SIGNIFICANT PLANT, ANIMAL, AND WETLAND RESOURCES OF LARIMER COUNTY AND THEIR CONSERVATION

A report to

Larimer County Parks
and
The Colorado Department of Natural Resources

by

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Summary

In 1996, The Colorado Natural Heritage Program (CNHP) was contracted to assess the natural heritage values of lands throughout Larimer County. The project consisted of two major parts: a county-wide Natural Heritage Inventory and a Wetland and Riparian Area Survey. The primary goal of this project was to identify the locations in Larimer County with natural heritage significance. These locations were identified by first examining existing biological data, then accumulating additional information on rare or imperiled plant species, animal species, and significant natural communities (collectively called **elements**) through exhaustive field surveys.

Over 150 rare or imperiled plant or animal species and significant natural communities (elements) have been documented in Larimer County. Several of these natural heritage elements are globally significant. The other elements found in the county have state-wide significance. Overall, the concentration of elements indicates that conservation in Larimer County will have state-wide as well as global consequences.

Locations in the County with natural heritage significance, places where elements have been documented, are presented in this report as potential **conservation sites**. **The preliminary planning boundaries designated in this report for these sites does not confer any regulatory protection on the site.** These boundaries were based on the ecological processes needed to support the elements at the site. Seventy-three sites are described and prioritized, including twenty-seven wetland and riparian sites. The sites are prioritized according to their **biodiversity rank**, or "B-rank," which ranges from B1 (outstanding biodiversity significance) to B5 (local biodiversity significance). The highest ranking sites (B2 in Larimer County) are the highest priorities for conservation actions. The sum of all the sites in this report represents the area CNHP believes needs to be protected to ensure the County's natural heritage is not lost. Recommendations for protection and management of each site are presented.

The new information gathered during this inventory was placed in the Natural Heritage Program's database, the Biological and Conservation Data System (BCD). The BCD is used throughout the entire Natural Heritage network (which consists of over eighty offices in North America and internationally) to maintain species and community information and to assess each element's degree of imperilment. By incorporating new information into the BCD we can refine our conservation priorities. The new information becomes part of a permanent record of Colorado's natural heritage. It is important to keep in mind that the BCD is a very active database. In other words, records are continuously updated as we gather new data.

The Wetland and Riparian Survey began as a project separate from the Natural Heritage Inventory. Field work was coordinated between the two projects, but the methodology was slightly different. Given their similar nature and intent of the two projects, the results are combined in this one report. Nonetheless, wetland and riparian areas still must occasionally be considered separately from other natural heritage resources. In addition to their biological significance, wetlands perform many functions that provide value to the residents of Larimer County. Wetlands help control flooding, maintain water quality, provide wildlife habitat, offer recreational opportunities, and add to the aesthetic quality of the county. These functions were evaluated for the most important wetland sites. Information from this effort that may enhance a program for hydrogeomorphic (HGM) wetland function assessment in the southern Rocky Mountains is also presented.

The Natural Heritage Inventory and the Wetland and Riparian Area Survey were conducted in several steps:

1. **Identify rare or imperiled species and significant natural communities with potential to occur in Larimer County.** Using known range and life history information, over 225 natural heritage elements potentially occurring in Larimer County were identified.

2. **Collect existing information.** CNHP databases were updated with information about both species' biology and locations within Larimer County. Sources included museum collections, scientific literature, and local naturalists and biologists including expert sources at the Colorado Division of Wildlife.

3. **Identify targeted inventory areas.** Using available information, targeted inventory areas were identified based on several factors including the presence of potential habitat for rare or imperiled species and evidence of little human disturbance.

4. **Conduct field surveys**. Targeted inventory areas were surveyed on site (with landowner permission only). Data on the existence or lack of elements were recorded, and an estimate of overall biological quality of the location was made.

5. **Delineate and prioritize proposed conservation sites.** Preliminary conservation planning boundaries were identified based on the ecological processes that support the natural heritage elements at the site.

Recommendations

1. **Develop and implement a plan for protecting the conservation sites profiled in this report, with the most attention directed toward sites with biodiversity rank (B-rank) B2 and B3.** The sites in this report provide Larimer County with a basic framework for implementing a comprehensive conservation program. The B2 and B3 sites, because they have global significance, should receive the most attention. The sum of all the sites in this report represents the area CNHP believes needs to be protected to ensure the County's natural heritage is not lost.

2. **Incorporate the information included in this report in the review of proposed activities in or near conservation sites so that the activities do not adversely affect natural heritage elements.** All of the sites presented contain natural heritage elements of state or global significance. Development activities in or near a site may affect the element(s) present. Wetland and riparian sites are particularly susceptible to impacts from off-site activities if the activities affect water quality or hydrologic regimes. In addition, cumulative impacts from many small changes can have effects as profound and far-reaching as one large impact. As proposed activities within Larimer County are considered, they should be compared to the site maps presented herein. If a proposed project potentially would impact a site, planning personnel should contact persons, organizations, or agencies with expertise to get detailed comments. The Colorado Natural Heritage Program, Colorado Natural Areas Program, and Colorado Division of Wildlife routinely conduct environmental reviews statewide and should be considered available resources

3. **Develop and implement a comprehensive county-wide program to protect wetlands**. Use the U.S. Fish and Wildlife Service definition of wetlands to guide this program, and include riparian areas in the wetland conservation program. Develop a system of buffers, while recognizing that some wetlands, such as those with natural heritage significance, require buffers larger than most.

4. **In the effort to protect natural diversity, promote cooperation among landowners and pertinent government agencies and non-profit conservation organizations.** The long-term protection of natural diversity in Larimer County will be facilitated with the cooperation of many government agencies, non-government organizations, and private landowners. The Larimer County Planning Department has played a leadership role in attempting to incorporate diverse opinions in the planning process. Efforts to this end should continue, providing stronger ties among federal, state, local, and private interests involved in the protection or management of natural lands.

5. **Promote proper management of the natural heritage resources that exist within Larimer County, recognizing that designation of conservation sites does not by itself confer protection on the plants, animals, and natural communities.** Development of a conservation plan is a necessary component of the site designation. Because some of the most serious threats to Larimer County's ecosystems are large-scale (altered hydrology, residential encroachment, non-native species invasion), considering each site in the context of its surroundings is critical. Building partnerships is essential to the long-term protection

of a site. An important component of partnerships could be the research and develop of techniques for maintaining or restoring sites to aid in the preservation of imperiled species or significant plant communities. Several organizations and agencies are available for consultation in the development of conservation plans, including the Colorado Natural Areas Program, The Nature Conservancy, the CNHP, the Colorado Division of Wildlife, and various academic institutions.

6. **Increase public awareness of the benefits of protecting significant natural areas.** Natural lands are becoming ever more scarce, especially those near densely populated metropolitan areas. Rare and imperiled species will continue to decline if not given appropriate protection. This will result not only in the loss of our natural heritage, but may also lead to additional conflicts between developers and natural resource managers. Increasing the public's knowledge of the remaining significant areas will build support for the programmatic initiatives necessary to protect them. Finally, to build awareness of the commitment to protect sites of biodiversity significance, the County should publicize the significant conservation actions taken.

7. **Consider using incentives, including tax incentives, to promote conservation actions on private lands.** Conservation of important natural heritage resources can only take place with the cooperation of private landowners. Tax incentives could be used to help landowners defray the costs of protecting something of value to all of the residents of Larimer County.

8. **Continue natural heritage resource inventories where necessary, including inventories for species that cannot be surveyed adequately in one field season and inventories on lands that CNHP could not access in 1996.** Not all targeted inventory areas can be field surveyed in one year and inventory for some species in one field season is often difficult. Despite the best efforts of one field season, it is likely that some elements occur at sites not identified in this report.

9. **Prohibit the introduction and/or sale of non-native species that are known to negatively and profoundly affect natural areas, especially wetlands and riparian areas.** These include but are not limited to purple loosestrife, Russian olive, tamarisk (salt cedar), and non-native fish species. Natural area managers, public agencies, and private landowners should be encouraged to remove these species from their properties.

PREFACE

The Natural Heritage Network and Biodiversity

Colorado is well known for it rich diversity of geography, wildlife, plants, and natural communities. However, like many other states, it is experiencing a loss of much of its flora and fauna. This decline in biodiversity is a global trend resulting from human population growth, land development, and subsequent habitat loss. Globally, the loss in species diversity has become so rapid and severe that Wilson (1988) has compared the phenomenon to the great natural catastrophes at the end of the Paleozoic and Mesozoic eras.

The need to address this loss in biodiversity has been recognized for decades in the scientific community. However, many conservation efforts made in this country were not based upon preserving biodiversity; instead, they primarily focused on preserving game animals, striking scenery, and locally favorite open spaces. To address this lack of a methodical, scientifically based approach to preserving biodiversity, Robert Jenkins, in association with The Nature Conservancy, developed the Natural Heritage Methodology in 1978.

Recognizing that rare and imperiled species are more likely to become extinct than common ones, the Natural Heritage Methodology ranks species according to their rarity or degree of imperilment. The ranking system is scientifically based upon the number of known locations of the species as well as its biology. By ranking the relative rareness or imperilment of a species, the quality of its populations, and the importance of associated conservation sites, the methodology can assist in prioritizing conservation efforts so that the most imperiled species can be preserved first. As the scientific community began to realize that communities are equally important as individual species, this methodology has also been applied to ranking and preserving significant natural communities.

The Natural Heritage Methodology is utilized by Natural Heritage Programs throughout North, Central, and South America, forming an international database network. Natural Heritage Network data centers are located in each of the 50 U.S. states, 5 provinces of Canada, and 13 countries in Latin America and the Caribbean. This network enables scientists to monitor the status of species from a state, national, and global perspective. It also enables conservationists and natural resource managers to make informed, objective decisions in prioritizing and focusing conservation efforts.

The Colorado Natural Heritage Program

The Colorado Natural Heritage Program (CNHP) is Colorado's primary comprehensive biological diversity data center, gathering information and field observations to help develop statewide conservation priorities. Its primary role is to collect, maintain, analyze and disseminate information on rare or imperiled plants and animals, and significant natural communities in Colorado. After operating in Colorado for 14 years, the CNHP was relocated from the Colorado State Division of Parks and Outdoor Recreation to the University of Colorado Museum in 1992, and more recently to the College of Natural Resources at Colorado State University.

The multi-disciplinary team of scientists and information managers gathers comprehensive information on rare and imperiled species and significant natural communities in Colorado. Life history, status, and locational data are incorporated into a continually updated data system, the Biological and Conservation Datasystem (BCD). Sources include published and

unpublished literature, museum and herbarium labels, and field surveys conducted by knowledgeable naturalists, experts, agency personnel, and our own staff of botanists, ecologists, and zoologists. Information management staff carefully plot the data on 1:24,000 scale USGS topographical maps and enter it into the Biological and Conservation Data System. The database can be accessed by many categories including taxonomic group, global and state rarity rank, federal and state legal status, source, observation date, county, quadrangle map, watershed, management area, township, range and section, precision, and conservation area.

In addition to participating in an international network of conservation data centers, CNHP has effective relationships with several state and federal agencies, including the Colorado Department Natural Resources, the Colorado Natural Areas Program, the Colorado Division of Wildlife, and the U.S. Forest Service. Numerous local governments and private entities also work closely with CNHP. Use of the data by many different individuals and organizations, including Great Outdoors Colorado, encourages a proactive approach to development and conservation, thereby reducing the potential for conflict. **Information collected by Natural Heritage Programs throughout the world provides a means to protect species before the need for legal endangerment status arises.**

What is Biodiversity?

The term *biodiversity* has multiple meanings depending on the biological scale to which the term is being applied. Most commonly, biological diversity refers to the full range of *species* on Earth, including single-celled organisms such as bacteria, viruses, and protista, as well as multicellular organisms such as plants, animals, and fungi. At finer levels of organization, biological diversity includes the genetic variation within species, both among geographically separated populations and among individuals within single populations. On a wider scale, biological diversity includes variations in the biological communities in which species live, the ecosystems in which communities exist, and the interactions among these levels. The continued survival of species and natural communities require the preservation of biodiversity at all scales.

Given these various scales of biodiversity, the biological diversity of an area can be described at four levels:

1. Genetic Diversity -- the genetic variation within a population and among populations of a plant or animal species. The genetic makeup of a species is variable between populations of a species within its geographic range. Loss of a population results in a loss of genetic diversity for that species and a reduction of total biological diversity for the region. This unique genetic information cannot be reclaimed. This level of biodiversity is critical in order for a species to adapt to changing circumstances and to continue to evolve in the most advantageous direction for that species.

2. Species Diversity -- the total number and abundance of plant and animal species and subspecies in an area.

3. Community Diversity -- the variety of natural communities or ecosystems within that area. These communities may be representative of or even endemic to an area. It is within these ecosystems that all life dwells.

4. Landscape Diversity -- the type, condition, pattern, and connectedness of natural communities or ecosystems within a landscape. Fragmentation of landscapes, loss of connections and migratory corridors, and loss of natural communities all result in a loss of biological diversity for a region. Humans and the results of their activities are integral parts of most landscapes.

The conservation of natural diversity must include all levels of diversity: genetic, species, community, and landscape. Each level is dependent on, and inextricably linked to the other levels. In addition, and all too often omitted, humans are also linked to all levels of this hierarchy. The Colorado Natural Heritage Program believes that a healthy natural and human environment go hand in hand, and that recognition of the most imperiled elements is an important step in comprehensive conservation planning.

INTRODUCTION

Purpose of Study

The Colorado Natural Heritage Program was contracted by Larimer County Parks in 1996 to conduct a county-wide assessment of natural heritage resources, identify potential conservation sites and prioritize them on a global and state-wide basis. The goal of the project was to assist Larimer County in achieving several objectives outlined in the Larimer County Land Use Plan (Larimer County Planning Department 1988). Identification of these sites containing natural heritage resources will allow conservation of these resources for future generations, and proactive planning to avoid conflicts in the future between developers and natural resource managers.

This report summarizes extensive research in area herbaria, museums, and libraries, discussions with appropriate resource management agencies, scientific experts and local naturalists, and one field season of on the ground surveys. It compares the recorded ecological elements with similar known occurrences to give an overall assessment of the County's biological diversity. Other items contained in this report include a discussion of conservation issues (such as habitat destruction, degradation and fragmentation), recommendations for further management of selected biological elements, and maps indicating the location of potential conservation sites.

The Colorado Natural Heritage Program does not consider this project completed with fulfillment of contract obligations. The partnerships developed among CNHP, Larimer County, and private landowners during this project are valuable. These should be nurtured further, promoting sound natural resource management and wise land-use planning as the County continues to experience growth pressures. CNHP, the Colorado Natural Areas Program, the Colorado Division of Wildlife, and other experts should be considered as resources to review activities on or near the significant sites presented in this report.

Relating this Report to Managing Biodiversity at the Landscape Level

The management of Biological Diversity must consider more than species specific management criteria but also consider the elements of human-use in the area. The conservation sites typically identified in this type of study may be considered as core areas for the protection of the full range of biological diversity. Some of these areas are best considered as candidates for special area designations, others as sites within a landscape that should be managed to include the maintenance of the site's integrity.

A basic premise in the landscape management approach starts with the delineation of core protected areas that can be represented by special designations. Where possible, these should be connected through corridors and appropriately buffered. Buffer areas should include the ecological processes supporting the diversity of the core area. Such is the basis of the development of preliminary conservation planning boundaries.

Overview of the Study Area

Larimer County is located in north-central Colorado and includes landscapes from the high plains to the Rocky Mountains. It encompasses over 2500 square miles including both public and private land. Nearly 50% of the land in the County is publicly owned, mostly within the Roosevelt National Forest. Elevation ranges from approximately 4740 feet near the Big Thompson and Cache la Poudre Rivers in the southeastern part of the County, to over 13,500 feet in Rocky Mountain National Park in the western part of the County. The results presented in this report are mainly from surveys on private lands within the County. Several County and/or city properties were included where additional management and/or inventory information was requested by County planners. The study area is shown on Figure 1.

Topography

The location of the County at the meeting of the Great Plains and the Rocky Mountains creates a wide diversity of landscapes and topographic features. The eastern part is generally characterized by flat to rolling grasslands and croplands. Where the plains and the foothills meet steep, rugged canyons are formed. Further west high mountains and parks (open grasslands) are common. Extending out from the foothills through the northeasternern part of the County is an area somewhat unusual for the Front Range. This region is a mosaic of bluffs, rolling hills, gullies, and washes that gradually transitions into high forested mountain peaks and open parks.

Climate

The climate of Larimer County is dominated, like most of the Colorado Piedmont, by continental air masses. Precipitation events originate in the Pacific, Arctic, or the Gulf of Mexico. The Continental Divide to the west is also influential in determining the area's climate, helping to generate occasional high winds and intense summer precipitation. Average air temperatures are highly variable across the County due to the elevational gradient from the plains to the mountains. Winters are generally cold, with the valleys often recording lower temperatures than the surrounding mountains because of cold air drainage. Summers are warm or hot on the plains and in the valleys and cool in the mountains. Climate data from Ft. Collins are fairly typical of the eastern plains and data from Estes Park are typical for the mountainous parts of the County. In July, generally the hottest month in Ft. Collins, high temperatures average 85° F and lows average 56° F. During January, the coldest month in Ft. Collins, high temperatures average 41° F and lows average 14° F. In Estes Park, generally the warmest month is also July and high temperatures average 78° F and low temperatures average 46° F. In January, the average high in Estes Park is 42° F and the average low is 14° F. The growing season is about 140 days long on the plains and about 90 days for the area around Estes Park. Rainfall at Ft. Collins averages 14.4 inches annually (U.S.D.A. Soil Conservation Service 1980).

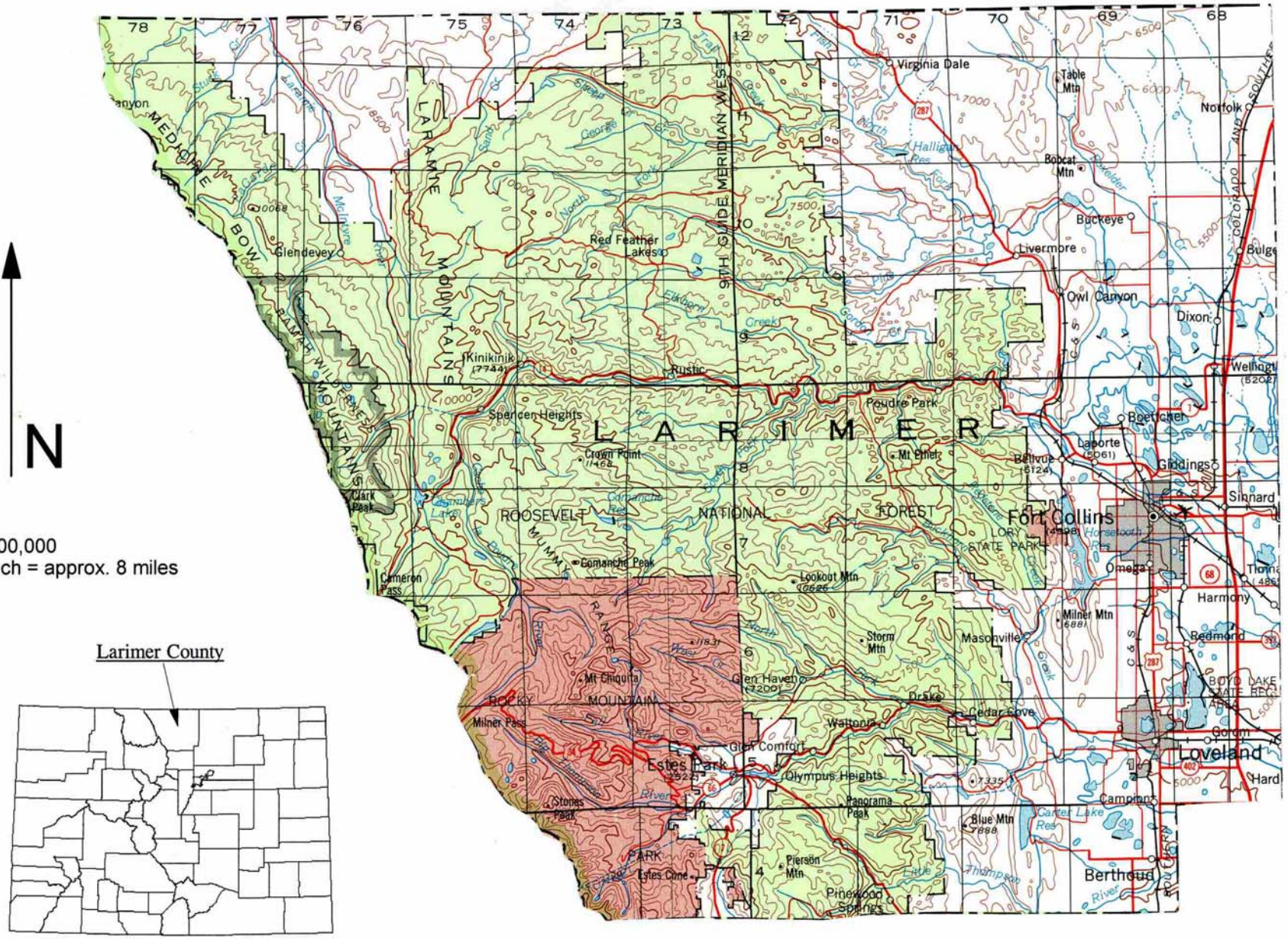


Figure 1. Study Area for the Larimer County Natural Heritage Inventory/Wetland and Riparian Survey.

Geology

The geology of the County can be divided into three general groups varying from the Great Plains, to the foothills, and then to the higher mountains to the west. The Great Plains in Larimer County are characterized by quaternary alluvium washed from the mountains which overlies sandstones and shales deposited by an ancient ocean (Chronic 1980). The foothills in Larimer County are very diverse geologically with numerous sandstones, shales, siltstones, mudstones, and limestones uplifted and exposed at various points. In many places steep ridges referred to as hogbacks are formed. This variety of geologic substrates helps to create some of the most diverse plant communities in the County. Most of the mountainous area of the County to the west is underlain by Precambrian granites, gneisses, and schists (see numerous geologic maps for Larimer County - most by Braddock *et al.*).

Soils

Soils on the Great Plains are highly variable in texture and drainage capacity, and are formed in alluvium, weathered sedimentary substrates, or wind blown sediments. Soils in the foothills are generally well drained and formed in materials weathered from sedimentary substrates. Most soils in the mountainous portions of the County are formed in materials weathered from granite and are well drained to excessively drained. The exceptions are those soils on stream terraces and benches formed in alluvium (U.S.D.A. Soil Conservation Service 1980).

Land Use

Prior to settlement by European Americans much of the County was utilized by both indigenous peoples and numerous ungulates. Bison and other large ungulates were hunted by native Americans. Numerous teepee rings, bison wallows, and at least one bison "jump" are known to occur in the area. Folsom man lived in the area approximately 10,000 years ago (RBD Inc. and Camp, Dresser & McKee, Inc. 1994). Later, European miners and settlers came to the area in search of mineral deposits, furs, and productive ground. Livestock ranchers, farmers, and military personnel settled the area in the middle to late 1800s.

Current land use in Larimer County is greatly influenced by topography and climate. Human use and development is highest in the eastern part of the County. This area contains many communities which are growing rapidly and serve as homes for people commuting to the cities of Fort Collins, Loveland, Boulder and Denver. The rest of the County, however, still retains a semblance of rural or small-town character, although that too is being increasingly altered by growth. Agriculture, primarily livestock production, is widespread. Irrigated croplands are very common in the eastern part of the County from the southern boundary to north of Wellington.

Mineral extraction is prominent in the area. Numerous oil and gas wells, and sand and gravel quarries exist especially in the eastern part of the County. Sand and gravel mining is occurs along most of the major drainages in the eastern part of the County.

Many of the lands in the eastern part of the County have been converted to agricultural use. Larimer County is one of the leading counties in Colorado in agriculture producing corn; wheat, hay , barley, dry beans, sugar beets, and oats. Much of the land has at one time, or is currently being used as pasture for cattle and calves, dairy cows and heifers, hogs, and pigs, and sheep (U.S.D.A. Soil Conservation Service 1980).

Flora and Fauna

Due to Larimer County's topography, climate, and location on the Colorado Piedmont, the flora and fauna are representative of both the High Plains and the Southern Rocky Mountains. This diverse mixture of geology and biology contributes to Larimer County's ecological character. Transition zones like these tend to support higher levels of biological diversity than other "non-transitional" areas (Odum 1972, Brewer 1990, Armstrong 1972).

No vertebrates and few invertebrates (at the species level) are endemic to the study area (Andrews and Righter 1992, Ferris and Brown 1981, Woodling 1985, Armstrong 1972, Hammerson 1982, Kippenhan 1990). However, there are some species endemic to the Colorado Piedmont that are found in the area, such as the globally imperiled mustard known as Bell's twinpod (*Physaria bellii*), and Hop's vine blue butterfly (*Celastrina* - undescribed species). Also, Opler (1995) has determined that the Front Range of Colorado is one of the nation's four most important areas for the conservation of lepidoptera (butterflies and moths) due to the area's very high species richness of that order.

Extirpations of large-sized and predaceous mammals are common in the study area. Black-footed ferret (*Mustela nigripes*), wolf (*Canis lupus*), grizzly bear (*Ursus arctos*) and bison (*Bison bison*) have been restricted throughout their range, and no longer occur here in natural populations (Fitzgerald *et al.* 1994). However, large ungulates such as mule deer (*Odocoileus hemionus*), elk (*Cervus elephus*), and antelope (*Antilocapra americana*) are all well known in the area, as are coyote (*Canis latrans*), black bear (*Ursus americanus*), and mountain lion (*Felis concolor*).

The mixture of bird species in Larimer County is very diverse. Species typical of prairies such as mountain plover (*Charadrius montanus*) and western meadowlarks (*Sturnella neglecta*) are found in close proximity to species with montane affinities such as Steller's jays (*Cyanocitta stelleri*), pygmy nuthatches (*Sitta pygmaea*), and goshawks hawks (*Accipiter gentilis*). A large number of passerine birds are known to breed in the study area. Raptors, including northern harriers, prairie falcon, golden eagles, and many hawks are common. Shorebirds are less common, but great blue herons (*Ardea herodius*) breed at dispersed heronries throughout Larimer County.

The fish of Larimer County are similarly diverse in the transition zone streams typical of the study area. Such streams lie between headwaters and their cold water environment and the warm waters of the eastern plains, and support fish species from both regions. Fish and their aquatic habitats have been highly impacted in Colorado due to water development and declines in water quality (Woodling 1985).

Amphibians are naturally rare in the study area due to the xeric conditions, although tiger salamanders (*Ambystoma tigrinum*) can be found in stock ponds and other pools. Reptiles such as plains garter snake (*Thamnophis radix*), western terrestrial garter snake (*Thamnophis elegans*), and western rattlesnake (*Crotalus viridis*) are common (Hammerson 1982).

In some ways, the vegetation of the study area is typical of the foothills/prairie ecotone of Colorado's Front Range. Grasslands of the eastern part of the County receive less moisture than those to the west. The resulting composition of grasslands generally follows this east to west moisture gradient, with typical shortgrass prairie species such as blue grama (*Bouteloua gracilis*) more common to the east, and midgrass species such as western wheatgrass (*Pascopyrum smithii*) and needle-and-thread grass (*Stipa comata*) becoming more common to the west. Tallgrass species such as big bluestem (*Andropogon gerardii*) and switchgrass (*Panicum virgatum)* are not uncommon in the foothills to the west.

Mountain mahogany (*Cercocarpus montanus)* shrublands are a dominant feature of the foothills of Larimer County, creating a mosaic of shrubs and grassland that cover the transition zone from plains to montane. These shrublands also occur in areas of mixed woodland with ponderosa pine (*Pinus ponderosa)*. Wetlands comprise a small but important portion of the study area. They are comprised mainly of herbaceous types located at springs or seeps, or shrub or tree dominated types in riparian areas. Riparian areas consist of dense shrubs, especially coyote willow (*Salix exigua)*, with some stands of narrowleaf and plains cottonwood (*Populus angustifolia, P. deltoides)*.

Coniferous forests of ponderosa pine dominate the lower elevation, mountainous western portions of the County. Cooler microhabitats on north aspect slopes contain some Douglas-fir (*Pseudotsuga menziesii)* forests with patches of aspen (*Populus tremuloides)*. Open parks are often dominated by sagebrush (*Artemisia* spp.) or grasslands.

Of the plant species targeted during the Larimer County Conservation Inventory, six are particularly significant because they are considered to be imperiled not only in Colorado, but throughout their ranges (CNHP 1996). These species were the focus of most of the botanical fieldwork. In general, these globally imperiled plant species are either confined to a narrowly distributed geologic substrate, or are found in wetlands or riparian areas that are naturally uncommon. Bell's twinpod (*Physaria bellii*) is known only from the shale outcrops along the eastern edge of the Front Range. A significant portion of this species' global range is located on private lands in Larimer County, in areas that are experiencing rapid development pressures. Larimer aletes (*Aletes humilis*) and Rocky Mountain cinquefoil (*Potentilla effusa* var. *rupincola*) are also known only from the Front Range of Colorado, and are confined to areas with large outcrops of Silver Plume Granite. These species are afforded some level of protection because of the relatively inaccessible nature of most of the known locations. The Ute Ladies' tresses orchid (*Spiranthes diluvialis*) is listed as a threatened species (U.S. Fish and Wildlife Service 1993). This species is known from one location in Larimer County, in a sedge-dominated wet meadow. Two other globally imperiled plant species that were historically, or are currently found in similar habitats in Larimer County are the Colorado butterfly plant (*Gaura neomexicana* ssp. *coloradensis*) and pale blue-eyed grass (*Sisyrinchium pallidum*). These species are regional endemics, known only from north-central Colorado and south-central Wyoming.

Figure 2. Landscapes and major vegetation types of Larimer County.

Major Impacts to Biodiversity in Larimer County

During the course of our study, it was found that some threats to biological diversity are pervasive throughout the County and should be addressed on a scale larger than individual conservation sites. While these threats are obviously interrelated, and certain actions may be placed in more than one category, generalized categories can be defined.

Human Alteration of the Landscape

Human alteration and development of the landscape has taken many forms in Larimer County. An agriculture dominated area until recently, development generally took the form of sparse buildings and roads, plowed fields, fences, and water diversions and impoundments. These developments significantly altered the landscape but retained large areas of open spaces that were sparsely inhabited by humans and still supported many of the native plants and animals. Today, while a significant agricultural economy remains, residential and commercial development increasingly dominate land use in Larimer County and present new challenges to the protection of biological diversity.

