), and Nu-West properties. The Boulder Valley Ranch outside of the Management Area is also irrigated with Farmers Ditch water (Lore and Ellison properties). The agricultural lease for the Belgrove property includes 1.625 shares of the Farmers Ditch, the Harrington and Nu-West agricultural lease includes 1.25 shares, the McKenzie agricultural lease includes 2 shares, and the Lousberg west agricultural lease includes that 1.25 shares.

ERO Resources Corporation (1996) reports that the historical average yield of Farmers Ditch is 79.2 acre-feet/share.

Seven water rights transfer cases (8407, 10518, 15012, W 7569, W 8485, W 9410, 81 C 466) involve the Farmers Ditch. However, these water court cases have not yet been examined and remain a data gap that will need to be resolved before the operation of this ditch is fully understood.

Green Ditch

Green Ditch diverts water from Boulder Creek. Green Ditch was originally appropriated on September 15, 1862, for 34.58 cubic feet/second. The physical capacity of the ditch is approximately 35 cubic feet/second. The City of Boulder owns 17.5 shares (54.7%) of the 32 shares outstanding in the company. Of this number, Open Space owns 3 shares with the remaining being held by the City of Boulder Utilities Department. No shares have ever been transferred out of this ditch.

No Open Space properties are irrigated with water from Green Ditch within the Management Area. However, the Biddle property, which is managed by Open Space for the City Utilities Department, has access to 13 shares of the Green Ditch.

Howard Ditch

Howard Ditch diverts water from South Boulder Creek on the Gebhard property. Howard Ditch was originally appropriated on April 1, 1860, for 36 cubic feet/second and has the number one priority date on South Boulder Creek.

The City of Boulder owns 21.349 shares of the Howard Ditch. Of these shares, Open Space owns 5.99 shares. There are 35.039 shares outstanding in the Howard Ditch. A number of cases in which water has been transferred out of the ditch has occurred and has resulted in the present number of shares in Howard Ditch. In addition, there are a total of 13 shares in the "Superfasical," a lateral of the Howard Ditch. The City of Boulder owns 2 shares in the Superfasical, which gives the City the right to run its Howard Ditch water though the lateral.

Open Space properties irrigated with water from the ditch within the Management Area include the Gebhard (2 shares) and Burke I and II (2 shares) properties. The remaining 1.99 shares are not assigned for use on the properties. Because of the seniority of the Howard Ditch, it calls water down to its headgate during low flow periods and is therefore important in maintaining minimum instream flows in South Boulder Creek.

Several water rights transfer cases (8960, 12698, 14023, 21299, W 7320, W 7786, W 8346, W 8500, and 87 W 017) involve the Howard Ditch. These water court cases have not yet been examined and remain a data gap that will need to be resolved to fully understand the operation of this ditch.

Jones and Donnelly Ditch

Jones and Donnelly Ditch diverts water from South Boulder Creek several hundred feet north of the point where Arapahoe Road crosses the creek. The headgate is shared with the Leggett inlet for the Public Service Company of Colorado Valmont Reservoir Complex. Jones and Donnelly Ditch was originally appropriated on May 1, 1860, for 14.36 cubic feet/second. The physical capacity of the

ditch is 10 cubic feet/second. All water from the Jones and Donnelly Ditch is delivered to and moved down the Butte Mill Ditch before it is used.

The City of Boulder holds 88 shares (25%) of the Jones and Donnelly Ditch. Of these shares, Open Space holds 64 shares (18.2%). There are 351 shares outstanding in the Jones and Donnelly Ditch.

Only one property is irrigated with water from the ditch within the Management Area. This is the Eccher property that has 6 shares assigned for use on the property. In addition, the Biddle property, which is owned by the City of Boulder Utilities Department but managed by Open Space, has three shares of water assigned for use on the property.

One transfer case (W 9308) has resulted in water being transferred out of the ditch. This case has not yet been examined and remains a data gap that will need to be resolved before the operation of this ditch is fully understood.

Marshallville Ditch

Marshallville Ditch diverts water from South Boulder Creek at a location immediately east of where Highway 93 crosses the Creek. Marshallville Ditch was originally appropriated on June 1, 1865, for 14.76 cubic feet/second. A subsequent appropriation of 17.16 cubic feet/second occurred on June 30, 1878. The physical capacity of the ditch is 40 cubic feet/second.

Open Space holds 26 2/3 shares of the Marshallville Ditch. No other City Department owns shares in this ditch. There are 80 shares outstanding in the Marshallville Ditch. Of these 80 shares, 10.5 shares have been transferred out of the ditch by Louisville. To date, no other shares have been transferred out of the ditch.

Only the Van Vleet property is irrigated with water from the Marshallville Ditch within the Management Area. The Van Vleet property includes 4 shares assigned for use. All other Open Space properties irrigated from the Marshallville Ditch lie outside of the Management Area.

One transfer case (87 CW 327) by the City of Louisville has resulted in 10.5 shares of water being transferred out of the ditch for municipal purposes.

McGinn Ditch

McGinn Ditch diverts water from South Boulder Creek on the Van Vleet property near the location where U.S. 36 crosses the creek. McGinn Ditch was originally appropriated on May 1, 1860, for 3.19 cubic feet/second. A subsequent appropriation of 10.87 cubic feet/second occurred on June 1, 1865. The physical capacity of the ditch is 18 cubic feet/second.

Open Space holds 13 shares (32.5%) of the McGinn Ditch. No other City Department owns shares in this ditch. There are 40 shares outstanding in the McGinn Ditch.

Open Space properties that have McGinn Ditch shares included in the lease within the Management Area include Baseline 75 (2 shares), St. Walburga (2.5 shares), and Van Vleet (1 share) properties. All other Open Space properties that have dedicated shares of McGinn Ditch lie outside of the Management Area. The Klein and Suitts properties are presently not leased, but Open Space staff irrigated portions of these properties with water from McGinn Ditch in 1996. In addition, the Clough property is presently not irrigated, but a headgate on McGinn Ditch exists that can, with minimal work, be used to reestablish irrigation on the property.

Two transfer cases (85 CW 137 and 87 CW 327) have resulted in 7.75 shares of water being transferred out of the ditch. These water court cases have not yet been examined and remain a data gap that will need to be resolved to fully understand the operation of this ditch.

North Boulder Farmer's Ditch

North Boulder Farmer's Ditch diverts water from Boulder Creek in City Park in Downtown Boulder. North Boulder Farmer's Ditch shares a headgate on Boulder Creek with the Boulder and White Rock Ditch and the Boulder and Left Hand Ditch. North Boulder Farmer's Ditch has two direct flow decrees. The first direct flow appropriation was on June 1, 1862, for 10.78 cubic feet/second and the second is for 37.22 cubic feet/second with an appropriation date of June 1, 1863. The physical capacity of the ditch is 48 cubic feet/second.

Originally, the company was set up with 120 shares, with each share having a pro rata ownership of both appropriations. In 1986, there was a 48:1 stock split, so there are now 5,760 shares outstanding in the company. The City of Boulder holds 1,264.2 shares total, of which Open Space holds 529.2 shares.

Only the Andrus property can be irrigated with water from the North Boulder Farmer's Ditch within the Management Area. Historically, the Andrus property was irrigated with water from the North Boulder Farmer's Ditch, but the headgates are no longer in operational condition. The Andrus property lease includes 168 shares assigned for use on the property. All other Open Space properties irrigated from the North Boulder Farmer's Ditch lie outside of the Management Area.

Several transfers of water out of the North Boulder Farmer's Ditch have occurred. In 1932, 1948, 1957, and 1961 the Boulder and Left Hand Ditch Company purchased a total of 804 North Boulder Farmer's shares (14% of total) and has diverted those shares into its service area without any change proceedings. Additional shares were purchased by the Boulder and Left Hand Ditch Company in 1965, 1966, and 1970 and were the subject of Case 82 CW 387 which required some of the North Boulder Farmer's water to return flow to Boulder Creek. Also, Case W 7413 by the Town of

Nederland changed 1 share prior to the stock split (1/120th of the company) to municipal uses on Middle Boulder Creek above Barker Reservoir.[15]

[15] John Gerstle and Lee Rozaklis to Carol Ellinghouse. November 20, 1992. Memo regarding North Boulder Farmer's Ditch.

South Boulder Bear Creek Ditch

South Boulder Bear Creek Ditch diverts water from South Boulder Creek on the Neuhauser property. South Boulder Bear Creek Ditch was originally appropriated on May 25, 1862, for 16.6 cubic feet/second. Three subsequent appropriations of 26.41 cubic feet/second on May 9, 1865, 54.69 cubic feet/second on May 15, 1868, and 31.4 cubic feet/second on May 15, 1871, have occurred. The physical capacity of the ditch is 20 cubic feet/second.

Open Space owns 1.75 shares (8.75%) of the South Boulder Bear Creek Ditch. No other City Department owns shares in this ditch. There are 20 shares outstanding in the South Boulder Bear Creek Ditch.

No Open Space properties within the Management Area are irrigated with water from the South Boulder Bear Creek Ditch. However, it may be possible to irrigate a portion of the Rolling Rock Ranch using water from the ditch.

One transfer case (W 8347) by the City of Lafayette has resulted in 17 shares of water being transferred out of the ditch for municipal purposes.

South Boulder Canyon Ditch

South Boulder Canyon Ditch diverts water from South Boulder Creek on the Church property. South Boulder Canyon Ditch was originally appropriated on May 15, 1870, for 26.37 cubic feet/second. A subsequent appropriation of 192 cubic feet/second occurred on June 2, 1882. The physical capacity of the ditch is 75 cubic feet/second. No transfer cases have affected this ditch.

Open Space holds 57 shares (9.3 %) of the South Boulder Canyon Ditch. No other City Department owns shares in this ditch. There are 610 shares outstanding in the South Boulder Canyon Ditch.

Only the Van Vleet property has South Boulder Canyon Ditch shares (20 shares) dedicated for use in the lease within the Management Area. All other Open Space properties that have dedicated shares of South Boulder Canyon Ditch lie outside of the Management Area.

Schearer Ditch

Schearer Ditch diverts water from South Boulder Creek on the Van Vleet property. Schearer Ditch was originally appropriated on June 1, 1860, for 26.08 cubic feet/second. The physical capacity of the ditch is 26 cubic feet/second. No transfer cases have affected this ditch.

Open Space holds 100% of the Schearer Ditch. No other City Department holds shares in this ditch. The Open Space properties irrigated by the Schearer Ditch are the Van Vleet and Suitts properties.

APPENDIX 5.2 OPEN SPACE LONG RANGE MANAGEMENT POLICIES: IV. E. WATER MANAGEMENT

1. **Water Rights.** Water for the preservation, management, and use of the Open Space system will be acquired and used in accordance with legal authority. The Department will generally obtain water rights with the purchase of irrigated lands on which the water rights have historically been used. Water rights separate from Open Space land acquisitions may be purchased from willing sellers when those rights can be used consistent with Open Space goals. During the acquisition of water rights, separately or with land acquisitions, the Department will request from the seller an affidavit describing historic uses.

   The Department will maintain the integrity of all water delivery and storage structures on its property and cooperate with the office of the State Engineer to the greatest extent possible to meet applicable requirements. When appropriate, the Department will coordinate activities with environmental goals, the City of Boulder 1988 Raw Water Master Plan, the Non-Point Source Pollution Control Program, and other adopted plans.

   The Open Space Department will responsibly manage water for beneficial uses to ensure protection of water rights to help achieve the purposes of Open Space as directed by the City Charter. To meet these purposes, the Open Space program may at some future date wish to file an application with the appropriate water court for change of use, for example, from agricultural to storage or instream flow. Such a change request would include adequate documentation to demonstrate a change from a previously decreed use.

2. **Water Quantity and Quality**. The Department will seek to perpetuate surface and ground waters as integral components of Open Space aquatic and terrestrial ecosystems. Open Space waters, either surface water or ground water, will be withdrawn for consumptive use only consistent with Open Space management goals and uses specified in the City Charter, in accordance with Open Space management plans, and in accordance with the administration of the office of the State Engineer. Decisions regarding use of surface and ground waters will take natural processes and ecosystem functions into consideration and comply with county, state, and federal regulations.

   The Open Space program will seek to restore, maintain, or enhance the quality of all surface and ground waters on Open Space lands consistent with the Clean Water Act, the City of Boulder Drainage Master Plan, and other applicable federal, state, and local laws and regulations. The quality of water originating within the boundaries of Open Space properties will be maintained through the following management actions:

   - Adequate sewage treatment and disposal will be provided for all public use and administrative facilities

   - Human activities will be managed to control erosion

- Agricultural leases will be managed to protect or enhance riparian areas, wetlands, and waterways on Open Space lands and to maximize the protection or enhancement of water quality whenever possible in accordance with the City of Boulder Non-Point Source Pollution Program

- Toxic substances, such as pesticides, petroleum products, and heavy metals, will be managed to minimize the risk of water contamination

- The nature and intensity of human use shall be regulated in certain areas and at certain times to protect water quality

- Activities with high potential for point or non-point source water pollution will be regulated and controlled as necessary

Consistent with state law, the Department will maintain the integrity of its water resources. This may include monitoring stream diversions, adjacent land uses, and ground water withdrawals and their effects on the occurrence, quantity, and quality of water necessary for the continued preservation of Open Space biota and ecosystems.

The Department may seek the support of, or recommend agreements with, other agencies, governing bodies, or individuals, as appropriate, to secure their cooperation in avoiding degradation of water resources.

3. **Floodplains and Wetlands**. Adverse impacts to floodplains and wetlands will be avoided wherever possible. Where avoidance cannot be achieved, mitigating measures will be implemented to minimize potential harm to the natural values of floodplains, riparian areas, and wetlands in accordance with the City's Wetlands Ordinance and other applicable regulations. Losses to wetlands will be compensated by restoration or creation of similar habitats elsewhere according to the standards set forth in the Wetlands Ordinance and other applicable regulations.

   The Department will:

   - Develop inventory methodologies and conduct inventories of wetlands, riparian areas, and floodplains as needed on Open Space lands

   - Identify areas subject to flooding and take actions to limit risks to people and property, as appropriate

   - Inventory existing facilities and uses that affect floodplains, riparian areas, and wetlands and prepare plans for protection or restoration, as appropriate

   - Identify native plants and animals that require these habitats and prepare plans for their protection

APPENDIX 7.1 NATURAL HERITAGE RANKING SYSTEM

7.1.1 The Natural Heritage Ranking System

Information is gathered by Colorado Natural Heritage Program on Colorado's plants, animals, and natural communities. Each of these species and natural communities is considered an element of natural diversity, or simply an element. Each element is assigned a rank that indicates its relative degree of imperilment on a five-point scale (e.g., 1 = critically imperiled because of extreme rarity, 5 = demonstrably secure). The primary criterion for ranking elements is the number of occurrences, i.e., the number of known distinct localities or populations. This factor is weighted more heavily because, all other factors being equal, an element found in one place is more imperiled than something found in twenty-one places. Also of importance are the size of the geographic range, the number of individuals, trends in both population and distribution, identifiable threats, and the number of already protected occurrences. However, the emphasis remains on the number of occurrences, such that ranks are an index of known biological rarity.

Element rarity ranks are assigned both in terms of the element's degree of imperilment within Colorado (its state or S-rank) and the element's imperilment over its entire range (its global or G-rank). Taken together, these two ranks give an instant picture of the degree of imperilment of an element. Colorado Natural Heritage Program actively collects, maps, and electronically processes specific occurrence information for elements considered critically imperiled to rare (S1-S3). Those with a ranking of S3S4 are "watchlisted," meaning that specific occurrence data are collected and periodically analyzed to determine whether more active tracking is warranted. Watchlisted species are noted in the lists by an asterisk (*) next to the species name. A complete description of each of the Natural Heritage ranks is provided in subsections 7.1.2 and 7.1.3.

This single rank system works readily for all species except those that are migratory. Those animals that migrate may spend only a portion of their life cycles within the state. In these cases, it is necessary to distinguish between breeding, non-breeding, and resident species. As noted in Table 1, ranks followed by a "B," e.g., S1B, indicate that the rank applies only to the status of breeding occurrences. Similarly, ranks followed by an "N," e.g., S4N, refer to nonbreeding status, typically during migration and winter. Elements without this notation are believed to be year-round residents within the state.