Agriculture

Agriculture, both crop and livestock production, have been traditional land uses in Larimer County since European settlement. Many crops were planted when settlers first arrived. Most agriculture in Larimer County has been, and continues to be, livestock production and irrigated or dryland farming.

The ecological effects of the landscape alterations that result from agricultural land uses are varied and controversial. In recent years, conservation biologists have paid special attention to this problem and have come closer to understanding the detrimental as well as desirable effects of agricultural practices.

Cropland in Larimer County is concentrated in the most increasingly urbanized portion of the County. Native plant communities in these areas are completely replaced with monotypic stands of crop species. This totally alters the grassland habitat within the field, and also has the effect of fragmenting formerly continuous grasslands in the area. The extent of native grasslands throughout North America has been seriously reduced since European settlement, as have many individual species that use the grasslands as habitat (Sampson and Knopf 1994). Conversion to agricultural land, overgrazing, and urban development have probably had the most significant impacts. Since croplands are so heavily altered and are therefore likely slow to recover to natural conditions, their current ecological value is relatively low. When continued land alteration is to take place, such as residential and commercial development, further damage may be minimized by building on these heavily altered areas in favor of converting still relatively intact natural areas.

Livestock production in Larimer County is the most prevalent land use and has significant effects on the natural ecosystems. The physical structure of environments is often changed by livestock grazing, altering habitats for the organisms that occur there. Fleischner

(1994) concludes that livestock grazing has affected all major attributes of ecosystems. Native plant diversity and densities are typically decreased by heavy grazing, and indirect effects can have profound impacts on animal populations including birds, small mammals, reptiles, and fish. The result is an alteration of native community species composition. Fundamental ecosystem functions such as plant succession can also be disrupted by preventing seedling establishment of certain species.

The effects of grazing in arid or semi-arid climates such as Colorado are most severe in riparian areas (Fleischner 1994). The ecological importance of riparian areas for various wildlife, including many species that are rare or imperiled, is well documented (Johnson *et al.* 1977, Brode and Brury 1984, Laymon 1984, Johnson 1989).

Residential and Commercial Development

A direct effect of residential and commercial development is typically the total alteration of the natural habitat where construction of buildings, roads, parking lots, and other infrastructure takes place. While affecting a relatively small percentage of Colorado's landscape, these effects may have devastating consequences when placed in habitats that are limited in extent. Hogbacks, wetlands and riparian areas are habitats that are typically limited, but other habitats may be so reduced by widespread alterations that only remnants remain. Similarly, habitats and sites that support rare or imperiled species are by their nature limited in extent and need to be protected from such wholesale alteration.

A variety of indirect effects that result from the increase in human density and the accompanying increase in development structures (including buildings, roads, and fences) exceed the direct habitat destruction in the percentage of the landscape affected (see Knight *et al.* 1995).

Human disturbances often affect natural interactions between species and between individuals, resulting in the alteration of animal communities and changing the number and types of species present (Knight and Gutzwiller 1995). The effects of these disturbances, including noise, human presence, and security lights, can be particularly acute when they occur in or near critical or sensitive habitats.

The effects of non-native plant and animal species is well known and discussed at greater length below. Since native species are rarely used in landscaping and erosion control, and many non-native species are favored by soil disturbance, developments can act as epicenters for non-native species dispersal to adjacent areas (Harty 1986).

Habitat fragmentation, a subject also presented separately in this report, is a major effect of rural development. Roads and fences can create significant barriers to dispersal for both large animals such as antelope and also smaller ones such as rodents and even butterflies. Furthermore, these same barriers may also act as corridors for dispersal of other species including non-native plants and animals (Schonewald-Cox and Buechner 1993 and references therein). Increased mortality from roads also effects certain species.

Mining has been intensive throughout much of the County. The floodplain of many rivers and larger creeks in the County have been or are being mined for sands and gravels. This activity totally alters the natural habitats, functions, and species associated with the sites.

Mines on the hogbacks are very common and have drastically altered natural habitats which often allows for invasion of non-native species.

Increased densities of domestic cats and dogs generally occur as human population density increases. Free roaming cats are known to consume large numbers of native rodents and songbirds (Parmalee 1953, Eberhard 1954, Jones and Coman 1981, Liberg 1984, Churcher and Lawton 1987). Aside from population effects to these animals directly, especially those which are rare or imperiled, native small-to-medium-sized predators, such as raptors, coyotes, and bobcats, may also be affected by reduced availability of prey (George 1974, Triggs *et al.* 1984).

Chemical and organic pollution of rivers and streams is one of the most visible threats to the health and survival of intact ecosystems. While it is unlikely that the extinction of any riverine species has been caused by pollution alone, it has been estimated (Miller *et al.* 1989) that pollution has played a role in 38% of the known extinctions in North America. For rare or imperiled river dwelling species, the effects of chemical and organic pollution may present a serious problem (Allan and Flecker 1993).

Likely sources of chemical pollution in Larimer County include the obvious such as industrial and sewage plants, but also the less conspicuous non-point sources such as fertilizer and pesticide runoff from suburban lawns and golf courses, spilled oil and gas, mud and silt, and lead from automobile emissions. Excessive use of an area by livestock can also result in excess enrichment and eutrophication of water sources, as well as increased siltation. All of these can have negative effects on aquatic habitats (Woodling 1985).

Lastly, increased rural development is likely to restrict landscape level processes such as fire, disease, predation, and movement of animals, processes which are integral to the maintenance of the entire spectrum of biological diversity (Knight *et al*. 1995).

Non-native Species

The problem of invasive non-native plants and animals is one of the greatest threats facing native habitats and the conservation of biological diversity (Primack 1993, Soule 1990). Such invasive aliens can have a number of impacts on natural systems (Bratton 1982, DeLoach 1991, Harty 1986, Hester 1991). Non-native organisms that become established in natural areas often displace the native plants and animals, altering the composition of native communities (Bock and Bock 1988), and affecting any other organisms that may have relied on these native communities. In some cases, the species being displaced are rare or imperiled plants and animals (Moore and Keddy 1988).

Most invasive non-native organisms are adapted to habitats that have been disturbed in some way, therefore the greatest impacts tend to occur in areas that have experienced the greatest landscape modification (White *et al*. 1993). This disturbance can take the form of soil removal, severe livestock grazing, changes in the regime of water fluctuations, adjacent forest clearance, fire suppression, and many others.

The origins of non-native plants and animals in Larimer County are varied. Many plants have been brought to this continent for use as garden and landscaping ornamentals, but have since "escaped" and established themselves in the wild. In fact, many non-native plants are recommended to gardeners on the basis of their "hardiness" or their adaptability to our

local environments. Recent trends in "xeriscaping" are certainly needed and well intentioned, but many of the plants used in such plans are in fact hardy non-native plants, some of which may establish wild populations.

Certain agricultural practices have also resulted in large scale non-native plant introductions. Pasture "improvements" involved seeding with various non-native grasses meant to increase the forage value for domestic livestock. The results are large areas dominated by a few non-native grasses and very few natives. This has been the fate of many of the grasslands throughout Larimer County. Additionally, cultivated hay is rarely composed of native grasses. Hay fields are typically monocultures of non-native grasses which, aside from displacing the former grassland or wetland, serve as a source of seeds for invasion of surrounding areas. These hay grasses, and any other weeds that may grow in the hay fields, are also spread by livestock and appear to quickly invade certain areas (especially riparian areas).

The control of excess erosion is essential to preventing the loss of topsoil and the maintenance of good water quality. Unfortunately, the control of erosion is often at the expense of native species, a serious problem in itself. Typically, areas such as ditches and roadcuts are reseeded with a seed mix recommended for our climate and soils. Unfortunately, these mixes rarely contain seeds of the locally native vegetation, instead they contain "hardy" non-native species that are chosen for their ability to thrive in this area. This has been the fate of many reseeded areas in the County, which are now dominated by various non-native grasses. Furthermore, these areas serve as a source for the subsequent invasion of adjacent areas.

Non-native animals are also found in natural areas in parts of Larimer County. Perhaps of greatest concern is the potential for introduced fish species to alter the native fish communities of Larimer County's streams, potentially impacting many rare or imperiled species. The brook trout (*Salvelinus fontinalis*) is one non-native species that has been introduced in Larimer County. Its presence in some of the most ecologically important habitats in Larimer County is reason for concern. Introduced species impact native fishes through predation, competition factors, the spread of disease, and hybridazition (Courtenay and Moyle 1992). Efforts to minimize the ecological damage done by invasive non-native plants and animals in Larimer County should attempt to prevent new introductions of non-native species, contain small or recent infestation, and attempt to control non-native species populations especially in significant conservation areas.

Another group of species similar to non-native species are those native species that take over an area when the historic natural conditions have changes. Baltic rush (*Juncus balticus*) and Nebraska sedge (*Carex nebrascensis*) are two species that dominate meadows after other native species are eliminated by heavy grazing. Cattail (*Typha latifolia* and *Typha angustifolia*) are two species that often dominate wetlands that have been disturbed by construction, where soil has been exposed, and then the wetland is flooded. While cattail occurs in the area naturally, wetlands dominated by these species are spreading at the expense of other wetland types. In terms of species diversity cattail marshes are not be considered an acceptable replacement for other wetland types.

Non-native Plant Species in Wetlands and Riparian Areas

Non-native plant species have the potential to radically alter the nature of our riparian and wetland areas. Some noxious weeds that cause problems in wetlands and riparian areas, such as Canada thistle (*Cirsium arvense*) and leafy spurge (*Euphorbia esula*), are so well established that there is little we can do to control them except in small, targeted areas. Preventing widespread establishment of a noxious species is usually the best way to avoid costly, deleterious consequences in the future, i.e., prevention is the best medicine. Three seriously harmful wetland and riparian plant species need to be controlled immediately in Larimer County. These species are:

Russian olive (*Eleagnus angustifolia*)--Although widely sold as an ornamental tree, Russian olive is a serious threat to wetlands in Larimer County. Its abundance in landscaping provides a copious seed source, and its adaptability means it can displace native species. This small tree grows especially well in wet meadows and riparian areas often shading out or outcompeting native species. The presence of Russian olive along the South Platte River is resulting in the loss of bird nesting habitat.

Tamarisk, salt cedar (*Tamarix ramosissima*)--This small tree is established only locally along the Cache la Poudre River and the Big Thompson River. In southwest Colorado and elsewhere this species has become a serious problem, completely displacing native plant communities. Tamarisk has an ability to concentrate salts in the soils around it, and to tolerate salty soils. This change in soil chemistry excludes the native species. Tamarisk should be exterminated wherever found.

Purple loosestrife (*Lythrum salicaria*)--Purple loosestrife has a remarkable ability to take over shallow water marshes, completely displacing native species in the process. Once established it is extremely difficult to eradicate. This noxious species is already well-established in some wetlands in the Denver and Boulder area. It is present in Larimer County, but has not yet become unmanageable. The City of Fort Collins has an active purple loosestrife eradication program; this type of program should be extended to the entire County.

Fragmentation

By using natural resources, building towns and cities and their suburbs, and creating new agricultural land, humans gradually create patches of natural habitats within human dominated landscapes. Conservation biologists term this breaking up of natural habitats "fragmentation." Many scientists consider fragmentation one of the greatest threats to biological diversity (Noss and Cooperrider 1994). Wilcove *et al.* (1986) describe fragmentation as 1) a decrease of a habitat type, and 2) breaking up of remaining habitat into smaller, more isolated pieces. Currently, the greatest mechanism of fragmentation in Larimer County is rural and suburban housing development and concurrent road and highway development. In the past, agricultural field and pasture development likely fragmented the Larimer County landscape.

In forest environments, fragmentation often allows more light into the forest interior, changing the plant composition. Animal species that prefer open habitats will often be able to invade, displacing those species adapted to the forest interior. While these changes might be less obvious in a grassland or shrubland, the same processes occur. Non-native species are able to invade, displacing the natives, often reducing the total number of species able to survive. Animal species associated with native grasslands and shrublands may not be able to survive in an area with only non-native, weedy vegetation.

Roads that accompany housing development often act as impenetrable barriers to animals, especially small animals, and may encourage the spread of weedy plant species along them. There may also be significant mortality on roads, especially where animals formerly used the area where the road now exists. Fences may also act as barriers to animals, especially species like pronghorn antelope that in most cases, do not jump over them.

Fragmentation is a process that occurs through many means, and usually occurs over several months, years, or decades. The fragmentation process may not result in immediate loss of plants, animals, and natural communities from an area, but an area may experience gradual turnover of plant and animal species able to survive. In some cases the results of fragmentation are not seen for several years as species gradually leave or die off within a fragment. The fragment size and surrounding landscape greatly influence the impacts on living things within the fragment.

Small patches of natural habitat, such as those created by large scale suburban development or large scale conversion of land to agriculture, will be unable to support plants and animals dependent on large areas of contiguous habitat. These small fragments may also experience a change in species composition, supporting more weedy plant and animal species. While the number of species may remain the same, small habitat fragments surrounded by suburban or agricultural development will likely experience species turnover which results in more of the common and even pest plants and animals.

Large habitat fragments are less vulnerable to complete change in species composition. However, even a large habitat area can experience loss of native, habitat specific plants and animals, especially on its edges. Intensive urban and suburban development at the edges of even a large natural area may cause changes in the species able to survive within the natural area.

Fragmentation threatens the significant natural features of Larimer County. Only concerted and well informed development and conservation planning are likely to save the remaining high quality natural areas in the County. The negative effects of fragmentation can be reduced by: concentrating housing and road development, leaving some areas relatively free from such pressures; planting only native species in lawns and gardens; leaving large buffers of open space around nature preserves, and discouraging the building of roads within these buffers; planning for large fragments as opposed to small ones; and educating local residents about impacts of fragmentation on the natural world.

Domestic Predators

Domestic cats (*Felis catus*) are naturally inclined to hunt and, as most cat owners know, often hunt small birds and rodents. Scientific evidence supports this notion and has demonstrated that small mammals and songbirds constitute a large proportion of the diet of free-ranging domestic cats (Parmalee 1953, Eberhard 1954, Jones and Corman 1981, Liberg 1984, Churcher and Lawton 1987). In fact, domestic predators such as cats have been implicated in the local extirpation and extinctions of songbirds and small mammals (Emlen 1974, Holler *et al.* 1989, Scott and Morrison 1990). Cats can have additional negative impacts on natural ecosystems, if not by eliminating certain prey species, then by reducing prey numbers to such an extent as to compete with native predators such as raptors (George 1974, Triggs *et al.* 1984). Cat predation may also be of concern to hunters and game managers since their prey includes game species such as rabbits, ring-necked pheasants, northern bobwhites, and possibly others (Hubbs 1951, Liberg 1984, Warner 1985).

One reason that the effects of cat predation are so severe is that cat numbers are kept artificially high by supplemental feeding by their owners. While native predator numbers respond to changes in prey density, domestic cats do not. Thus, even when prey populations are very low, cats continue to kill. Cats continue to kill wild prey despite being fed at home (Davis 1957, Polsky 1975, Adamec 1976).

The threat posed by these domestic predators is believed to be proportional to the number of cats present in a given area. Coleman and Temple (1993) demonstrated that most free-ranging domestic cats in rural areas are associated with non-farm rural residences. Although farm residences typically support a higher number of cats per household, the higher densities of non-farm rural housing results in a higher number of cats in an area. In some areas cat density was found to equal that of native predators, and in certain instances exceeded the number of native predators by several fold. This suggests that rural development may present an indirect, but serious, threat to certain species.

Protecting important or sensitive areas from excess cat predation will be pertinent to conservation of rare and imperiled species in Larimer County. Some suggestions on minimizing this threat can be made: 1.) Increasing housing development is related to increasing cat densities, therefore planning should consider limiting the density of housing near areas that may be especially susceptible to excess predation, such as those identified having imperiled bird species. Cats are known to use an area of approximately one mile radius from their feeding place (Coleman 1995). This suggests that homes within this distance may pose a threat to certain native species. 2.) It may be possible for developers or homeowners' associations to agree to limit the number of cats that will be present at developments within this distance from sensitive areas. 3.) Where housing already exists minimizing the number of cats will require enlisting the help of cat owners. Coleman and Temple (1993) found that many people were willing to reduce the number of pet cats to benefit wildlife, suggesting that free-ranging cats could be substantially reduced in number if cat owners were informed of the negative impacts of their cats. Providing means for resident to control the reproductive output of the cats may also serve to reduce their numbers.

Hydrologic Modifications

Natural areas and their constituent plant and animal species often depend on an intact hydrologic regime to persist. Many of the rare and imperiled species and significant natural communities in Larimer County depend upon a natural hydrologic regime. Changes in hydrology and related changes in water quantity, quality, and periodicity threaten many natural areas across the United States, and high quality natural areas in Larimer County.

Human induced modification of the hydrologic regimes often change the quantity, place, and timing of natural water flow. Activities at one place can impact areas many miles downstream. Modifications to hydrology are caused by: water diversions or removal; groundwater depletion; vegetation removal and subsequent stream channelization; dam building; and housing and road construction.

Water diversion and removal from natural streams often affects water flow downstream. These activities often cause formerly perennial streams to run intermittently. Fish species that depend on having water throughout the year are not able to survive these hydrologic modifications even if they take place many miles upstream. A reduction in water flow often causes the entire drainage to dry up. Plants and animals that depend on year round moisture usually disappear from these drainages. Wells usually do not remove water directly from a naturally wet area, but it may lower the water table sufficiently to cause ephemeral aquatic habitats to be eliminated. Lowering the water table eventually has the same effects as direct water removal. Perennial streams may run intermittently, and the plant and animal species associated with them are not able to survive. Vegetation removal from riparian areas from grazing, agriculture, or residential and commercial development often changes the natural water flow. Water flows much more quickly across the surface causing greater erosion rates. This in turn changes habitats dependent on water. Wetlands associated with streams often disappear as groundwater levels decrease, and species that depend on them will disappear. Urban environments are designed to move water off more quickly, causing greater erosion and decreased replenishment of ground water. When water eventually reaches streams or wetlands it often carries eroded materials that cloud the water, and potentially harm native plants and animals dependent upon the water.

Related to hydrologic modifications are changes in water quality. Sediments or chemicals that run off agricultural fields and lawns into streams and wetlands may kill plant and animal species living in these areas. Excess nutrients in natural waters may cause growth of certain algae species to explode, depleting oxygen levels and eventually killing aquatic animals, especially fish.

Changes in water quality and quantity must be considered in planning for protection of significant natural features of Larimer County. Conservation of these features will often mean considering the hydrologic modifications far away from the actual conservation site, as well as in the immediate vicinity. Potential long term impacts of certain types of development to hydrology and water quality must be addressed. New developments should not be placed next to streams and rivers. New water diversions upstream of significant natural areas should be avoided. Well drilling and use must be considered with respect to the maintenance of the water table. Run off from fields and livestock feedlots should be carefully monitored to ensure the runoff is not negatively impacting conservation areas.

Alteration of Natural Fire Regimes

Fire suppression has drastically altered natural systems and, in many areas, increased the chance of catastrophic wildfire. Fires were frequent components in the natural disturbance regimen of most grasslands and ponderosa pine (*Pinus ponderosa)* woodlands (Mehl 1992) and are important in promoting patch dynamics and enhancing community diversity on a large spatial scale (Collins 1990). Anderson (1990) contends that fires were common in most grasslands although more common in eastern North American grasslands than in arid western grasslands. Grasslands along the Front Range in general have been invaded by ponderosa pine woodlands. Fire suppression and intense grazing (which reduces competition from grasses) are often cited as reasons for the expansion.

Simulating natural fire regimes may be necessary in some areas. Goals for fire management, possibly species-specific goals, should be developed before a fire management plan is implemented. In some cases disturbance from fires may provide the opportunity for non-native species to increase in dominance. In addition, frequent fires in tallgrass prairie have been shown to reduce the diversity of butterflies and moths (Swengel and Swengel 1995) and burning all of the butterfly habitat in one year could potentially extirpate populations (Moffat and McPhillips 1993).

General Observations

From our field observations, several general conclusions can be made regarding the overall status of natural areas in Larimer County.

- Over 100 years of human habitation and accompanying land uses such as cattle grazing, timbering, and quarries have left an indelible mark. Nearly all of Larimer County's landscapes are somewhat altered.

- High priority conservation areas identified in this report support rare or imperiled species or examples of significant natural communities. This suggests that some sensitive species and communities have escaped negative effects or are resistant to such impacts.

- Grasslands have been especially impacted through years of agricultural use. While we do know that bison were native to the area, the long term impacts of domestic livestock grazing are certainly different yet still debatable. Land management activities such as pasture seeding, irrigation, and heavy livestock grazing have left very few of the grasslands in the County unaltered. Some natural grassland types persist in a few small remnants and even with limited biodiversity values can serve as important reference areas and educational tools.

- The riparian and aquatic habitats of Larimer County comprise several of the high priority conservation sites. This indicates that the processes which create and support these habitats are still intact, even though the vegetation composition of the riparian communities is greatly altered. These include hydrological processes such as flooding, seasonal flow variation, and water quality. These processes are currently threatened.

- Shrub habitats are extensive in the County. While much of this habitat remains, some of it in relatively good condition, it has been greatly fragmented by mining, development and accompanying roads, and is often heavily invaded by non-native species.

- Open savannas of ponderosa pine were once found along the foothills of the County. Today few good examples of this habitat remain. Most areas that were potentially savanna have been encroached upon by dense growths of young trees and shrubs, likely due to years of fire suppression and grazing impacts.

- Wetlands in Larimer County have been drastically altered by past land uses. Most wetlands in Larimer County are associated with rivers and streams, in oxbows, or creek confluences where water spreads out over a larger area, and remains throughout the year to support wetland vegetation. Typical for the Colorado Piedmont in general, most wetlands in the County have been modified by grazing, water diversions, or conversion to hay meadows. Those remaining tend to be small and contain a high percentage of weedy plant species. Still, a few Larimer County wetlands remain relatively intact and provide important functions such as wildlife habitat and flood abatement. These remaining wetlands, while somewhat degraded, still merit conservation efforts. Larimer County wetlands are discussed in detail later in this report.

- CNHP botanists searched for new (previously undocumented) occurrences of the federally endangered orchid, Ute ladies' tresses (*Spiranthes diluvialis*), in Larimer County without success. Sub-irrigated meadows and riparian areas considered potential habitat visited by CNHP botanists were often overgrown with weeds or very heavily grazed. Many places with potential habitat were not visited at the landowners request.

- CNHP zoologists trapped (approximately 3000 trap nights) for the Preble's meadow jumping mouse (*Zapus hudsonius preblei)* without success. Because of the time intensive methods of trapping we were able to search only a few sites. Numerous other sites exist in the County which potentially could support the species and should be considered for further inventory.

- Open space designation alone may not protect occurrences of significant natural heritage resources. Recreation and other activities normally associated with open space designation may impact these elements. In some cases management plans for designated open space may need to include provisions for limited access to protect these elements. Certainly, trail designs, facility placements, and transportation corridors should be designed with the goal of protecting significant natural heritage resources.

- Prairie dogs are still common in parts of the County, however few large and viable colonies exist. Large colonies are known to support some species which are declining or currently imperiled. It is apparent that prairie dog colonies near urban centers do not support the same number of animal species when compared with colonies in more remote settings.

ELEMENTS DOCUMENTED IN LARIMER COUNTY

Field surveys by CNHP scientists and technicians took place from April 1996 through October 1996. Substantial information was gained regarding the natural significance of the study area. Numerous historical records were updated and new records discovered. The occurrences of rare or imperiled plants, animals and significant natural communities known on private lands were nearly doubled with the work from this project (elements documented to occur in Larimer County are listed in Table 1). These occurrences resulted in a delineation of 73 conservation sites for proposed conservation sites and associated biodiversity ranks).

Table 1. Rare and imperiled plants and animals and significant natural communities known to occur in Larimer County.

Scientific Name	Common Name	Global Rank	State Rank	Fed. Status	State Status	Fed. Sens.
Amphibians						
Bufo boreas boreas pop 1	boreal toad (southern rocky mountain population)	G5T2Q	S1	C	E	FS
Rana sylvatica	wood frog	G5	S3		T	FS
Birds						
Ardea herodias	great blue heron	G5	S3B,SZN			
Pandion haliaetus	osprey	G5	S2S3B			FS
Accipiter gentilis	northern goshawk	G5	S3B,SZN			FS
Buteo regalis	ferruginous hawk	G4	S3B,S4N		SC	FS
Charadrius montanus	mountain plover	G2	S2B,SZN	C	SC	FS
Himantopus mexicanus	black-necked stilt	G5	S3B,SZN			
Coccyzus erythropthalmus	black-billed cuckoo	G5	S2B			
Aegolius funereus	boreal owl	G5	S2B			FS
Cypseloides niger	black swift	G4	S3B			FS
Empidonax minimus	least flycatcher	G5	S1B,SZN			
Bombycilla cedrorum	cedar waxwing	G5	S3B,S5N			
Lanius ludovicianus	loggerhead shrike	G4G5	S3B,SZN			FS
Dendroica pensylvanica	chestnut-sided warbler	G5	S2B,SZN			
Dolichonyx oryzivorus	bobolink	G5	S3B,SZN			
Loxia leucoptera	white-winged crossbill	G5	S1B,SZN			
Coccothraustes vespertinus	evening grosbeak	G5	S3B,S5N			
Fish						
Oncorhynchus clarki stomias	greenback cutthroat	G4T2	S2	LT	T	
Hybognathus hankinsoni	brassy minnow	G5	S3			
Notropis cornutus	common shiner	G5	S2		SC	
Fundulus sciadicus	plains topminnow	G4	S2		SC	FS
Etheostoma exile	Iowa darter	G5	S2		SC	
Etheostoma nigrum	Johnny darter	G5	S3			
Mammals						
Sorex hoyi montanus	pygmy shrew	G5T2T3	S1			FS
Plecotus townsendii	Townsend's big-eared bat	G4	S3			FS
Zapus hudsonius preblei	Preble's meadow jumping mouse	G5T2	S2		SC	FS
Vulpes velox	swift fox	G3	S3?	C		FS
Ursus arctos	grizzly or brown bear	G4	SX	LT	E	
Gulo gulo	wolverine	G4	S1		E	FS
Felis lynx canadensis	lynx	G5	S1		E	FS

Scientific Name	Common Name	Global Rank	State Rank	Fed. Status	State Status	Fed. Sens.
Invertebrates						
Aeshna eremita	lake darner	G5	S1?			
Amblyscirtes simius	Simius roadside skipper	G4	S3			
Anodonta grandis	giant floater	G5	S1			
Archilestes grandis	great spreadwing	G5	S3			
Atrytone arogos	arogos skipper	G3G4	S2			
Atrytonopsis hianna	dusted skipper	G4G5	S2			
Boloria selene sabulocollis	sandhill fritillary	G5T2	S1S2			
Callophrys mossii schryveri	Moss's elfin	G4T3	S2S3			
Celastrina sp 1	hop-feeding azure	G2	S2			
Coloradia luski	a buckmoth	G?	S1?			
Cordulia shurtleffi	American emerald	G5	S1?			
Enallagma basidens	double-striped bluet	G5	S1			
Erynnis martialis	mottled dusky wing	G4	S2S3			
Euphilotes rita coloradensis	Colorado blue	G4T2T3	S2			
Euphyes bimacula	two-spotted skipper	G4	S1			
Pyrgus ruralis	two-banded skipper	G4	S3			
Satyrodes eurydice fumosa	smoky eyed brown butterfly	G5T3T4	S1			
Somatochlora hudsonica	Hudsonian emerald	G5	S2S3			
Somatochlora minor	ocellated emerald	G5	S1			
Speyeria idalia	regal fritillary	G3	S1			FS
Sympetrum vicinum	yellow-legged meadowfly	G5	S?			
Communities						
Abies lasiocarpa/Senecio triangularis	montane riparian forests	G2G3	S2S3			
Alnus incana/ Calamagrostis canadensis	montane riparian shrubland	G3	SU			
Alnus incana/Equisetum arvense	montane riparian shrublands	GU	S2S3			
Alnus incana/mesic graminoid	montane riparian shrubland	G2G3	SU			
Andropogon gerardii-Schizachyrium scoparium	xeric tallgrass prairies	G2	S2			
Artemisia tridentata wyomingensis/ Pseudoroegneria spicata	xeric sagebrush shrublands	G5	S3?			
Artemisia tridentata wyomingensis/Leymus ambiguus	mixed foothill shrublands	G3	S2			
Artemisia tripartita/Festuca idahoensis	mixed foothill shrublands	G4G5	S1?			
Atriplex canescens/Bouteloua gracilis	shortgrass prairies	G3	S3			
Calamagrostis canadensis	montane wet meadows	GU	S?			
Calamagrostis canadensis-Carex scopulorum-Mertensia ciliata	mesic alpine meadows	GU	S?			
Caltha leptosepala-Sedum rhodanthum	montane wet meadows	GU	SU			
Cercocarpus montanus/Stipa comata	mixed foothill shrublands	G2	S2			
Cercocarpus montanus/Stipa	foothills shrubland	G2G3	S2S3			

Scientific Name	Common Name	Global Rank	State Rank	Fed. Status	State Status	Fed. Sens.
neomexicana						
Cercocarpus montanus/Stipa scribneri	foothills shrubland	GU	SU			
Danthonia parryi	montane grasslands	G2?	S2?			
Distichlis spicata var *stricta*	great plains salt meadows	G4	S3			
Eleocharis quinqueflora-Triglochin spp.	alkaline spring wetlands	GU	SU			
Glyceria borealis	montane emergent wetland	G3?	S2			
Juniperus scopulorum/ Cercocarpus montanus	foothills pinyon-juniper woodlands/scarp woodlands	G2	S2			
Juniperus scopulorum/ Cercocarpus montanus	scarp woodlands	GU	SU			
Juniperus scopulorum/ Purshia tridentata	foothills pinyon-juniper woodlands	G2	S2			
Muhlenbergia montana-Stipa comata	montane grasslands	G2	S2			
Picea engelmannii/ Calamagrostis canadensis	montane riparian forest	G3	SU			
Picea pungens/Alnus incana	montane riparian forests	G3	S3			
Picea pungens/Alnus incana phase *Corylus cornuta*	foothills riparian forest	GU	SU			
Picea pungens/Cornus sericea	montane riparian forest	G4	S2			
Pinus contorta/ Vaccinium scoparium	seral lodgepole pine forests	G5	S4			
Pinus ponderosa/ Cercocarpus montanus/ Andropogon gerardii	foothills ponderosa pine scrub woodlands	G2	S2?			
Pinus ponderosa/ Leucopoa kingii	foothills ponderosa pine savannas	G3	S3			
Populus angustifolia/Alnus incana	montane riparian forest	G?	S?			
Populus angustifolia/Prunus virginiana	narrowleaf cottonwood/common chokecherry	G2?	S1?			
Populus angustifolia/Salix exigua	narrowleaf cottonwood riparian forests	G3	S3			
Populus angustifolia / Salix irrorata	Foothills cottonwood riparian forests	GU	SU			
Populus angustifolia/ Symphoricarpos albus	montane riparian forest	GU	SU			
Populus deltoides-(Salix amygdaloides)/Salix exigua	plains cottonwood riparian woodland	G2G3	S2S3			
Populus tremuloides/ Corylus cornuta	montane riparian forests	G3?	S1			
Pseudoroegneria spicata- Poa secunda	montane grasslands	G4	S1			
Pseudotsuga menziesii/ Corylus cornuta	montane forest	GU	S2			
Purshia tridentata/ Artemisia frigida/ Stipa comata	mixed foothill shrublands	G1G2	S1S2			
Purshia tridentata/ Muhlenbergia montana	mixed foothill shrublands	G2	S2			