7.1.2 Definition of Natural Heritage Global Rarity Ranks[16]

Global Rank (G): Based on the range-wide status of a species.

G1 Critically imperiled globally because of extreme rarity (five or fewer occurrences, or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extinction (critically endangered throughout its range).

[16]These ranks should not be interpreted as legal designations.

G2 Imperiled globally because of rarity (six to twenty occurrences), or because of other factors demonstrably making it very vulnerable to extinction throughout its range (endangered throughout its range).
G3 Very rare or local throughout its range or found locally in a restricted range (21-100 occurrences)(threatened throughout its range).
G4 Apparently secure globally, though it might be quite rare in parts of its range, especially at the periphery.
G5 Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.
GX Presumed extinct.
G#? Indicates uncertainty about an assigned global rank.
GU Unable to assign rank due to lack of available information.
GQ Indicates uncertainty about taxonomic status.
G#T# Trinomial rank (T) is used for subspecies or varieties. These taxa are ranked on the same criteria as G1-G5.

7.1.3 Definition of Natural Heritage State Rarity Ranks

These ranks should not be interpreted as legal designations.

State rank (S): Based on the status of a species in an individual state. S ranks may differ between states based on the relative abundance of a species in each state.

S1 Critically imperiled in state because of extreme rarity (five or fewer occurrences, or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extirpation from the state (critically endangered in state).
S2 Imperiled in state because of rarity (six to twenty occurrences), or because of other factors demonstrably making it very vulnerable to extirpation from the state (endangered or threatened in state).
S3 Rare in state (21-100 occurrences).
S3S4 Watchlisted; specific occurrence data are collected and periodically analyzed to determine whether more active tracking is warranted
S#B Refers to the breeding season imperilment of elements that are not permanent residents.
S#N Refers to the non-breeding season imperilment of elements that are not permanent residents. Where no consistent location can be discerned for migrants or non-breeding populations, a rank of SZN is used.
SZ Migrant whose occurrences are too irregular, transitory, and/or dispersed to be reliably identified, mapped, and protected.
SH Historically known from the state, but not verified for an extended period, usually fifteen years; this rank is used primarily when inventory has been attempted recently.
SX Presumed extirpated from state.
S#? Indicates uncertainty about an assigned state rank.
SU Unable to assign rarity rank, often because of low search effort or cryptic nature of the element.
SA Accidental in the state.

SR Reported to occur in the state but unverified.
S? Unranked; some evidence that species may be imperiled, but awaiting formal rarity ranking.
Federal and State Agency Special Designations

7.1.4 Federal Status

U.S. Fish and Wildlife Service (58 Federal Register 51147, 1993) and (61 Federal Register 7598, 1996)

LE Endangered: taxa formally listed as endangered.
E(S/A) Endangered due to similarity of appearance with listed species.
LT Threatened: taxa formally listed as threatened.
P Proposed E or T: taxa formally proposed for listing as endangered or threatened.
C Candidate: taxa for which the Service has on file sufficient information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened.
(C1) FORMERLY: Notice of Review, Category 1: taxa for which substantial biological information exists on file to support proposing to list as endangered or threatened.
(C2) FORMERLY: Notice of Review, Category 2: taxa for which current information indicates that proposing to list as endangered or threatened is possible, but appropriate or substantial biological information is not on file to support an immediate rulemaking.
(C2*) FORMERLY: Taxa believed to be possibly extirpated in the wild.
(3A) FORMERLY: Taxa for which the U.S. Fish and Wildlife Service has persuasive evidence of extinction.
(3B) FORMERLY: Names that based on current taxonomic knowledge do not represent taxa meeting the Endangered Species Act's definition of a species.
(3C) FORMERLY: Notice of Review, Category 3C: taxa that have proven to be more abundant or widespread than was previously believed, and/or those that are not subject to any identifiable threat.

U.S. Forest Service (Forest Service Manual 2670.5) (noted by the Forest Service as "S")

FS: Sensitive: those plant and animal species identified by the Regional Forester for which population viability is a concern as evidenced by: (1) significant current or predicted downward trends in population numbers or density, (2) significant current or predicted downward trends in habitat capability that would educe a species' existing distribution.

Bureau of Land Management (BLM Manual 6840.06D) (noted by BLM as "S")

BLM: Sensitive: those species found on public lands, designated by a State Director, that could easily become endangered or extinct in a state. The protection provided for sensitive species is the same as that provided for C (candidate) species.

7.1.5 State Status

Colorado Division of Wildlife

E Endangered
T Threatened
SC Special Concern

7.1.6 Legal Designations

Natural Heritage rarity ranks should not be interpreted as legal designations. Although most species protected under state or federal endangered species laws are extremely rare, not all rare species receive legal protection. Legal status is designated by either the U.S. Fish and Wildlife Service under the Endangered Species Act or by the Colorado Division of Wildlife under Colorado Statutes 33-2-105 Article 2. In addition, the U.S. Forest Service recognizes some species as "sensitive," as does the Bureau of Land Management. Table 2 defines the special status assigned by these agencies and provides a key to the abbreviations used by Colorado Natural Heritage Program.

Please note that the U.S. Fish and Wildlife Service has issued a Notice of Review in the February 28, 1996 Federal Register for plants and animal species that are "candidates" for listing as endangered or threatened under the Endangered Species Act. The revised candidate list replaces an old system that listed many more species under three categories: Category 1 (C1), Category 2 (C2), and Category 3 (including 3A, 3B, 3C). Beginning with the February 28 notice, the Service will recognize as candidates for listing only species that would have been included in the former Category 1. This includes those species for which the Service has sufficient information on their biological status and threats to propose them as endangered or threatened under the Endangered Species Act.

Candidate species listed in the February 28, 1996 Federal Register are indicated with a "C." Former Category 2 and Category 3 codes are noted in this publication in parentheses, e.g., (C2). Although obsolete legal status codes will not be provided in future issues, Colorado Natural Heritage Program will continue to maintain them in its Biological and Conservation Data system for reference.

7.1.7 Boulder County Comprehensive Plan Animals of Special Concern

Birds

Class I. Extirpated Species.
- A. Extirpated breeding species in Boulder County.
  1. Those species for which there is historical documentation but no sightings during the breeding season in the last ten years.
  2. Based on Boulder County Wildlife Inventory (Boulder Audubon Society 1974-1983).

Class II. Endangered and Threatened Species.
- A. Federally endangered and threatened species.
- B. State endangered and threatened species.

Class III. Species Undergoing Long-Term, Noncyclical Population Declines.
- A. From Supplement IV.1, "Comparative Status of the Breeding Birds of Boulder County."
- B. American Birds "Blue List " (Tate and Tate 1982).

Class IV. Species with Habitat Restrictions.
- A. Rare breeding bird species in Boulder County.
  1. Based on Boulder County Wildlife Inventory and Holitza and Krieg (1981).
- B. Breeding bird species with isolated or restricted populations.
  1. Based on Boulder County Wildlife Inventory (Boulder Audubon Society 1974-1983).
- C. Colorado Division of Wildlife "Stenotopic Birds-Colorado."
  1. Based on Graul et al. (1980).
- D. Winter resident species with restricted habitats.
  1. Based on Boulder County Wildlife Inventory (Boulder Audubon Society 1974-1983).

Class V. Colorado Natural Heritage Inventory "Animal Species of Special Concern".

Fish

The relative abundance category has five basic classifications:

1. extirpated
2. threatened or endangered--State or Federal
3. rare--less than fifty fish per collection and ten or fewer sites; sub-units of 1, 2, or 3 refer to reason for rarity; Rare-1 is due to limited amount of preferred habitat; Rare-2 species were never common; Rare-3 species were historically more common but declines have been due to habitat degradation; continued declines could lead to extirpation of these species from the County; none of the seven rare species has been historically abundant
4. uncommon--less than 100 fish per collection and at eleven to twenty-five sites; habitat deterioration has affected a number of these species or they may have very specific habitat requirements which have precluded them from becoming common
5. common--more than 100 fish per collection and at twenty-five-plus sites

APPENDIX 7.2 SENSITIVE PLANT SPECIES AND COMMUNITIES

Sensitive plant species and communities occurring in the South Boulder Creek Management Area (Colorado Natural Heritage Program 1996).

Common Name	Scientific Name	Global Rank*	State Rank*	Federal Status*	State Status*
Sensitive species					
Ute ladies'-tresses	*Spiranthes diluvialis*	G2	S2	LT	
American groundnut	*Apios americana*	G5	S2		
Toothcup	*Rotala ramosior*	G5	S1?		
Sensitive communities					
Xeric tallgrass prairie	*Andropogon gerardii/ Schizachyrium scoparium*	G2	S2		
	Andropogon gerardii/ Sporobolus heterolepis	G2	S2?		
Wet prairie	*Andropogon gerardii/Sorghastrum nutans*	G1	S1?		
Shortgrass prairie	*Bouteloua gracilis/Buchloe dactyloides*	G2?	S2?		
Plains cottonwood riparian forest	*Populus deltoides/Salix amygdaloides/Salix exigua*	G2G3	S1		
Plains cottonwood riparian woodland	*Populus deltoides/ Symphoricarpos occidentalis*	G2G3	S1		
Sensitive communities expected but not documented					
Plains cottonwood riparian forest	*Populus deltoides/Panicum virgatum*	G1G2	S1S2		
Plains cottonwood riparian woodland (expected but not documented)	*Populus deltoides/Carex lanuginosa*	G1S2	S1S2		
	Populus deltoides/Salix amygdaloides/Spartina pectinata	G1S2	S1		

* See Appendix 7.1 for Colorado Natural Heritage Program ranking definitions.

APPENDIX 7.3: SUBAREAS FOR THE SOUTH BOULDER CREEK AREA INVENTORY

Overview

Three subareas are proposed for the South Boulder Creek Management Area. These are: South Boulder Creek/Dry Creek, Boulder Creek, and Fourmile Canyon Creek.

These subareas are being proposed to provide structure for sections of the Management Area inventory project. In developing the wetland section, it was discovered that there were groups of properties that had more in common with each other than with other such groups. Examining this aspect of "relatedness," showed that it held true from a number of perspectives. This appendix provides a brief description of what was considered when developing these subareas.

Landscape Factors

Is Open Space the Matrix or Is It a Patch Type?

The degree of patchiness is an important characteristic of the landscape for the management plan because it relates to the proximity and number of neighbors and the relative percentage of land that can be managed by the Open Space Program. As land managers, the Program may want to concentrate certain types of conservation projects where large, contiguous blocks of Open Space dominate the landscape. Outreach efforts might be most important and effective in areas where Open Space represents a small (but intensely used) portion of the landscape.

Excepting the Ditzel property, all the Open Space land in the North Boulder Valley Management Area is either contiguous or separated only by public rights-of-way. The landscape *matrix* is Open Space. Within the bounds of the Management Area, the distribution of private land is *patchy*. However, the South Boulder Creek Management Area presents a different picture. The matrix:patch ratio varies widely. In some parts of the Management Area Open Space dominates the landscape (e.g., South Boulder Creek floodplain from Marshall Road to South Boulder Road). In the Fourmile Canyon Creek drainage, Open Space ownership is more patchy, but Open Space is approximately as abundant as private land. The Open Space properties in the Management Area near Boulder Creek are small patches in a landscape of private ownership.

Patch Size and Shape

The size and shape of Open Space parcels varies widely across the Management Area. However these patterns tend to be clumped. Reclaimed gravel mines occupy the relatively narrow floodplain of Boulder and South Boulder Creek in the vicinity of 55th St and Valmont Road. In these areas, a narrow portion of the natural floodplain was reclaimed post mining to convey floodwaters. Typically, a small linear "legal floodplain" was purchased or donated as Open Space. These properties tend to be small and elongate. The Fourmile Canyon Creek and South Boulder Creek/Dry Creek subareas are (generally) comprised of larger, typically squarish parcels reflecting the historic ownership patterns rather than recent mining activity.

Surrounding Land Uses
Patchiness of ownership is not the only perspective or even the most important. The land uses adjacent to Open Space in the Management Area are highly variable. The privately owned hayfields and pastures along South Boulder Creek and its high terraces are indistinguishable from the surrounding Open Space. Along Boulder Creek, industrial development contrasts sharply against the adjacent Open Space lands.

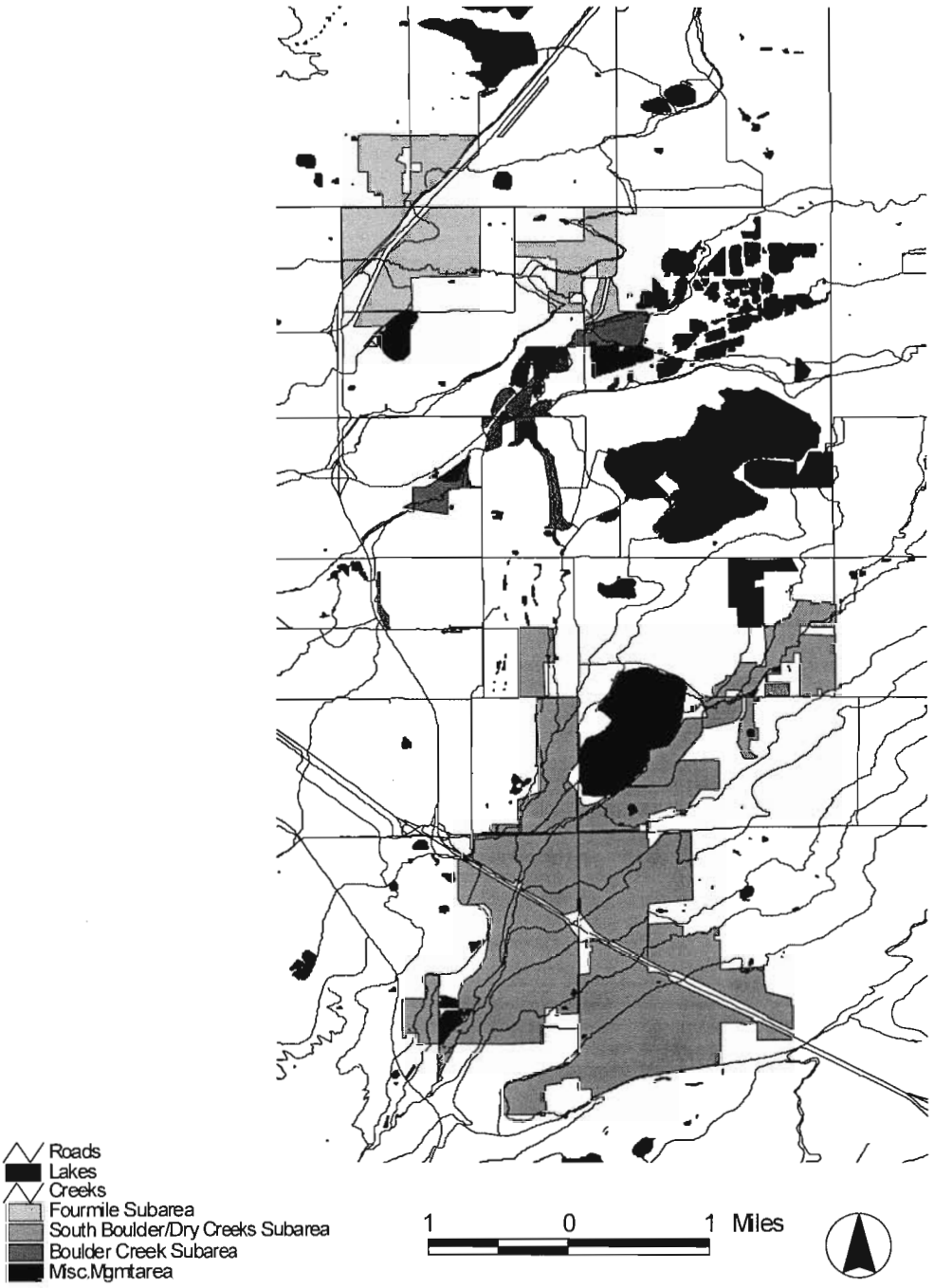
Land Use History
A variety of land uses characterize the Management Area. Gravel mining, irrigation, grazing, and neglect are the historic landscape themes. However, these land uses are clumped rather than randomly distributed. Gravel mining is characteristic of the Management Area along Boulder and South Boulder Creeks north of Arapahoe Road. Deep ponds with steep (or absent) shorelines are typical of these areas. Most reclaimed gravel areas are dominated by exotic plants. They are usually extremely weedy (because they sat for so long disturbed). The reclamation areas that are fairly free of weeds tend to be dominated by the exotic species (crested wheat, *Agropyron cristatum*; sweet clover, *Meliolotus* spp.) which were recommended for reclamation in the 1950s-1970s

The South Boulder Creek/Dry Creek and Fourmile Canyon Creek subareas have been in agricultural production for nearly a century. Much of this agricultural land is irrigated and at least seasonally grazed resulting in a distinctive vegetation pattern.