Scientific Name	Common Name	Global Rank	State Rank	Fed. Status	State Status	Fed. Sens.
Ribes cereum/ Leymus ambiguus	mixed foothill shrublands	G2	S2?			
*Salix drummondiana/*mesic forb	Drummond's willow/mesic forb	G3	S3			
Salix geyeriana-Salix monticola/ Calamagrostis canadensis	montane willow carrs	G3	S3			
Salix geyeriana/ Calamagrostis canadensis	montane willow carr	GU?	SU?			
Salix geyeriana/ Carex utriculata	Geyer's willow/beaked sedge	G5	S2			
Salix monticola/ Calamagrostis canadensis	montane willow carr	GU	SU			
Salix planifolia/ Calamagrostis canadensis-Carex aquatilis	montane willow carrs	G2G4	S2S4			
Salix planifolia/ Caltha leptosepala	montane willow carr	GU	SU			
Salix planifolia/ Carex aquatilis	montane willow carrs	GU	S?			
Scirpus tabernaemontani-Scirpus acutus	great plains marshes	GU	S?			
Stipa comata - east	great plains mixed grass prairies	G2	S2			
Stipa comata- Bouteloua gracilis	montane grasslands	G5	S2S3			
Typha latifolia	great plains marshes	G5	S3?			
Plants						
Acorus calamus	sweet flag	G5	S1			
Agastache foeniculum	lavender hyssop	G4G5	S1			
Aletes humilis	Larimer aletes	G2G3	S2S3			FS
Aquilegia saximontana	Rocky Mountain columbine	G3	S3			
Aristida basiramea	forktip three-awn	G5	S1			
Botrychium echo	reflected moonwort	G2	S2			FS
Botrychium hesperium	western moonwort	G3	S2			
Botrychium lanceolatum var *lanceolatum*	lance-leaved moonwort	G5T4	S2			
Botrychium lunaria	moonwort	G5	S2			
Botrychium minganense	Mingan moonwort	G4	SRF			
Botrychium multifidum	leathery grape fern	G5	S1			
Carex diandra		G5	S1			
Carex lasiocarpa	slender sedge	G5	S1			
Carex limosa	mud sedge	G5	S2			
Carex livida	livid sedge	G5	S1			FS
Carex peckii	Peck sedge	G4G5	S1?			
Carex saximontana	Rocky Mountain sedge	G5	S1			
Chionophila jamesii *	Rocky Mountain snowlover	G4?	S3S4			
Comarum palustre	marsh cinquefoil	G5	S1S2			
Cypripedium fasciculatum	purple lady's-slipper	G4	S3			FS
Cypripedium pubescens	yellow lady's-slipper	G5	S2			
Draba fladnizensis	arctic draba	G4	S2S3			
Draba grayana	Gray's peak whitlow-grass	G2	S2			
Draba streptobrachia	Colorado divide whitlow-grass	G3	S3			

Scientific Name	Common Name	Global Rank	State Rank	Fed. Status	State Status	Fed. Sens.
Dryopteris expansa	spreading wood fern	G5	S1			
Eustoma russellianum	showy prairie gentian	G5	S3			
Festuca hallii	hall fescue	G3	S1			FS
Gaura neomexicana ssp. *coloradensis*	Colorado butterfly plant	G4T2	S1	C		FS
Isoetes echinospora	spiny-spored quillwort	G5	S2			
Juncus tweedyi	Tweedy rush	G3	S1?			
Juncus vaseyi	Vasey bulrush	G3G5	S1			
Liatris ligulistylis	gay-feather	G5?	S1S2			
Lilium philadelphicum	wood lily	G5	S3			
Listera borealis	northern twayblade	G4	S2			
Listera convallarioides	broad-leaved twayblade	G5	S2			
Mimulus gemmiparus	Weber monkey-flower	G2	S2			FS
Parnassia kotzebuei	Kotzebue grass-of-parnassus	G4	S1			
Pellaea atropurpurea	purple cliff-brake	G5	S2S3			
Penstemon laricifolius ssp. *exilifolius*	larch-leaf beardtongue	G4T3	S1			
Physaria bellii	Bell's twinpod	G2	S2			
Polypodium hesperium	western polypody	G5	S1S2			
Potentilla ambigens	southern Rocky Mountain cinquefoil	G3	S1S2			
Potentilla effusa var. *rupincola*	Rocky Mountain cinquefoil	G3G5T2	S2			FS
Rhododendron albiflorum	white-flowered azalea	G4	S2			
Salix candida	hoary or silver willow	G5	S2			
Salix serissima	autumn willow	G4	S1			FS
Sisyrinchium pallidum	pale blue-eyed grass	G2G3	S2			
Solidago ptarmicoides	prairie goldenrod	G5	S2S3			
Spiranthes diluvialis	Ute ladies' tresses orchid	G2	S2	LT		
Subularia aquatica	water awlwort	G5	S1			
Viola selkirkii	Selkirk violet	G5?	SH			FS

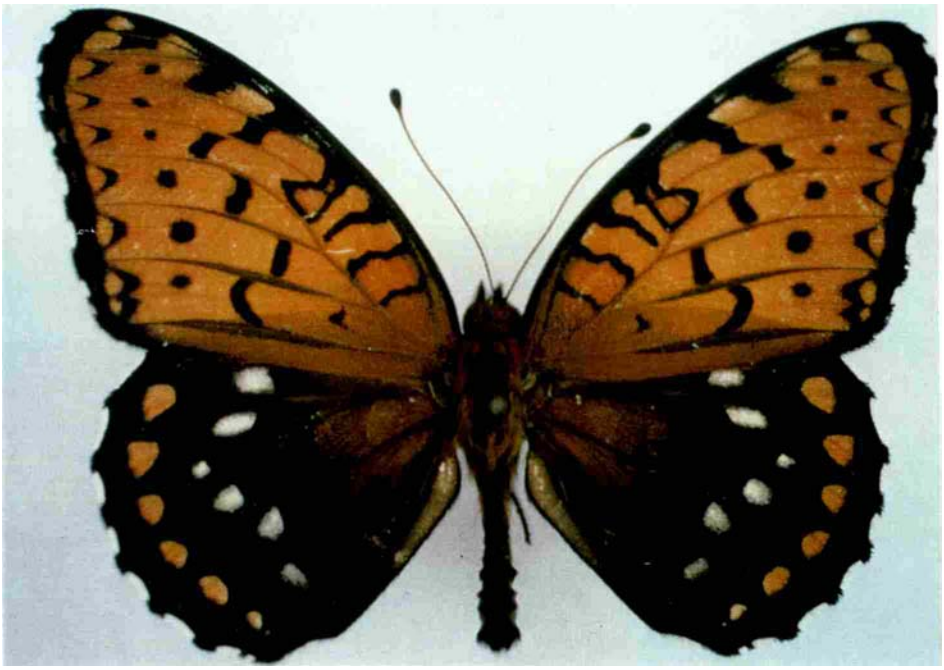


Figure 3. Examples of imperiled animals which occur in Larimer County. Top: Mountain plover (*Charadrius montanus*) - photo courtesy of Fritz Knopf. Bottom: Regal fritillary (*Speyeria idalia*).

RESULTS: LARIMER COUNTY SITES WITH NATURAL HERITAGE SIGNIFICANCE

The Colorado Natural Heritage Program (CNHP) identified seventy-three (73) conservation sites in Larimer County. These sites are described in this section. The importance of conservation sites is determined using Natural Heritage Methodology. This Methodology is implemented on three different levels. Taken together, these three levels allow a comprehensive, scientific approach to prioritizing conservation efforts.

On the first level, **elements** of natural diversity (rare or imperiled plants, animals, and significant natural communities) are ranked[1] according to their rarity and/or degree of imperilment. The relative rarity of the various elements is based upon the scientific information known about the element and the number of population currently known. As new information is acquired, element ranks can be modified.

The second level of the Heritage Methodology is the ranking of populations or **occurrences** of a particular element. It is frequently impossible to protect all populations of a particular plant, animal, or natural community. Therefore, the CNHP evaluates the relative quality of all known occurrences of an elements so that conservation efforts can be focused on the largest, most viable populations.

On the third level CNHP delineates potential **conservation sites** that contain elements occurrences. These sites are then ranked according to their significance, enabling planners to determine which sites deserve the most attention. The rank is called the biodiversity significance rank (B-rank). The highest ranking sites (B1 sites) contain the rarest elements and/or the highest quality occurrences. The lowest ranking sites (B5 sites) typically contain an element that is rare in Colorado but common elsewhere, or a low quality occurrence of an element. "Macro" sites and "Mega" sites are sites that include several standard sites that are connected by landscape position or ecological processes. Locations of all sites are shown on the oversized map "Potential Conservation Sites in Larimer County" (folded inside back cover).

The elements contained in some of the conservation sites described below are globally rare (e.g., the Bell's twinpod mustard - *Physaria bellii*) and their conservation is of global importance. In other words, **the protection of these species and natural communities in Larimer County will have major consequences across their ranges**. Other sites are significant for their contribution to the Colorado's natural heritage. Some sites are relative "hotspots," containing many elements within a relatively large and intact habitat complex. The Laramie Foothills site, for example, supports the globally rare Bell's twinpod, several other rare plants, and several significant plant communities.

CNHP in no way suggests that other areas of the County not included in conservation sites are not important for conserving the County's natural values. The sites presented here represent the highest land protection priorities for the County based on known element occurrences. Ideally, these sites could serve as core natural areas that are surrounded by adequate buffer zones and connected to other core sites with well designed corridors. It will be necessary to adequately plan and protect lands beyond those recommended here if these highly significant sites are to retain their full natural value. Furthermore, other sites may be worthy of conservation actions based on other values such as game species, aesthetics, or recreation.

[1] See the section on Natural Heritage Methodology for a detailed explanation of the Heritage Program ranking system.

The sites are presented below in six sections. The first section contains sites of very high natural heritage significance (B-rank = B2). These are the most important conservation sites in Larimer County. Loss of these sites could imperil an entire species or plant community. Where possible, conservation resources should be directed to them before all others. The second section contains sites of high significance (B-rank = B3). These sites are generally only slightly less important than the B2 sites. They are also a high conservation priority.

The next two sections contain sites of moderate and low significance (B-ranks = B4 and B5) which were identified during the riparian and wetland survey. Although lower priorities than the B2 and B3 sites, these sites are the best examples of the Larimer County wetland types not found in the first two groups. A wetland conservation program seeking to protect the best examples of all wetland types in the county would target these sites.

Finally, the last two sections contain moderate and low priority sites that are both wetland and non-wetland sites. A conservation program that included all of these moderate and low priority sites could be considered very thorough, especially if it is combined with a system of buffers and corridors as described above.

The last two groups of sites were given low priority during the inventory phase of this project. In most cases there was not sufficient time to visit these sites. Therefore, information about these sites was retrieved from CNHP's Biological and Conservation Data System (BCD). As a result, many fields in the last two groups of site profiles are not complete.

Site Profile Explanation

This following explains the fields contained in the site profiles.

SITE NAME: Centered at the top of the site profile, the site is generally named by CNHP after a prominent landscape feature. "(R/W)" after the name signifies that the site is a riparian and/or wetland site.

SIZE: The approximate acreage included within the preliminary conservation planning boundary for the site.

BIODIVERSITY RANK (B-rank): The overall significance of the site in terms of rarity of the natural heritage resources and the quality (health, abundance, etc.) of their occurrences. As explained above, these ranks range from B1 (Outstanding Significance) to B5 (Low Significance). In general the B-ranks should be used to prioritize protection efforts. The element which drives the biodiversity rank is noted but multiple elements often occur in a single site.

PROTECTION URGENCY RANK (P-rank): An estimate of the time frame in which conservation protection must occur. This rank generally refers to the need for a major change of protective status (e.g., ownership or designation as a natural area). The ranks range from P1 (immediate urgency; protection must occur within a one year time frame or the element will be lost) to P5 (no known urgency). For a better understanding of protection urgency, refer to the section on protection considerations toward the end of the site profile. Protection urgency ranks are further explained in the section on Natural Heritage Methodology.

MANAGEMENT URGENCY RANK (M-rank): The time frame in which a change in management of the element or site must occur. Using best scientific estimates, this rank refers to the need for management in contrast to protection (e.g., increased fire frequency, decreased herbivory, weed control, etc.). The ranks range from M1 (immediate urgency, within one year) to M5 (no known urgency). For a better understanding of management urgency, refer to the section on management considerations toward the end of the site profile. Management urgency ranks are further explained in the section on Natural Heritage Methodology.

LOCATION: General location, followed by the USGS 7.5' quadrangles and the township, range, and section that include the Conservation Site.

GENERAL DESCRIPTION: A brief narrative picture of the topography, vegetation, and current use of the conservation site. Common names are used along with the scientific names.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: A synopsis of the rare species and significant natural communities that occur on the conservation site. See the section on Natural Heritage Methodology for a description of element and element occurrence ranks.

CURRENT STATUS: A summary of the ownership, degree of protection currently afforded the conservation site, and threats to the site or natural heritage resources as determined to date.

BOUNDARY JUSTIFICATION: The preliminary conservation planning boundary delineated in this report, which includes all known occurrences of natural heritage resources and, in some cases, adjacent lands required for their protection.

PROTECTION CONSIDERATIONS: A summary of major land ownership issues that may affect the site and the element on the site.

MANAGEMENT CONSIDERATIONS: A summary of site management issues that may affect the long-term viability of the site.

Sites Ranked "B2" - Very High Significance

Cap Rock Preserve

SIZE: Approximately 160 acres.

BIODIVERSITY RANK: B2 - Very high significance. An excellent occurrence of a globally imperiled plants species.

PROTECTION URGENCY RANK: P4 - No threat known for foreseeable future.

MANAGEMENT URGENCY RANK: M4 - Management to control tree encroachment (possibly prescibed fires) may be needed in the future to maintain the current quality of the element occurrences.

LOCATION: Approximately 6 miles west of Virginia Dale. Cherokee Park Quadrangle. Township 11 North, Range 72 West, sections 3 and 4.

GENERAL DESCRIPTION: The site is characterized by a steep canyon with vertical walls of blocky reddish granite. North-facing slopes are dominated by ponderosa pine (*Pinus ponderosa)*, Douglas fir (*Pseudotsuga menziesii)*, and mountain ninebark (*Physocarpus monogynus*). Slopes are dry and soils are formed in decomposed granitic gravel. South-facing slopes are more open with ponderosa pine, antelope bitterbrush (*Purshia tridentata)* and King's spikefescue (*Leucopoa kingii)*. The top of the canyon is weedy; cheatgrass (*Bromus tectorum*) and Kentucky bluegrass (*Poa pratensis)* are common.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: A large population of Larimer aletes *(Aletes humilis)* within the context of a high quality community is included in this site. Also within the boundaries is a small occurrence of Rocky Mountain cinquefoil *(Potentilla effusa* var. *rupincola)* in moderate condition, and a small occurrence of the state rare kittentail (*Besseya wyomingensis.* This location is unusual for Larimer aletes because plants are growing in pine duff and not on rocky outcrops. Plants here probably receive greater snowfall and moisture than other sites for Larimer aletes. Plants are more protected in the forest from wind, rock fall, etc. The site also includes the uncommon grass fern (*Asplenium septentrionale*).

Table 2. Natural Heritage Elements at the Cap Rock Preserve Site.							
Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Aletes humilis	Larimer aletes	A	G2G3	S2S3			FS
Potentilla effusa var. *rupincola*	Rocky Mountain cinquefoil	C	G3G5T2	S2			FS
Besseya wyomingensis	kittentail	C	G5	S1			
Asplenium septentrionale	grass fern	C	G5	S3S4			

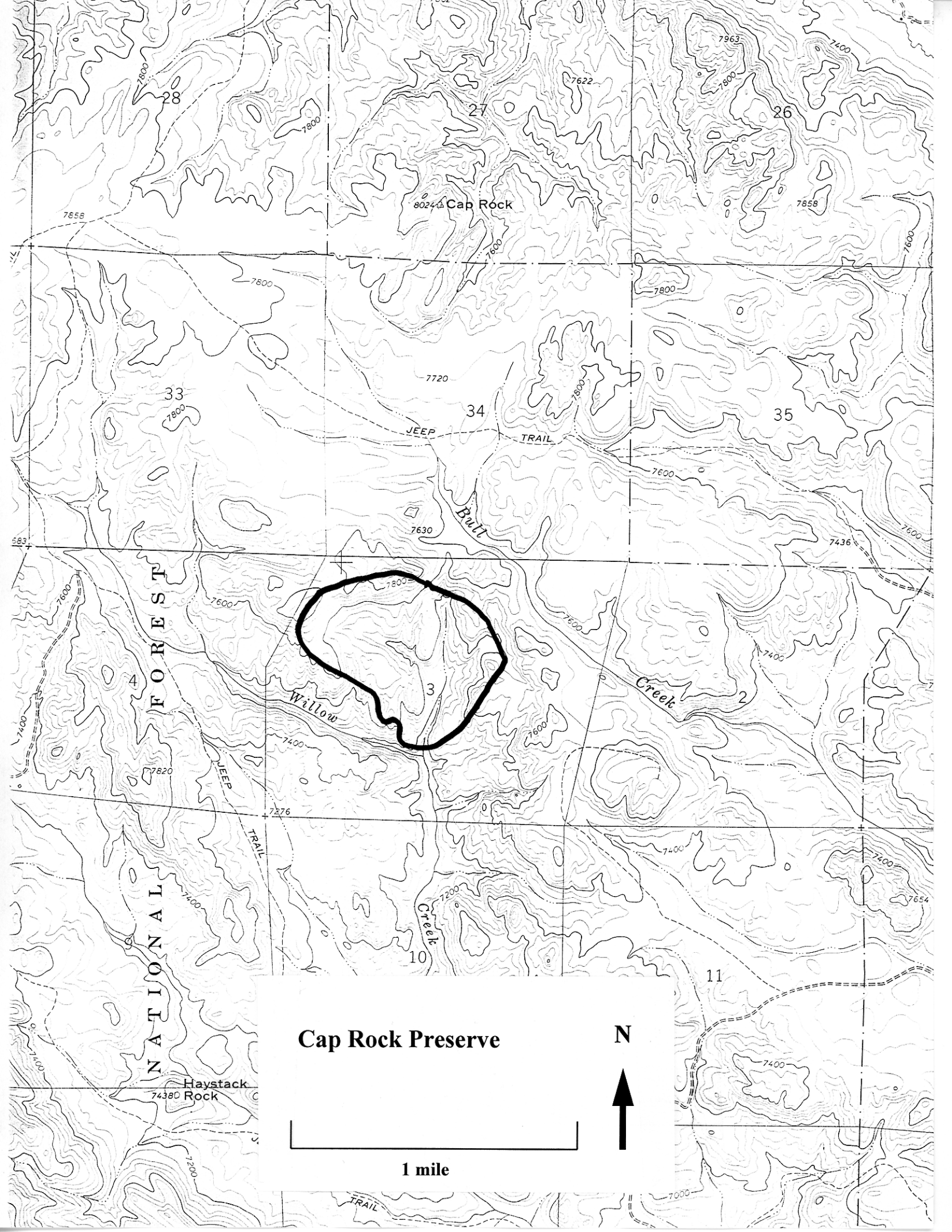
*EO = element occurrence

CURRENT STATUS: This site is owned by The Nature Conservancy and the threats are low.

BOUNDARY JUSTIFICATION: The boundary includes the occurrences of four rare plant species and a buffer to protect from direct disturbances.

PROTECTION CONSIDERATIONS: The occurrence is protected within the Cap Rock Preserve (owned by The Nature Conservancy). It is a remote location without trail access.

MANAGEMENT CONSIDERATIONS: Trampling of individual plants should be avoided. Falling pine branches are burying the Larimer aletes plants and killing them. Pre-settlement fire regimes may have naturally kept this from happening. Fire prescriptions will be required to maintain the site's quality. Cheatgrass (*Bromus tectorum)* and Kentucky bluegrass (*Poa pratensis)* occur at the top of the canyon and may need to be controlled.


Cap Rock Preserve
N
1 mile
8024 Cap Rock
JEEP TRAIL
Bull Creek
Willow Creek
NATIONAL FOREST
Haystack Rock
7438
28
27
26
33
34
35
4
3
2
10
11

Dale Creek

SIZE: Approximately 250 acres.

BIODIVERSITY RANK: B2 - Very high significance. An excellent occurrence of a globally imperiled plant species.

PROTECTION URGENCY RANK: P4 - No threat known for foreseeable future.

MANAGEMENT URGENCY RANK: M4 - Management may be needed in the future to maintain the current quality of the element occurrence.

LOCATION: Dale Creek drainage approximately 1.5 miles north of Halligan Reservoir. Virginia Dale Quadrangle. Township 11 North, Range 71 West, sections 16, 17, 20, and 21.

GENERAL DESCRIPTION: The Dale Creek drainage is surrounded by granite hills and vertical cliffs. The creek flows north to south and most of the surrounding slopes have east or west-facing aspects. Ponderosa pine (*Pinus ponderosa)* is sparse on the hillsides which are mostly dominated by mountain mahogany (*Cercocarpus montanus)*, golden current (*Ribes aureum)*, and skunkbush (*Rhus trilobata)*. The understory consists mainly of buckwheat (*Eriogonum umbellatum)*, pricklypear cactus (*Opuntia)*, fringed sage (*Artemisia frigida)*, mountain muhly (*Muhlenbergia montana)*, and hairy golden aster (*Heterotheca villosa)* often with much exposed bare rock. Large dramatic outcrops of Silver Plume granite are common.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: This site supports an occurrence of the Larimer aletes *(Aletes humilis)* on Silver Plume granite cliffs. This species is only known from Larimer and Boulder Counties which makes this excellent occurrence very important to conservation. The scenic values and the large, natural landscape surrounding this occurrence adds to its importance.

Table 4. Natural Heritage Elements at the Dale Creek Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Aletes humilis	Larimer aletes	A	G2G3	S2S3			FS

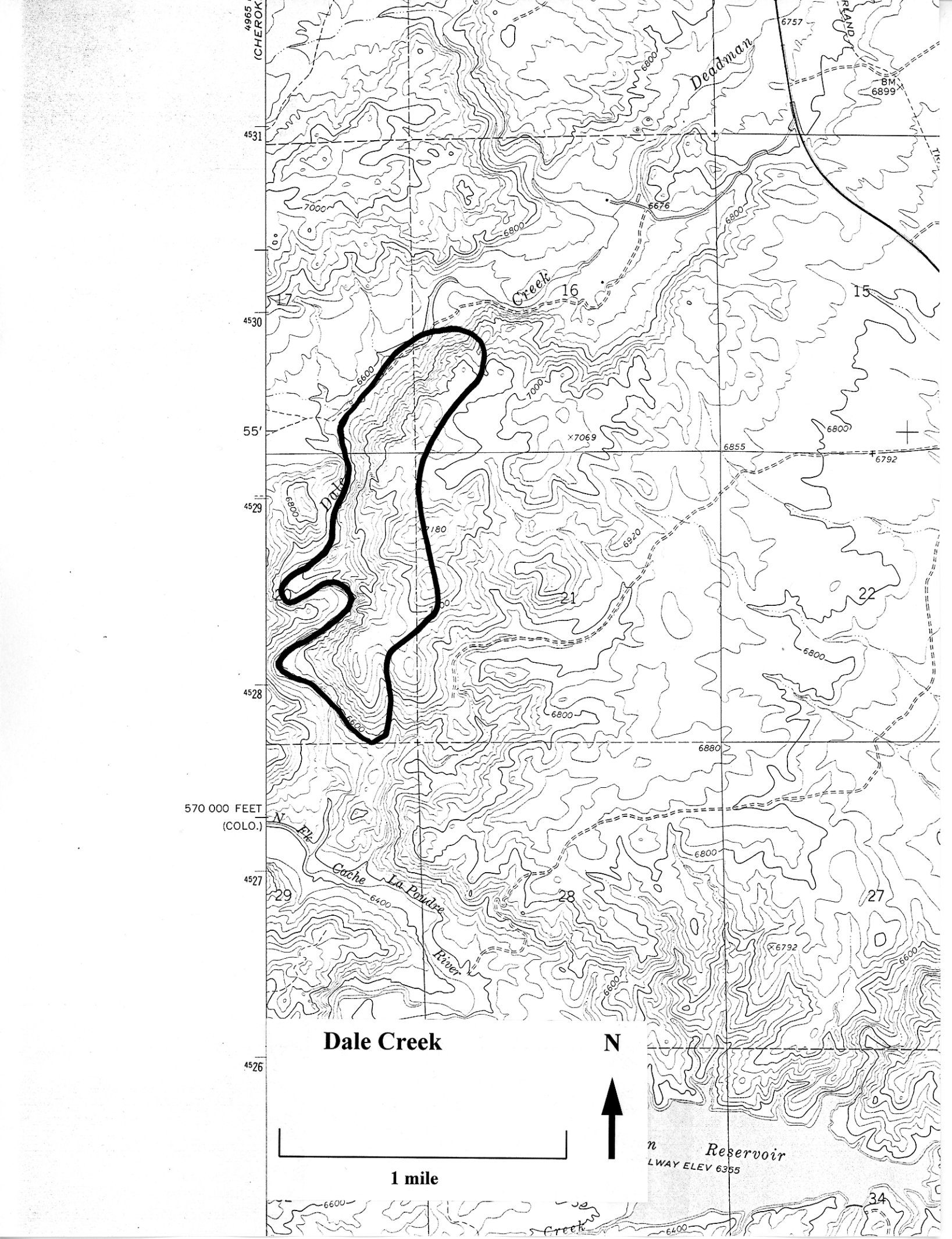
*EO = element occurrence

CURRENT STATUS: This site is privately owned.

BOUNDARY JUSTIFICATION: The boundary is drawn to protect the known occurrence and includes a buffer to protect against direct and indirect disturbances. The steep slopes on which the plant occurs offer some natural protection.

PROTECTION CONSIDERATIONS: The Nature Conservancy's Colorado Program is interested in buying land or securing a conservation easement for property around this site.

MANAGEMENT CONSIDERATIONS: Cheatgrass *(Bromus tectorum)* was found to be dense in areas within the site. Restoration of native riparian vegetation is needed. Grazing poses a threat to the condition of the surrounding riparian and upland plant communities. Planned expansion of Halligan Reservoir, which is downstream, may inundate habitat close to this site. Impacts from recreation or other activities associated with reservoirs should be considered if the reservoir is expanded.


Dale Creek
N
1 mile
Deadman
Creek
Dale
N. Fk.
Cache La Poulre
River
Reservoir
570 000 FEET
(COLO.)
4531
4530
4529
4528
4527
4526
55'
16
15
21
22
29
28
27
34
6757
6899
6676
7069
6855
6792
7180
6920
6880
6792
6600
6800
7000
6400

Deadman Creek Macrosite

SIZE: Approximately 41,000 acres

BIODIVERSITY RANK: B2 - Very high significance. An excellent occurrence of a globally imperiled plant.

PROTECTION URGENCY RANK: P2 - Threat expected within 5 years from encroaching development.

MANAGEMENT URGENCY RANK: M4 - Management of non-native plant species may be needed in the future to maintain the current quality of the element occurrences.

LOCATION: Approximately 7 miles northwest of Livermore, extending to the north to the Wyoming line and bounded on the south by the Cherokee Park Road. Cherokee Park , Haystack Gulch, Virginia Dale, Livermore Mountain, Livermore, and Table Mountain Quadrangles. Township 10 North Range 71 West, sections 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14; Township 10 North Range 70 West, sections 5, 6, 7, 8, 9, 17, 18, Township 11 North Range 71 West sections 1, 2, 3, 9-16, 20-29; Township 11 North Range 70 West sections 3-10, 15-19, 30, 31; Township 12 North Range 71 West sections 23-26, 35, 36; Township 12 North Range 70 West sections 19-22, 27-34.

INCLUSIVE SITES: This site is designated as a "macrosite" because it is large and contains multiple smaller standard sites which are interrelated. While these smaller site have been separated based on ecological factors such as breaks in the distribution of elements, the designation of the macrosite recognizes the importance and value of the larger system in the maintenance and long term viability of the smaller sites. Standard sites within the Deadman Creek Macrosite include Phantom Canyon and Dale Creek.

GENERAL DESCRIPTION: The site is mostly characterized by rolling grasslands. Scattered groves of ponderosa pine (*Pinus ponderosa*) occur on granitic outcrops (tors), and in small canyons where the rock is exposed. Numerous small streams drain the area. The plant communities within the riparian zones are very diverse and structurally intact but have been somewhat impacted by the invasion of non-native plant species. Elevations range from approximately 6000 feet to over 7400 feet.

The site is very scenic and wildlife is abundant. Antelope, elk, deer, bear, and mountains lions are commonly seen in the area, as are a variety of birds. Much of the site is utilized as range for livestock but low density residential development has taken place and will probably increase in the near future.

Highway 287 and one county road run through the site as do numerous gravel or two-track roads, pipelines and power lines.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: Included within the site is the Phantom Canyon site owned by The Nature Conservancy. This site supports a population of the Larimer aletes *(Aletes humilis)*, a plant in the parsley family. This plant is only known to occur

in Boulder and Larimer Counties. This occurrence is high quality. Also included is the Dale Creek site which also supports a high quality population of the Larimer aletes.