Hydrology
The properties within each subarea share similar hydrology. Fourmile Canyon Creek flows through much of the Fourmile Canyon Creek subarea where irrigation water is delivered by the Farmers Ditch and its laterals. The Boulder Creek subarea lies along Boulder Creek and the confluence of its tributaries. South Boulder Creek/Dry Creek subarea falls either within the watershed of South Boulder Creek or includes those Open Space parcels which are irrigated by South Boulder Creek water.

Relationship with Other Management Areas
Another way in which the subareas have common elements within, but differ from each other is in their relationship with other management areas. The Fourmile Canyon Creek subarea is nearby the North Boulder Valley and shares many characteristics with that area. The South Boulder Creek/Dry Creek subarea is not as related to other management areas, and forms the "heart" for the Management Area.

Subareas and Coordinated Resource Management Areas
It also appears that these subareas will prove useful when considering patterns of lease management. All three of the Coordinated Resource Management Areas overlap the Management Area to some degree. The subareas do not perfectly reflect the Coordinated Resource Management Area boundaries. Most notable is the overlap of the East Coordinated Resource Management Area with portions of each of the subareas.


Roads
Lakes
Creeks
Fourmile Subarea
South Boulder/Dry Creeks Subarea
Boulder Creek Subarea
Misc.Mgmtarea
1 0 1 Miles

South Boulder Creek/Dry Creek Subarea
Aweida II
Baseline 75
Burke I
Burke II
Church
Church of Christ
City on the Hill
Clough
Clyncke, Mary
Cohagen
Damyanovich
Fancher
Gallucci
Gebhard
Greenbelt Meadows subdivision
Hogan Brothers
Hoover Hill
Jirkovsky
Klein
Lauffenberger Trail
Lewis
Matheson
Merle-Smith
Methvin (Brandt)
Moad-Cillessen
Oakley
Reich
Richardson I
Rolling Rock Ranch
Salaman
Short
St. Walburga Abbey
Suitts
Ute Industrial Park
Van Vleet
Wille
Yunker

Boulder Creek Subarea
Arnold, William
Boulder Conservative Synagogue
Colorado Open Lands
Colorado Open Lands, Cottonwood Pond
Colorado Open Lands, KOA Lake
Copper Door
Cottonwood Farms
Cottonwood Grove
Eason
Eccher
Flatiron Industrial Park
Foothills Parkway Industrial Park
Hatch-Quinby-Phipps
LakeCentre I and II
Lentsch
Pearl Street Industrial Park
Postle
Short and Milne
Sisk
Sunrise Center I and II
Syntex
Union Pacific Railroad
Valmont Industrial Park

Fourmile Canyon Creek Subarea
Andrus
Belgrove
Celestial Seasonings
Colorado Open Lands II
Harrington
James
Lousberg
McKenzie
N.B.I.
Nu-West
Paddock
Reynolds
Short and Milne

APPENDIX 8.1 SIGNIFICANT WETLAND DEFINITION

Significant wetlands are those wetlands which meet any of the following criteria.

1. Meet the criteria set forth in the *Boulder County Comprehensive Plan* as follows:
   a. wetlands important for flood control, water quality, and runoff stabilization
   b. wetlands designated as Critical Wildlife Habitat
   c. wetlands designated as a Critical Plant Association
   d. wetlands designated as a part of a County Natural Area

   or;

2. Perform at least one wetland function to a high degree.
   The procedure for the evaluation of wetland function is given in *Advanced Identification of Wetlands in the City of Boulder Comprehensive Planning Area* (Cooper, 1988). Wetlands identified during the Advanced Identification project have been evaluated. The evaluation sheets are available from the City of Boulder Planning Department.

   or;

3. Provide habitat for a species of special concern including:
   a. species (plants and animals or wildlife) listed as threatened or endangered by the U.S. Fish and Wildlife Service
   b. animal or wildlife species listed by the State of Colorado as threatened or endangered, species of special concern, or species or undetermined status
   c. plant species listed by the State of Colorado as species of special concern
   d. critical animal or wildlife species as listed in the *Boulder County Comprehensive Plan*

   or;

4. Could be made significant by a reasonable restoration effort.

   or;

5. Those wetlands with a direct hydrological connection to a significant wetland, the destruction of which would adversely affect the significant wetland.

APPENDIX 8.2 APPLICABLE WETLAND POLICIES

Wetland Policies Relevant to South Boulder Creek

The development and management of wetlands are governed by federal, County and City regulations and policies.

Federal Policy
Section 404 of the Clean Water Act requires the federal government to regulate the dredging and placement of fill materials in waters of the United States. "Waters of the United States" is a broad regulatory concept; it has not been interpreted to include all the water in the United States but does include wetlands and creeks such as South Boulder Creek. The Army Corps of Engineers and the Environmental Protection Agency jointly administer the Clean Water Act, with the Corps of Engineers generally responsible for the regulatory program.

The regulation of wetlands by the federal government, however, is not synonymous with wetland protection. The intent of the Clean Water Act is to "restore and maintain the physical, chemical and biological integrity of our nation's waters;" only the filling and dredging of wetlands are regulated. No federal regulations prohibit the draining of wetlands or the removal of wetland vegetation, two activities which could destroy a wetland as effectively as filling or dredging. The Clean Water Act requires a regulatory review of activities that may destroy wetlands, but it does not prohibit such activities.

The Corps of Engineers operates the permitting process by which regulated activities are reviewed. To streamline the permit application review, the Corps of Engineers issued a set of standing permits for many commonplace activities. In most cases there is no requirement to even notify the Corps of a proposed regulated activity if it is authorized by one of these standing permits. Perhaps the most well known of these permits is the "Nationwide 26" permit. Under the provisions of this permit a person may:

- fill up to one acre of wetland without notifying the Corps
- fill from one to under ten acres of wetland without an individual permit if he or she first notify the Corps and receive a letter of authorization

Nationwide permit 26 is applicable in all isolated wetlands *except* those below the headwaters of a "5-cfs" stream. In the Boulder Valley there are only two "5-cfs streams"--that is creeks or streams which achieve a discharge of 5 cubic feet per second (cfs). These are Boulder Creek and South Boulder Creek. The headwaters of a "5-cfs stream" is that point on the stream where the discharge averages 5 cfs. The headwaters of Boulder Creek are at Boulder Falls, and the headwaters of South Boulder Creek are just southwest of Nederland in Gilpin County. The entire reaches of both these streams as they flow through the Boulder Valley are below their respective headwaters.

Someone wishing to fill a wetland along the bank of Boulder Creek could not receive authorization from the Corps of Engineers under Nationwide 26. Nationwide 26 does not apply to wetlands

adjacent to a 5-cfs stream below its headwaters. No exact definition of adjacent has been offered. The determination of agency application of this term is usually made by the field representative of the Corps of Engineers.

Applicants must request an individual Department of the Army permit for activities that cannot be authorized by any nationwide permit. The Corps may require compensatory mitigation. The requirement is usually to construct or restore a wetland to offset the wetland loss resulting from the permitted activity allowed through the individual permit process.

Boulder County Policies

The following goal and policies are part of the *Boulder County Comprehensive Plan* (Boulder County 1997).

Goal

B.5. Wetlands which are important to maintaining the overall balance of ecological systems should be conserved.

Policies: Wetlands

ER 6.01 Landowners of existing significant wetlands will be encouraged to seek assistance from Soil Conservation Services or Parks and Open Space Department for the purpose of formulating management plans.

ER 6.02 The County will encourage applicants of land use proposals to avoid damaging, disturbing, or disrupting any significant wetlands. Where impacts to significant wetlands are unavoidable, the County shall request appropriate mitigation including restoration, enhancement, and/or creation of wetlands along with the implementation of a management and monitoring plan. Although requested protection measures for locally significant wetlands may exceed the requirements of other governmental agencies, the practices are intended to complement, and not negate, any other wetland requirements.

ER 6.03 Boulder County shall cooperate with the Soil Conservation Service's policy of providing no financial or technical assistance for the conversion of significant wetlands to other uses.

ER 6.04 The County shall cooperate and participate with other governmental agencies and other public and private organizations to develop regional approaches to wetlands protection. Where significant wetlands have been identified on public land, the County will pursue intergovernmental agreements to ensure the specific protection of these resources. Where significant wetlands exist within Community Service Areas [such as the Boulder Valley], Boulder County shall provide assistance to municipalities for the establishment of wetland management plans to avoid the degradation of such wetlands.

ER 6.05 Significant wetlands, which in addition have been identified as critical wildlife habitats or critical plant associations or rare plant sites, should conform with the applicable goals and policies of the *Boulder County Comprehensive Plan.*

ER 6.06 Development proposals affecting wetlands other than those identified as significant, particularly those with high functional ratings, a large size, hydrologic connections, wildlife habitat value, or human interest, should also be evaluated for potential impacts and mitigation measures. The *Boulder County Comprehensive Plan* also calls upon County staff to:

1. Research and evaluate wetlands to determine which are considered significant
2. Use conservation easements to protect significant wetlands on private property
3. Amend County regulations to require details of wetland impacts for land use proposals having a potential to adversely impact significant wetlands

City of Boulder Policies

The *Boulder Valley Comprehensive Plan* (1996a) has a specific wetland policy statement:

4.09 Wetland Protection.
Natural and human-made wetlands are valuable for their ecological and, where appropriate, their recreational functions including their ability to enhance water and air quality. Wetlands also function as important wildlife habitat, especially for rare, threatened, and endangered plants and wildlife. The City and the County will continue to develop programs to protect and enhance wetlands in the Boulder Valley. The City shall discourage the destruction of wetlands, but in the rare cases when development is permitted and the filling of wetlands cannot be avoided, they shall be restored or replaced.

The *Long Range Management Policies* contains the following general guidance regarding wetlands protection:

IV. E. Water Management

2. Water Quantity and Quality.
   - Agricultural leases will be managed to protect or enhance riparian areas, wetlands, and waterways on Open Space lands and to maximize the protection or enhancement of water quality whenever possible in accordance with the City of Boulder Non-Point Source Pollution Program;

3. Floodplains and Wetlands. Adverse impacts to floodplains and wetlands will be avoided wherever possible Where avoidance cannot be achieved, mitigating measures will be implemented to minimize potential harm to the natural values of floodplains, riparian areas, and wetlands in accordance with the City's Wetlands Ordinance and other applicable regulations. Losses to wetlands will be compensated by restoration or creation of similar habitats elsewhere according to the standards set forth in the Wetlands Ordinance and other applicable regulations.

   The Department will:
   - Develop inventory methodologies and conduct inventories of wetlands, riparian areas, and floodplains as needed on Open Space lands;
   - Identify areas subject to flooding and take actions to limit risks to people and property, as appropriate;

- Inventory existing facilities and uses that affect floodplains, riparian areas, and wetlands and prepare plans for protection or restoration, as appropriate; and
- Identify native plants and animals that require these habitats and prepare plans for their protection.

X. D. Open Space Access, Trail Systems and Related Facilities

6. Trails.

...Wetlands and other sensitive natural areas will be avoided when building trails.

APPENDIX 8.3: PLANTS RECORDED FROM WETLANDS IN THE SOUTH BOULDER CREEK MANAGEMENT AREA

There are 186 species in the Management Area. Weed species of concern are shown in highlighted text. NWI Rankings are explained in the Wetlands section.

Scientific Name	Common Name	NWI Rank
Acer glabrum	Mountain maple	FAC
Acer saccharinum	Silver maple	FACW+
Agalinis tenuifolia	Purple agalinis	FACW+
Agrimonia striata	Agrimony	FACU
Agropyron repens	Quack grass	FAC
Agrostis gigantea	Redtop	FACW+
Agrostis stolonifera	Bentgrass, spreading	FAC+/FACW
Alisma triviale	Water plantain	OBL
Alnus incana	Narrow-leaf alder	UPL
Alopecurus aequalis	Foxtail	OBL
Ambrosia artemisiifolia	Ragweed	FACU
Amorpha fruticosa	Lead Plant	OBL
Apocynum cannabinum	Indian Hemp	FAC
Apocynum sibiricum	Dogbane	FAC
Arctium minus	Burdock	UPL
Asclepias incarnata	Marsh milkweed	OBL
Asclepias speciosa	Showy milkweed	FAC
Asparagus officinalis	Wild asparagus	FACU-
Aster falcatus	Aster	FAC
Aster hesperius	Aster	OBL
Aster laevis	Aster	UPL
Atriplex prostrata (?)	Spear orache	FACW+
Bacopa rotundifolia	Water-hyssop	OBL
Beckmannia syzigachne	Slough-grass	OBL
Betula fontinalis	River Birch	FACW+
Bidens cernua	Nodding bur-marigold	OBL
Bidens frondosa	Beggars tick	FACW+
Bolobschoenus maritimus	Alkali bulrush	OBL
Breea arvensis	Canada Thistle	NI

Scientific Name	Common Name	NWI Rank
Bromopsis inermis	Smooth brome	UPL
Campanula rapunculoides	Harebell	NI
Cardaria latifolium	White top	FACW+
Carex brevior	Sedge	FAC
Carex emoryi	Sedge	OBL
Carex hystricina	Sedge	OBL
Carex interior	Sedge, Inland	OBL
Carex lanuginosa	Sedge	OBL
Carex nebrascensis	Sedge	OBL
Carex praegracilis	Sedge	FACW+
Carex scoparia	Broomlike sedge	FACW+
Carex simulata	Sedge	NI
Carex stipata	Sedge	OBL
Carex vulpinoidea	Sedge	OBL
Cichorium intybus	Chicory	UPL
Cirsium arvense	Canada thistle	FACU
Cirsium ochrocentrum	Wavy-leaved thistle	FACU
Clematis ligustifolia	Virgin's Bower	FACU
Conium maculatum	Poison Hemlock	FACW+
Cornus stolonifera	Red-osier dogwood	FACW
Corylus cornuta	Beaked Hazelnut	n/a
Crataegus erythropoda	Hawthorne	NI
Critesion brachyantherum	Foxtail barley	FACW+
Cynoglossum officinale	Houndstongue	UPL
Dactylis glomerata	Orchard grass	FACU
Dipsacus sylvestris	Teasle	(fac)
Distichlis stricta	Saltgrass	FACW+
Dodecatheon pulchellum	Shooting star	FAC
Echinochloa crus-galli	Barnyard grass	FACW+
Elaeagnus angustifolia	Russian olive	FAC
Eleocharis acicularis	Spike rush	OBL
Eleocharis coloradoensis	Spike rush	OBL
Eleocharis macrostachya	Spike rush	OBL
Eleocharis palustris	Spikerush, creeping	OBL
Elodea canadensis	Elodea	OBL

Scientific Name	Common Name	NWI Rank
Epilobium adenocaulon	Willow-herb	OBL
Festuca pratensis	Meadow fescue	FAC
Fraxinus pensylvanicus	Green ash	FACW+
Gleditsia tricanthos	Honey locust	FAC
Glyceria grandis	Manna grass	OBL
Glyceria striata stricta	Manna grass	OBL
Glycyrrhiza lepidota	Wild liquorice	FACU
Helenium autumnale	Sneezeweed	FACW+
Helinthus nuttalli	Nuttal's sunflower	FAC
Liverworts	liverworts	n/a
Heracleum sphondylium	Cow parsnip	FACW+
Hippochaete hyemailis	Horsetail	FACW+
Hippochaete laevigata	Horsetail	FACW+
Humulus lupulus	Wild hops/common hops	FACU
Hydrophyllum fendleri	Waterleaf	FACW+
Impatiens capensis	Impatiens	FACW+
Iris missouriensis	Iris	OBL
Iva axillaris	Marsh elder	FAC
Jamesia americana	Waxflower	n/a
Juncus arcticus ater	Arctic Rush	OBL
Juncus articulatus	Rush	OBL
Juncus brachycephalus	Rush	UPL
Juncus compressus	Rush	UPL
Juncus confusus	Rush, Colorado	FAC+
Juncus effusus	Soft-rush	OBL
Juncus gerardii	Rush	UPL
Juncus interior	Rush	FAC
Juncus longistylis	Rush	FACW+
Juncus marginatus	Rush	FACW
Juncus nodosus	Rush	OBL
Juncus saximontanus	Rush	FACW+
Juncus torreyi	Rush	FACW+
Leersia oryzoides	Rice cutgrass	OBL
Lemna minor	Duckweed	OBL
Linum lewisii	Blue Flax	UPL

Scientific Name	Common Name	NWI Rank
Lobelia siphilitica	Lobelia	OBL
Lotus tenuis	Lotus	UPL
Lycopus americanus	Water horehound	OBL
Lythrum alatum	Loosestrife	OBL
Lythrum sailicaria	Purple loosestrife	OBL
Mentha arvense	Mint	FACW+
Mimulus glabratus	Monkey flower	OBL
Monarda fistulosa	Pink bergamot	FACU-
Muhlinbergia asperifolia	Alkali muhly	FACW+
Myriophyllum exalbescens	Water milfoil	OBL
Nasturtium officionale	Water-cress	OBL
Negundo aceroides	Box-elder Maple	FAC
Oenothera coronopifolia	Evening primrose	UPL
Padus virginiana	Chokecherry	FACU
Parthenocissus quinquefolia	Virginia creeper	FAC
Pascopyrum smithii	Western wheatgrass	FACU
Pastinacea sativa	Parsnip	UPL
Persicaria amphibia	Smartweed	OBL
Persicaria coccinea	Smartweed	OBL
Persicaria hydropiper	Smartweed	OBL
Persicaria lapathifolia	Smartweed	OBL
Persicaria maculata	Smartweed	OBL
Persicaria pensylvanica	Smartweed	FACW+
Phalaris arundinacea	Reed canary grass	facw±
Phleum pratense	Timothy	FACU
Physocarpus monogynus	Mountain Ninebark	fac
Plantago elongata	Slender Plantain	FAC
Plantago lanceolata	English plantain	FAC
Plantago major	Common plantain	FAC
Poa compressa	Canada bluegrass	FACU
Poa pratensis	Kentucky bluegrass	FACU
Polypogon monospeliensis	Rabbits foot grass	OBL
Populus angustifolia	N.L. cottonwood	FACW
Populus deltoides monolifera	Plains cottonwoods	FAC
Populus X acuminata	Cottonwood	FAC

Scientific Name	Common Name	NWI Rank
Potemogeton foliosus	Pondweed	OBL
Potemogeton gramineus	Pondweed	OBL
Potemogeton pectinatus	Pondweed	OBL
Prunella vulgaris	Heal-all	FAC
Prunus americana	American plum	UPL
Pseudotsuga menziesii	Douglas-Fir	n/a
Pteridium aquilinum	Bracken fern	FACU
Puccinellia airoides	Alkali grass	OBL
Puccinellia distans	Alkali grass	OBL
Pyrus malus	Apple	NI
Ranunculus macounii	Buttercup	OBL
Rhus americana trilobata	Skunkbrush	UPL
Ribes aureum	Golden currant	FACW+
Rorippa palustris	Cress	OBL
Rosa arkansana	Wild rose	NI
Rudbeckia laciniata	Tall cone flower	FAC
Rumex crispus	Dock	FACW+
Rumex triangulivalvis	Willow dock	OBL
Sagittaria cuneata	Arrowroot	OBL
Sagittaria latifolia	Arrowroot	OBL
Salix alba	Golden Osier willow	FACW
Salix amygdaloides	Peach leaf willow	FACW+
Salix exigua	Sandbar willow	OBL
Salix fragilis	Crack Willow	FAC
Salix irrorata	Blue Stem Willow	FACW+
Sanicula marilandica	Black snakeroot	NI
Schoenoplectus lacustris acutu	Softstem bulrush	OBL
Schoenoplectus pungens	Tule; Bulrush	OBL
Scirpus lineatus	Field sedge	OBL
Scirpus microcarpus	Bulrush	OBL
Scirpus pallidus	Bulrush	OBL
Scirpus pungens	Three square	OBL
Scutellaria galericulata	Marsh Skullcap	OBL
Setaria glauca	Bristle-grass	FAC
Smilacina racemosa	False Solomon's Seal	FAC

Scientific Name	Common Name	NWI Rank
Smilacina stellata	False Solomon's Seal	FAC
Solidago gigantea	Golden rod	FACW+
Sorgastrum avenaceum	Yellow indian grass	FACU
Spartina pectinata	Prarie cordgrass	FACW+
Spergularia media	Sand spurry	UPL
Spiranthes diluvialis	Ute ladies'-tress	FACW?
Symphoricarpos albus	Snowberry	FACU
Thermopsis divaricata	Golden banner	UPL
Toxicodendron radicans	Poison ivy	FACU
Trifolium pratense	Red clover	FACU
Trifolium repens	White clover	FACU
Typha angustifolia	Narrow leaf cattail	OBL
Typha latifolia	Broad leaf cattail	OBL
Ulmus americanus	American elm	FAC
Verbena hastata	Blue vervain	FACW+
Veronica anagallis-aquatica	Speedwell	OBL

APPENDIX 9.1 RESEARCH LITERATURE

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APPENDIX 9.2: EXPECTED AND OBSERVED SPECIES IN THE MANAGEMENT AREA

▒ = Expected
◆ = Observed

Common Name	1	2	3	4	5	6	7	8	9	10	11	12
Bigmouth shiner						▒						
Black bullhead						▒				▒		
Black crappie						◆				▒		
Blacknose shiner						▒						
Bluegill						◆				◆		
Brassy minnow						▒						
Brook stickleback						▒						
Brook trout						▒				▒		
Brown bullhead						▒				▒		
Brown trout						◆				◆		
Central stoneroller						◆				◆		
Channel catfish						▒				▒		
Common carp						◆				◆		
Common shiner						▒						
Creek chub						◆				◆		
Fathead minnow						◆				◆		
Gizzard shad						▒				▒		
Golden shiner										▒		
Goldfish						▒				▒		
Grass carp										▒		
Green sunfish						◆				◆		
Greenback cutthroat trout						▒				▒		
Hornyhead chub						▒				▒		
Iowa darter						▒				▒		
Johnny darter						▒						
Kokanee salmon										▒		
Lake chub						▒						
Lake trout										▒		
Largemouth bass						◆				◆		
Longnose dace						◆				◆		
Longnose sucker						◆				◆		
Mosquitofish						◆				◆		
Northern redbelly dace						▒						
Orangespotted sunfish						◆						
Plains killifish						▒						
Plains minnow						▒						
Plains topminnow						◆				◆		
Pumpkinseed						◆				▒		
Quillback						▒						
Rainbow trout						◆				◆		
Redfin shiner						▒				▒		
Sand shiner						▒						
Smallmouth bass										▒		
Stonecat						▒						

1=alfalfa/alfalfa hay; 2=annual crops; 3=cliff; 4=marsh; 5=mixed grass prairie; 6= moving water; 7=plains riparian; 8=short grass prairie; 9=shrubland; 10=standing water; 11=tall grass prairie; 12=wet meadow

Common Name	1	2	3	4	5	6	7	8	9	10	11	12
Suckermouth minnow						▒						
Threadfin shad										▒		
Walleye										▒		
White crappie										▒		
White sucker						◆				◆		
Yellow perch						▒				▒		
Bullfrog				▒		▒	▒			▒	▒	▒
Great plains toad	▒	▒			▒		▒	▒			▒	
Northern leopard frog				▒		▒	▒			▒	▒	▒
Plains spadefoot					▒			▒			▒	
Tiger salamander				▒	▒	▒	▒	▒	▒	▒	▒	▒
Western chorus frog				▒			◆			◆	◆	▒
Woodhouse's toad	▒	▒		▒			▒				▒	◆
Common garter snake				▒	▒	▒	▒		▒	▒	▒	
Eastern fence lizard			▒		▒			▒	▒			
Gopher snake		▒			▒		▒	▒	▒		▒	
Lesser earless lizard					▒		▒		▒			
Lined snake					▒		▒	▒	▒		▒	
Many-lined skink					▒			▒	▒			
Milk snake					▒		▒		▒		▒	
Northern water snake				◆		▒	◆			▒		
Ornate box turtle					▒		▒	▒			◆	
Painted turtle				▒		▒	◆			▒		▒
Plains blackhead snake					▒		▒	▒	▒		▒	
Plains garter snake				▒	▒		◆	▒	▒		▒	▒
Racer	▒			▒	◆		◆	▒	▒		▒	
Short-horned lizard					▒			▒				
Six-lined racerunner					▒		▒	▒	▒			
Smooth green snake									▒		▒	
Snapping turtle				▒		▒	▒			▒		▒
Spiny softshell				▒		▒	▒			▒		
Western hognose snake					▒			▒				
Western rattlesnake		▒	▒		▒			▒	▒			
Western terrestrial garter snake	▒	▒		▒	▒	▒	▒		▒	▒	▒	▒
American avocet				▒								
American bittern				▒								▒
American coot				▒						▒		
American crow	▒	▒			▒		◆	▒	▒		▒	▒
American dipper						▒	▒					
American goldfinch	▒	▒					◆		▒			
American kestrel	◆	◆			◆		◆	▒			◆	▒
American pipit		▒			▒		◆	▒				
American redstart							◆					
American robin	▒	▒		◆	◆		◆	▒	▒		◆	▒
American tree sparrow	▒	▒			▒		◆		▒			
American white pelican										◆		
American wigeon	▒	▒		▒		▒	◆			▒		▒
American woodcock							◆					
Ash-throated flycatcher							▒					
Baird's sandpiper				▒								

1=alfalfa/alfalfa hay; 2=annual crops; 3=cliff; 4=marsh; 5=mixed grass prairie; 6= moving water; 7=plains riparian; 8=short grass prairie; 9=shrubland; 10=standing water; 11=tall grass prairie; 12=wet meadow

Common Name	1	2	3	4	5	6	7	8	9	10	11	12
Bald eagle	▒	◆			◆	▒	◆	◆	▒	◆	◆	◆
Baltimore oriole					◆		◆		▒			
Band-tailed pigeon	▒	▒					◆		▒			
Bank swallow	▒	▒		▒	◆		◆			▒	▒	▒
Barn owl		▒	▒	◆	◆		◆				◆	◆
Barn swallow	▒	▒	▒	▒			▒			▒	▒	▒
Barrow's goldeneye						▒				▒		
Bay-breasted warbler							◆					
Belted kingfisher				▒		▒	◆			◆		
Black rosy finch									▒			▒
Black swift			▒									
Black tern				▒						▒		
Black-and-white warbler							◆					
Black-billed magpie	◆	▒		◆	◆		◆	▒	▒		◆	▒
Black-capped chickadee				◆	◆		◆		▒		◆	◆
Black-crowned night-heron				▒		▒	◆			◆		◆
Black-headed grosbeak							◆		▒			
Black-necked stilt												◆
Black-throated blue warbler							◆		▒			
Black-throated gray warbler							◆					
Black-throated green warbler							◆					
Blackpoll warbler							▒					
Blue grosbeak	▒	▒					◆		▒			
Blue jay					◆		◆				◆	
Blue-gray gnatcatcher						▒	▒		▒			
Blue-headed vireo							◆					
Blue-winged teal	▒	▒		▒		▒	◆			◆		▒
Blue-winged warbler							◆					
Bobolink	▒	◆			◆		◆				◆	◆
Bohemian waxwing	▒	▒			▒		◆					
Bonaparte's gull										▒		
Brewer's blackbird	▒	▒		▒	▒	▒	◆	▒	▒		◆	◆
Brewer's sparrow	▒	▒			▒				▒			
Broad-tailed hummingbird					◆		◆					
Broad-winged hawk							◆					
Brown creeper					◆		◆					
Brown thrasher							▒		▒			
Brown-headed cowbird	▒	▒		◆	▒		◆	▒	▒		◆	▒
Bufflehead										▒		
Burrowing owl					▒			▒				
Bushtit									▒			
California gull		▒		▒			◆			▒		▒
Canada goose	▒	▒		◆	◆	▒	◆			◆	◆	▒
Canvasback				▒						▒		
Canyon wren			▒									
Cassin's finch							◆					
Cedar waxwing	▒	▒					◆		▒			
Chestnut-sided warbler							◆					
Chimney swift							◆					
Chipping sparrow	▒	▒			▒		◆		▒			

1=alfalfa/alfalfa hay; 2=annual crops; 3=cliff; 4=marsh; 5=mixed grass prairie; 6= moving water; 7=plains riparian; 8=short grass prairie; 9=shrubland; 10=standing water; 11=tall grass prairie; 12=wet meadow

Common Name	1	2	3	4	5	6	7	8	9	10	11	12
Cinnamon teal	▒	▒		▒		▒	◆			▒		▒
Clark's grebe										▒		
Clark's nutcracker	▒	▒					▒					
Clay-colored sparrow					▒		◆		▒			
Cliff swallow			▒		◆		◆			▒	◆	
Common goldeneye						▒				▒		
Common grackle	▒	▒		◆	◆		◆				◆	▒
Common loon					◆					◆		
Common merganser						▒	◆			◆		
Common nighthawk	▒	▒			◆		◆	▒	▒			
Common poorwill							▒	▒	▒			
Common raven	▒	▒	▒		◆		◆	▒	▒		◆	◆
Common redpoll		▒			▒		▒	▒	▒			
Common snipe		◆		◆	◆	▒	◆			◆	◆	◆
Common yellowthroat				▒			◆					
Cooper's hawk		▒			◆		◆		▒		◆	
Cordilleran flycatcher							▒		▒			
Dark-eyed junco					◆		◆		▒			
Double-crested cormorant							◆			◆		◆
Downy woodpecker				◆	◆		◆				◆	◆
Dusky flycatcher									▒			
Eared grebe						▒				▒		
Eastern bluebird							◆					
Eastern kingbird	▒	▒			◆		◆	▒	▒		▒	▒
Eastern screech-owl							◆					
Eastern towhee							◆		▒			
European starling	◆	▒	▒	◆	◆		◆	▒	▒		◆	◆
Evening grosbeak							◆					
Ferruginous hawk	▒	◆			◆		◆	◆	▒		▒	◆
Forster's tern				▒						▒		
Fox sparrow							◆					▒
Franklin's gull		▒		▒			◆			▒		▒
Gadwall	▒	▒			◆	▒	◆			▒	▒	▒
Golden eagle	▒	◆	▒		◆		◆	▒	▒		▒	▒
Golden-crowned kinglet							◆					
Grasshopper sparrow	▒	▒			◆		◆				◆	▒
Gray catbird							◆		▒			
Great blue heron				◆	◆	▒	◆			◆	◆	◆
Great egret				▒		▒	▒			▒		
Great horned owl	◆	◆		◆	◆		◆		◆		◆	▒
Greater scaup										▒		
Greater yellowlegs				▒			◆					▒
Green heron							◆					
Green-tailed towhee							◆		▒			
Green-winged teal	▒	▒		▒			◆			▒		▒
Hairy woodpecker							◆					
Hammond's flycatcher							◆					
Harris' sparrow							▒					
Hermit thrush					◆		◆		▒			
Herring gull		▒		▒						▒	◆	▒

1=alfalfa/alfalfa hay; 2=annual crops; 3=cliff; 4=marsh; 5=mixed grass prairie; 6= moving water; 7=plains riparian; 8=short grass prairie; 9=shrubland; 10=standing water; 11=tall grass prairie; 12=wet meadow