The mountain muhly-needle and thread grass (*Muhlenbergia montana-Stipa comata)* montane grassland is only known to occur in northern Colorado. Few occurrences of this plant community have been documented. This occurrence appears to be in good to fair condition.

The Rocky Mountain juniper/mountain mahogany (*Juniperus scopulorum/Cercocarpus montanus)* foothills juniper woodland has only been documented from the Front Range of Colorado. The occurrence at this site is one of the best ones documented but other high quality occurrences are expected to occur along the Colorado Front Range.

Two occurrences of the mountain mahogany/needle and thread grass (*Cercocarpus montanus/Stipa comata)* foothills shrubland occur within the site. Both of these are considered low quality because of the small size and invasion of non-native species.

The needle and thread grass-blue gramma (*Stipa comata-Bouteloua gracilis)* mixed grass prairie occurs on the rolling hills in the area and is represented in its best condition just to the east to the east of The Nature Conservancy's Phantom Canyon Preserve. This plant association is reported from Alberta and Saskatchewan south through North Dakota, Montana, South Dakota, Wyoming, and Colorado, but large examples in good condition are thought to be uncommon. The occurrence at the Deadman Creek site is one of the largest, good condition examples known in Colorado.

Table 5. Natural Heritage Elements at the Deadman Creek Macrosite.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Aletes humilis	Larimer aletes	A	G2G3	S2			FS
Aletes humilis	Larimer aletes	A	G2G3	S2			FS
Muhlenbergia montana-Stipa comata	Montane grassland	BC	G2	S2			
Cercocarpus montanus/ Stipa comata	Foothills shrubland	C	G2	S2			
Cercocarpus montanus/ Stipa comata	Foothills shrubland	CD	G2	S2			
Juniperus scopulorum/ Cercocarpus montanus	Foothills juniper woodland	B	G2	S2			
Stipa comata-Bouteloua gracilis	Mixed grass prairie	A	G5	S2S3			
Aquila chrysaetos	Golden eagle		G5	S3S4B SZN			
Myotis thysanodes pahasapensis	Fringed myotis		G5	S3S4			

*EO = element occurrence

CURRENT STATUS: Much of the site is privately owned. Some parcels are for sale and ranchettes have been developed in the area. The Nature Conservancy owns part of the site (the Phantom Canyon Preserve) and holds a conservation easement on the large grassland to the northeast of Phantom Canyon encompassing the occurrence of the Larimer aletes and the highest quality part of the needle and thread grass-blue gramma grassland.

BOUNDARY JUSTIFICATION: The boundary of this site is thought to represent an intact ecological system where natural ecological processes still function or can be restored. The boundary to the west represents the transition to more dense woodlands and forest, areas that are ecologically similar to much of the U. S. Forest Service land in the county. The boundary to the east represents the point on the landscape where sedimentary rock is exposed creating a landscape which is dominated more by shrublands and grasslands and less by ponderosa pine.

PROTECTION CONSIDERATIONS: The area is under heavy development pressures. Numerous homes have been built in the area and many parcels are going on the market. Densities are not expected to be high and landowner covenants may help protect the natural character of the land but even limited development will probably have some impact on the natural communities and the functioning of the natural ecological processes (especially animal migration and fire).

MANAGEMENT CONSIDERATIONS: Cheatgrass (*Bromus tectorum*) and Japanese brome (*Bromus japonicus)* are common on the ridges with the mountain mahogany and in swales on the grasslands. Further increase of non-native species may decrease the biodiversity significance of the site by altering the native floral and faunal species composition (Bock and Bock 1988). Grazing or fire management could be used as a tool to reduce the dominance of these species and increase the proportion of native species (see discussion of the problems of non-native species). The occurrences of the Larimer aletes do not appear to be threatened at this time and are being monitored by The Nature Conservancy.

Deadman Creek Macrosite

N

1 mile

ALBANY CO

LARAMIE CO

Table Mtn

Little Bald Mtn

Little Twins

Virginia Dale

Sheep Mountain

Red Mtn

Red Nose

Halligan Reservoir (N. Poudre Res No 16)

Livermore Cem

Deadman Butte

Table Rock

Graveyard Ridge

Gaging Sta

OVERLAND TRAIL

PIPELINE

GRANITE CANYON

RED MOUNTAIN ROAD

Lovers Loop

Virginia Dale Sch

Deadman Creek

Rabbit Ear Creek

Dixon Creek

SIZE: Approximately 625 acres.

BIODIVERSITY RANK: B2 - Very high significance. A good occurrence of a globally imperiled plant species.

PROTECTION URGENCY RANK: P2 - Threat expected within 5 years.

MANAGEMENT URGENCY RANK: M3 - Management may be needed within 5 years to maintain the current quality of the element occurrences.

LOCATION: Shale hogback and adjacent shrublands and grassland east of Dixon Reservoir and south to County Road 58E. Horsetooth Reservoir Quadrangle. Township 7 North, Range 69 West, sections 20,28,29,32,and 33; Township 6 North, Range 69 West, section 4 and 9.

GENERAL DESCRIPTION: The primary feature of this site is a Niobrara Formation shale hogback. This ridge runs north-south at this location for approximately 3 miles. Road 38E bisects the ridge; there are a few houses on the north side of 38E and there is a new housing development to the south. City of Fort Collins Open Space land, contained within the site, supports an open mountain mahogany *(Cercocarpus montanus)* stand on the top of the ridge, grasses dominate down the slope to the east. There are many trails used by hikers and mountain bikers which dissect the Open Space in many places. The valley south of Dixon Reservoir supports an extensive prairie dog colony; there is another prairie dog colony at the southern tip of the site.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: This site includes two large occurrences of Bell's twinpod *(Physaria bellii)* and one smaller one. This species is a Colorado endemic and is only known to occur on shale hogbacks of the Front Range from Jefferson County north to the Wyoming border. A few occurrences have been found on red sandstone.

Table 6. Natural Heritage Elements at the Dixon Creek Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Physaria bellii	Bell's twinpod	B	G2	S2			
Physaria bellii	Bell's twinpod	CD	G2	S2			
Physaria bellii	Bell's twinpod	C	G2	S2			

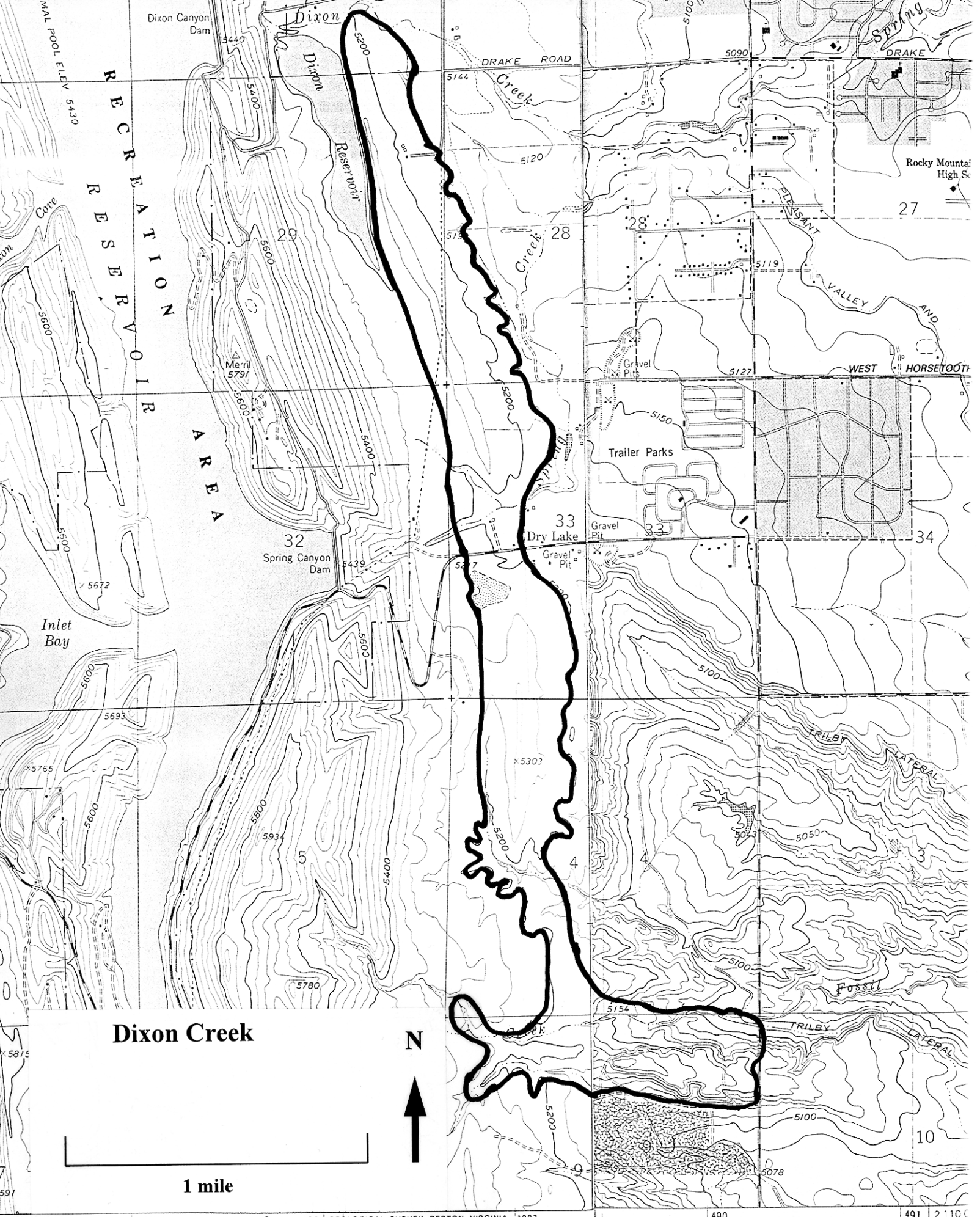
*EO = element occurrence

CURRENT STATUS: The City of Fort Collins Open Space owns most of this site and the rest is privately owned. Recreational use threatens parts of the occurrences managed by the City. Residential development threatens the areas (one occurrence) on private land.

BOUNDARY JUSTIFICATION: Includes three occurrences and the adjacent slopes. The site as drawn encompasses some land already disturbed by residential development. This disturbed land has little conservation value; it is included in the site because of the difficulty of delineating small parcels on the maps. Little buffer is provided because this is a relatively weed-resistant habitat, but little is known about the pollination biology of the Bell's twinpod.

PROTECTION CONSIDERATIONS: Development, associated landscaping and road development of the south part of this ridge are destroying much of the habitat for Bell's twinpod. The City of Fort Collins is working to manage for the Bell's twinpod occurrences on open space lands. The Cathy Fromme Prairie (City of Ft. Collins Open Space) management provisions state that there will be no more encroachment from developments of Westridge Ranch and Taft Canyon subdivisions.

MANAGEMENT CONSIDERATIONS: Recreational use is a threat to Bell's twinpod in the Dixon Reservoir Open Space through trampling and the increase of non-native species. The Cathy Fromme Prairie is closed to recreational use until a site management plan is completed. Hiking and biking may cause a threat in the future due to trampling and increases in erosion if careful design of the infrastructure is not accomplished. Notification and education of the homeowners within the housing development may prove useful in the plants protection. Cheatgrass *(Bromus tectorum),* smooth brome *(Bromus inermis),* and hound's tongue *(Cynoglossum officinale)* are spreading in the area.


Dixon Creek
N
1 mile
RECREATION RESERVOIR AREA
Dixon Canyon Dam
Dixon Reservoir
Dixon Creek
DRAKE ROAD
Spring Creek
Rocky Mountai
High S
PLEASANT VALLEY AND
WEST HORSETOOTH
Trailer Parks
Gravel Pit
Merril
5791
Spring Canyon Dam
5439
Dry Lake
Inlet Bay
TRILBY LATERAL
Fossil
5078
487000m E
105°07'30"
490
491
INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1992
ROAD CLASSIFICATION
Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA
Topography by photogrammetric methods from aerial

Grayback Ridge

SIZE: Approximately 21,000 acres

BIODIVERSITY RANK: B2 - Very high significance. One of the best occurrences of a community element.

PROTECTION URGENCY RANK: P2 - Threat expected within 5 years from encroaching residential development.

MANAGEMENT URGENCY RANK: M4 - Management of non-native vegetation may be needed in the future to maintain the current quality of the element occurrences.

LOCATION: North of the town of Livermore. Livermore and Table Mountain Quadrangles. Township 10 North, Range 69 West, sections 3, 4, 5, 6, 7, 8, 9, 18, 19, 29, 30, 31, 32, 33; Township 10 North, Range 70 West, sections 1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 14, 15, 16, 17, 20, 21, 22, 23, 24, 25, 26; Township 11 North, Range 70 West sections 2, 3, 10, 11, 14, 15, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 32, 33, 34, 35, 36.

GENERAL DESCRIPTION: The site is characterized by rolling grasslands and rocky exposures that are dominated by mountain mahogany (*Cercocarpus montanus)* shrublands. Numerous streams drain the area and several flow the entire year, often because of water from numerous springs in the area. Elevations range from approximately 5900 feet at the southern end of the site to 7200 feet at the northern end.

Most of the grasslands occur on soils derived from numerous sedimentary rocks. The grasslands are dominated by species such as needle and thread grass (*Stipa comata*), western wheatgrass (*Pascopyrum smithii*), and blue gramma (*Bouteloua gracilis*). Rocky ridges and slopes are dominated by mountain mahogany plant communities with scattered piñon (*Pinus edulis)* and ponderosa pine (*Pinus ponderosa)*. Riparian areas often contain cottonwood trees (*Populus* spp.) and several species of willow (*Salix* spp.) in the overstory and mesic grasses and sedges in the understory. Many non-native plant species occur in these riparian areas which are somewhat degraded by heavy livestock use.

Several prominent landmarks occur on the site and are formed from sedimentary substrates including Steamboat Rock, Red Nose, Red Mountain, and Grayback Ridge. As one moves west and north the landscape begins to transform to a more montane character. Ponderosa pine and Rocky Mountain juniper (*Juniperus scopulorum)* become more common.

Numerous teepee rings and historic buffalo wallows are said to occur on the site. The site is very scenic and wildlife are abundant including pronghorn and raptors. Several prairie dog towns were observed but only one was active during the summer of 1996.

NATURAL HERITAGE SIGNIFICANCE: The mountain mahogany/New Mexico feathergrass (*Cercocarpus montanus/Stipa neomexicana*) foothills shrubland was first documented from this area in 1994 and is globally rare. The occurrence at this site is the best known example of this plant community. It is large, relatively undisturbed, and occurs in a natural mosaic with other plant communities.

The mountain mahogany/Scribner's needlegrass (*Cercocarpus montanus/Stipa scribneri)* foothills shrubland appears to be relatively uncommon but its status has not been determined to date. The occurrence at this site is in good condition, and although still fairly small, is one of the largest seen in Larimer County.

This site supports a wide variety of plant communities which commonly occur along the Front Range. One of the highest values of the site is that these communities occur in a natural mosaic and are connected to other relatively natural areas. This may provide the opportunity for more naturally functioning ecological processes (plant and animal migration, fire, herbivory).

Table 7. Natural Heritage Elements at the Grayback Ridge Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Cercocarpus montanus/Stipa neomexicana	Foothills shrubland	A	G2G3	S2S3			
Cercocarpus montanus/Stipa scribneri	Foothills shrubland	B	GU	SU			
Dolichonyx oryzivorus	Bobolink	C	G5	S3B SZN			

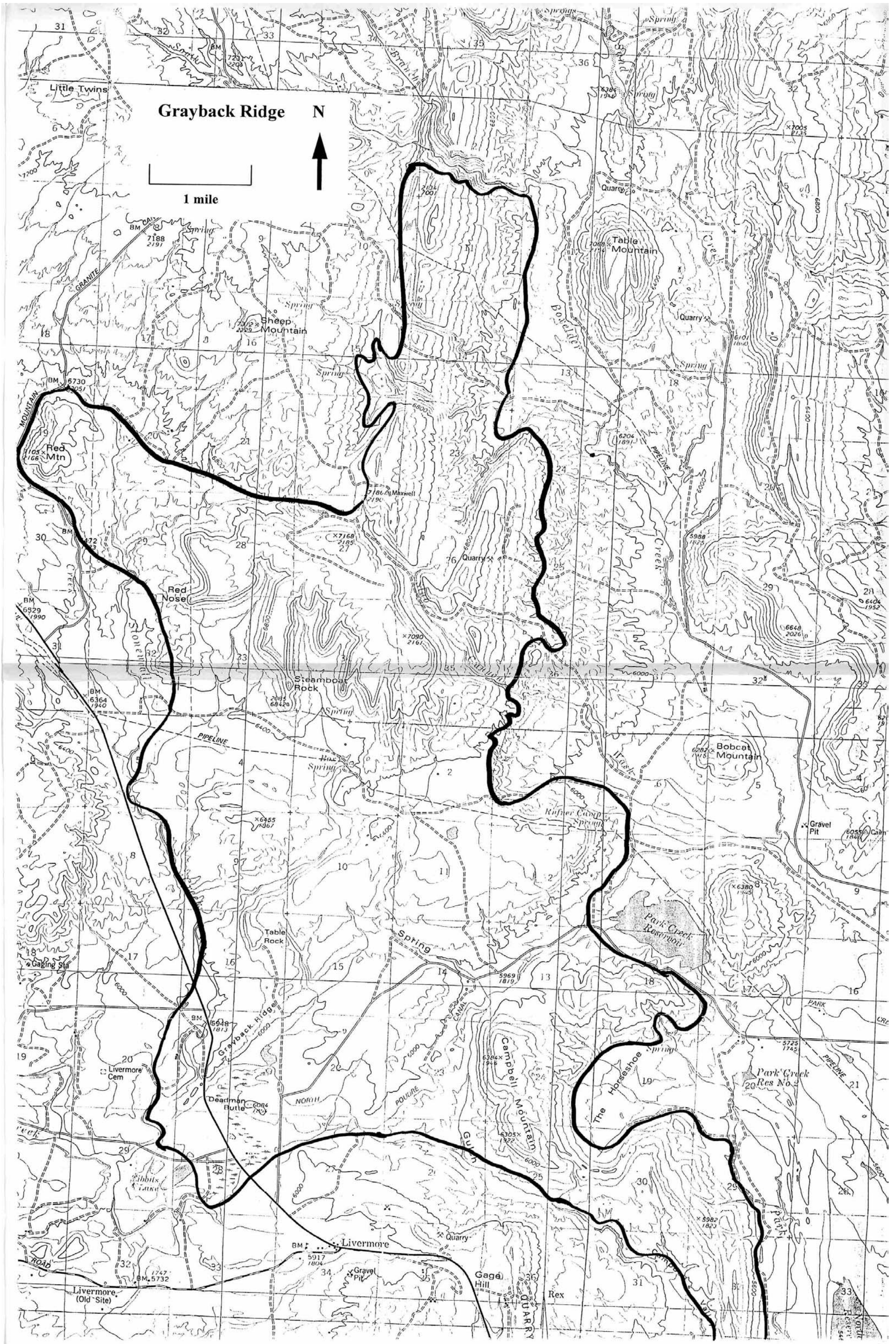
*EO = element occurrence

CURRENT STATUS: The majority of the site is privately owned and part of several large ranches. The Nature Conservancy is currently attempting to purchase the Roberts Ranch which encompasses much of the south end of the site. Several State Land Board parcels occur within the site.

BOUNDARY JUSTIFICATION: The boundary is intended to protect the occurrences and provide a buffer which will allow natural ecological processes such as fire, grazing, and wildlife migration to occur. The boundary encompasses most of a continuous hogback and associated outcrops in the areas.

PROTECTION CONSIDERATIONS: The area is under increasing development pressures. Numerous ranchette homes have been built in the area and many parcels are going on the market.

MANAGEMENT CONSIDERATIONS: Current management has allowed the plant communities to survive and will generally not degrade the occurrences but a major increase in grazing pressure may impact these plant communities. Numerous non-native species are common in the riparian areas and may need to be controlled. The springs and riparian areas would benefit from a rest-rotation grazing regime. The non-native species toadflax (*Linaria dalmatica)* was observed in small patches within the site and may continue to spread if not controlled. Further increase of non-native species may decrease the biodiversity significance of the site by altering the native floral and faunal species composition (Bock and Bock 1988).


Grayback Ridge
N
1 mile
Little Twins
Table Mountain
Quarry
Sheep Mountain
GRANITE
Red Mtn
Red Nose
Steamboat Rock
Table Rock
Bobcat Mountain
Gravel Pit
Gaging Sta
Livermore
Livermore (Old Site)
Gage Hill
Rex
Campbell Mountain
The Horseshoe
Park Creek Reservoir
Park Creek Res No. 2
Deadman Butte
Livermore Cem
Maxwell
Graybeck Ridge
PIPELINE
Spring
Quarry
ROAD

Haystack Rock

SIZE: Approximately 90 acres.

BIODIVERSITY RANK: B2 - Very high significance. A good quality occurrence of a globally imperiled plant species.

PROTECTION URGENCY RANK: P3 - Definable threat but not within the next 5 years.

MANAGEMENT URGENCY RANK: M4 - Management of recreational activities may be needed in the future to maintain the current quality of the element occurrences.

LOCATION: 1 mile east of Haystack Rock on a promontory locally called Rattlesnake Rock. Cherokee Park Quadrangle. Township 11 North, Range 72 West, sections 10,11, and 15.

GENERAL DESCRIPTION: The site is an outcrop of Silver Plume granite in a foothills ponderosa pine (*Pinus ponderosa*) forest. Larimer aletes *(Aletes humilis)* grows on and around the rock outcrops.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: A good occurrence of a globally imperiled plant species.

Table 8. Natural Heritage Elements at the Haystack Rock Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Aletes humilis	Larimer aletes	B	G2G3	S2S3			FS

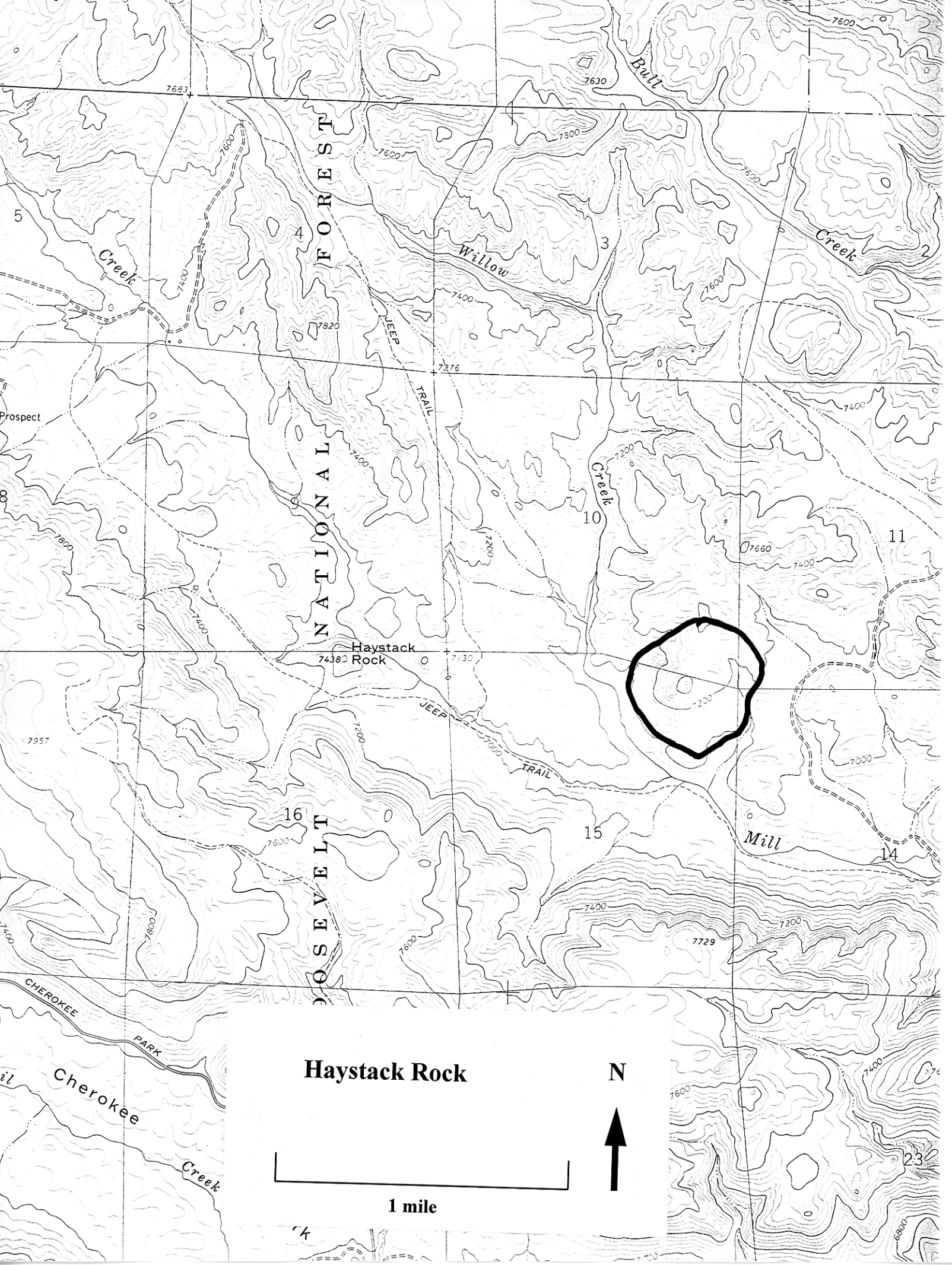
*EO = element occurrence

CURRENT STATUS: US Forest Service and multiple private individuals own this site. The threats currently appear to be low, but could become more prominent in the future with increases in residential developments, recreational uses, and/or livestock grazing.

BOUNDARY JUSTIFICATION: The boundary includes the occurrence and some downslope buffer to protect from direct disturbances.

PROTECTION CONSIDERATIONS: Seek management agreement with Forest Service and adjacent landowners to assure long-term protection of the Larimer aletes at this site.

MANAGEMENT CONSIDERATIONS: Concerns include road building for right-of-way access and trespass grazing (Bustos 1995). Residential development is increasing in this area. These activities could decrease the overall quality and condition of this site by fragmenting the occurrence and/or introducing non-native plant species.


Haystack Rock
N
1 mile
Haystack Rock
7438
Prospect
Willow Creek
Bull Creek
Cherokee Park
Cherokee Creek
Mill
JEEP TRAIL
JEEP TRAIL
ROOSEVELT NATIONAL FOREST
5
4
3
2
8
10
11
16
15
14
23

Horsetooth Park

SIZE: Approximately 670 acres

BIODIVERSITY RANK: B2 - Very high significance. A good quality occurrence of a globally imperiled element.

PROTECTION URGENCY RANK: P4 - No threat known for foreseeable future.

MANAGEMENT URGENCY RANK: M4 - Management of recreational activities may be needed in the future to maintain the current quality of the element occurrences.

LOCATION: In and around Horsetooth Mountain Park west of Horsetooth Reservoir. Horsetooth Reservoir Quadrangle. Township 7 North, Range 70 West, sections 25, 35, 36; Township 7 North, Range 69 West, section 31.

GENERAL DESCRIPTION: The site occurs on the ridges just southeast of Horsetooth Mountain, west of Horsetooth Reservoir. Lower slopes are composed of sedimentary sandstones which give way to granitic formations as elevation increases. The elevations at the site ranges from 5600 feet to 7200 at Horsetooth Mountain.

The vegetation is dominated by mountain mahogany (*Cercocarpus montanus*) shrublands and small grassland openings with ponderosa pine (*Pinus ponderosa*) woodlands higher on the slopes.

Residential development has occurred along the lower boundaries of the site. Numerous picnic grounds and recreational trails (hiking and mountain biking) exist in the park.

NATURAL HERITAGE SIGNIFICANCE: This site supports a colony of the imperiled butterfly hop-feeding azure (*Celastrina* sp1). This species is only known to occur on the Colorado Front Range from Douglas County north to Larimer County. This is a good occurrence which has been persistent since at least the 1980's.

The site also supports a good occurrence of the mottled dusky wing butterfly (*Erynnis martialis*) which is globally common but rare to uncommon in Colorado.

Several other elements are documented from the area but precise locations are not known. These include Schryver's elfin butterfly (*Callophrys mossii schryveri*), prairie goldenrod (*Solidago ptarmicoides = Unamia alba*), and the forktip three-awn grass (*Aristida basiramea*). The site includes habitat for, and may protect these species.

Table 9. Natural Heritage Elements at the Horsetooth Park Site.							
Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Celastrina sp.1	Hop feeding azure butterfly	B	G2	S2			
Erynnis martialis	mottled duskywing butterfly	B	G4	S2S3			

*EO = element occurrence

CURRENT STATUS: Most of the site is part of the Horsetooth Mountain Park owned by Larimer County. Small parcels of private land occur in the southeastern and southwestern parts of the site.