Common Name	1	2	3	4	5	6	7	8	9	10	11	12
Hooded merganser						◆				◆		
Hooded warbler							◆					
Horned grebe										◆		
Horned lark		◆			◆			◆	◆			
House finch		◆		◆	◆		◆		◆		◆	◆
House sparrow		◆		◆	◆		◆		◆		◆	
House wren				◆	◆		◆		◆			◆
Indigo bunting	◆	◆					◆		◆			
Killdeer	◆	◆		◆	◆		◆	◆		◆	◆	◆
Lapland longspur		◆			◆			◆				
Lark bunting	◆	◆			◆			◆	◆			
Lark sparrow	◆	◆			◆		◆	◆	◆			
Lazuli bunting							◆		◆			
Least bittern				◆								
Least sandpiper				◆								◆
Lesser goldfinch	◆	◆			◆		◆		◆			◆
Lesser scaup				◆						◆		
Lesser yellowlegs				◆								◆
Lewis' woodpecker		◆					◆		◆			
Lincoln's sparrow				◆			◆		◆			
Loggerhead shrike	◆				◆		◆	◆	◆		◆	◆
Long-billed curlew					◆			◆			◆	◆
Long-billed dowitcher				◆								
Long-eared owl							◆		◆			
Macgillivray's warbler							◆		◆			
Magnolia warbler							◆					
Mallard	◆	◆		◆	◆	◆	◆			◆	◆	◆
Marbled godwit	◆			◆							◆	◆
Marsh wren				◆			◆					
Merlin	◆	◆			◆		◆	◆			◆	◆
Mountain bluebird	◆	◆			◆		◆	◆	◆		◆	◆
Mountain chickadee							◆		◆			
Mountain plover								◆				
Mourning dove		◆		◆	◆		◆	◆	◆		◆	
Nashville warbler							◆					
Northern bobwhite	◆	◆			◆		◆					◆
Northern flicker	◆			◆	◆		◆				◆	
Northern goshawk							◆		◆			
Northern harrier	◆	◆		◆	◆		◆	◆	◆		◆	◆
Northern mockingbird	◆	◆			◆		◆		◆		◆	
Northern parula												
Northern pintail	◆	◆		◆		◆	◆			◆		◆
Northern rough-winged swallow	◆	◆		◆			◆			◆	◆	◆
Northern saw-whet owl							◆					
Northern shoveler	◆	◆		◆		◆				◆	◆	◆
Northern shrike	◆				◆		◆	◆	◆		◆	◆
Northern waterthrush				◆		◆	◆					
Olive-sided flycatcher							◆					
Orange-crowned warbler					◆		◆		◆			
Orchard oriole							◆					

1=alfalfa/alfalfa hay; 2=annual crops; 3=cliff; 4=marsh; 5=mixed grass prairie; 6= moving water; 7=plains riparian; 8=short grass prairie; 9=shrubland; 10=standing water; 11=tall grass prairie; 12=wet meadow

Common Name	1	2	3	4	5	6	7	8	9	10	11	12
Osprey							◆			◆		
Ovenbird							◆					
Pacific loon										◆		
Palm warbler							◆					
Pectoral sandpiper												◆
Peregrine falcon	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
Pied-billed grebe							◆			◆		
Pine siskin	◆	◆					◆		◆			
Pinyon jay					◆		◆		◆			
Prairie falcon	◆	◆	◆		◆		◆	◆	◆		◆	◆
Purple Finch							◆					
Red crossbill							◆					
Red-breasted merganser						◆				◆		
Red-breasted nuthatch							◆					
Red-eyed vireo							◆					
Red-headed woodpecker		◆			◆		◆					
Red-naped sapsucker					◆		◆					
Red-shouldered hawk							◆					
Red-necked phalarope										◆		
Red-tailed hawk	◆	◆			◆		◆	◆	◆		◆	◆
Red-winged blackbird	◆	◆		◆	◆		◆				◆	◆
Redhead				◆						◆		
Ring-billed gull		◆		◆			◆			◆	◆	◆
Ring-necked duck				◆			◆			◆		
Ring-necked pheasant	◆	◆			◆		◆				◆	
Rock dove		◆	◆		◆		◆				◆	
Rock wren			◆		◆		◆	◆	◆		◆	
Rose-breasted grosbeak							◆					
Rough-legged hawk	◆	◆		◆	◆		◆	◆	◆		◆	◆
Ruby-crowned kinglet					◆		◆					
Ruddy duck				◆						◆		
Rufous hummingbird									◆			◆
Rusty blackbird	◆	◆			◆		◆	◆			◆	◆
Sage thrasher	◆	◆			◆		◆		◆			
Sandhill crane	◆	◆		◆								◆
Savannah sparrow				◆	◆		◆				◆	◆
Say's phoebe					◆		◆	◆	◆		◆	◆
Semipalmated sandpiper				◆								
Sharp-shinned hawk	◆	◆			◆		◆		◆		◆	
Sharp-tailed grouse	◆	◆					◆		◆			◆
Short-eared owl	◆			◆	◆			◆	◆		◆	◆
Snow goose	◆	◆		◆	◆					◆		◆
Snowy egret	◆	◆		◆		◆	◆			◆		◆
Solitary sandpiper				◆			◆					
Song sparrow				◆	◆		◆					
Sora				◆						◆		◆
Spotted sandpiper				◆	◆	◆	◆			◆		◆
Steller's jay							◆		◆		◆	
Summer tanager							◆					
Swainson's hawk	◆	◆			◆		◆	◆	◆		◆	◆

1=alfalfa/alfalfa hay; 2=annual crops; 3=cliff; 4=marsh; 5=mixed grass prairie; 6= moving water; 7=plains riparian; 8=short grass prairie; 9=shrubland; 10=standing water; 11=tall grass prairie; 12=wet meadow

Common Name	1	2	3	4	5	6	7	8	9	10	11	12
Swainson's thrush							◆		▒			
Swainson's warbler							◆					
Swamp sparrow							◆					
Tennessee warbler							◆					
Townsend's solitaire							◆		▒			
Townsend's warbler							◆		▒			
Tree swallow				▒	◆		◆			▒	◆	▒
Tundra swan										▒		
Turkey vulture	◆	▒	▒		◆		◆	◆	▒		◆	▒
Veery							◆					
Vesper sparrow	▒	▒			◆		◆	▒	▒		◆	
Violet-green swallow			▒	▒	◆		◆			▒	▒	▒
Virginia rail				▒								▒
Virginia's warbler							◆		▒			
Warbling vireo							◆		▒			
Western bluebird	▒	▒			◆		◆		▒		▒	▒
Western grebe										◆		
Western kingbird	▒	▒			◆		◆	▒	▒		▒	▒
Western meadowlark	◆	▒		◆	◆		◆	▒	▒		◆	◆
Western screech-owl							◆					
Western sandpiper				▒								
Western scrub jay									▒			
Western tanager							◆		▒			
Western wood-pewee					◆		◆					
White-breasted nuthatch							◆					
White-crowned sparrow					◆		◆		▒			
White-faced ibis				▒								◆
White-throated sparrow							◆		▒			
White-throated swift			▒		◆		◆					
Wild turkey	▒	▒							▒			
Willet				▒								▒
Williamson's sapsucker							▒					
Willow flycatcher							◆					
Wilson's phalarope		◆		▒						▒		◆
Wilson's warbler							◆		▒			▒
Winter wren							◆		▒			
Wood duck						▒	◆			▒		
Wood thrush							◆					
Yellow warbler				◆	◆		◆		◆		◆	
Yellow-bellied sapsucker							◆					
Yellow-billed cuckoo							◆					
Yellow-breasted chat							▒		▒			
Yellow-headed blackbird				▒	◆							
Yellow-rumped warbler				◆	◆		◆				◆	
American badger	▒	▒			▒			▒			▒	
American beaver				▒			▒					
Big brown bat		▒	▒	▒			▒		▒	▒	▒	
Black bear							▒		▒			
Black-footed ferret					▒			▒				
Black-tailed jackrabbit					▒			▒	▒			

1=alfalfa/alfalfa hay; 2=annual crops; 3=cliff; 4=marsh; 5=mixed grass prairie; 6= moving water; 7=plains riparian; 8=short grass prairie; 9=shrubland; 10=standing water; 11=tall grass prairie; 12=wet meadow

Common Name	1	2	3	4	5	6	7	8	9	10	11	12
Black-tailed prairie dog	◆	▒			◆		▒	◆◆			◆	
Bobcat							▒		▒			
Chickaree							◆					
Colorado chipmunk									▒			
Common muskrat				▒		▒	◆			◆		
Common porcupine							▒		▒			
Coyote	◆	◆			◆		◆	◆	▒		◆	◆
Deer mouse	▒	▒		▒	▒		◆	▒	▒		▒	◆
Desert cottontail					▒			▒				
Dwarf shrew									▒			
Eastern cottontail							◆		◆			
Eastern mole											▒	
Eastern spotted skunk									▒			
Ermine		▒		▒	▒		▒	▒	▒		▒	
Fox squirrel					◆		◆					
Fringed myotis			▒	▒					▒	▒		▒
Golden-mantled ground squirrel							▒		▒			
Gray fox	▒	▒		▒	▒		▒	▒	▒		▒	▒
Hispid pocket mouse					▒			▒			▒	
Hoary bat							▒					
House mouse		▒		▒	▒		◆	▒	▒		▒	◆
Least chipmunk									▒			
Little brown myotis		▒	▒	▒			▒		▒	▒		
Long-eared myotis			▒						▒	▒		
Long-legged myotis			▒						▒	▒		
Long-tailed vole												▒
Long-tailed weasel		▒		▒	▒		▒	▒	▒		▒	
Masked shrew				▒			◆					◆
Meadow jumping mouse				▒			◆				▒	
Meadow vole	▒	▒		▒	▒		◆	▒	▒		▒	◆
Merriam's shrew									▒		▒	
Mexican woodrat							▒	▒	▒			
Mink							▒					
Montane shrew				▒			▒		▒			
Montane vole												▒
Mountain cottontail									▒			
Mountain lion			▒				◆		▒			
Mule deer	◆	◆			◆		◆		◆		◆	
Northern grasshopper mouse					▒			▒			▒	
Northern pocket gopher	▒	▒			▒			▒	▒		▒	
Northern river otter							▒					
Northern rock mouse									▒			
Norway rat	▒	▒		▒			▒					◆
Olive-backed pocket mouse					▒			▒				
Plains pocket gopher	▒	▒			▒			▒			▒	
Prairie vole	▒	▒		▒	▒		◆	▒	▒		▒	◆
Pronghorn					▒			▒				
Raccoon		▒		▒	◆		◆	▒	▒		◆	
Red bat							▒					
Red fox	▒	◆		▒	◆		◆	◆	◆		◆	◆

1=alfalfa/alfalfa hay; 2=annual crops; 3=cliff; 4=marsh; 5=mixed grass prairie; 6= moving water; 7=plains riparian; 8=short grass prairie; 9=shrubland; 10=standing water; 11=tall grass prairie; 12=wet meadow

Common Name	1	2	3	4	5	6	7	8	9	10	11	12
Ringtail									▒			
Rock squirrel					◆		◆		▒			
Striped skunk	▒	▒		▒	▒		▒	▒	▒		▒	▒
Swift fox					▒			▒				
Thirteen-lined ground squirrel	▒	◆			◆		◆	▒				
Townsend's big-eared bat			▒						▒	▒		
Western harvest mouse					▒		▒	▒			▒	
Western small-footed myotis			▒						▒	▒		
White-tailed deer	▒	▒					▒				▒	
White-tailed jackrabbit					▒				▒			
Yellow-bellied marmot							▒		▒			
Yellow-faced pocket gopher		▒			▒			▒			▒	

1=alfalfa/alfalfa hay; 2=annual crops; 3=cliff; 4=marsh; 5=mixed grass prairie; 6= moving water; 7=plains riparian; 8=short grass prairie; 9=shrubland; 10=standing water; 11=tall grass prairie; 12=wet meadow

APPENDIX 9.3 VERTEBRATE SPECIES STATUS

Vertebrate Species Status Boulder County Ranking, Global Rank, State Rank, Federal Status, and Federal Sensitive

Class	Common Name	Occurrences	Boulder County Ranking	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	FEDERAL SENSITIVE
Fish	Orange-spotted sunfish	1	7					
Fish	Plains topminnow	9	8	G4	S2	C2	SC	FS
Bird	American redstart	1	3	G5	S1?B SZN			
Bird	American white pelican	2		G3	S1B SZN		SC	
Bird	Bald eagle	28		G4	S1B S3N	LT	T	
Bird	Bank swallow	3	3					
Bird	Black-crowned night-heron	33	4	G5	S3B SZN			
Bird	Black-necked stilt	1		G5	S3B SZN			
Bird	Bobolink	90	4	G5	S3B SZN			
Bird	Cedar waxwing	1	4	G5	S3B S5N			
Bird	Chestnut-sided warbler	1	3	G5	S2B SZN			
Bird	Chestnut-sided warbler	1	4	G5	S2B SZN			
Bird	Cooper's hawk	6		G4	S3S4B S4N			
Bird	Double-crested cormorant	3	4					
Bird	Eastern bluebird	2		G5	S2B SZN			
Bird	Evening grosbeak	1		G5	S2S3B S5N			
Bird	Ferruginous hawk	12		G4	S3B S5N	C2	SC	FS
Bird	Fox sparrow	1	4					
Bird	Golden eagle	8	4	G5	S3S4B S4N			
Bird	Grasshopper sparrow	19	4	G5	S3S4B SZN			
Bird	Gray catbird	3	4	G5	S3S4B SZN			
Bird	Great blue heron	46	4	G5	S3B SZN			
Bird	Green heron	1		G5	S3B SZN			
Bird	Green-winged teal	2	4					
Bird	Hooded merganser	2		G5	S1B SZN			
Bird	Hooded warbler	1		G5	SUB SZN			
Bird	Indigo bunting	1		G5	S3S4B SZN			
Bird	Lewis' woodpecker	1	2					
Bird	Lewis' woodpecker	1	4					
Bird	Loggerhead shrike	1	1	G4	S3B SZN			FS
Bird	Loggerhead shrike	1	4	G4	S3B SZN			FS
Bird	Long-eared owl	1	1	G5	S3S4B SZN			
Bird	Marsh wren	1		G5	S3B SZN			
Bird	Merlin	1		G5	S1B S4N			FS
Bird	Northern bobwhite	2	1					
Bird	Northern goshawk	1	2	G5	S3S4B S4N	C2		FS
Bird	Northern harrier	22	1	G5	S3S4B S4N			
Bird	Northern harrier	22	4	G5	S3S4B S4N			
Bird	Northern mockingbird	1	3					
Bird	Northern mockingbird	1	4					
Bird	Olive-sided flycatcher	1		G5	S3S4B			FS
Bird	Orchard oriole	1		G5	S3S4B			
Bird	Osprey	4		G5	S1B SZN			FS
Bird	Ovenbird	1	3	G5	S2B			
Bird	Peregrine falcon	3	3	G3	S2B SZN	LE	T	
Bird	Peregrine falcon	3	4	G3	S2B SZN	LE	T	
Bird	Prairie falcon	17	4	G5	S3S4B S4N			
Bird	Red-eyed vireo	1		G5	S3B SZN			
Bird	Red-headed woodpecker	3	2	G5	S3S4B SZN			
Bird	Red-headed woodpecker	3	4	G5	S3S4B SZN			

Vertebrate Species Status Boulder County Ranking, Global Rank, State Rank, Federal Status, and Federal Sensitive

Class	Common Name	Occurrences	Boulder County Ranking	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	FEDERAL SENSITIVE	
Bird	Ring-billed gull	6		G5	SHB SZN				
Bird	Ring-necked duck	2	4						
Bird	Rose-breasted grosbeak	1		G5	S1B				
Bird	Savannah sparrow	2	4	G5	S3S4B SZN				
Bird	Sharp-shinned hawk	3		G5	S3S4B S4N				
Bird	Snow goose	1		G5	S3S4N				
Bird	Sora	2		G5	S3S4B SZN				
Bird	Swainson's hawk	12	2						
Bird	Turkey vulture	22		G5	S3B SZN				
Bird	Veery	1	3	G5	S3S4B SZN				
Bird	Willow flycatcher	1	2						
Bird	Willow flycatcher	1	4						
Bird	Wood duck	4	4						
Bird	Yellow-headed blackbird	1	4						
Mammal	Common muskrat	4	12						
Mammal	Eastern cottontail	10	13						
Mammal	Meadow jumping mouse	1	12	G5T2	S1S2	C2	SC	FS	
Mammal	Meadow jumping mouse	1	13	G5T2	S1S2	C2	SC	FS	
Mammal	Meadow vole	7	12						
Mammal	Rock squirrel	4	12						
Mammal	Thirteen-lined ground squirrel	4	12						

APPENDIX 13.1 CRITERIA AND DESCRIPTIONS OF SIGNIFICANT AGRICULTURAL LANDS

13.1.1 Agricultural Lands of National Importance

Agricultural lands of national importance are either "prime" or "unique" farmlands.

Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oil seed crops and is also available for those uses (the land could be cropland, pasture land, rangeland, forest land or other land, but not urban built-up land or water). Soils of national importance have the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops when treated and managed, including water management, according to acceptable farming methods.

To be considered prime farmland, the soil must meet specific criteria which are outlined in the following U.S. Department of Agriculture publications: *Soil Taxonomy, Agriculture Handbook 436; Soil Survey Manual, Agriculture Handbook 18*; *Rainfall-Erosion Losses from Cropland, Agriculture Handbook 282*; *Wind Erosion Forces in the United States and Their Uses in Predicting Soil Loss, Agriculture Handbook 346*; and *Saline and Alkali Soils, Agriculture Handbook 60.*

Prime farmland soils, as defined by the U. S. Department of Agriculture, are soils that are best suited to produce food, feed, forage, fiber, and oil seed crops. Such soils have properties that are favorable for the economic production of sustained high yields of crops. The soils need only to be treated and managed using acceptable farming methods. The moisture supply, of course, must be adequate and the growing season has to be sufficiently long. Prime farmland soils produce the highest yields with minimal inputs of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils may presently be in use as cropland, pasture, or woodland, or they may be in other uses. They either are used for producing food or fiber or are available for these uses. Urban or built-up land and water areas cannot be considered prime farmland.

Prime farmland soils usually get an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The acidity or alkalinity level of the soils is acceptable. The soils have few or no rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not subject to frequent flooding during the growing season. The slopes range from 1-6%. Soils that have a high water table, are subject to flooding or saline may qualify as prime farmland soils if the limitations or hazards are overcome by drainage, flood control or leaching. On-site evaluation is necessary to determine the effectiveness of corrective measures. More information on the criteria for prime farmland soils can be obtained at the local office of the Natural Resource Conservation Service, formally the Soil Conservation Service.

Unique farmland is land other than prime farmland that is used for the production of specific high value food and fiber crops. It has the special combination of soil quality, location, growing season, and

moisture supply needed to economically produce sustained quality and/or high yield of a specific crop, when treated and managed according to acceptable farming methods. Two areas in Colorado are considered unique farmlands of national importance. The fruit orchards in the Grand Valley and the Delta-Montrose areas and the seed potato and fruit and vegetable producing areas of the San Luis Valley.

13.1.2 Agricultural Lands of Statewide Importance

These areas are of statewide importance because of their production of food, feed, fiber, forage, and oilseed crops. Three categories used for considering soils as statewide important are irrigated land (not prime), irrigated land (water supply inadequate), and high potential dry cropland.

Irrigated land (not prime) are lands that are important to the state's agricultural economy but do not meet the prime criteria for one or more reasons. The State has determined that these crops could be grown in other parts of the state but should receive special consideration when planning and evaluating the agricultural resources of the state. These areas have a combination of soils, climate, historic land use and/or geographic location which contribute to the viability of the local livestock industry, fruit and vegetable growing areas, and certified fruit and vegetable seed producing areas.

Irrigated land (water supply inadequate) is identified in some counties as statewide important farmland. On these lands the irrigation water is inadequate to meet the moisture requirements of prime farmlands.

High potential dry cropland is identified as statewide important farmland. These soils have adequate moisture supply and water holding capacity for an alternate crop-fallow system. They are not salt or sodium affected. When managed properly, they are not highly erosive. Although yield is not used as specific criteria for defining this category, these soils can be expected to yield twenty bushels of wheat per acre or better under a wheat -fallow rotation. Most of this land is used for dryland wheat, although grain sorghum, forage sorghum, and corn are also grown. In most instances, soils in this category meet the requirements for prime farmland and would become prime if they were irrigated. These areas may or may not be farmed at the present time.

13.1.3 Agricultural Lands of Local Importance

Agricultural lands of local importance contains three categories: irrigated cropland, dry cropland, and rangeland. These are lands which, based on their current and historic use and their inherent soil properties, are the County's most important agricultural lands.

Identification of the three categories of agricultural land of local importance is based on criteria devised by the Longmont office of the Natural Resource Conservation Service and the Boulder County Extension Office. These lands are lands which, based on their current and historic land use and their inherent soil properties, are the County's most important agricultural lands. Based on the Natural Resource Conservation Service and Extension work with farmers over the years, the irrigated cropland, dry cropland, and rangeland that are identified are those agricultural lands of key importance to our local agricultural economy.

APPENDIX 13.2 STANDARD AGRICULTURAL LEASE TERMS AND PROVISIONS

SECTION 1. TERM OF LEASE/OPTION TO RENEW
This section describes the starting and ending dates for the lease as well as any renewal options. Also found in this section is a month-to-month clause that allows the lessee to continue the lease under existing conditions after the lease has expired.

SECTION 2. NO PARTNERSHIP, EMPLOYMENT OF AGENCY
This section describes that this lease doesn't constitute a partnership between the lessee and the City of Boulder. Neither party shall be liable for debts or obligations incurred by the other.

SECTION 3. RENT
This section describes the amount of rent that is required. The lease can be constructed as a "cash lease" or a "calculated lease." If the lease amount is calculated, this section will explain how the calculation will be carried out. The date that the rent is due will also be found in this section. Late payment penalties are explained in this section as well.

SECTION 4. CROP, GRAZING, AND WILDLIFE MANAGEMENT PROVISIONS
This section outlines management requirements in the following areas:

- Crop management
- Grazing
- Wildlife management
- Other duties
- Cultural resource management

SECTION 5. OPERATOR'S INVESTMENT AND EXPENSES
This section describes what type of investment and expense items the lessee is responsible for. There is a detailed list of expenses and each party's responsibilities in Exhibit B. This section also spells out the insurance requirements necessary to occupy the property.

SECTION 6. TALLGRASS PRAIRIE PRESERVATION
This section identifies the Open Space Tallgrass Management program. If the operator is requested to manage the property for tallgrass prairie, he or she will do so in accordance with the provisions found in Exhibit B.

SECTION 7. WETLAND MANAGEMENT
This section mandates that the lessee protect all wetland areas located on the property as specifically set forth in Exhibit B.

SECTION 8. CONSERVATION PROGRAMS OR PRACTICES
This section describes the lessees' involvement in any conservation or government programs or practices designed to aid agriculture.

SECTION 9. ENDANGERED PLANTS
This section mandates that the lessee protect any endangered, threatened, or rare plants species on the property.

SECTION 10. TERMINATION
This section spells out the "Grounds for Termination," "Settlement Upon Termination," and the "Condition of Property" after termination.

SECTION 11. GENERAL COVENANTS
This section has several sub-sections that cover the basic rules of the Open Space Program as they apply to the lessee.

SECTION 12. POSTING OF PROPERTY/USE BY PUBLIC AND OWNER
The City may post the name and telephone number of the lessee at any entrances to the property. The property will remain open to the public for use under the Open Space regulations and ordinances.

SECTION 13. NOTICE
The addresses for correspondence by the City and the lessee.

SECTION 14. SEVERABILITY
This section simply states that if one part of the lease is found to be unenforceable by a court, the remainder of the lease shall remain in effect.

SECTION 15. NON-WAIVER
"No assent, express or implied, to any breach of any one or more of the provisions hereof shall be deemed or taken to be a waiver of any succeeding or other breach of the same or a different provision."

SECTION 16. AMENDMENTS/ENTIRE AGREEMENT
This section contains the signatures of the City Manager on behalf of the City and of the lessee.

APPENDIX 14.1 PREVIOUS PASSIVE RECREATION MANAGEMENT

Although the Open Space Program began acquiring properties in the South Boulder Creek Management Area in the late 1960s, these lands did not become well known or heavily visited until the mid 1980s. The principal focus of passive recreation management in past years has been to inventory and maintain designated trails and access points. Many of the trails in the Management Area were never formally constructed or designed as trails. In some cases, extensive reconstruction has occurred because these trails were never properly located, designed, or constructed.

Discussions with long-term employees indicate that management activities consisted mainly of agriculture, fencing, weed control, and minor trail maintenance prior to 1985. Routine trail maintenance is conducted by Open Space Program Conservation Corp crews on an annual basis. Service roads and trails are maintained by heavy equipment as needed. A brief summary of work completed in various areas is provided below.

The Cottonwood Trail was constructed as an 8- to 10-foot-wide gravel trail/service road in 1985. A small trailhead was located on Independence Road and eventually became the Cottonwood Trailhead.

In 1985, a service road/trail was constructed and opened along the south side of South Boulder Road and through the Van Vleet property south of South Boulder Road. Visitors were restricted to trail use only and dogs were prohibited. The trail was constructed as an emergency access road/trail, 8- to 10-feet-wide and surfaced with recycled asphalt. Visitor access was limited to the trail until 1986 when the lease with the Van Vleets ended.

In 1986 and 1987, large wooden signs were placed at trailheads designating them as City of Boulder Open Space land, and the first edition of the Open Space Trail Map was printed and distributed. The new map and the addition of the new trailhead signs contributed to increased use in the South Boulder Creek Management Area and Open Space system-wide. A fence line was built around the perimeter of the riparian corridor on the Burke I property to exclude cattle. This fence focused visitor use within the riparian corridor and discouraged use outside the riparian corridor.

In 1988, a ten-station, self-guided interpretive trail was installed in the riparian corridor of the Burke I property.

In 1989, a pedestrian gate was placed along the southwest corner of the Gebhard property to provide access for the residents of the Greenbelt Meadows subdivision. The access gate was part of the Planned Unit Development agreement, but no trail connections were designated.

The Dry Creek Trail and Trailhead were constructed during 1991. Original plans were to connect the trail to the South Boulder Creek Trail using Open Space lands along the south and west sides of Baseline Reservoir. Concerns were raised about potential impacts to wintering bald eagles that used the large cottonwoods in that area, and completion of the trail was stopped. Although some additional

Open Space lands have been purchased in this area, additional land purchases are still needed to complete this trail.

A trail use report for South Boulder Creek Trail was prepared by Deborah Keammerer in August of 1991. This report was completed for the City of Boulder Transportation Department to assess the current and projected trail and site conditions resulting from the completion of the East Boulder Community Center and increased local housing development. This study only included trails on the Burke I property; other trails within the current Management Area were not inventoried. Designated and existing undesignated trails were walked and subjectively placed into four classes in this study. Definitions used to classify each trail are given below.

Class 1:	Narrow, vegetated trails, with only slight compaction--result from minor traffic over an area.
Class 2:	Narrow trails carrying enough traffic to impair but not prevent growth of vegetation. Compaction is moderate. Vegetation could restore itself quickly if use is reduced.
Class 3:	Trails less than 3 feet wide with little or no vegetation and heavy compaction. Soil preparation and seeding would be necessary for restoration of vegetation.
Class 4:	Trails greater than 3 feet wide with no vegetation and heavy compaction. Restoration of vegetation would require soil preparation and seeding.

The results of the study indicated there were 2,750 linear feet of Class 4 trail consisting of the main trail and the easy access points to South Boulder Creek, 1,350 linear feet of Class 3 trails, 3,150 of Class 2 trails, and 8,200 linear feet of Class 1 trails. Class 1 trails represented the largest impacted area. Edges of the main trail and small areas between the main trail and the stream were included as Class 1 trails.

All designated and undesignated trails within the project area were mapped and evaluated during August of 1993 to compare with the results of the 1991 report. Since locations of the 1991 trail classifications were not included in the original report, it is difficult to determine whether trails changed from various classes (e.g., from Class 1 to Class 2 or 3). We assume, based on field evaluations, that the trails are in the same locations as the 1991 study but have become more heavily used. Additional undesignated trails developed in the vicinity of the East Boulder Community Center and along both sides of the creek to the south leading to Greenbelt Meadows subdivision.

A bridge was placed across South Boulder Creek directly east of the East Boulder Community Center in 1994. The Open Space Program began a trail planning effort in 1994 to determine the best location for South Boulder Creek Trail. An inventory report describing the recreation, cultural, and natural resources was completed in April, 1994 for the Open Space lands south of the Wellman Canal, west of Cherryvale Road, east of 55th Street, and north of South Boulder Road (City of Boulder Open Space 1994). In addition, information was provided to describe the resources between the Cherryvale Operations Center and South Boulder Road.

In 1995, the trail planning effort was completed, Bobolink Trailhead was reconstructed, the South Boulder Trail was surfaced with crusher fines and relocated in a few short sections, two creek access

points were created, and seven new interpretive signs were placed along the section of trail on the Burke I property.

As part of the 1995 trail planning effort, an undesignated trail monitoring program was set up to evaluate whether the management actions were successful in discouraging off-trail use. Data from this monitoring effort indicates that overall use of undesignated trails has declined substantially. Many of the small paths along the creek have revegetated and currently receive little to no use. No management actions were taken to discourage use of the surrounding fields on the Burke I and Gebhard properties and, as a result, a well-established, undesignated trail loop has developed starting at the Enterprise Ditch and traveling south to a pedestrian gate on the Gebhard property. Use of the surrounding fields and access to these areas should be further evaluated and managed accordingly.

In 1997, the Greenways Program completed the new section of concrete trail just outside the riparian corridor, increasing overall visitor use of the area.

APPENDIX 14.2 BOULDER OPEN SPACE REGULATIONS

DOG REGULATIONS Dogs must be within sight of the owner/keeper and under voice control at all times here and on other Open Space land outside of Boulder City limits. If dogs do not meet the requirements of voice and sight control, they must be leashed. Dogs observed harassing or menacing any person, wildlife, or livestock may be destroyed by a City Ranger or other authorized person. Visitors are responsible for picking up their pet's excrement. Other dog regulations are in effect in other areas. Please check these regulations before bringing any pet onto Open Space.

BIKING REGULATIONS Bicycles (non-motorized vehicles) are permitted only on those trails designated and signed as being open to bicycles.

GLASS CONTAINERS Glass containers are prohibited.

DAMAGING PROPERTY Any damaging or removing of Open Space property or natural features, including but not limited to wildflowers, rocks, wildlife, trees, etc., is prohibited.

WILDLIFE PROTECTION It is prohibited to disturb any wildlife or wildlife habitat on Open Space land. Hunting, trapping, chasing or removing wildlife is specifically prohibited. Any research project must be authorized by the Open Space Department.

CAMPING Camping is prohibited on Open Space, along with use of a vehicle as a residence. No tents or nets can be erected.

FIRES Fires are permitted only in designated firepits. Fires are prohibited between 11:00 p.m. and 6:00 a.m. Fires must be extinguished completely prior to leaving the area. During times of extreme fire danger, fire bans may be instituted.

FIREWORKS Possession or discharge of fireworks is prohibited. Fireworks include firecrackers, roman candles, model rockets, hot air balloons, and numerous other items.

LITTER Please dispose of litter properly or remove it from the area if trash containers are full. It is prohibited to dispose of trash on Open Space land or in Open Space trash receptacles which is not generated by activities conducted on Open Space.

CURFEW It is prohibited to park a vehicle on Open Space or in an Open Space lot between 12:00 midnight and 5:00 a.m.

MOTOR VEHICLES Motor vehicles are prohibited except in parking lots.

WEAPONS AND FIREARMS Possession or discharge of a firearm or weapon, or discharge of any projectile from a firearm, bow, slingshot, or other weapon, is prohibited.

TRESPASS Entering closed areas or climbing on buildings is prohibited.

HORSE AND LIVESTOCK/GRAZING Grazing of domestic animals and commercial livestock operations are prohibited without a permit. Livery operations are prohibited without a permit from the City of Boulder Open Space Department.

PERMITS FOR ORGANIZED EVENTS Any recreational, athletic, or social event intended for an attendance of 50 or more persons will need a permit. Contact the City of Boulder Open Space Department for application information.

BOLTING No person involved in rock climbing is allowed to place or attach any fixed hardware.

OTHER PROHIBITED CONDUCT Golfing, polluting the water, wading or boating on lakes or ponds, sliding (sledding) except in designated areas, amplified sound systems, and disturbing the peace of other users by noise.

ALCOHOL Please be aware that state law prohibits the consumption of alcohol greater than 3.2% in any public place.