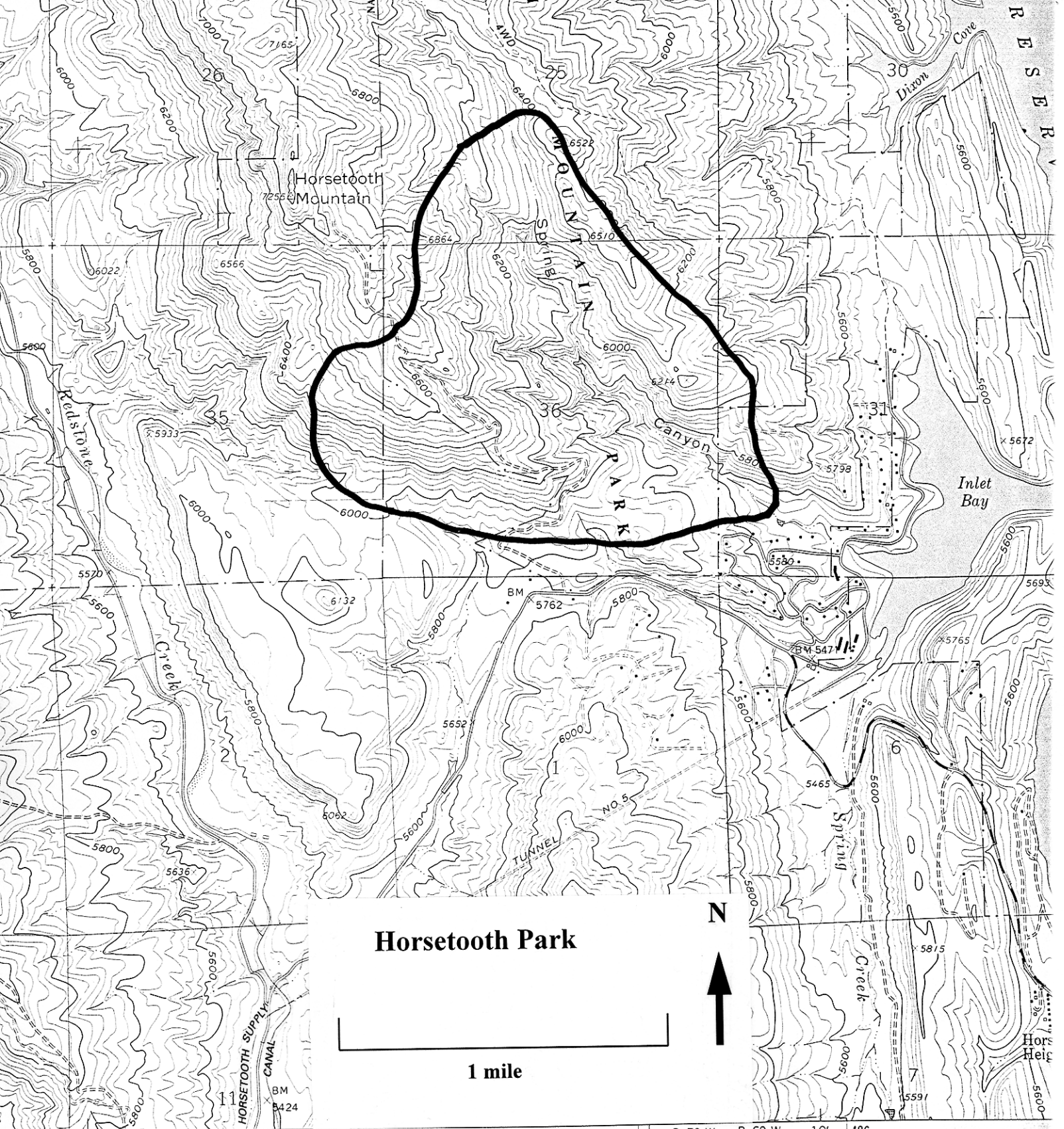
BOUNDARY JUSTIFICATION: The boundary is intended to protect the occurrences from direct disturbance and provide a small buffer of several hundred meters. This includes most of Spring Canyon for the hop-feeding azure and much of the mountain mahogany dominated slopes to the south which provides habitat for the mottled dusky wing butterfly. These species are not known to move long distances.

PROTECTION CONSIDERATIONS: Most of the site is owned by Larimer County and managed as a park. Protection of the small privately owned parcels included in the site would help insure the viability of the butterflies. Several of the owners have expressed interest in working with Larimer County Parks to preserve these areas.

MANAGEMENT CONSIDERATIONS: Recreation activities are common at the site and may need to be managed in the future to avoid excessive disturbance of the habitat.

Non-native or weedy native species are very common and dominant in some places. Trails may provide corridors for the invasion of non-native species. These species include bromes (*Bromus tectorum, B. japonicus, B. inermis)*, and toadflax (*Linaria dalmatica*). Control of these species may be necessary so that host plants for the butterflies are able to compete and remain as an important component of the plant communities. Further increase of non-native species may decrease the biodiversity significance of the site by altering the native floral and faunal species composition (Bock and Bock 1988). Grazing or fire management could be used as a tool to reduce the dominance of these species and increase the proportion of native species (see the Introduction for a discussion of the problems of non-native species).

Goals for management, possibly species-specific goals, should be developed before a fire management plan is implemented. Disturbance from fires may provide the opportunity for non-native species to increase in dominance. In addition, frequent fires in eastern tallgrass prairie have been shown to reduce the diversity of lepidoptera (Swengel and Swengel 1995). Burning all of the butterfly habitat in one year could potentially extirpate populations (Moffat and McPhillips 1993). We recommend that management goals include a mosaic of vegetation types.



THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS

FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092

Map photoinspected 1975

Horsetooth Reservoir Hogbacks

SIZE: Approximately 9000 acres.

BIODIVERSITY RANK: B2 - Very high significance. A concentration of good to fair quality occurrences of globally imperiled to vulnerable plants,animals, and plant communities.

PROTECTION URGENCY RANK: P2 - Threats from expanding residential development, fragmentation, and increased recreational use are expected within 5 years.

MANAGEMENT URGENCY RANK: M4 - Management of non-native plant species may be needed in the future to maintain the current quality of the element occurrences.

LOCATION: The hogbacks east and west of Horsetooth Reservoir from the north end of the reservoir south to near the Devil's Backbone. Horsetooth Reservoir and Masonville Quadrangles. Township 8 North, Range 69 West, section 31; Township 8 North Range 70 West, section 36; Township 7 North, Range 69 West, sections 6, 7, 17, 18, 19, 20, 29, 30, 31, 32; Township 7 North, Range 70 West, sections 1, 12, 13; Township 6 North, Range 69 West, sections 5, 6, 7, 8, 16, 17, 18, 20, 21, 28, 29, 31, 32; Township 5 North, Range 69 West, sections 5 and 6.

GENERAL DESCRIPTION: The site occurs on the hogback ridges just east and west of Horsetooth Reservoir. Several different geologic formations are exposed on the hogback, most are sandstones. In some areas the sandstone forms a "pavement" and vegetation is confined to the cracks in the rock. The elevation at the site ranges from 5430 near the Horsetooth Dam to 5930 feet near the southern end of the reservoir.

The vegetation is characterized by sparse ponderosa pine (*Pinus ponderosa*) woodlands, mountain mahogany (*Cercocarpus montanus*) shrublands, and small grassland openings. Some parts of the valleys between hogbacks have been converted to agricultural use, hay meadows, or pastures and are generally dominated by non-native species.

Residential development has occurred at a rapid pace in the area and houses are built or are being built within the site. Some past mining was evident. Numerous picnic grounds and recreational trails (hiking and mountain biking) exist in the general area.

The valley to the south of the reservoir is somewhat unique for the area. An old homestead is located in the area and nearby residential development is hidden from view. This allows one to imagine what the area was like in the times of the early European settlers.

NATURAL HERITAGE SIGNIFICANCE: The Bell's twinpod (*Physaria bellii*) was found on sandstones with intermixed shales south of Horsetooth Reservoir. This occurrence is somewhat small but of interest because it is one of the few that occurs on sandstone instead of the typical Niobrara shale.

The ponderosa pine/mountain mahogany/big bluestem (*Pinus ponderosa/Cercocarpus montanus/Andropogon gerardii)* foothills woodland is only known from the northern Front Range of Colorado. Most occurrences have been destroyed or degraded by development, overgrazing, or mining. This site has been impacted to some extent by these activities and the occurrence is degraded but probably still viable.

The big bluestem-little bluestem (*Andropogon gerardii-Schizachyrium scoparium*) xeric tallgrass prairie has only been documented from the Front Range of Colorado. Most occurrences are severely degraded. This occurrence is in fair condition and is relatively small but is one of the best remaining in Larimer County.

The mountain mahogany-skunkbush/big bluestem (*Cercocarpus montanus-Rhus trilobata/Andropogon gerardii)* foothills shrubland has been documented from few locations. This plant community occurs in patches throughout the site near Horsetooth Reservoir. Although much of the area to the south of Horsetooth Reservoir was not ground checked, roadside observations indicate that this plant community is extensive on hogback slopes there also.

The mountain mahogany/New Mexico feathergrass (*Cercocarpus montanus/Stipa neomexicana*) foothills shrubland is known only from Colorado and Wyoming. The occurrence at this site is relatively small.

The Ottoe skipper butterfly (*Hesperia ottoe)* may be vulnerable and has declined throughout its range. This species relies on tallgrass prairie plants that occur along the hogbacks.

The mottled dusky wing butterfly (*Erynnis martialis)* is common globally but imperiled to vulnerable in Colorado. This species is found on hilltops with mountain mahogany or buckbrush (*Ceanothus* spp.) which are in relatively natural condition.

The dusted skipper butterfly (*Atrytonopsis hianna)* is common globally but rare imperiled in Colorado. This species prefers canyons or open pine woodlands and relies on big bluestem and little bluestem as host plants for the larvae.

Table 10. Natural Heritage Elements at the Horsetooth Reservoir Hogbacks Site.							
Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Physaria bellii	Bell's twinpod	C	G2	S2			
Andropogon gerardii-Schizachyrium scoparium	Xeric tallgrass prairie	C	G2	S2?			
Pinus ponderosa/ Cercocarpus montanus/ Andropogon gerardii	Foothills woodland	C	G2	S2			
Cercocarpus montanus/Stipa neomexicana	Foothills shrubland	C	G2G3	S2S3			
Cercocarpus montanus-Rhus trilobata/Andropogon gerardii	Foothills shrubland	BC	G2G3	S2S3			
Hesperia ottoe	Ottoe skipper butterfly		G3?	S2			
Erynnis martialis	mottled ducky wing butterfly		G4	S2S3			
Atrytonopsis hianna	dusted skipper butterfly	B	G4G5	S2			

*EO = element occurrence

CURRENT STATUS: Much of the land adjacent to Horsetooth Reservoir is owned by the public but significant portions of the site are owned by private landowners. Several landowners in the area appear to be willing to work with the County.

BOUNDARY JUSTIFICATION: The site includes most of the hogback complex east and west of Horsetooth Reservoir continuing south to near the Devil's Backbone. Much of the land south of Horsetooth Reservoir was not field surveyed but roadside surveys and aerial photo interpretation indicate that the habitat similar to that supporting the occurrences continues to the south. The boundary is intended to protect the community occurrences and habitat for the butterflies, several of which are somewhat dependent on big bluestem and little bluestem for some part of their life cycle. Those species of grass are present throughout the length of the hogbacks included in the site.

PROTECTION CONSIDERATIONS: Much of this land is very valuable for residential development, which is happening at an alarming rate. Numerous tracts have been developed and it may be necessary to protect any large parcels still intact.

This site is somewhat isolated from other natural areas. Both residential development and agricultural conversion have altered lands around the site. Protecting large tracts may help insure the viability of the site by allowing some natural ecological processes to function.

MANAGEMENT CONSIDERATIONS: Recreation around Horsetooth Reservoir has impacted the land in many places. Fire pits are common and many social trails have been created which may contribute to the spread of non-native plant species.

Current and future development may preclude natural fires (which may be an integral part of this ecosystem), fragment the landscape, and introduce domestic pets into the area which can impact native wildlife populations.

Livestock grazing has been a prominent land use factor since European settlement. The valley bottoms in the site are degraded from years of heavy grazing and would need to be

restored if possible. Non-native or weedy native species are very common and dominant in some places. These species include bromes (*Bromus tectorum, B. japonicus, B. inermis)*, crested wheatgrass (*Agropyron cristatum),* leafy spurge *(Euphorbia esula*), toadflax (*Linaria dalmatica*), and ragweed (*Ambrosia trifida).* Further increase of non-native species may decrease the biodiversity significance of the site by altering the native floral and faunal species composition (Bock and Bock 1988). Grazing or fire management could be used as a tool to reduce the dominance of these species and increase the proportion of native species (see discussion of the problems of non-native species). With both of these tools special attention would need to be given to the time of implementation.

Goals for management, especially species-specific goals, should be developed before a fire management plan is implemented. Disturbance from fires may provide the opportunity for non-native species to increase in dominance. In addition, frequent fires in eastern tallgrass prairie have been shown to reduce the diversity of lepidoptera (Swengel and Swengel 1995). Burning all of the butterfly habitat in one year could potentially extirpate populations (Moffat and McPhillips 1993). We recommend that management goals include a mosaic of vegetation types as naturally connected as possible.

Horsetooth Reservoir Hogbacks

N

1 mile

Lake Pasture (R/W)

SIZE: Approximately 380 acres.

BIODIVERSITY RANK: B2 **-** Very high significance. This site contains an unusual and possibly globally imperiled Front Range wetland.

PROTECTION URGENCY RANK: P1 - Immediately threatened by development if current owners decide they have to sell because they do not soon reach agreement on a conservation easement. Protect within one year.

MANAGEMENT URGENCY RANK: M4 - Management of recreation and grazing may be needed in the future to maintain the current quality of the element occurrences.

LOCATION: Elk Park, east of Route 7, southern Larimer County on the border with Boulder County (Smitherman Property)**.** Marked as "Lake Pasture" on USGS 7.5' topographic map. Panorama Peak Quadrangle. Township 4 North, Range 72 West, section 28.

GENERAL DESCRIPTION: Lake Pasture is a cluster of small ponds that were likely formed at the end of the most recent glaciation, around 10,000-13,000 years ago[2]. Currently a visitor to this site sees several small ponds separated by low ridges surrounded by extensive wet meadows. The water is rather shallow, probably no more than 2 meters at the deepest, allowing rooted aquatic plants to thrive even in the pond centers. Elk visit these ponds frequently, as do waterfowl that breed in them and rest there during migration.

The ponds are situated in the northeastern portion of Elk Park. The Park itself is dominated by European hay grasses such as smooth brome (*Bromus inermis*) and timothy grass (*Phleum pratensis*) in moist areas and native sedges and grasses in wetter areas. Conifers, especially ponderosa pine (*Pinus ponderosa*), dominate the surrounding forests, as is typical for mid-montane elevations in the Front Range.

NATURAL HERITAGE SIGNIFICANCE: The Lake Pasture site is a very significant element of the this area's natural heritage. An intensive survey of Larimer County wetlands on non-public land has revealed only two other sites similar to this one, but nothing as large and high-quality as Elk Park Ponds. Even on a statewide bases, sites such as this one are rare. Most ponds of this sort occur in subalpine areas (above 9,500 ft.) and provide habitat for different plants and animals. The frequency of natural occurrences of this type suggest that those remaining in natural condition should be protected in order to preserve this unusual aspect of Colorado's natural heritage.

This site is significant on two levels. First, shallow montane ponds are uncommon. Such ponds provide special habitat not only for the obvious wildlife such as elk and waterfowl, but also for many poorly known animals (i.e., perhaps species of dragonflies or other insects) that

[2] Whether these ponds formed by glacial action or another means is still being debated by scientists who know about this site. Regardless of their origin, this type of wetland at this elevation on the Front Range is both valuable and imperiled.

may survive only in this environment. Second, based on existing reports of aquatic vegetation and the experience of the Colorado Natural Heritage Program, the plant communities that occur in these ponds appear to be rare in Colorado. These plant communities suggest that the site has high natural heritage value.

Two communities are of particular interest: (1) A dense pondweed (*Potamogeton natans*) community covers most of the deeper water in at least one larger pond, and (2) a bladderwort (*Utricularia vulgaris*) community is found in water less than a meter deep. Bladderworts are carnivorous plants that feed on microorganisms in the water. This particular species (*U. vulgaris*) occurs in many lakes and ponds in Colorado, but only rarely occurs in the numbers and density seen here.

The significance of this site is increased dramatically by the great conditions in which the pond vegetation exists. Grazing in and around the ponds has recently been light, so the plants and plant communities are robust. Very few non-native species of plants occur with the wetland vegetation. Also, there are no signs of major alterations to the natural hydrology of these sites.

Table 11. Natural Heritage Elements at the Lake Pasture Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Potamogeton natans	Montane floating/submergent wetland	A	G5?	S2			
Utricularia vulgaris	Montane floating/submergent wetland	A	G3?	S1			
Glyceria borealis	Montane emergent wetland	B	G3	S1?			
Carex utriculata	Montane wet meadow	A	G5	S3			

*EO = element occurrence

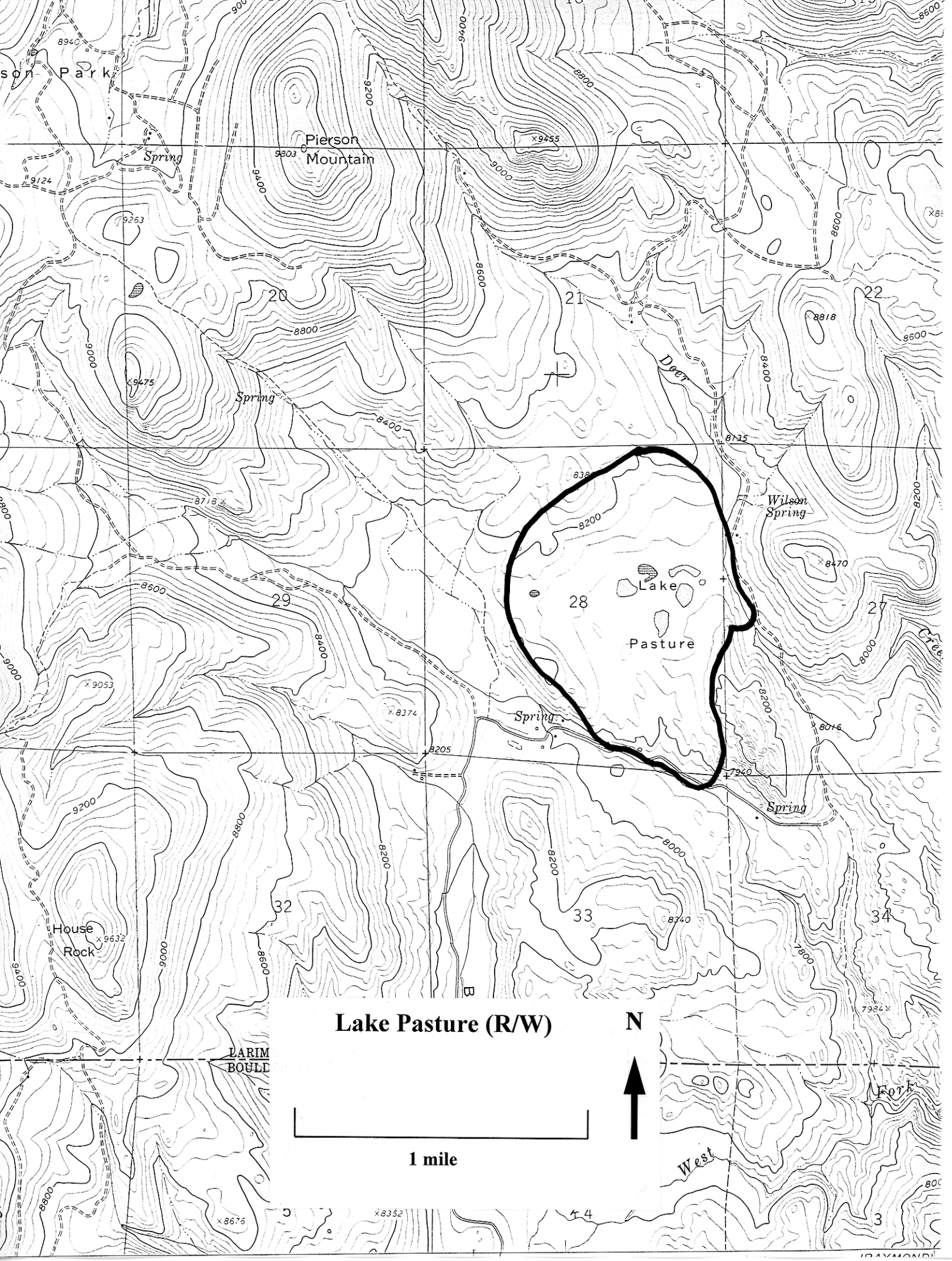
CURRENT STATUS: The site is owned by a family that is currently working with the Estes Valley Land Trust to place an easement on the property. The site is leased by Aspen Lodge. The Lodge brings visitors to and through the site on horseback. The light travel and grazing by horses appears to cause no adverse effects at the site, although a campsite between two of the ponds should be moved into the adjacent forest so that it does not block wildlife movement between the ponds

Surveys for imperiled animals that may occur at this wetland are desirable, but they have not been conducted.

BOUNDARY JUSTIFICATION: The boundary includes the kettle ponds, adjacent wetlands, seep wetlands upslope from and adjacent to the ponds, and a buffer around the wetlands to protect from direct and indirect human impacts. The buffer generally extends to about 1000 ft. beyond the edge of the wetlands, or to the tops of ridges that naturally separate the wetland ecosystem from adjacent areas.

PROTECTION CONSIDERATIONS: The current owners want to place a conservation easement on the property, but the opportunity for acting on this desire is expected to be available only for the next year.

MANAGEMENT CONSIDERATIONS: As suggested above, the most critical factor governing the viability and integrity of this site is the maintenance of natural hydrology. No water should be added or removed from the ponds, and water levels should not be altered by any means, including levees, ditches, etc. Non-native plant species will not be a problem as long as grazing along the edges of the ponds remains light. Heavy grazing will expose bare soil, providing a niche for invasive species. Any buildings constructed in the area should be placed well back from the pond edges to maintain the game and non-game wildlife values of the ponds. Care should be taken so that effluent from buildings or runoff from roads does not add nutrients to the pond water.


Lake Pasture (R/W)
N
1 mile
Pierson Mountain
Spring
Lake
Pasture
Wilson Spring
House Rock
Dyer
20
21
22
27
28
29
32
33
34

Laramie Foothills Megasite

SIZE: Approximately 110,000 acres

BIODIVERSITY RANK: B2 - Very high significance. Contains multiple B2 standard sites.

PROTECTION URGENCY RANK: P2 - Threat expected within 5 years from encroaching residential development.

MANAGEMENT URGENCY: M3 - Management actions that improve vegetation structure and control non-native species may be needed within 5 years to maintain the current quality of the element occurrences.

LOCATION: Larimer County, Colorado. Near the town of Livermore, CO. Round Butte, Table Mountain, Livermore, Laporte, Cherokee Park, Haystack Gulch, Virginia Dale, Livermore Mountain, and Livermore Quadrangles.

INCLUSIVE SITES: This site is designated as a "megasite" because it is very large and contains multiple smaller standard sites which are interrelated. While the smaller site have been separated based on ecological factors such as breaks in the distribution of elements, the designation of the megasite recognizes the importance and value of the larger system in the maintenance and long term viability of the smaller sites.

Standard sites within the Laramie Foothills Megasite include Grayback Ridge, Park Creek Hogback, Park Creek Reservoir #2, Horsethief Pass, Soapstone Hills, Owl Canyon Piñon Grove (Brackenbury Natural Area), and the Deadman Creek Macrosite which includes Phantom Canyon and Dale Creek.

GENERAL DESCRIPTION: The Laramie Foothills site is along a transition zone from the prairie on the Colorado Piedmont to the east and to the Rocky Mountains to the west. Within the area the bedrock geology changes drastically from sedimentary rock to the east to more resistant granitic rock to the west. Lowlands have been used for cattle grazing (in some small areas irrigated hay fields occur). These areas are generally dominated by native mixed grass prairie. There are several prairie dog towns which have been active in the recent past (5 years) and at least one small town that is currently active.

Many of the streams and draws east of Highway 287 (generally on soils formed from sedimentary substrates) are deeply eroded and appear to be actively doing so. Some small ravines and canyons in the sedimentary rock support juniper (*Juniperus scopulorum)* and skunkbush (*Rhus trilobata)*. Numerous springs are present but most are heavily utilized by cattle and are in degraded condition.

Occasionally, piñon pine (*Pinus edulis)* occurs on ridge tops east of Highway 287. Scattered "islands" of Ponderosa pine (*Pinus ponderosa*) occur on outcrops of granitic rock in the area and support a sparse understory of mostly native species. These features, called "tors", are probably a result of the ability of the trees to utilize moisture that collects in cracks in the granite. Surface fires on these "tors" would probably be rare because of the lack of fuels in the understory. Steep sedimentary hogbacks often support more dense stands of ponderosa pine.

Native Americans may have used this area extensively judging from the artifacts found in the area. The area was a site for the Overland Trail stage line. Large cattle ranches are common in the area today. The area is quite scenic. Some ranches have been subdivided into smaller parcels for residential development.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The site supports both rare elements and good condition examples of more common plant community elements. The Bell's twinpod (*Physaria bellii)* occurrence is the best known for that species. The mountain mahogany/New Mexico feathergrass (*Cercocarpus montanus/Stipa neomexicana*) foothills shrubland is globally rare (G2G3) and the occurrence is the largest and best condition known. Several populations of the Larimer aletes (*Aletes humilis)* occur within the site which are excellent occurrences. A good condition example of the needle and thread-blue gramma grassland occurs in the site. Occurrences of several state rare animal species are included within the site.

Table 12. Natural Heritage Elements at the Laramie Foothills Megasite.							
Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Physaria bellii	Bell's twinpod	A	G2	S2			
Aletes humilis	Larimer aletes	A	G2G3	S2S3			FS
Aletes humilis	Larimer aletes	A	G2G3	S2S3			FS
Potentilla effusa var. *rupincola*	Rocky Mountain cinquefoil	B	G3G5 T2	S2			FS
Pellaea atropurpurea	Purple cliff -break		G5	S2S3			
Cercocarpus montanus/ Stipa neomexicana	Foothills shrubland	A	G2G3	S2S3			
Cercocarpus montanus/ Stipa neomexicana	Foothills shrubland	B	G2G3	S2S3			
Cercocarpus montanus/ Stipa scribneri	Foothills shrubland	B	GU	SU			
Juniperus scopulorum/ Cercocarpus montanus	Foothills juniper woodland	B	G2	S2			
Muhlenbergia montana-Stipa comata	Montane grassland	BC	G2	S2			
Cercocarpus montanus/ Stipa comata	Foothills shrubland	C	G2	S2			
Cercocarpus montanus/ Stipa comata	Foothills shrubland	C	G2	S2			
Cercocarpus montanus/ Stipa comata	Foothills shrubland	CD	G2	S2			
Cercocarpus montanus/Stipa comata	Foothills shrubland	D	G2	S2			
Cercocarpus montanus-Rhus trilobata/Andropogon gerardii	Foothills shrubland	C	G2G3	S2S3			
Cercocarpus montanus/ Muhlenbergia montana	Foothills shrubland	C	GU	S2			
Stipa comata-Bouteloua gracilis	Mixed grass prairie	A	G5	S2S3			
Cercocarpus montanus/ Elymus lanceolata x Pseudoroegneria spicata	Foothills shrubland	C	G3	S3			
Cercocarpus montanus/ Elymus lanceolata x Pseudoroegneria spicata	Foothills shrubland	D	G3	S3			
Etheostoma exile	Iowa darter	?	G5	S2		SC	
Etheostoma nigrum	Johnny darter	?	G5	S3			
Aquila chrysaetos	Golden eagle	?	G5	S3S4B, SZN			
Plecotus townsendii	Townsend's big-eared bat	?	G4	S3			
Callophrys mossii schryveri	Schryver's elfin butterfly	?	G4T3	S2S3			
Lanius ludovicianus	Loggerhead shrike	D	G4G5	S3B,SZN			FS
Dolichonyx oryzivorus	Bobolink	C	G5	S3B,SZN			

*EO = element occurrence

CURRENT STATUS: Most of the land has been historically and is currently being used for cattle ranching, although some of the ranches in the area have been sold and are being sub-

divided. The Nature Conservancy currently owns the Phantom Canyon Preserve on the North Fork of the Cache la Poudre River which protects a high quality population of the Larimer aletes. The Brackenbury Natural Area to the south protects one of the northern most populations of piñon pine on the Colorado Front Range, although mining is already occurring in the area and may be one of the biggest threats.

BOUNDARY JUSTIFICATION: The boundaries delineated for the megasite are expected to protect the elements from direct impacts such as mining, trampling, weed invasion, physical alteration, nesting disturbance, etc. These boundaries should be large enough to include the major ecological processes that allow the elements to survive. These may include but are not limited to fire, herbivory, and others. These boundaries are generally delineated for the standard sites. Boundaries for the megasite encompass these but also expand to what is thought to represent an intact ecological system where natural ecological processes still function or can be restored. The boundary to the east represents the point on the landscape where sedimentary rock outcrops are no longer exposed and the landscape is dominated by prairie systems. The boundary to the west represents the transition to more dense woodlands and forest, areas that are ecologically similar to much of the U. S. Forest Service land in the county. The southern boundary represents the area where the outcrops of sedimentary hogbacks narrow to the appearance more similar to that of the rest of the Colorado Front Range. The northern boundary is delineated by the Wyoming state.

PROTECTION CONSIDERATIONS: The area is quite scenic and has been discovered by the growing population of the Colorado Front Range, which has led to increased development with many ranches being subdivided into smaller parcels.

MANAGEMENT CONSIDERATIONS: The main threats to the elements of concern are the modification of the vegetation structure and/or increasing the abundance of non-native species, or direct interference with the activities of the animals of concern. Cheatgrass (*Bromus tectorum)* and Japanese brome (*Bromus japonicus)* are present on the site but not extensive at this time. Further increase of non-native species may decrease the biodiversity significance of the site by altering the native floral and faunal species composition (Bock and Bock 1988). Grazing or fire management could be used as a tool to reduce the dominance of these species and increase the proportion of native species (see discussion of the problems of non-native species).

Fragmentation could also impact many of the elements depending the location and extent of subdividing or mining. Even low intensity development may limit the use of some management techniques (i.e., fire) which may be essential for the long term persistence of the elements at the site.

Laramie Foothills Megasite

N

1 mile

LARIMER CO

Virginia Dale

Mishawaka

Poudre Park

Bellvue

Laporte

Waverly

Buckeye

Teds Place

Stove Prairie

Owl Canyon

Table Mountain

Red Mountain

Sheep Mountain

Gilman Mountain

Bobcat Mountain

Deadman Butte

Gravel Pits

Quarries

Gaging Sta

Filtration Plant

Landing Strips

Horsethief Pass

Goat Hill

Gilmore Lake

Claymore Lake

Miners Lake

Watson Lake

Dry Creek Reservoir

Park Creek Reservoir

Boettcher Water Supply and Storage Reservoir No 3

Douglass Reservoir

Spicer Lake

Bubbles Lake

Terry Lake

Kenyon Corner

Rabbit Ears Pass

Rawhide Flats

Old RR Grade

Poudre Trail

Pipeline

Ditch

Canal

Lateral

Tunnel

Well

Spring

Lone Pine Creek North

SIZE: Approximately 800 acres.

BIODIVERSITY RANK: B2 - Very high significance. A good occurrence of a globally imperiled plant species.

PROTECTION URGENCY RANK: P4 - No threats known for the foreseeable future. Mostof the site is owned by the U.S. Forest Service and the Colorado Division of Wildlife.

MANAGEMENT URGENCY RANK: M5 - No serious management needs known anticipated.