THESE ARE ONLY SOME OF THE REGULATIONS IN EFFECT ON CITY OF BOULDER OPEN SPACE. PLEASE BE AWARE THAT YOU ARE RESPONSIBLE FOR KNOWING AND OBEYING ALL OPEN SPACE REGULATIONS. VIOLATIONS MAY RESULT IN FINES AND/OR IMPRISONMENT. FOR FURTHER INFORMATION, PLEASE CONTACT THE CITY OF BOULDER OPEN SPACE DEPARTMENT, AT 441-4142 OR 441-3440. IN CASE OF AN EMERGENCY, DIAL 911.

APPENDIX 15.1 INVENTORY OF VOLUNTEER PROGRAMS AND PROJECTS

The following is an overview of volunteer programs and projects within the South Boulder Creek Management Area. Hours reflect annual range (utilizing statistics for the past four years) when such information is available.

15.1.1 Research, Inventory, and Monitoring

Examples: Herbarium group collects, classifies, catalogues plant specimens for area, and trains seasonal staff in field identification. Rope counts of *Spiranthes diluvialis*. Mapping of prairie dog town sites. Inventories of historic buildings and sites.

Program	Hours
Avian transects	50-100
Bat studies	0- 50
Cultural/historic studies	50-200
GIS internships	0-100
Herbarium	200-300
Heron studies	0-200
Native Plant Conservation Program	0-100
Other non-funded research	0-500+
Prairie dog studies	0-100
Predator/raptor studies	0-100
Resource Conservation intern	0-200
Seed collection	50-100
Spiranthes diluvialis studies	100-300
Tallgrass studies	0-100
Toad and frog vocalization studies	0-100
Vegetation mapping	100-300
Wildlife inventory/data entry	0- 50

15.1.2 Restoration and Maintenance

Examples: Cedars youth group--340 hours in 1996 planting shrubs and maintenance; 1995 Bobolink Trail Project--46 volunteers/180 hours; Platt Middle School Stewardship built bat boxes and did maintenance. Community Corrections Crew contributed over 1,700 hours since 1994. National Community Conservation Corps: trailwork and fence construction; assisted young students in the field.

Program	Hours
Boulder Regional Conservation Crewleaders	10-100
Community Corrections Crew	300-800
One day projects/special events	100-400
National Community Conservation Corps	0-300

Native Plant Conservation Program	0-100
Resource conservation internships	0-200
Service learning internships	0-100
Stewardship Program	100-400
Stewardship internships	0-100
Weed eradication	300-500
Youth and Student Service Learning Programs	300-800

15.1.3 Education and Outreach

Examples: Public information dispersal, information gathering, education of dog owners by Open Space Trail Guides. Self-directed study on ecology and history of the area. Preparation and presentation of trail programs.

Program	Hours
Common Ground Program	0- 50
Education and outreach internships	0- 50
Trail Guides Program	400-500

SOUTH BOULDER CREEK INVENTORY REPORT
PUBLIC COMMENT RESPONSE SUMMARY
NOVEMBER 1997

Responses to public comments and suggestions are provided below. The first column paraphrases and summarizes the comment or issue. The second column describes the Open Space staff response and how the proposed Inventory Report addresses the comment; redlined text will be added to the final inventory report. The third column explains the rationale behind the response. The comments are grouped and ordered in categories that correspond to the sections in the Inventory Report. Please see those sections for more information.

COMMENT / ISSUE	OPEN SPACE STAFF RESPONSE	EXPLANATION OF RESPONSE
GENERAL		
Boulder Open Space is going to be heavily impacted by surrounding development. Is maintenance going to be able to keep up. Are citizens anticipating this impact?	Agree that there will be significant land management needs.	Management needs are figured into budget projections. Staff will work to reduce impacts by designating trail access points, monitoring non-native plants, and acquiring adjacent lands to reduce fragmentation.
Coordinate with other government and private property owners.	Agree	Open Space staff strives to notify and work with government agencies and neighbors that may be affected by the Management Plan. For example notification at various planning steps is provided by mail, information boards, and in the local newspaper. Potentially affected government agencies are invited to participate in the planning activities. A contact person is identified to answer inquiries or refer interested people to the right staff person.
Adding a map of the County Comprehensive Plan Environmental Conservation Areas would help in the planning of the South Boulder Creek Management Area.	Agree. The Environmental Conservation Areas map will be added to the Report.	Environmental Conservation Areas provides valuable guidance to preliminary planning efforts. Information in the Inventory Report provides greater detail for Area Management Plans.
Clarify the statement beginning with "Gene flow on the edge of the range..." In section 3.6.	Agree. The new language will be clarified by stating: "Gene flow... occurs largely undetected but may become..."	Gene flow on the edge of the range may be directional, stabilizing, or disruptive. In simple terms, it is sensitive and easily influenced.

COMMENT / ISSUE	OPEN SPACE STAFF RESPONSE	EXPLANATION OF RESPONSE
Why are private landowners/residential areas considered to have "potential conflicts" in management?	Open Space staff seeks to work with adjacent private landowners to ensure mutual management objectives can be accomplished where possible. Activities on adjacent private lands can "spill over" and influence significantly management of undeveloped public lands.	Conflicts from residential and industrial areas on natural lands can include, but are not limited to: 1) migration of weed species used as ornamentals such as purple loosestrife, Mediterranean sage, and Russian olive, 2) run off of nitrates and sediment into water bodies, 3) loose pets harassing or killing small mammals or birds or bothering Open Space visitors, 4) additional fragmentation of wildlife habitat from undesignated trail use, and 5) public access and privacy of adjacent landowners.
What percentage of the Management Area is residential? I know you border on the incorporated area, but there are the county residents in your study area, they are there, and it is a land use.		The management area is fragmented by a variety of residential and commercial activities both within and out of the Boulder city limits. There is no accurate way to figure the percentage of the area that is developed. It is possible to determine how much of the area is in a city and in the County: 20% is incorporated land in a city and 80% is unincorporated county.

COMMENT / ISSUE	OPEN SPACE STAFF RESPONSE	EXPLANATION OF RESPONSE
The Report should identify areas, species, and management practices of concern. The identification of these concerns will allow for appropriately cautious management of Open Space lands. Identification of significant knowledge gaps is crucial to the development of an effective Management Plan. When lacking information about areas, species, and practices the Open Space Department should be especially conservative and cautious and not risk costly or irreversible impacts through the miscalculation or misjudgment of potential impacts. In addition, management practices that may impact these concerns should receive rigorous and effective monitoring before they are initiated, while they are occurring, and after they have been completed. Such monitoring should be closely linked to explicit provisions, incorporated into the Management Plan, for adaptive management of Open Space lands. The Open Space Department should aggressively seek to fill the knowledge gaps and to monitor the impacts of use and the Management Plan should provide for changes in the management of these lands as the data gaps are filled and monitoring data acquired.	Agree. The report lists data gaps so they can be prioritized in the Management Plan.	Management approaches will be outlined in the Management Plan. When information is lacking, staff will use the best information available, professional judgement, and employ a cautious approach that limits the possibility of irreversible damage to the resource.

COMMENT / ISSUE	OPEN SPACE STAFF RESPONSE	EXPLANATION OF RESPONSE
The Report states: "an ecosystem approach will be employed to maintain fundamental ecological processes, where possible" (p. 7). However, a fundamental tenet of ecosystem approaches, by definition, is the consideration of how species, natural processes, and management activities interact across the entire management area and in the surrounding area. One Report weakness is the failure to provide an adequate basis for an ecosystem approach to managing the South Boulder Creek Management Area.	Partially agree. The report does provide base information that is known by Open Space staff. This information, in context with other Management Plan and regional information, is an adequate basis for an ecosystem approach.	Understanding complex biological linkages and connections at an ecosystem level is resource intensive and occurs over time. Open Space staff is fully committed to the ecosystem management approach, but the process is achieved over time as resources allow and as new information is acquired.
First, the issues raised in each of the Report's sections are not well integrated; in some cases they are redundant and in other cases they overlook important connections. For instance, the Water Resources section's discussion of minimum instream flows is not integrated with the Wildlife section's discussion of aquatic species. The relationship between the water infrastructure and the spread of noxious weeds is not addressed. The final report should include a fuller exploration of the relationships between various types of activities, types of impacts, species, communities, and habitat types.	Integration will occur in the development of the Management Plan.	The report addresses information and issues by content area. The Management Plan will be used as a tool to integrate management decisions and priorities. Public participation will be part of the Management Plan steps: general management direction, draft plan including identification and prioritization of action items, and final plan.

COMMENT / ISSUE	OPEN SPACE STAFF RESPONSE	EXPLANATION OF RESPONSE
Second, the activities and impacts of the management area must be considered in the context of activities and impacts surrounding the management area. For example, the impacts of the recreational trail system within the management area can only be reasonably evaluated when considered in the context of the presence and use patterns of the surrounding recreational trails. Habitat fragmentation and movement and dispersal barriers, for instance, can only be understood in this larger context. The utilization of an ecosystem approach is not crucial simply because of the City of Boulder's adoption of it as a basic management concept; it is also crucial for the effective and responsible management of the species and ecosystems that inhabit Open Space.	Agree. The context of regional landscapes and impacts from lands surrounding Open Space are an important influence on the ability to apply ecosystem management concepts. Comprehensive knowledge of impacts from surrounding Open Space lands is a data gap. The report lists data gaps so they can be prioritized in the Management Plan. Management approaches will be outlined in the Management Plan.	Open Space staff recognizes that there are numerous, significant impacts from adjacent lands and works with land owners, private businesses, and agencies to minimize the impact from lands adjacent to Open Space.
The City needs an ecosystem management plan.	Agree. An ecosystem management plan will be completed. In the interim Area Management Plans will use an ecosystem approach.	

COMMENT / ISSUE	OPEN SPACE STAFF RESPONSE	EXPLANATION OF RESPONSE
WATER		
In the Summary of Inventory Report: Water, Domestic well use should be included, probably as well as septic systems. These also need protection or at least recognition and possibly education other than the thou shalt not litany.	The report already includes water quality as an important issue in the Water chapter. Information about wells on or adjacent to Open Space is listed as a data gap.	Development of the Management Plan will consider this data gap.
VEGETATION		
Eradication of non-native vegetation.	Agree. Management of non-native weed species is a priority for Open Space staff.	Eradication of non-native weed species is not a realistic goal of the Open Space Program. To control weed species does not mean to "eradicate" a plant from an area, nor does the presence of a species warrant control efforts. Controlling a species using integrated weed management techniques to suppress the species to tolerable levels (damage thresholds) is based on many factors: plant ecology, economics, recreation, aesthetics, and others. A weed map is included in the Inventory Report as Figure 7.5.
Ground check LANDSAT imagery.	Agree	LANDSAT imagery is only one resource management tool. "Ground truthing" or field checking LANDSAT imagery occurs as needed. Imagery is never the sole information source for management decisions.

COMMENT / ISSUE	OPEN SPACE STAFF RESPONSE	EXPLANATION OF RESPONSE
The final report should include thorough discussions of each species of concern. The Report's discussion of Ute Ladies'-tresses (pp. 72-74) might serve as a good model for these discussions. The final report should disclose the habitat requirements, current status and distribution, and current threats for each of these species (e.g., Rotala ramosior). It should also explore the ways in which past and current management have shaped current conditions. For example, the section entitled "Summary of Current Management, Management History, Issues and Information Gaps" (p. 89) should be extended in the final report.	Agree. There are three plant species of concern in the area and two are discussed in the Draft Inventory Report. The third, toothcup, will be added to the rare species list and the following text will be included in the final inventory report: Toothcup (*Rotala ramosior*) is a rare species known in Boulder Valley from two ephemeral (seasonal) wetland sites within and near the management area. One site is in the South Boulder Creek floodplain near the riparian zone, and the other is near Baseline Lake. In Colorado, the species is at the western edge of its range, and may even be considered non-native by some botanists. Toothcup habitat is found along stream margins, wet depressions and mudflats. The site where the plant occurs in the management area is a wet depression by a gate providing access to an agricultural field. This occurrence was recently discovered and documented. The species appears to exist on the site in spite of light use by vehicles, cattle, and pedestrians. Planning for recreation, agriculture, and water resources should consider toothcup occurrences and potential habitat. Frequent, repeated trampling of toothcup habitat should be avoided, particularly during the growing season (from approximately June through October). Surveys of likely habitat and monitoring of documented occurrences can add information needed for conserving the species.	The inventory document is refined and expanded as suggested. Also, the Current Management and Management History section referred to has been expanded in the inventory report and will be used to improve vegetation management direction in the final report.

COMMENT / ISSUE	OPEN SPACE STAFF RESPONSE	EXPLANATION OF RESPONSE
The Report discusses the impact of exotic plant species at some length. The Management Plan should include a commitment to continuing the identification, monitoring, and prioritization of infestations of exotics in the management area, as well as continuing research into the spread and control of such exotics. The Management Plan's provisions on this issue should also be integrated into area-wide weed management planning including development of an Open Space Integrated Plant Management Plan. The final report should be developed in such a way that the inclusion of these critical elements in the Management Plan are facilitated. For example, we strongly encourage continued and improved vegetation mapping, especially in areas where infestations of noxious weeds is likely or is already occurring.	Agree. The Management Plan will include all facets of integrated weed management including ranking noxious weed species, and prioritizing areas for control.	The inventory report does address commitment to Integrated Pest Management and related issues in detail. Vegetation mapping is a priority and is conducted as resources permit. Staff is working on a system-wide integrated weed management plan and a draft has been prepared. In 1997, 95% of the management area was mapped for weed species, providing updated information that will be used to develop an operating plan and to monitor the programs effectiveness.
Use riparian concepts for ditches.	Riparian concepts will be used to manage ditches when possible.	Ditch maintenance is under the jurisdiction of the ditch companies. As a result specific management is usually not controlled by Open Space land managers. Open Space staff works with ditch companies to minimize the impacts of ditch maintenance on native plant and animal communities. The City will seek to manage ditches for multiple purposes where that can happen without affecting adjacent water rights on those ditches where the City is the majority stakeholder.

COMMENT / ISSUE	OPEN SPACE STAFF RESPONSE	EXPLANATION OF RESPONSE
WILDLIFE		
South Boulder Creek water plan and habitat for trout.	The aquatic habitat project conducted by the Boulder Flycasters is described in Chapter 5 - Water Resources.	The issues section of Chapter 5 includes the issue of native verses non-native fisheries and how each reach of stream should be managed. This issue will be addressed in the Management Plan.
Why use trout for in stream flows when they aren't native to the water? Is your goal to cultivate game fish or preserve natural habitat for native species?	The Colorado Water Conservation Board, the only entity in Colorado that can hold an instream flow right, uses trout to establish minimum flow standards.	The issues section of Chapter 5 includes the issue of native versus non-native fisheries and how each reach of stream should be managed. Appropriate management of aquatic habitat will be determined in the Management Plan after public education and input.
The section on bobolink is thorough and accurate, although it could be improved with an extended treatment of known nesting sites and habitat components (i.e., mapping), current management threats, and habitat requirements. The Report should include similar sections on conserving habitat of riparian woodland species of concern, such as American redstart, willow flycatcher, and red-headed woodpecker. The discussion of Ute Ladies'-tresses orchid (pp. 72-74) might also be a good model for species-specific discussions. The need for such sections is due, in part, to the degradation of important habitat throughout the management area (e.g., habitat for shrub-nesting and shrub-foraging birds along the Bobolink Trail on South Boulder Creek).	Area Management Plans emphasize an ecosystem management approach rather than species-specific approach. Habitat needs for species of special concern will be included in the ecosystem approach. Information about species such as American redstart, willow flycatcher, and red-headed woodpecker is a data gap. The report lists data gaps so they can be prioritized in the Management Plan. Management approaches will be outlined in the Management Plan.	The report discusses the needs of bobolink with respect to agriculture, recreation, and other wildlife needs, specifically the jumping mouse and Ute Ladies'-tresses orchid.