LOCATION: The site is approximately 10 miles west of the town of Livermore. Haystack Gulch Quadrangle. Township 10 North, Range 72 West, section 35; Township 10 North, Range 71 West, section 31; Township 9 North, Range 72 West, section 1; Township 9 North, Range 71 West section 6.

GENERAL DESCRIPTION: The site is characterized by a large granitic outcrop within the ponderosa pine (*Pinus ponderosa)* dominated zone of the foothills.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: This site supports a good occurrence of a globally rare plant species. Larimer aletes (*Aletes humilis)* is restricted to a small area in Colorado and is known from Wyoming only historically (last observation 1890). This species is found primarily on or associated with large outcrops of Silver Plume Granite.

Table 13. Natural Heritage Elements at the Lone Pine Creek North Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Aletes humilis	Larimer Aletes	B	G2G3	S2S3			FS

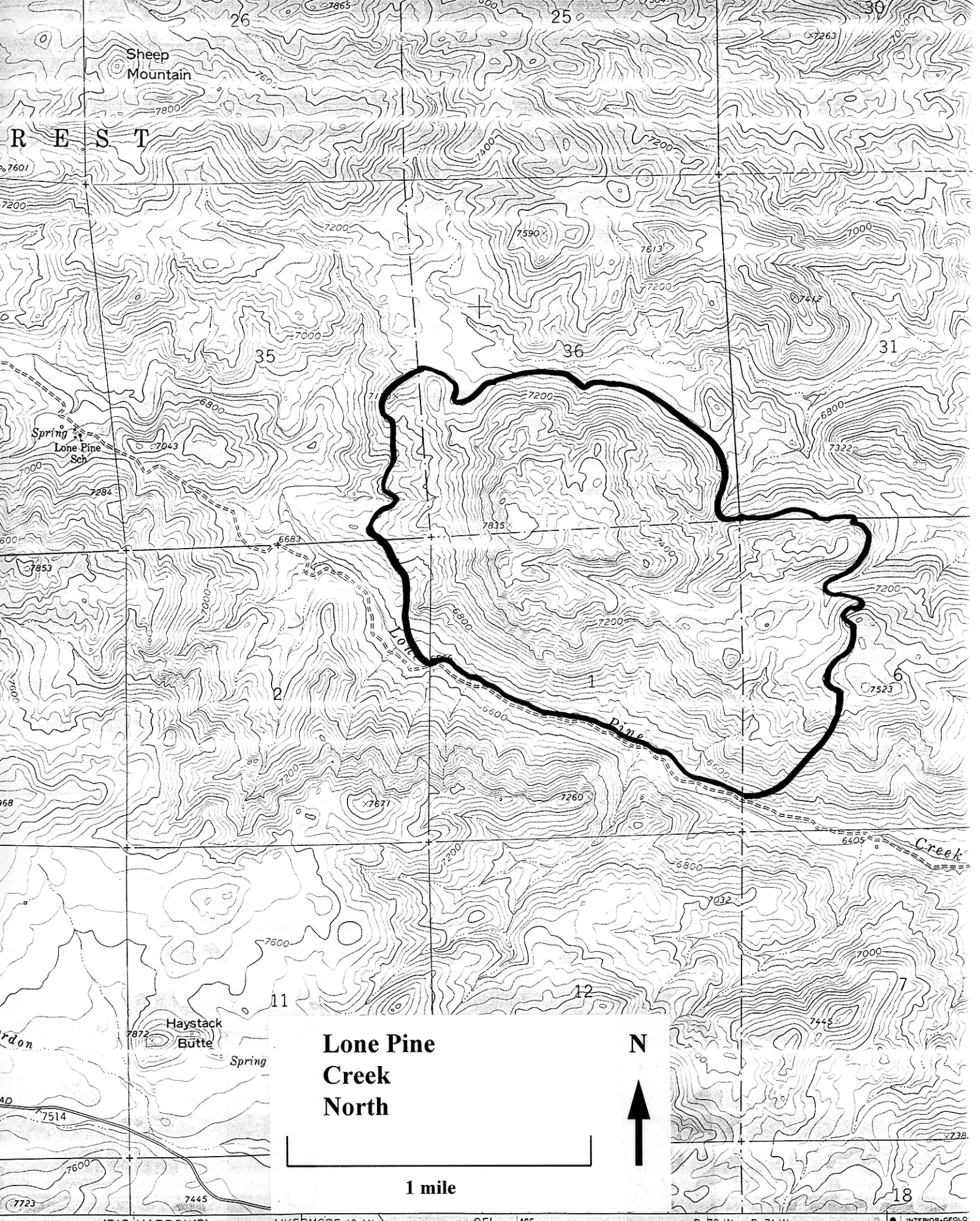
*EO = element occurrence

CURRENT STATUS: Most of the site is owned and managed by the US Forest Service and the Colorado Division of Wildlife. Small parts of the site are privately owned.

BOUNDARY JUSTIFICATION: The site includes the entire granite outcrop and the associated slopes. All supporting ecological processes are believed to be incorporated within the site except natural fire regimes.

PROTECTION CONSIDERATIONS: Much of this site is too steep for alternative uses.

MANAGEMENT CONSIDERATIONS: No serious management needs are known or anticipated, but the site should be monitored for possible changes in status.


Lone Pine
Creek
North
N
1 mile
Sheep
Mountain
Haystack
Butte
Spring
Lone Pine
Sch
Pine
Creek
(BIG NARROWS)
4965 III NW
SCALE 1:24000
0
1 MILE
1000
2000
3000
4000
5000
6000
7000 FEET
LIVERMORE 13 MI.
FORT COLLINS 33 MI.
R. 72 W.
R. 71 W.
ROAD CL

Lovers Leap

SIZE: Approximately 500 acres.

BIODIVERSITY RANK: B2 - Very high significance. Excellent occurrences of two globally imperiled plant species.

PROTECTION URGENCY RANK: P3 - Definable threat from residential development but not within the next 5 years.

MANAGEMENT URGENCY RANK: M3 - Management actions to control non-native plants may be needed within 5 years to maintain the current quality of the element occurrences.

LOCATION: Large granitic outcrops northwest of Virginia Dale. Virginia Dale Quadrangle. Township 12 North, Range 71 West, sections 32 and 33.

GENERAL DESCRIPTION: This site is defined by large granitic outcrops surrounded by a grassland and shrubland mosaic. The site is bisected by a secondary road and incorporates a short section of State Highway 287. Dale Creek runs through the middle of the site. The dominant vegetation consists of ponderosa pine *(Pinus ponderosa)*, waxflower *(Jamesia americana)*, mountain mahogany *(Cercocarpus montanus),* wax currant *(Ribes cereum)*, cinquefoil *(Potentilla* spp.), buckwheat *(Eriogonum* sp.), prickly pear cactus *(Opuntia* sp.), blue gramma *(Bouteloua gracilis)* and other grasses, with about 40% cover composed of bare rock and gravel. Lichens are prevalent on the granite and *Selaginella* is a common ground cover. The soil is mostly granite gravel. The Dale Creek riparian area is degraded but recoverable. It is dominated by alder *(Alnus incana)*, river birch *(Betula occidentalis)*, coyote willow (*Salix exigua*), mountain maple (*Acer glabrum*), golden currant (*Ribes aureum*), bluebell (*Campanula rotundifolia*), and mixed graminoids.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: This site includes three high ranked occurrences of two rare plant species. Larimer aletes (*Aletes humilis*) is restricted to a small area in Colorado and is known from Wyoming only historically (last observation in 1890). This species is found primarily on or associated with large outcrops of Silver Plume Granite. Rocky Mountain cinquefoil *(Potentilla effusa* var. *rupincola)* is found in similar habitats with a similar distribution though this species is found further south than Larimer aletes. The plant communities present are in good to excellent condition.

Table 14. Natural Heritage Elements at the Lovers Leap Site.							
Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Aletes humilis	Larimer Aletes	B	G2G3	S2S3			FS
Potentilla effusa var. *rupincola*	Rocky Mountain cinquefoil	B	G3G5 T2	S2			FS
Potentilla effusa var. *rupincola*	Rocky Mountain cinquefoil	A	G3G5 T2	S2			FS

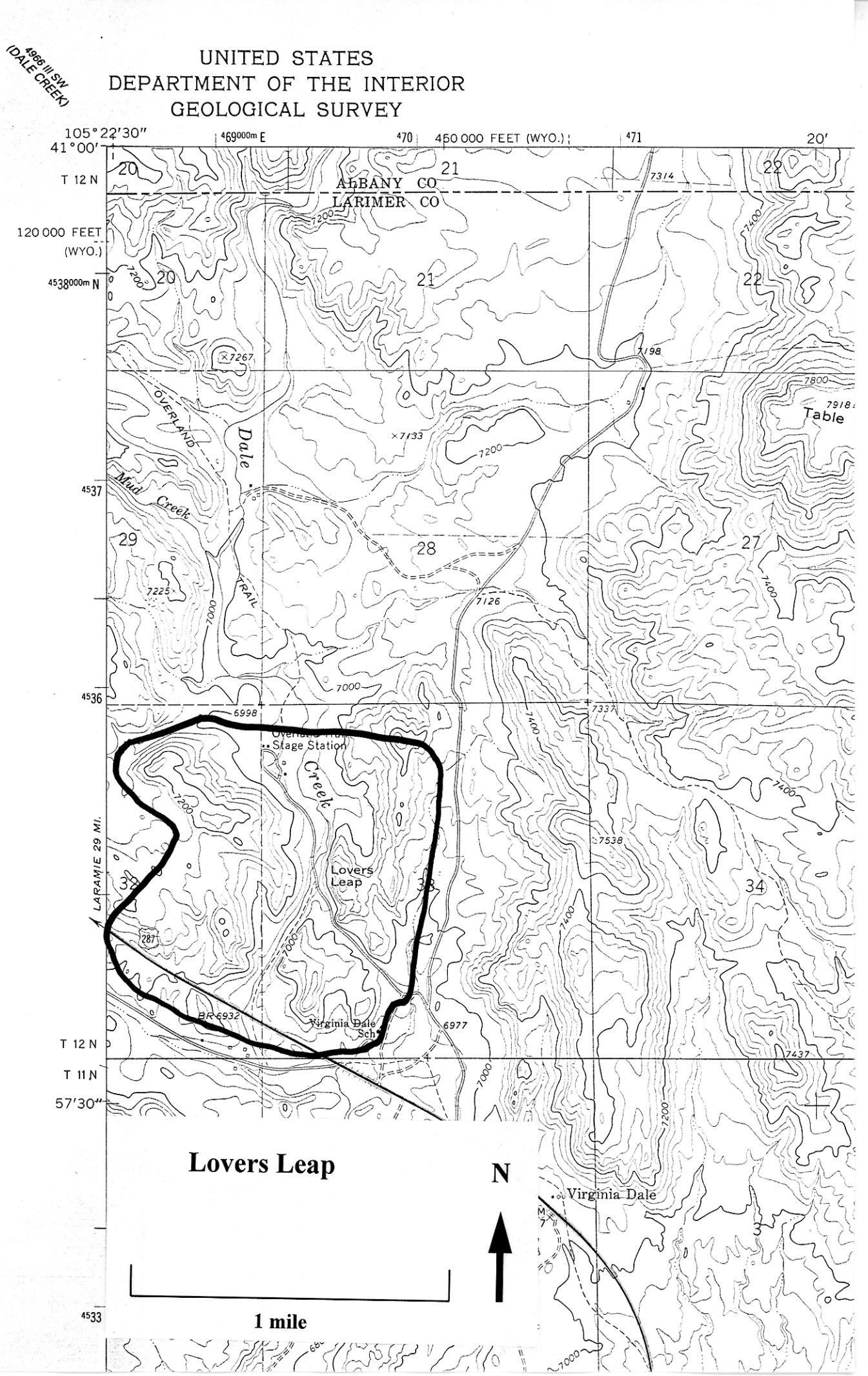
*EO = element occurrence

CURRENT STATUS: This site is partially owned by several ranches and the North Poudre Irrigation Company. The spread of non-native plant species threatens to degrade the associated plant communities and could threaten the integrity of the rare plant occurrences, particularly where these species are found off of the large rock outcrops. Development in the site may be a threat in the future though specific land use plans for the site are unknown.

BOUNDARY JUSTIFICATION: Includes the granite outcrops that are known to support occurrences of two rare plant species, as well as some portion of the surrounding high quality plant communities as a buffer to protect against direct disturbances.

PROTECTION CONSIDERATIONS: Land use plans are unknown.

MANAGEMENT CONSIDERATIONS: Restoration efforts may be needed within some of the plant communities. Cheatgrass *(Bromus tectorum)* is very dense in areas, and hound's tongue *(Cynoglossum officinale)* and great mullein *(Verbascum thapsus)* occur along Dale Creek. Management plans should monitor the spread of these and other non-native plant species, and aim to prevent further degradation of the high quality plant communities. Horses, cows and humans may be the source for the distribution of these non-natives. Riparian areas around Dale Creek have been grazed heavily by horses and cattle. The state highway department should be contacted to secure a management agreement and assure protection for the plants on the roadside of Highway 287.


4966 III SW
(DALE CREEK)
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
105°22'30"
41°00'
469000m E
470
450 000 FEET (WYO.)
471
20'
T 12 N
120 000 FEET
(WYO.)
4538000m N
ALBANY CO
LARIMER CO
Overland Trail
Stage Station
Dale Creek
Mud Creek
Lovers Leap
Virginia Dale Sch.
Virginia Dale
Table
LARAMIE 29 MI.
T 12 N
T 11 N
57'30"
4537
4536
4533
Lovers Leap
N
1 mile

Park Creek Hogback

SIZE: Approximately 1250 acres

BIODIVERSITY RANK: B2 - Very high significance. An excellent occurrence of a globally imperiled plant.

PROTECTION URGENCY RANK: P3 - definable threat from development but not within the next 5 years.

MANAGEMENT URGENCY RANK: M4 - management may be needed in the future to maintain current quality of the element occurrences if recreation or road use increases.

LOCATION: Approximately 2 miles southwest of the town of Buckeye. Livermore and Buckeye Quadrangles. Township 9 North, Range 69 West, sections 4 and 9; Township 10 North, Range 69 West, sections 19, 20, 21, 28, 29, and 33.

GENERAL DESCRIPTION: The dominant feature of this site is a hogback composed of Niobrara shale which is exposed for several miles. The Bell's twinpod is nearly always restricted to this substrate. Most of the outcrop is vegetated with mountain mahogany (*Cercocarpus montanus)* shrublands with a sparse understory. An access road follows the top of the hogback for about one mile.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: This sites contains one of the best known occurrence of the Bell's twinpod (*Physaria bellii*) which is only known from a narrow band of sedimentary rock from near Denver to northern Larimer County.

The site also supports a good occurrence of the mountain mahogany/new Mexico feathergrass (*Cercocarpus montanus/Stipa neomexicana)* foothills shrubland.

An access road runs along the top of the hogback for over one mile but it doesn't seem to have much impact on either occurrence. Small amounts of habitat are physically disturbed but non-native species are not invading.

Table 15. Natural Heritage Elements at the Park Creek Hogback Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Physaria bellii	Bell's twinpod	A	G2	S2			
Cercocarpus montanus/Stipa neomexicana	Foothills shrubland	B	G2G3	S2S3			

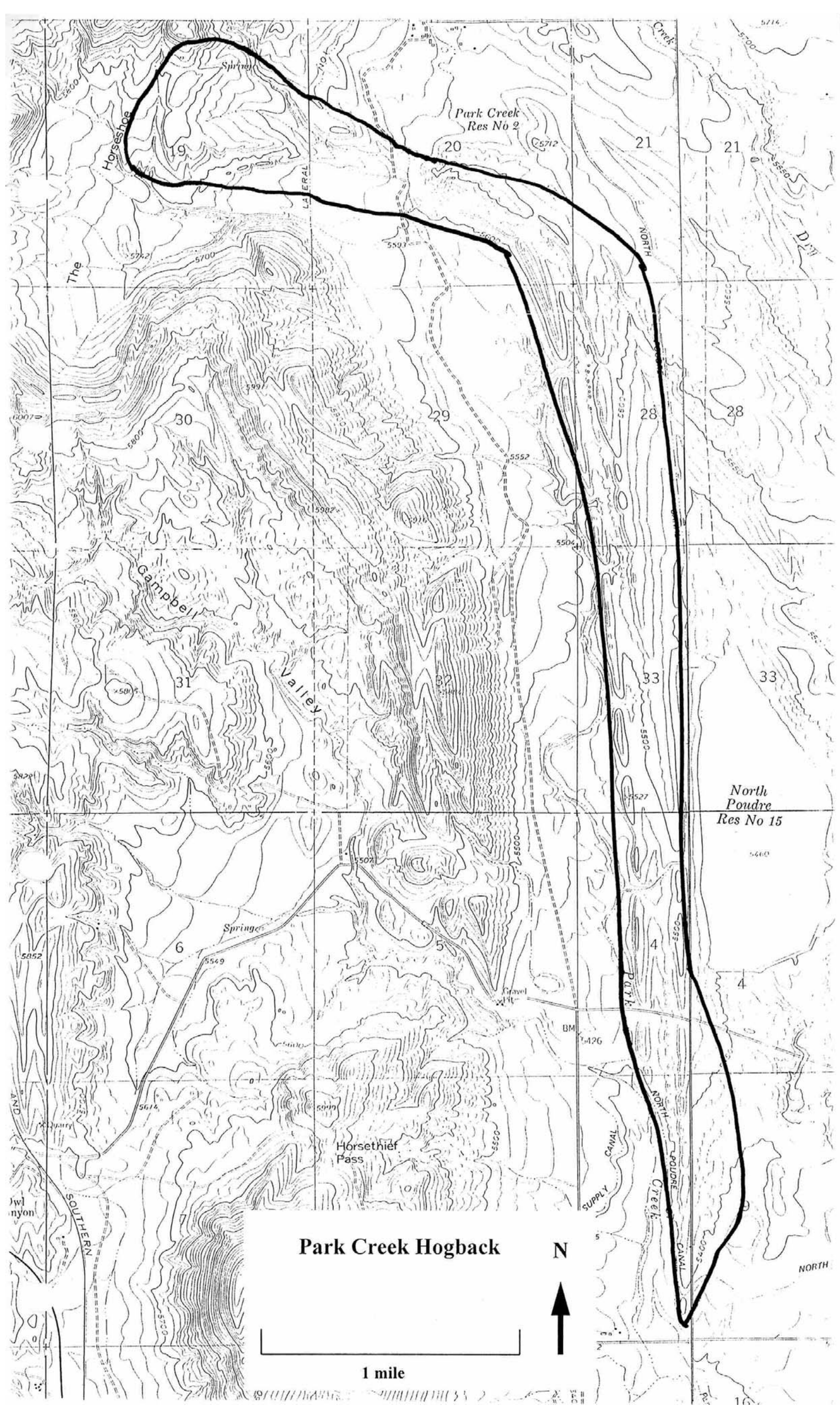
*EO = element occurrence

CURRENT STATUS: Currently the site is privately owned by two or more landowners. Access to North Poudre Reservoir No. 15 is through the site.

BOUNDARY JUSTIFICATION: The site boundary includes the two occurrences and adjacent areas believed to be sufficient to protect important ecological processes. A buffer of approximately 300 meters is provided to support unidentified pollinators of the Bell's twinpod.

PROTECTION CONSIDERATIONS: Mining has occurred on similar substrates in the area. Ranchette development has occurred in the area and will probably continue to increase in the future. Both of these activities could impact the elements at this site.

MANAGEMENT CONSIDERATIONS: Current management appears to be compatible with survival of the elements; however, monitoring efforts would be appropriate if significant changes in management occur. Increased recreatonal use or work on the reservoir access road may impact the population of the Bell's twinpod.


Park Creek Hogback
N
1 mile
Park Creek Res No 2
North Poudre Res No 15
Horsethief Pass
Campbell Valley
The Horseshoe
NORTH POUDRE SUPPLY CANAL
SOUTHERN

Phantom Canyon

SIZE: Approximately 1500 acres.

BIODIVERSITY RANK: B2 - Very high significance. An excellent occurrence of a globally imperiled plant species.

PROTECTION URGENCY RANK: P4 - No threat known for foreseeable future.

MANAGEMENT URGENCY RANK: M3 - Management of non-native may be needed within 5 years to maintain the current quality of the element occurrences.

LOCATION: Approximately 7.5 air miles NW of Livermore. Livermore Mountain Quadrangle. Township 10 North, Range 71 West, sections 1, 2, 3, 7, 10 ,11 ,12 ,13 ,14, and 18.

GENERAL DESCRIPTION: Phantom Canyon is one of the few roadless canyons on the Front Range of Colorado. The canyon is a spectacular geological feature within igneous and metamorphic substrates. Extensive cliffs and adjacent shrub and grassland are included in the area. The canyon is nearly invisible to approaches through the surrounding prairie. The canyon is carved through the rock by the North Fork of the Cache la Poudre River. Several golden eagles and prairie falcons use the area for breeding and hunting. Other cliff-dwelling animals are common in the vicinity, e.g., white throated swifts, violet-green swallows, and canyon wrens. The river flows all year to provide for a trout fishery dominated by non-native species. Flow is maintained by agreement with upstream providers. The riparian zone is a composite of grassland, shrubland, and woodland communities. Although the hydrological regime is altered, it is expected that large flood events will still occur and therefore maintain some of the natural community dynamics known for these riparian systems. Many non-native grasses dominate the riparian understory, but the overstory remains dominated by native vegetation. Relative isolation of the canyon is indicated by the large numbers of dippers breeding along the river course. North-facing canyon slopes are dominated by shrubs and coniferous trees, including mountain mahogany (*Cercocarpus montanus*), skunkbush (*Rhus trilobata*), ponderosa pine (*Pinus ponderosa*), and Douglas fir (*Pseudotsuga menziesii*). This vegetation occurs in pockets where bare rock and cliffs do not dominate. South-facing slopes are more grassy and shrubby. Grasses are mostly native species with the exception of Japanese brome (*Bromus japonicus*). The dominant shrub of these slopes is the mountain mahogany, but there are significant stands of bitterbrush (*Purshia tridentata*). Occasional junipers are also found in this habitat. Whereas these shrubs occur on the canyon rim, their numbers decline sharply a short distance from the canyon. These woodlands support a diverse array of birds from the montane forest zone and the shrubland zone. It is not uncommon to find pygmy nuthatches, Stellar's jays, rufous-sided towhees, and Lazuli buntings throughout the area. Surrounding grasslands are classified as midgrass prairie in their present condition. These grasslands are rather rich in composition and dominated by native species. Much of the area can be described as a needle and thread grass-blue grama grassland (*Stipa comata-Bouteloua gracilis* plant association). It dominates a mosaic of other association on the rolling hills to the east of the Phantom Canyon Preserve. Within the preserve boundaries, grazing has been controlled and the grassland structure is maintained as midgrass prairie. Grasslands birds are common in this habitat, particularly vesper sparrows, lark

sparrows, horned larks, and common nighthawks. Ground squirrels, mule deer, and pronghorn are also common

NATURAL HERITAGE RESOURCE SIGNIFICANCE: This site supports a population of the Larimer aletes *(Aletes humilis*) on Silver Plume granite cliffs. This species is only known from Larimer and Boulder Counties which makes this excellent occurrence very important to conservation. The scenic values and the large, natural landscape surrounding this occurrence adds to its importance.

Table 16. Natural Heritage Elements at the Phantom Canyon Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Aletes humilis	Larimer aletes	A	G2G3	S2S3			FS
Potentilla effusa var *rupincola*	Rocky Mountain cinquefoil	B	G3G5 T2	S2			FS
Cercocarpus montanus / Stipa comata	Mixed foothills shrubland	C	G2	S2			
Callophrys mossii schryveri	Moss's elfin	?	G4T3	S2S3			

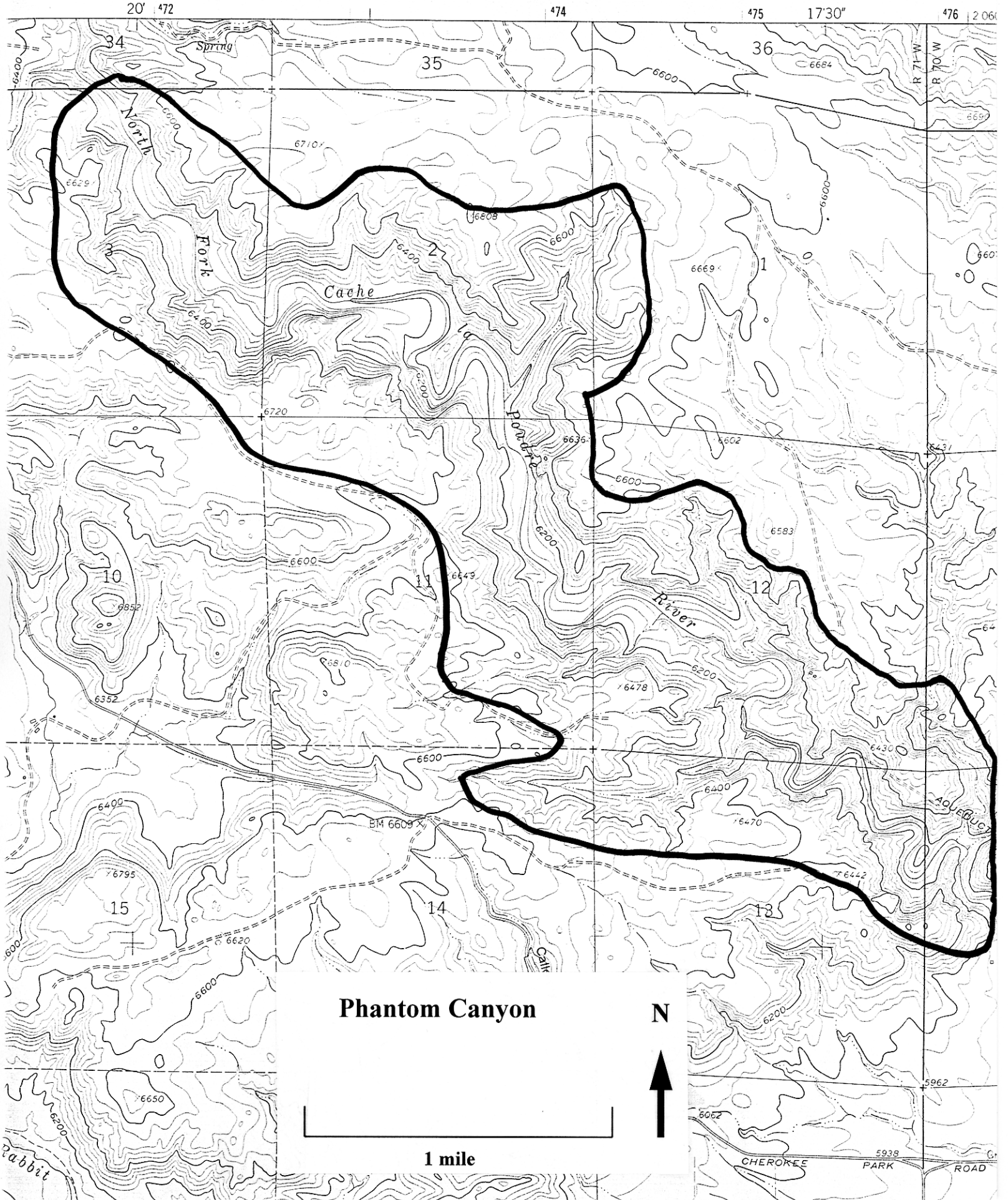
*EO = element occurrence

CURRENT STATUS: This site is privately owned by The Nature Conservancy and is managed for conservation of the elements.

BOUNDARY JUSTIFICATION: The recommended site boundary incorporates all known occurrences of rare or imperiled species. Buffers to the canyon habitats include significant areas on and adjacent to the canyon rims. The boundary is drawn to protect the known occurrence and includes a buffer to protect against indirect disturbance.

PROTECTION CONSIDERATIONS: The Phantom Canyon site is largely owned by The Nature Conservancy. Several conservation easements are held on portions of the preserve and its buffer. Rapid growth of subdivisions occurs largely on the south side of the canyon. The preserve is used for education, donor programs, and fishing in addition to its more significant conservation values.

MANAGEMENT CONSIDERATIONS: The largest threat to the ecology of the preserve is the invasive non-native vegetation. This is particularly troublesome in the canyon bottom, but extends onto the canyon slopes in many places. Many acres of Phantom Canyon Preserve are occupied by invasive alien plants. To maintain the present condition of the site, weed invasions must be controlled. Special care should be taken to take the path of least disturbance to the nesting golden eagles of the canyon. Consideration should be given to the possibility of restocking greenback cutthroat trout to this reach of the North Fork of the Cache la Poudre. Fire management will be beneficial to much of the vegetation, but caution should be used so that the butterfly community is not lost from the ecosystem or severely altered.


Phantom Canyon
N
1 mile
North Fork
Cache la Poudre
River
Spring
CHEROKEE PARK ROAD
AQUEDUCT
BM 6609
34
35
36
1
2
3
10
11
12
13
14
15
R 71 W
R 70 W

Rawhide Flats Macrosite

SIZE: Approximately 14,000 acres

BIODIVERSITY RANK: B2 - Very high significance. A good occurrence of a globally imperiled animal.

PROTECTION URGENCY RANK: P3 - Definable threat from development and recreational use but probably not within the next 5 years.

MANAGEMENT URGENCY RANK: M3 - Management of grazing, biosolids disposal, and activities around raptor nests may be needed within 5 years to maintain the current quality of the element occurrences.

INCLUDED SITES: The Jacks Spring wetland site is included in this macrosite.

LOCATION: Approximately 20 miles north of Highway 14 west of Interstate 25 to the Rawhide Flats. Carr West, Carr Southwest, Round Butte, Buckeye Quadrangles. Township 10 North, Range 68 West, sections 2, 3, 4, 5, 6, 7, 8, 9, 10, 16, 17, 18; Township 10 North, Range 69 West, sections 1, 12; Township 11 North, Range 68 West, sections 1-4, 7-12, 14-36; Township 11 North, Range 69 West, sections 36; Township 12 North, Range 68 West, sections 22-27, 34-36.

GENERAL DESCRIPTION: The site is characterized by rolling grasslands with numerous swales and small drainages, and occasional bluffs or buttes. Elevations range from approximately 5600 to 6000 feet.

Much of the grassland is dominated by blue grama (*Bouteloua gracilis*) and western wheatgrass (*Pascopyrum smithii*) with some needle and thread grass (*Stipa comata*). The grasslands are more similar to the mixed grass prairie to the north than the shortgrass prairie found to the east on the Pawnee National Grassland. The small bluffs or buttes that rise above the landscape are often covered with shrublands dominated by mountain mahogany (*Cercocarpus montanus*).

Most of the site is used for cattle grazing although some parcels have been converted to agricultural fields, some of which are active, some of which are fallow. Numerous stock ponds and windmills and an occasional old homestead site can be found on the landscape. Numerous dirt and gravel roads and a railroad exist within the site. Bison currently graze on the Platte River Power Authority property and pronghorn are common throughout the area. Small prairie dog towns are present within the site, several of which support burrowing owl populations.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The site supports breeding population of mountain plovers (*Charadrius montanus)*. Twelve nest were located in 1992 and 7 nests were located in 1993. In 1996, nesting plovers were observed at the site (R. Ryder - pers. communication). Although this area is thought to be marginal habitat for the species localized habitats or grazing patterns may allow for good nesting conditions.

The mottled dusky wing butterfly (*Erynnis martialis*) was documented from the grasslands on the site.

The site also supports occurrence of several state rare or declining bird species including chestnut-collared longspur, burrowing owl, ferruginous hawk, grasshopper sparrow, loggerhead shrike, short-eared owl, savannah sparrow, and golden eagle.

Although the plant communities appear to be somewhat altered over much of the areas, the size of the landscape and the diversity of conditions appears sufficient to support viable occurrences of most of imperiled species (see table below). This site, and its surroundings encompass large tracts of relatively natural prairie. Although this habitat is not uncommon regionally a large percentage in Larimer County has been destroyed by urban development or heavily altered by agricultural conversion. This site would protect not only several species imperiled at a global or state level, but would also protect many common species and a valuable part of Larimer County's natural heritage.

Table 17. Natural Heritage Elements at the Rawhide Flats Macrosite.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Charadrius montanus	Mountain plover	?	G2	S2B SZN	C	SC	FS
Cercocarpus montanus/ Elymus lanceolata x Pseudoroegneria spicata	Foothills shrubland	C	G3	S3			
Erynnis martialis	mottled duskywing butterfly	B	G4	S2S3			
Calcarius ornatus	chestnut collared longspur	?	G5	S2B SZN			
Buteo regalis	ferruginous hawk	BC	G4	S3B S5N		SC	FS
Ammodramus savannarum	grasshopper sparrow	C	G5	S3S4B SZN			
Lanius ludovicianus	loggerhead shrike	?	G4G5	S3B SZN			
Asio flammeus	short-eared owl	?	G5	S2B SZN			
Passerculus sandwichensis	savannah sparrow	B	G5	S3S4B SZN			
Aquila chrysaetos	golden eagle	?	G5	S3S4B SZN			
Athene cunicularia	burrowing owl	?	G4	S3S4B			
Carex simulata	wet meadow	C	G5	S3			
Carex nebrascensis	wet meadow	C	G5	S4			

*EO = element occurrence

CURRENT STATUS: The site is currently owned by numerous landowners but much of the acreage is owned by the Platte River Power Authority and the City of Fort Collins (Meadow Springs Ranch).

BOUNDARY JUSTIFICATION: The boundary is intended to protect the grassland habitats necessary for the survival of the mountain plover. It is thought that this boundary will also protected viable populations of the numerous state rare bird species documented within this site. This boundary would protect a variety of habitats; bluffs for raptors, hill tops for larkspurs, mesic swales for savanna and grasshoppers sparrows, fence lines for loggerhead shrikes, windmills and

trees around old home sites and bluffs for the ferruginous hawk, and open prairie for the mountain plovers. The southern boundary is intended to exclude lands which are already converted to agricultural use. The boundary will also permit ecological processes to occur, on a scale that has biological significance.

PROTECTION CONSIDERATIONS: Limited residential development has occurred in the area but future growth along the Front Range may impact this area over the long term. This is one of the few areas in Larimer County with large tracts of relatively undisturbed Great Plains grasslands. The large size would allow ecological processes (especially grazing and fire) to function in a more natural way than possible on most smaller grassland sites in the eastern part of the County. Creating a mosaic of natural ecosystems - short and mixed grass prairie, shrublands, riparian areas, and small patches of cottonwood trees - will be necessary to protect many of the species at the site.

MANAGEMENT CONSIDERATIONS: Any activities associated with grazing management or biosolid disposal at this site should consider the sensitive elements present. A review of these activities by knowledgeable experts should be considered part of the planning process. If Holistic Range Management is considered for the site, research into the affects on sensitive species would be warranted. Recreational use should be planned around sensitive elements and should use existing trails or roads where possible to minimize fragmentation of the area.

The site should be managed for the persistence of the mountain plover. Some areas within the site are dominated by shortgrass prairie species and/or grazed low enough to provide nesting habitat for the mountain plovers. Activities on the Meadow Springs Ranch are limited around the known plover nesting sites during the breeding season (G. McGaha-Miller).

Prairie dog colonies should be allowed to expand naturally. These colonies are a natural part of this ecosystem and provide habitat for burrowing owls and mountain plovers, and food for various raptors including the ferruginous hawk. Activities around the ferruginous hawk and golden eagle nest sites should be limited until after the young have fledged. The Colorado Division of Wildlife should be consulted to determine specific buffer distances and times of year to avoid nesting sites for hawks and eagles.

This grassland ecosystem evolved with disturbance form both grazing and fire. Both of these disturbances should still be considered a vital to the long term persistence of the elements at this site. A natural mosaic of vegetation would best support the diverse assemblage of elements documented at the site. We recommend that the vegetation be kept in a natural mosaic by spatially and temporally distributing grazing to mimic natural (bison) grazing. The wetlands have been heavily impacted by grazing. Fencing of the wetlands and a rotation grazing system would allow the wetland plant communities to approach more natural conditions.

Rawhide Flats Macrosite

N

1 mile

Turkey Roost

SIZE: Approximately 1500 Acres.

BIODIVERSITY RANK: B2 - Very high significance. An excellent occurrence of a globally imperiled plant species.

PROTECTION URGENCY RANK: P4 - No threat known for foreseeable future.

MANAGEMENT URGENCY RANK: M4 - Management of recreational activities may be needed in the future to maintain the current quality of the element occurrences.

LOCATION: Large granitic outcrops in the northern Laramie Mountains off of Cherokee Park Road. About 2.5 air miles northwest of Halligan Reservoir. USGS Quadrangle name: Cherokee Park Quadrangle. Township 11 North, Range 72 West, sections 23,24,25,26,and 27

GENERAL DESCRIPTION: This site contains hillslopes of ponderosa pine *(Pinus ponderosa)* woodlands with large cliffs and outcrops of pre-Cambrian Silver Plume granite. The woodlands include limber pine *(Pinus flexilis),* Douglas fir (*Pseudotsuga menziesii)*, wax flower *(Jamesia americana),* currants *(Ribes* spp.), *Drymocallis fissa*, fringed sage *(Artemisia frigida),* and a mix of native grasses. The granite outcrops support Larimer aletes *(Aletes humilis)* and Rocky Mountain cinquefoil *(Potentilla effusa* var. *rupincola)*. There are a few dirt roads and a portion of Cherokee Park Road included within the site.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: This site includes one occurrence of Larimer aletes *(Aletes humilis)* and two occurrences of Rocky Mountain cinquefoil *(Potentilla effusa* var. *rupincola).* Both of these species are Colorado endemics which occur on granite outcrops. This site is in good condition and the threats are low.

Table 18. Natural Heritage Elements at the Turkey Roost Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Potentilla effusa var. *rupincola*	Rocky Mountain cinquefoil	B	G3G5 T2	S2			FS
Potentilla effusa var. *rupincola*	Rocky Mountain cinquefoil	C	G3G5 T2	S2			FS
Aletes humilis	Larimer Aletes	A	G2G3	S2S3			FS

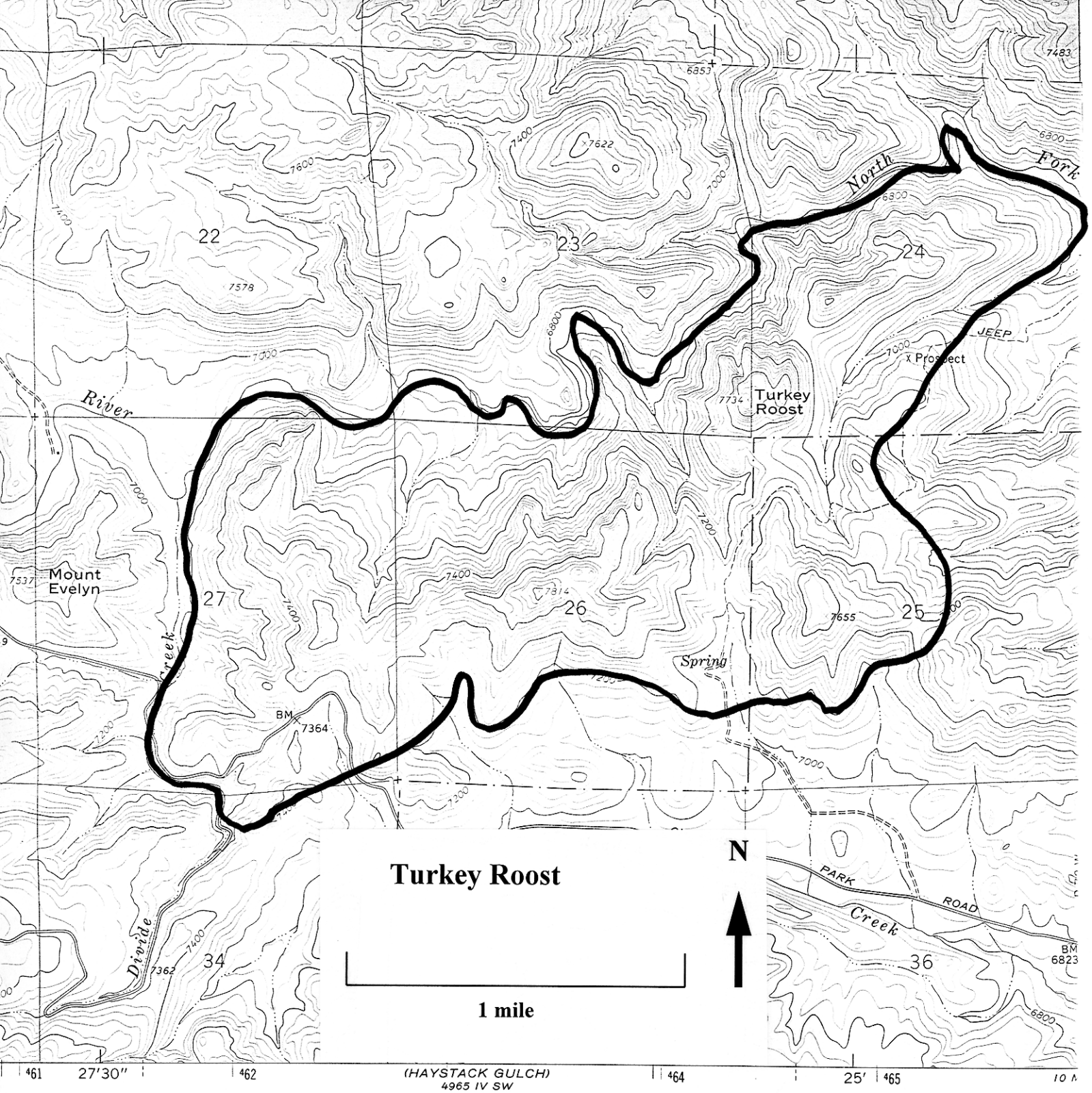
*EO = element occurrence

CURRENT STATUS: The site is partially owned and managed by the Colorado Division of Wildlife as Cherokee Park State Wildlife Area. The site is not currently threatened but if recreational use increases the site could be negatively impacted. Adjacent lands are privately owned.

BOUNDARY JUSTIFICATION: The boundary includes the occurrences and adjacent natural habitats to form a buffer. The ecological processes, such as erosion and gap succession, that are believed to support the occurrences are present with the exception of fire.

PROTECTION CONSIDERATIONS: There are no known immediate threats; however, the area is managed for wildlife. Management agreement with Colorado Division of Wildlife should be sought

MANAGEMENT CONSIDERATIONS: Larimer aletes grows on steep, inaccessible cliffs. Recreational climbing activity has not been observed at this location, though this site could become popular with climbers in the future, and management would need to address the threats posed by this use. The dirt road through the site has been closed. There is no grazing on the Colorado Division of Wildlife land, although there is some grazing on the adjacent private lands which could threaten the rare plants that occur off of the rock outcrops as well as the overall condition of the associated plant communities. Currently the site is mostly free of non-native plant species. There is a lot of residential development occurring along Cherokee Park Road (Bustos 1995), and residential development pressures in this area are generally high. Work with the Colorado Division of Wildlife and the private landowners to reach a management agreement to assure long-term protections for Larimer aletes and Rocky Mountain cinquefoil at this site.



(HAYSTACK GULCH)
4965 IV SW

SCALE 1:24 000

1 MILE
7000 FEET
1 KILOMETER

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

COLORADO

QUADRANGLE LOCATIO

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR WASHINGTON, D. C. 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

Sites Ranked "B3" - High Significance

Big Thompson Canyon South

SIZE: Approximately 100 acres.

BIODIVERSITY RANK: B3 - High significance. A fair quality occurrence of a globally imperiled plant community.

PROTECTION URGENCY RANK: P2 - Threat from development and fragmentation expected within 5 years.

MANAGEMENT URGENCY RANK: M3 - Management of non-native species may be needed within 5 years to maintain the current quality of the element occurrences.

LOCATION: South of the Big Thompson River approximately 4 miles west of Lake Loveland. Masonville Quadrangle. Township 5 North, Range 70 West, section 12.

GENERAL DESCRIPTION: The site is the northern rim of a hogback bounded to the north by the Big Thompson River. This is a small site generally surrounded by residential development.

NATURAL HERITAGE SIGNIFICANCE: This ponderosa pine/mountain mahogany/big bluestem (*Pinus ponderosa/Cercocarpus montanus/Andropogon gerardii)* foothills woodland is only known from the northern Front Range of Colorado. Most occurrences have been destroyed or degraded by development, overgrazing, or mining. This site has only been viewed from nearby roads and the condition is unknown although expected to be somewhat degraded.

Table 19. Natural Heritage Elements at the Big Thompson Canyon South Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Pinus ponderosa/ Cercocarpus montanus/ Andropogon gerardii	Foothills woodland	C	G2	S2			

*EO = element occurrence

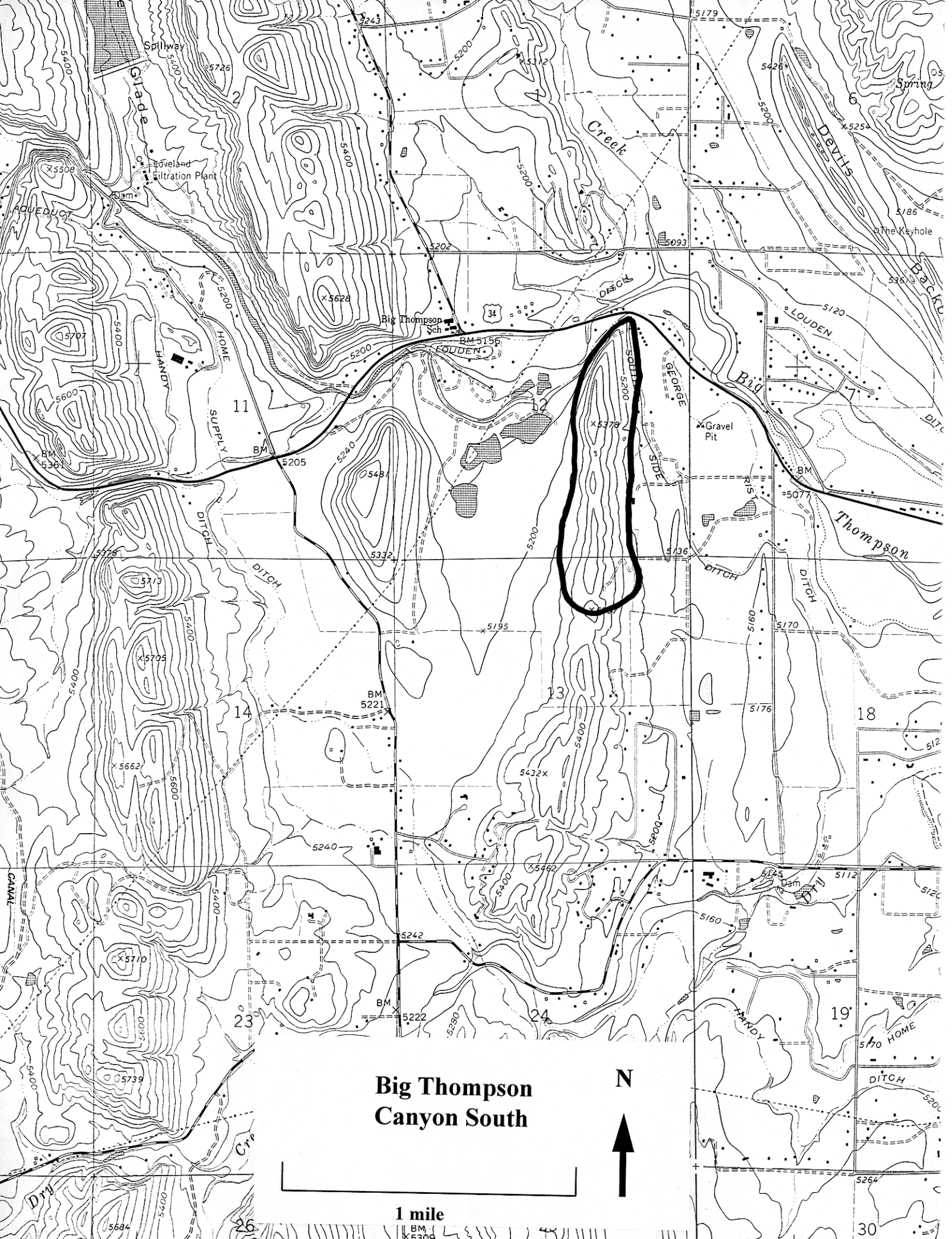
CURRENT STATUS: The site is privately owned. Dense residential development has occurred in the nearby area.

BOUNDARY JUSTIFICATION: The boundary includes the occurrence and very narrow buffer on the slopes. Fire is thought to be important but not naturally contained within the boundary.

PROTECTION CONSIDERATIONS: Further development and fragmentation will impact the element at the site.

MANAGEMENT CONSIDERATIONS: Sites surrounded by non-natural landscapes such as residential subdivisions often are impacted by invasion of non-native species. This should be

monitored at the site and control measures taken if the non-native plant species begin to dominate.


Big Thompson
Canyon South
N
1 mile
Spillway
Glade
Loveland
Filtration Plant
Dam
AQUEDUCT
Big Thompson
Sch
BM 5156
LOUDEN
HOME
HANDY
SUPPLY
BM
5205
BM
5361
DITCH
Gravel
Pit
Big Thompson
Creek
Devils
Spring
The Keyhole
LOUDEN
GEORGE
SIDE
RIST
BM
5077
BM
5221
BM
5222
BM
5309
Dam
Dry
CANAL
(CARTER LAKE RESERVOIR)
R. 70 W.
R. 69 W.
12'30"
10'
482
483
485
486
080 000 FEET

Big Thompson School North

SIZE: Approximately 290 acres.

BIODIVERSITY RANK: B3 - High significance. A poor quality occurrence of a globally imperiled plant community.

PROTECTION URGENCY RANK: P2 - Threat expected within 5 years from further residential development.

MANAGEMENT URGENCY RANK: M4 - Management of non-native plant species may be needed in the future to maintain the current quality of the element occurrences.

LOCATION: East of the Loveland Filtration Plant north of Highway 34. Masonville Quadrangle. Township 5 North, Range 70 West, sections 2, 11 and 12

GENERAL DESCRIPTION: The site occurs on north-south trending sandstone hogback. The elevation ranges from approximately 5200 feet to 5700 feet. Much of the surrounding area has been developed to some extent and is heavily altered from its natural state.

NATURAL HERITAGE SIGNIFICANCE: This ponderosa pine/mountain mahogany/big bluestem (*Pinus ponderosa/Cercocarpus montanus/Andropogon gerardii)* foothills woodland is only known from the northern Front Range of Colorado. Most occurrences have been destroyed or degraded by development, overgrazing, or mining. Much of the site or surrounding area has been impacted to some extent by these activities. This site may not support all the natural ecological processes that it once did but may provide good recreation or education opportunities.

Table 20. Natural Heritage Elements at the Big Thompson School North Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Pinus ponderosa/ Cercocarpus montanus/ Andropogon gerardii	Foothills woodland	D	G2	S2			

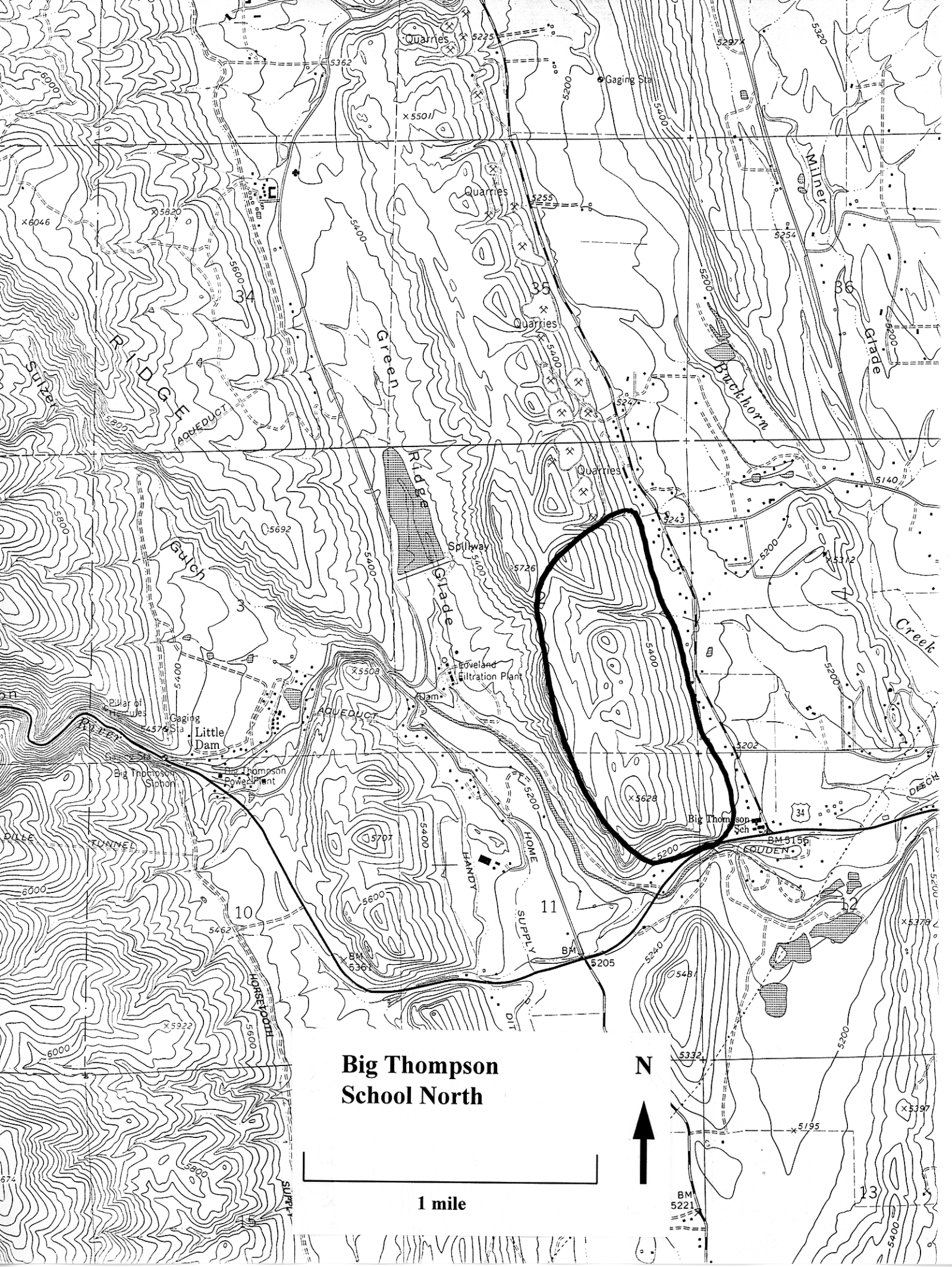
*EO = element occurrence

CURRENT STATUS: The land is privately owned.

BOUNDARY JUSTIFICATION: The boundary includes the occurrences and surrounding similar habitat. The boundary in this case is intended to allow some semblance of natural ecological processes to occur (especially fire) but large scale natural ecological processes may not be viable within the site.

PROTECTION CONSIDERATIONS: Avoid further fragmentation from residential development or mining.

MANAGEMENT CONSIDERATIONS: Sites surrounded by non-natural landscapes such as residential subdivisions often are impacted by invasion of non-native species. This should be monitored at the site and control measures taken if the non-native plant species begin to dominate.


Big Thompson
School North
N
1 mile

Big Thompson South

SIZE: Approximately 800 acres.

BIODIVERSITY RANK: B3 - High significance. Fair quality occurrences of two globally imperiled plant communities.

PROTECTION URGENCY RANK: P4 - No threat known for foreseeable future.

MANAGEMENT URGENCY RANK: M4 - Management of non-native plant species may be needed in the future to maintain the current quality of the element occurrences.

LOCATION: South of the Big Thompson River approximately 7 miles west of Loveland. Masonville (4010542) Quadrangle. Township 5 North, Range 70 West, sections 9, 10 and 15.

GENERAL DESCRIPTION: The site is on an east facing slope and elevations range from 5460 to 6200 feet. The vegetation is characterized by a mosaic of ponderosa pine (*Pinus ponderosa*) woodlands on the higher slopes and mountain mahogany (*Cercocarpus montanus*)shrublands on the lower slopes. Most of the valley below has been heavily altered and is generally dominated by non-native species.

NATURAL HERITAGE SIGNIFICANCE: The mountain mahogany/needle and thread grass *(Cercocarpus montanus/Stipa comata*) foothills shrubland is globally imperiled. Almost all known occurrences are highly degraded by invasion of the non-native cheatgrass (*Bromus tectorum*). The occurrence at this site is small and has been invaded by an abundance of cheatgrass and toadflax (*Linaria dalmatica*).

This ponderosa pine/mountain mahogany/big bluestem (*Pinus ponderosa/Cercocarpus montanus/Andropogon gerardii)* foothills woodland is only known from the northern Front Range of Colorado. Most occurrences have been destroyed or degraded by development, overgrazing, or mining. This site has been impacted to some extent by these activities and the occurrence is degraded.

Table 21. Natural Heritage Elements at the Big Thompson South Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Cercocarpus montanus/Stipa comata	Foothills shrubland	C	G2	S2			
Pinus ponderosa/ Cercocarpus montanus/ Andropogon gerardii	Foothills woodland	C	G2	S2			

*EO = element occurrence

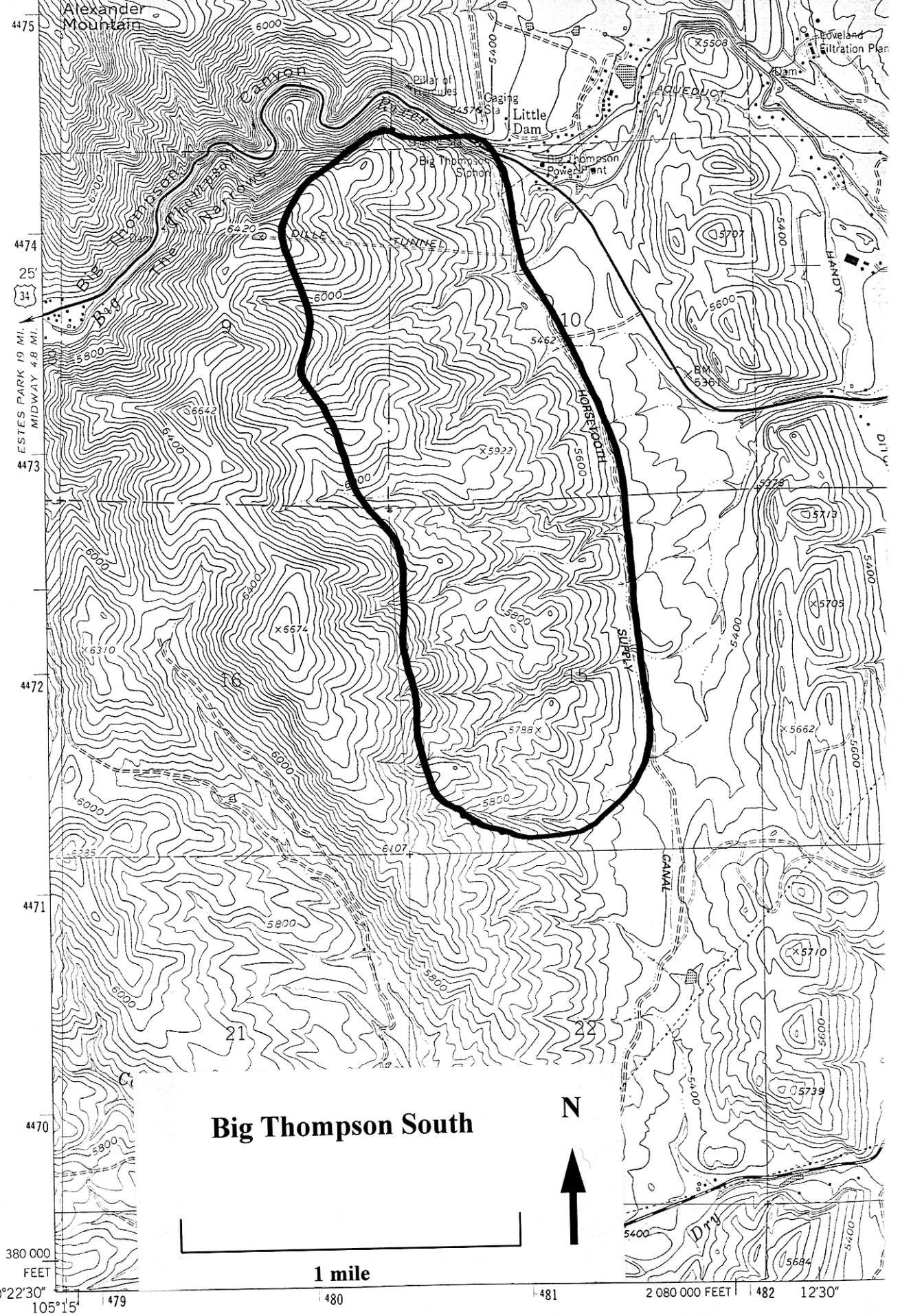
CURRENT STATUS: The site is owned by one landowner who apparently has no interest is subdividing or selling the ranch. Some residential development has occurred in the adjacent area to the east.