COMMENT / ISSUE	OPEN SPACE STAFF RESPONSE	EXPLANATION OF RESPONSE
Although the Report mentions western-screech owls, the species has never been documented in northeastern Colorado. The report mentions burrowing owls in the prairie dog section but not in the bird section. Once common in this drainage, they are now rare and declining in Boulder County. An eastern screech owl inventory along South Boulder Creek, conducted during the winter of 1995-96, found four active territories at approximately two-mile intervals. Long-eared owls have been observed in winter in ponderosa pine forest on Marshall Mesa, northern sawwhet owls are known to have nested near Baseline Reservoir, and great horned owls are known to nest throughout the area. Osprey and bald eagle perch and fish around Baseline Reservoir and along South Boulder Creek. The Report should specifically address osprey and bald eagle so that the Management Plan can adequately protect nesting and perch sites, as well as enhancing nesting habitat for American bittern and northern harrier.	Agree. Available owl data will be incorporated into the inventory report. Agree that there should be mention of Osprey and bald eagle habitats within the management area. The new text is: *Species of concern*: The bald eagle is listed as threatened by the U.S. Fish & Wildlife Service. It has been observed in seven out of twelve habitat types in the South Boulder Creek Management Area. Historic winter habitat, including perch sites, exist around Baseline Reservoir. Presence and use of the area is well documented in Audubon Christmas bird counts. Christmas bird count data indicate generally a stable population of raptors in the area around Baseline Reservoir. Besides bald eagles; golden eagles, ferruginous hawks, red-tailed, and rough-legged hawks are common around the reservoir in the winter months. The area is used by osprey and Swainson's hawks in the spring, summer, and early fall. *Management issues and concerns*: The area around Baseline Reservoir and South Boulder Creek is an important winter habitat for bald eagles and summer habitat for osprey and Swainson's hawks. Prairie dog colonies exist on Suits, Klein and Rolling Rock properties and are important winter food sources for the bald eagles. Maintaining viable prairie dog populations and grassland habitats for other small mammals and avoiding disturbance of hunting raptors by humans will be important to protect this area.	Staff will continue to pursue the best available information. The report lists data gaps so they can be prioritized in the Management Plan. Management approaches will be outlined in the Management Plan. Staff will incorporate these data gaps, along with other wildlife data gaps, in the plan and planning process.

COMMENT / ISSUE	OPEN SPACE STAFF RESPONSE	EXPLANATION OF RESPONSE
The Report lacks discussion of flow regime requirements for native aquatic, riparian, and wetland species. The habitat needs of all native aquatic, riparian, and wetland species which have specific hydrologic regime requirements, especially those identified as at risk (e.g., by the Colorado Natural Heritage Program), should be noted, and the impacts of current flow management and potential changes to these flows (e.g., the Enterprise Ditch) should be discussed. Hydrological regime requirements are not always limited simply to minimum flow requirements. The survival of some species may require a more complex set of hydrologic conditions.	Presently, modeling capability for flow regimes and wildlife habitat requirements is a data gap. The report lists data gaps so they can be prioritized in the Management Plan. Management approaches will be outlined in the Management Plan.	Open Space staff recognizes that flow regimes are extremely complex issues which, at this time, require additional investigation. Staff continues to develop additional water resource analysis. The lack of information about *all* native aquatic, riparian, and wetland species especially those identified as at risk (e.g., by the Colorado Natural Heritage Program) will be addressed in the plan and planning process as a data gap. Because of the large cost and difficulty of timely collection of information on all species on Open Space, the Open Space research program prioritizes issues for research. Open Space management decisions are based on best available information.
Invertebrates need more attention in the Report. For example, the Report notes the importance of pollinators to the viability of native flowering plans (e.g., p. 64), but fails to consider specific invertebrate pollinators, their distribution, and their habitat needs. Colorado Natural Heritage Program invertebrate listings offer a good starting point to identify and address invertebrate species of concern, such as native plant pollinators, freshwater mollusks, etc.	Agree. The habitat needs and distribution of many invertebrate pollinators are unknown, while some are known. Known information about invertebrate native plant pollinators will be considered in the planning process and final plan. The lack of information about other species is a data gap, and will be prioritized in the Management Plan. Presently, information about freshwater mollusks is a data gap. The report lists data gaps so they can be prioritized in the Management Plan. Management approaches will be outlined in the Management Plan.	The report *Systematic inventory of rare and imperiled butterflies on the City of Boulder Open Space and Mountain Parks* documented several rare or imperiled butterfly species existing on Open Space properties; however, none are known to exist within the South Boulder Creek Management Area. Open Space will use the Colorado Natural Heritage Program's database of invertebrates and the University of Colorado Museum's *Documentation of historical insect collections from Boulder County, with special emphasis on lepidoptera, coleoptera, and hymenoptera* in management planning.

COMMENT / ISSUE	OPEN SPACE STAFF RESPONSE	EXPLANATION OF RESPONSE
The Report should include specific discussions of habitat associations and requirements, current state and global status, and current threats to viability for all species of concern in the management area. The Colorado Natural Heritage Program is one good source for much of this information. Additionally, the final report should directly explore how past and current management has contributed to the current status and distribution of these species.	Comprehensive knowledge of all species of concern is a data gap. The report lists data gaps so they can be prioritized in the Management Plan. Management approaches will be outlined in the Management Plan. Staff has included some historical land use information when it is known. On some properties land use practices and histories are unknown, and is recognized as a data gap. The staff will consider land use management in the planning process and in the final plan.	Staff is aware of the Heritage Program's resources and does use them in decision-making. Open Space staff acquires information as it becomes available. Comprehensive and integrated management is incremental and occurs over time. Open Space Staff will continue to improve its knowledge base. Past and current management practices are recognized as important influences in status and distribution of species. Some land-use history is known, areas that require further study are identified as a data gaps and will be addressed in the plan and planning process.
It would be easier to understand and work with the "Expected and Observed (avian) Species in the Management Area" (Appendix 9.2) if the species were listed in phylogenetic order. It would also be constructive to break the list down into breeding species, winter residents, and migrants. This would facilitate better prioritization of management concerns, as breeding bird species (such as bobolink and burrowing owl) are much more important than accidental migrants (such as black-throated blue warbler). There are several corrections to the list.	Agree. It would be helpful to have species in phylogenetic order. Presently this is a data gap and will be addressed in the planning process and in the Management Plan. Corrections to the expected observed species list, as recommended, will be made. Additionally, Hallock's (1993) *Boulder County avian species of special concern* will be added to the reports reference section.	The Open Space wildlife database has some limitations as to how information can be queried and extracted. The database design will be changed as resources become available.

COMMENT / ISSUE	OPEN SPACE STAFF RESPONSE	EXPLANATION OF RESPONSE
The final report should fully explore the potential for restoring native species and communities in the management area, and the Management Plan should aggressively pursue the restoration of native aquatic, riparian, and wetlands species, natural processes, and ecosystems. Protecting and restoring wetlands and riparian areas should be a major management priority, and recreational activity and other human uses of Open Space land should occur within the context of this protection and restoration.	Agree in principle. There is a need to explore the potential for restoring native species and communities. This will be included as a data gap in the final inventory report and considered in the management plan.	Restoration is a priority for Open Space land management. It is an on-going process and several projects are in progress. Human use of the land will be considered in the context of ecological condition and restoration potential of the land. The Long Range Management Policies states: "Weighing of potential benefits and impacts of proposed management actions will include consideration of the long-term viability and health of natural ecosystems."

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The identification of areas, species, and management areas of concern, and, more generally, the ability to develop an effective Management Plan, is heavily dependent on acquiring and maintaining an understanding of the habitat needs, current distribution status, and current threats of species of concern in the management area. In some (but not all) cases, the Report discusses the current status and distribution of such species. Rarely, however, are habitat needs, current threats, the mapping of habitat components and known nesting sites, etc. discussed. This data is fundamental to the ability to manage Open Space lands in a manner that minimizes adverse environmental impacts. Similarly, developing a clear understanding of how past and current management practices have contributed to current conditions is crucial. Each of the final report's sections should fully explore these relationships.	Partially agree. Much of the information requested is included in the Draft Inventory Report. Additional information needs will be included as a data gap in the final inventory report and considered in the Management Plan.	Species of concern are identified, habitat is mapped, and habitat needs have been explored to the best of staff's ability and resources. This information is contained in the report and its appendices 9.1, 9.2 and 9.3. The mapping of habitat components and known nesting sites of known species is depicted in figure 9.1. As additional information becomes available it will be incorporated in to management decisions and actions. Data gaps in information are recognized and will be addressed in the plan and planning process.

COMMENT / ISSUE	OPEN SPACE STAFF RESPONSE	EXPLANATION OF RESPONSE
The Management Plan should include the aggressive pursuit of reintroductions of extirpated native species (and augmentations of native imperiled species). The final report, then, should include evaluations of the potential for reintroducing and augmenting specific extirpated and imperiled species (e.g., sharp-tailed grouse, burrowing owl, long-billed curlew). Similarly, the final report should fully explore the potential for restoring native communities in the management areas. Clearly, the reintroduction and augmentation of species and the restoration of communities should be closely linked.	Partially agree. This will be included as a data gap in the final inventory report and considered in the Management Plan.	Reintroduction of extirpated species is an interest for the Open Space Program; however, it is a complex issue involving numerous jurisdictions as well as private land owners. Open Space will work with the appropriate agencies when there is possibility for species reintroduction and recovery.
PASSIVE RECREATION		
ACCESS Protect land between gate at Greenbelt meadows access gate and the South Boulder Creek Trail on the opposite (east side) of the creek by building a designated trail connection or reducing use.	The Passive Recreation section of the Inventory Report documents the informal use of this area and it is identified as an issue. The Management Plan will address how to resolve this issue.	

COMMENT / ISSUE	OPEN SPACE STAFF RESPONSE	EXPLANATION OF RESPONSE
We urge that the Open Space Department to carefully analyze the potential impacts of improving public transportation access to Open Space trailheads. In cases where such improvements are not likely to reduce vehicular traffic and are likely to increase overall use of the trailhead beyond that area's use capacity, they may not be desirable. In cases where they are likely to reduce the overall vehicular traffic and not contribute to over-capacity use of an Open Space area, they may be desirable.	Agree.	Public transportation improvements will be carefully analyzed on a case by case basis in the development of the Management Plan. Determining the use capacity of an area is extremely difficult and can be evaluated in many ways. Recreational carrying capacity is the amount of recreational use an area can support without causing significant impacts to the quality of the recreational experience (i.e., crowding, visitor conflicts). Other factors to consider include the distribution of visitor use, types of activities, and how these uses impact other resources (i.e., agriculture, plant and animal habitats, etc.). Visitor use is monitored on a periodic basis and could be correlated with other resource information as it becomes available. Enhancing public transportation and providing alternative modes of transportation can help reduce the impacts of providing large parking areas and impacts caused by overflow parking on adjacent lands.
TRAILS Dry Creek multi-use trail connection from East Boulder to South Boulder Creek.	The Passive Recreation section of the Inventory Report identifies this trail connection as an issue. The Management Plan will address how to resolve this issue.	
Cottonwood Trail multi-use trail connection to Twin Lakes.	This potential trail connection will be added to the Passive Recreation section of the Inventory Report as an issue. The Management Plan will address how to resolve this issue.	

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Complete Trail connections outlined in County Comprehensive Management Plan.	Disagree.	Trail connections outlined in the County Comprehensive Management Plan and Boulder Valley Comprehensive Management Plan are only conceptual. Each potential trail connection will be further evaluated in the development of the Management Plan and balanced with other management goals.
Why isn't the trail mentioned in the property table for Ute Industrial in the Recreation chapter?	The property table will be changed to state: A subdivision referral from the County mentions a trail across the property. While the subdivision was approved by the County, except for two buildings, it was never built. A conceptual trail corridor in the area was removed from both the Boulder Valley and Boulder County Comprehensive Plans. The property was purchased in 1994 by City Open Space primarily for wildlife purposes and trails were not listed as a reason for purchase. Valmont Reservoir is designated a wildlife sanctuary by the Colorado Division of Wildlife. The Public Service Company is concerned about safety issues from currents created in the reservoir from the water used for power production.	The trail is not mentioned in the recreation section because there is no plan for a trail in the area. The trail mentioned in the property table was from a 1987 memorandum about a subdivision referral from the County.
Existing trails outside the management area should be included on the map in order to assess the potential for new connecting trails.	Agree. A new map will be included in the final Inventory Report.	The new map will assist in evaluating trail proposals within the Management Area and potential trail connections to existing and proposed trails outside the management area.
Consider trails in addition to the Boulder Valley Comprehensive Management Plan and the Boulder County Comprehensive Management Plans.	Agree.	Potential trail connections within and outside the management area are listed as issues in the Passive Recreation section of the Inventory Report. These issues will be resolved in the development of the Management Plan.

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Consider the quality of the user experience as well as the impact to the resource.	Agree.	The quality of the visitor experience is an important consideration when developing additional passive recreational opportunities and must be balanced with other resource goals. Careful consideration of potential recreational impacts will ensure natural resources are protected and preserved, enhancing the long-term quality of the user experience.
In addition to the trail connections listed on p. 227, please consider: 1) Dry Creek (Clough), Marshall, South Boulder Road, Van Vleet, Highway 36 underpass, Yunker, Damyanovich/Hogan to S 66th St., 2) Dry Creek, Marshall, (private land with Open Space potential), 76th Street, O'Conner/Steinbach, Louisville, 3) McKenzie/Belgrove, Lousberg/Nu-West, Gallagher, (private land with Open Space potential), Boulder Valley Ranch.	Agree. The following text will be added under 14.3 of the Passive Recreation section, "Trails, Potential connections to trails in surrounding areas: Dry Creek Trail south to trails around Marshall Mesa, Dry Creek Trail east and north to trails around Louisville, and Cottonwood Trail north, and west to trails around North Boulder Valley."	These issues will be added to the Passive Recreation section of the Inventory Report. The Management Plan will address how to resolve these issues.

COMMENT / ISSUE	OPEN SPACE STAFF RESPONSE	EXPLANATION OF RESPONSE
The final report should also include a fuller discussion of the impacts of unleashed dogs in the Open Space areas, the degree of compliance with dog leash requirements, and the extent of enforcement of such requirements. The ability of the Management Plan to adequately address dog leash issues is contingent, to some extent, on the thoroughness with which the final report explores these issues.	Partially agree. Section 14.3 of the Passive Recreation chapter lists domestic pets and associated impacts and enforcement as issues related to dog management. A map depicting dog regulations within the management area is included as Figure 14.3. "Impacts From Passive Recreation" is listed as a data gap in 14.4 of the Passive Recreation section. The following text will be added in this section, "Additional research is needed to evaluate the potential impacts of passive recreation on natural resources (fragmentation of sensitive plant and animal communities, effects of various recreational activities such as dogs off leash) and visitor experiences (crowding, visitor conflicts). The following text will be added to the data gaps,"**Compliance With Dog Regulations**, Revised dog regulations are in effect in many areas of Open Space. Monitoring and further analysis are needed to determine visitor compliance and the effectiveness of these regulations."	Normally when information is lacking, staff will use the best information available, professional judgement, and employ a cautious approach that limits the possibility of irreversible damage to natural, agricultural, cultural, and passive recreational resources. Comments related to dog management are currently being compiled and should be incorporated into future management decisions. The Management Plan will address how to resolve and prioritize these issues and data gaps.

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A related concern is the proliferation and use of undesignated/unofficial trails on Open Space lands. The Open Space Department and the South Boulder Creek Area Management Plan should vigorously discourage the creation and use of undesignated trails and other off-trail activities. The final report, in order to facilitate an adequate treatment of this concern in the Management Plan, should address the presence and use of such trails as fully as possible.	Agree.	The Inventory Report currently contains a map depicting all known undesignated trails and a brief narrative describing current use levels of these trails. Section 14.3 of the Passive Recreation chapter lists use of undesignated trails as an issue. In the development of the Management Plan, alternatives will be considered to reduce the potential of undesignated trails.
The Open Space Department should evaluate the efficacy of various educational and other methods for managing trail (and other) use of Open Space lands. Understanding which methods work most effectively under what conditions should aid in formulating effective management provisions. This should be discussed in the final report	Agree.	Various studies have evaluated the effectiveness of various management techniques upon influencing recreational behavior. These studies, public involvement in the planning process, and staff experience will be used to determine what techniques should be used to address the passive recreation issues in the development of the Management Plan.
Develop an "unsuitable soils" theme in the Geographic Information System used by the Open Space Department (p. 55). This should aid in the ability to intelligently plan and manage human activity (e.g., designated and undesignated trails) in the management area.	Partially agree.	A coverage depicting soils suitable and unsuitable for trails is currently available in the Geographic Information System used by the Open Space Department. This information must be analyzed on a case by case basis and balanced with other resource information (e.g., critical plant and wildlife habitats, existing visitor use patterns). In this Management Area, soils unsuitable for trails can usually be resolved with simple construction techniques.