BOUNDARY JUSTIFICATION: The boundary is intended to protect the occurrences from direct disturbance and provide some buffer. This boundary should provide for most natural ecological processes to occur. The lower valley to the east of the site has been heavily degraded and is not included in the site.

PROTECTION CONSIDERATIONS: Protection could be provided to this site by keeping the land unfragmented and in low impact agricultural use.

MANAGEMENT CONSIDERATIONS: Livestock grazing has been a prominent land use factor since European settlement. The valley bottoms in the site are degraded from years of heavy grazing and would need to be restored to increase the biodiversity values of the site. Non-native or weedy native species are very common and dominant in some places. Further increase of non-native species within the site may decrease the biodiversity significance by altering the native floral and faunal species composition (Bock and Bock 1988). Grazing or fire management could be used as a tool to reduce the dominance of these species and increase the proportion of native species (see discussion of the problems of non-native species).

The current owner apparently does not graze cattle but does have some horses on the property. This low intensity use may help the plant communities to recover but more aggressive management activities may be needed to fully restore the site. Some development is taking place in the area and this could affect the management methods used at the site.



Mapped, edited, and published by the Geological Survey

Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs taken 1958. Field checked 1962

Polyconic projection. 1927 North American Datum
10,000-foot grid based on Colorado coordinate system, north zone

(PINEWOOD LAKE) 4964 IV SE

MN
GN
0°07'
2 MILS
12°
213 MILS

Boxelder Canyon (R/W)

SIZE: Approximately 130 acres.

BIODIVERSITY RANK: B3 - High significance. Boxelder Canyon contains a fair quality occurrence of a riparian community that may be globally imperiled.

PROTECTION URGENCY RANK: P2 - Threat expected within 5 years. This area is rapidly developing.

MANAGEMENT URGENCY RANK: M4 - Management may be needed in the future to maintain the current quality of the element occurrences. Non-native species in the site may increase without management.

LOCATION: Along Boxelder Creek, on the west side of the Big Hole. One mile northwest of Table Mountain. Table Mountain Quadrangle. Township 11 North, Range 70 West, section 2.

GENERAL DESCRIPTION: Boxelder Canyon is a moderately narrow and deep foothills canyon in the Laramie Foothills region. The north canyon wall consists of red sandstone, while granite comprises the south canyon wall. The riparian zone is about 50% forested with narrowleaf cottonwood (*Populus angustifolia*). The shrub layer is diverse, but dominated by blue stem willow (*Salix irrorata*). The herbaceous layer is also very diverse, but contains many alien species, especially Canadian thistle (*Cirsium arvense*) and smooth brome (*Bromus inermis*). Upland communities on the site consist primarily of mountain mahogany (*Cercocarpus montanus*) shrublands. An on-site visit was not possible but the canyon was viewed from adjacent lands. This may necessitate a modification of this description in the future.

The foothills of Larimer County may be the only place where this community occurs in Colorado. Boxelder Canyon appears to be the only canyon in this area that supports this community yet does not have a road running through the bottom of the canyon. Haygood Canyon, north of Boxelder Canyon and near the Wyoming border, may also be in similar condition.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The riparian forest community present at this site (*Populus angustifolia/Salix irrorata*) has been reported only in Larimer County in Colorado. The canyons in the foothills of the northern end of the Front Range may the only place in Colorado where this community occurs. It has been reported from the Pecos River Basin in New Mexico. Note that a more accurate description of this community and a more complete assessment of the element occurrence rank should be done if access to the site is gained.

Table 22. Natural Heritage Elements at the Boxelder Canyon Site.							
Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Populus angustifolia/Salix irrorata	Foothills riparian plant association	C	G3?	S1?			

*EO = element occurrence

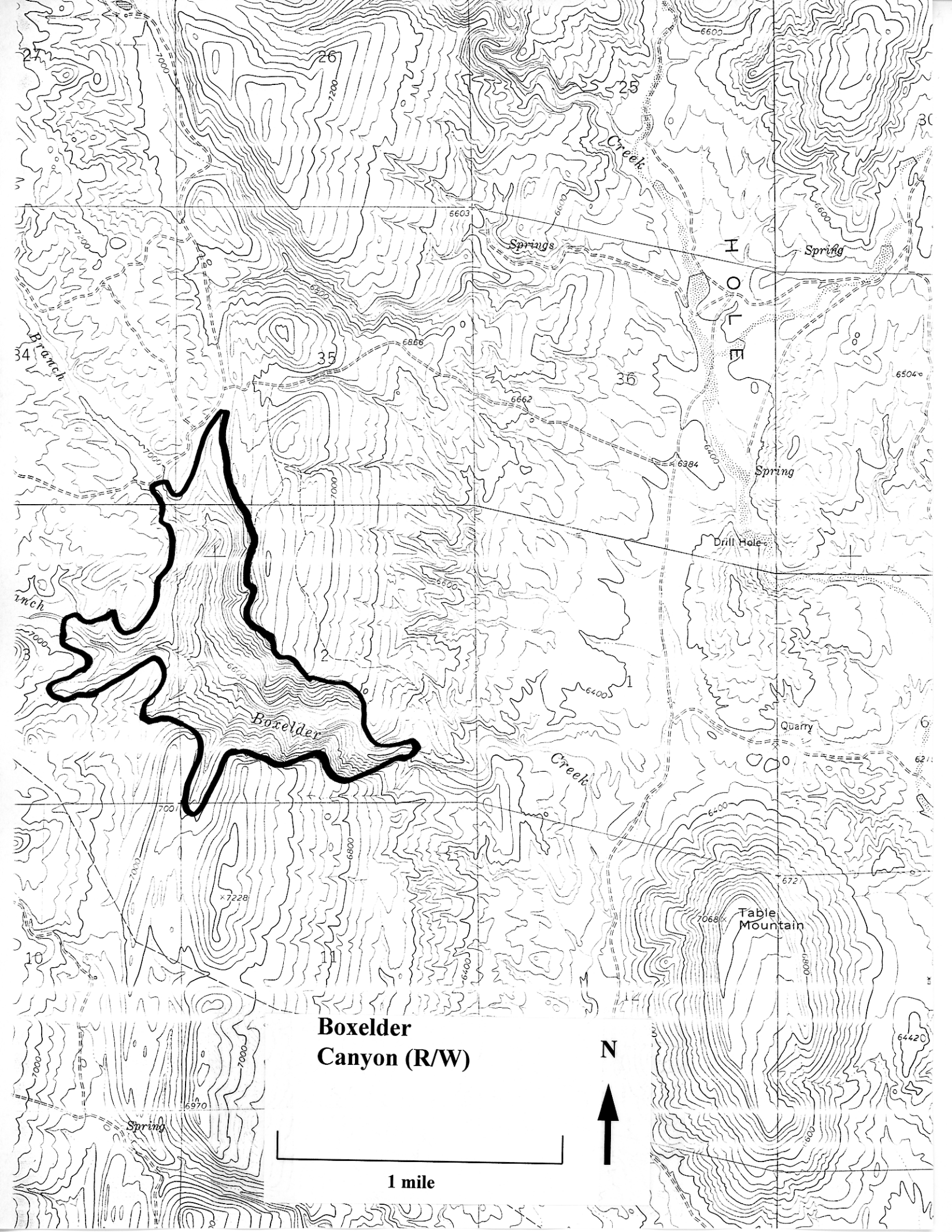
CURRENT STATUS: Boxelder Canyon is privately owned. It may be grazed, but not heavily. There is no road through the canyon.

BOUNDARY JUSTIFICATION: The boundary includes the entire length of the narrow, cool canyon. The boundary also includes a buffer consisting of the sides of the canyon and small draws draining into the canyon in order to protect the riparian area from the effects of roads and other direct impacts. Because an on-the-ground survey was not possible at this site the boundary needs to be verified.

Hydrology is critical to this riparian system. The integrity of the riparian community could be affected by any major hydrologic modifications upstream, even beyond the site boundaries.

PROTECTION CONSIDERATIONS: This site could be protected by a conservation easement designed to prohibit buildings and roads within the site boundaries.

MANAGEMENT CONSIDERATIONS: The plant community to be protected by this site may benefit from weed management in the canyon.


Boxelder
Canyon (R/W)
N
1 mile
Boxelder
Creek
Springs
Spring
Spring
Spring
Drill Hole
Quarry
Table
Mountain
Branch
Creek
HOLE
6603
6600
6504
6662
6384
6400
6866
7228
7068
6970
6442
6800
7000
7200
25
26
27
34
35
36
1
2
3
10
11
14

Bull Garden

SIZE: Approximately 70 acres.

BIODIVERSITY RANK: B3 - High significance. An excellent occurrence of a globally imperiled plant species.

PROTECTION URGENCY RANK: P4 - No threat known for foreseeable future.

MANAGEMENT URGENCY RANK: M4 - Management may be needed in the future to maintain the current quality of the element occurrence.

LOCATION: Along Prairie Divide Road, just west of where the road descends into the drainage of Divide Creek. Cherokee Park Quadrangle. Township 11 North, Range 72 West, section 33.

GENERAL DESCRIPTION: The site is characterized by a ponderosa pine *(Pinus ponderosa)* woodland in the Front Range foothills. Site is adjacent to Prairie Divide Road. The only observations of the site were made from this road.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: This site includes an excellent occurrence of Rocky Mountain cinquefoil *(Potentilla effusa* var. *rupincola).* This species is endemic to Colorado and is restricted to areas that have large outcrops of silver Plume Granite. This site is in excellent condition and the threats are low.

Table 23. Natural Heritage Elements at the Bull Garden Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Potentilla effusa var. *rupincola*	Rocky Mountain cinquefoil	A	G3G5 T2	S2			FS

*EO = element occurrence

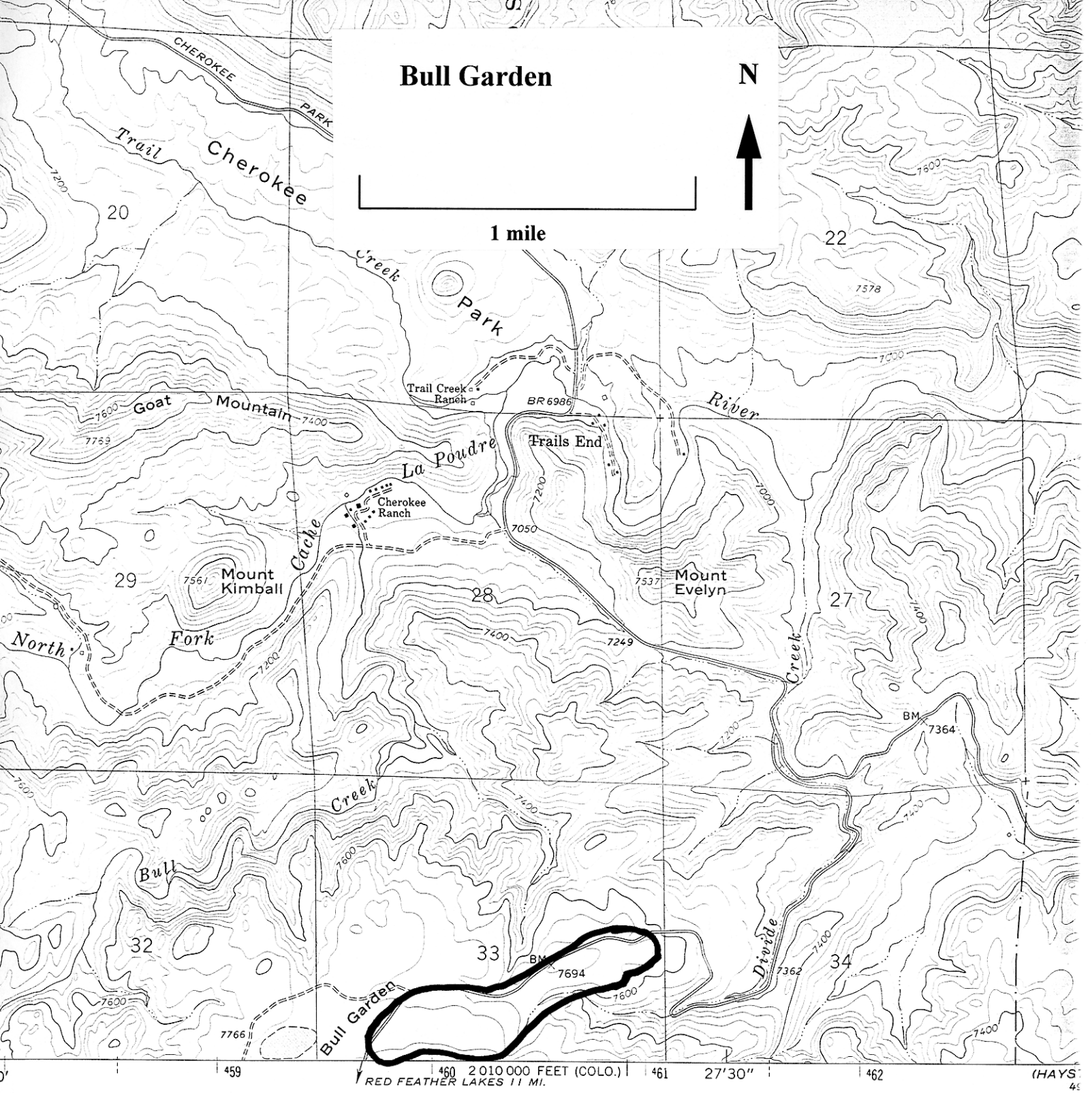
CURRENT STATUS: Specific land ownership and threats are unknown at this time.

.

BOUNDARY JUSTIFICATION: Includes the occurrence and a narrow buffer to protect from direct disturbances. Most ecological processes are intact although natural fires may have been suppressed.

PROTECTION CONSIDERATIONS: Future plans for the area are not known.

MANAGEMENT CONSIDERATIONS: There are no threats documented now but the future plans for this site are not known.



459 460 2 010 000 FEET (COLO.) 461 27'30" 462

RED FEATHER LAKES 11 MI.

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ntrol by USGS and USC&GS

pography by photogrammetric methods from aerial
otographs taken 1966. Field checked 1967

yconic projection. 1927 North American datum
,000-foot grids based on Colorado coordinate system, north zone
Wyoming coordinate system, east zone
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2 N., Sixth Principal Meridian, is duplicated in
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GN MN
0°17' 13½°
5 MILS 240 MILS

UTM GRID AND 1967 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

SCAL

1 ½
1000 0 1000 2000
1 5

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FOR SALE BY U. S. GEOLOGICAL SURVEY, DEN
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Carter Lake Reservoir Hogbacks

SIZE: Approximately 1850 acres.

BIODIVERSITY RANK: B3 - High significance. A fair occurrence of a globally imperiled plant community.

PROTECTION URGENCY RANK: P2 - Threat expected within 5 years from fragmentation and from increased residential development.

MANAGEMENT URGENCY RANK: M2 - Management of recreation and non-native plant species may be needed within 5 years to prevent loss of element occurrences.

LOCATION: Immediately west of Carter Lake Reservoir. Carter Lake Reservoir Quadrangle. Township 4 North, Range 70 West, sections 3, 4, 9, and 16; Township 5 North, Range 70 West, section 34.

GENERAL DESCRIPTION: The site occurs on a hogback ridge just west of Carter Lake Reservoir. Several different sandstone formations are exposed on the hogback. In some areas the sandstone forms a "pavement" and vegetation is confined to the cracks in the rock. The elevation at the site ranges from 5760 feet at the level of Carter Lake Reservoir to 6227 feet at the highest point on the hogback.

The vegetation is characterized by a mosaic of ponderosa pine (*Pinus ponderosa*) woodlands, mountain mahogany (*Cercocarpus montanus*) shrublands, and small grassland openings. There is evidence of past fire in the area.

Residential development has occurred at a rapid pace in the area and house are built or being built at the northern end. Extensive mining has also taken place, especially to the south where many quarries exist. Numerous picnic grounds and recreational trails (hiking and mountain biking) exist in the general area.

NATURAL HERITAGE SIGNIFICANCE: This ponderosa pine/mountain mahogany/big bluestem (*Pinus ponderosa/Cercocarpus montanus/Andropogon gerardii)* foothills woodland is only known from the northern Front Range of Colorado. Most occurrences have been destroyed or degraded by development, overgrazing, or mining. This site has been impacted to some extent by these activities and the occurrence is degraded.

The mountain mahogany/New Mexico feathergrass (*Cercocarpus montanus/Stipa neomexicana*) foothills shrubland was first documented from this area in 1994. The occurrence at this site is of moderate size but somewhat degraded.

Table 24. Natural Heritage Elements at the Carter Lake Reservoir Hogbacks Site.							
Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Pinus ponderosa/ Cercocarpus montanus/ Andropogon gerardii	Foothills woodland	C	G2	S2			
Cercocarpus montanus/Stipa neomexicana	Foothills shrubland	C	G2G3	S2S3			

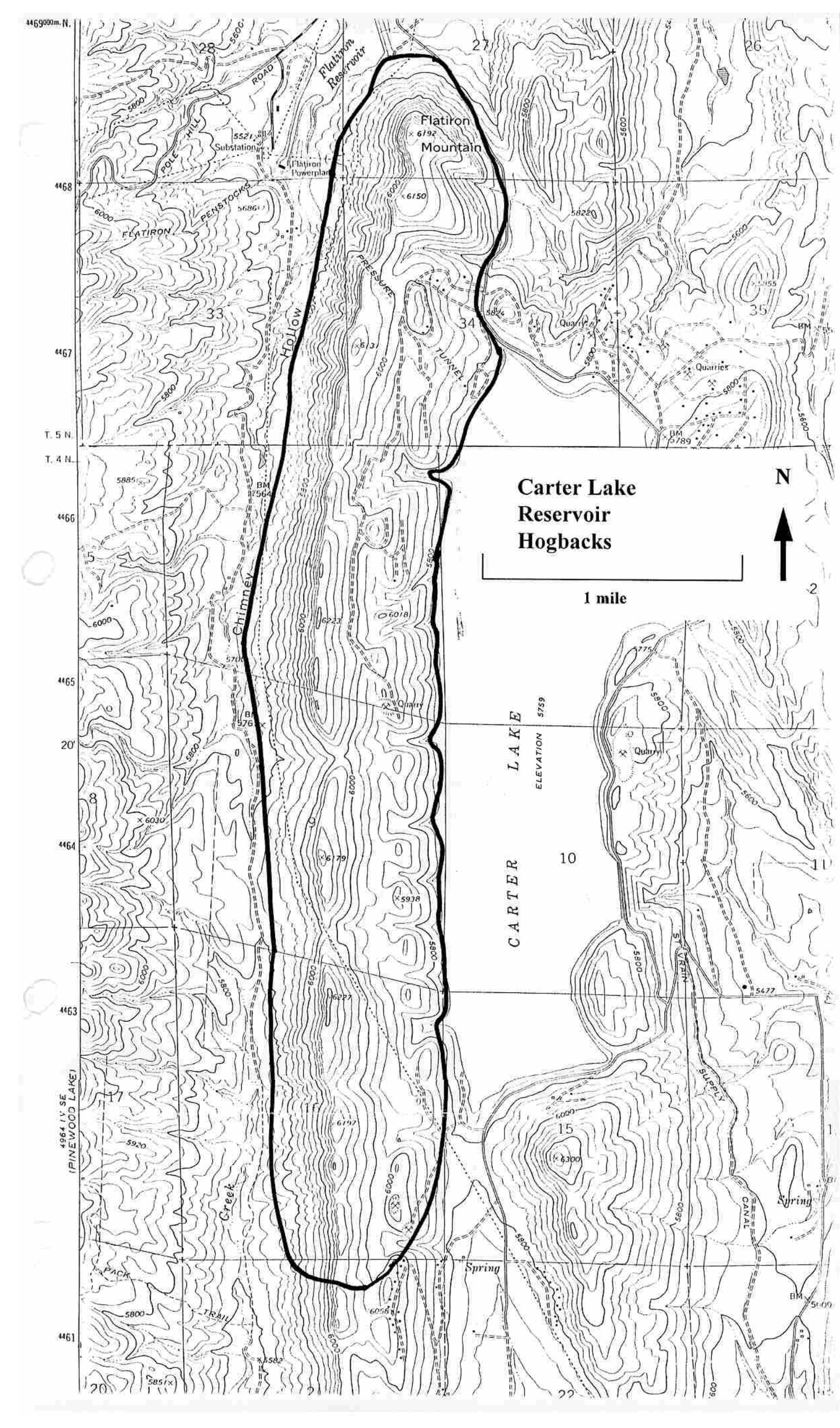
*EO = element occurrence

CURRENT STATUS: The site is owned by numerous private landowners and also includes one section of State Land Board land and some lands owned by Hewlett-Packard. Currently, no formal protection is provided to this site.

BOUNDARY JUSTIFICATION: The boundary is intended to protect the occurrences from direct disturbance and provide some buffer. The boundary to the north excludes an area already under residential development. The boundary to the south excludes lands disturbed by quarrying. The lower valley to the west of the site (Chimney Hollow) has been heavily degraded but still may provide corridors for animal migration to and from the west.

PROTECTION CONSIDERATIONS: The site encompasses land that has very high value for residential development and much has already occurred. Development plans for the area are unknown at this time. The State Land Board parcel should be considered for management for conservation purposes.

MANAGEMENT CONSIDERATIONS: Recreation use is heavy in the area and would need to be managed to protect the quality of the elements. Cheatgrass (*Bromus tectorum)* and Japanese brome (*Bromus japonicus)* are common. Further increase of non-native species may decrease the biodiversity significance of the site by altering the native floral and faunal species composition (Bock and Bock 1988). Grazing or fire management could be used as a tool to reduce the dominance of these species and increase the proportion of native species (see discussion of the problems of non-native species).


Carter Lake
Reservoir
Hogbacks
N
1 mile
Flatiron
Mountain
Flatiron
Reservoir
Chimney
Hollow
CARTER
LAKE
ELEVATION
5759
Quarry
Quarries
Spring
Creek
PACK
TRAIL
ROAD
POLE
HILL
Substation
Flatiron
Powerplant
PENSTOCKS
FLATIRON
PRESSURE
TUNNEL
ST. VRAIN
SUPPLY
CANAL
T. 5 N.
T. 4 N.
4964 IV SE
(PINEWOOD LAKE)

Cherokee Park South

SIZE: Approximately 160 acres.

BIODIVERSITY RANK: B3 - High significance. A good occurrence of a globally imperiled plant species.

PROTECTION URGENCY RANK: P4 - No threat known for foreseeable future.

MANAGEMENT URGENCY RANK: M4 - Management may be needed in the future to maintain the current quality of the element occurrences if recreational use increases.

LOCATION: About 7 miles south of the Colorado-Wyoming border along Cherokee Park Road, one half mile north of Trail's End. Cherokee Park Quadrangle. Township 11 North, Range 72 West, sections 14,15,21,and 22.

GENERAL DESCRIPTION: Larimer aletes *(Aletes humilis)* is found here on north and west-facing granite outcrops within a foothills woodland.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: This site includes a large occurrence of Larimer aletes *(Aletes humilis)* in good condition.

Table 25. Natural Heritage Elements at the Cherokee Park South Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Aletes humilis	Larimer Aletes	B	G2G3	S2S3			FS

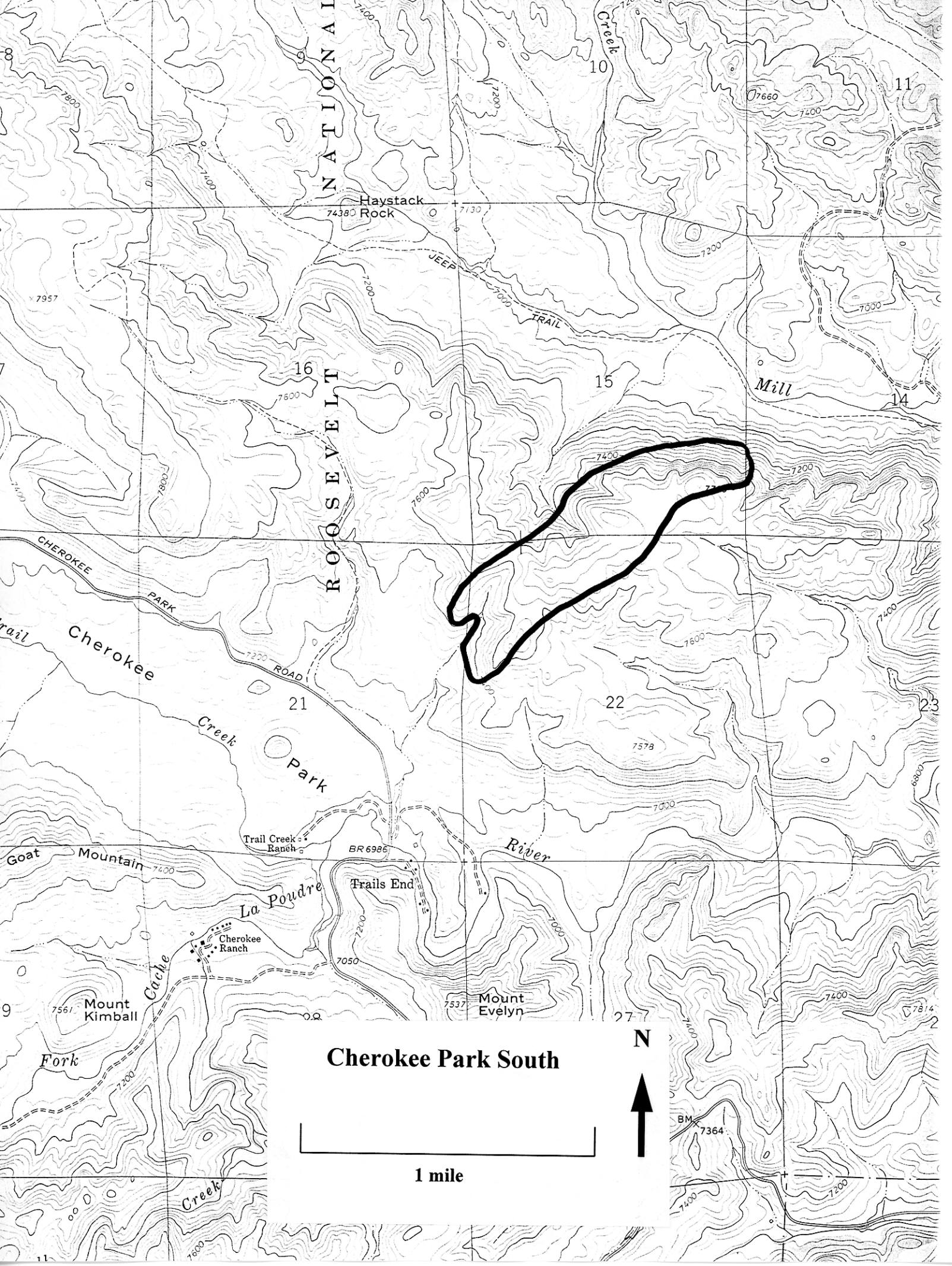
*EO = element occurrence

CURRENT STATUS: This site is within the Cherokee Park State Wildlife Area, managed by the Colorado Division of Wildlife. The site is currently not threatened but an increase in recreational use could impact the plant by trampling and increasing erosion along trails.

BOUNDARY JUSTIFICATION: Boundary is drawn to protect this occurrence of Larimer aletes *(Aletes humilis)* and provide some adjacent suitable habitat. The boundary will protect this species from direct disturbances that would destroy plants and/or habitat.

PROTECTION CONSIDERATIONS: Threats are not reported but the future plans for the site are not known.

MANAGEMENT CONSIDERATIONS: The future plans for this site are unknown. Work with Colorado Division of Wildlife to assure appropriate management, including routing of trails if necessary.


Cherokee Park South
N
1 mile
ROOSEVELT NATIONAL
Haystack Rock
7438
JEEP TRAIL
Mill
CHEROKEE PARK ROAD
Cherokee Park
Trail Creek Ranch
BR 6986
Trails End
La Poudre River
Goat Mountain
Cherokee Ranch
Mount Kimball
7561
Mount Evelyn
7537
Cache
Fork
Creek
BM 7364
7957
7578
7814

Claymore Lake South (R/W)

SIZE: Approximately 40 acres.

BIODIVERSITY RANK: B3 - High significance. A fair quality occurrence of a globally imperiled plant species.

PROTECTION URGENCY RANK: P2 - Threat expected within 5 years. The future of this site is uncertain, but its proximity to Fort Collins makes its protection urgent.

MANAGEMENT URGENCY RANK: M2 - Management of hydrology and grazing may be needed in the next 5 years on at least the Colorado State University portion of the site where the occurrence of Ute ladies' tresses orchid (*Spiranthes diluvialis)* is not in good condition.

LOCATION: About 0.5 miles south of Claymore Lake, extending east from the irrigation canal. Horsetooth Reservoir Quadrangle. Township 7 North, Range 69 West, sections 5, 6.

GENERAL DESCRIPTION: The Claymore Lake South site is a wet meadow containing both alien and native plant species, including Baltic rush (*Juncus balticus*), Nebraska sedge (*Carex nebrascensis*), redtop (*Agrostis stolonifera*), and great blue lobelia (*Lobelia siphilitica* var. *ludoviciana*). There are no woody species in the wetland where the orchid occurs, although a few cottonwoods and willows occur within the site buffer. Most of the area surrounding the wet meadow is dry pasture land, except at the east end of the meadow where there is a small stock pond. The pond edges provide habitat for stands of cattail (*Typha* spp.) and threesquare (*Scirpus pungens*).

The source of water on the site, which is probably critical to the element, is not entirely clear. It is clear that the wet meadow area receives some water from the irrigation canal, but the degree to which the hydrology may also have a natural component is uncertain. Factors suggesting natural hydrology include both landform--the wet meadow is adjacent to an obvious drainage--and the small reservoir on the east end of the site. Such reservoirs are often built where there is natural spring discharge.

Natural Heritage Significance: This site contains a relatively large population of the Ute ladies-tresses orchid, a species listed as threatened under the federal Endangered Species Act. This plant is not known to occur anywhere else in Larimer County, and it is known in fewer than twenty other locations in Colorado.

Table 26. Natural Heritage Elements at the Claymore Lake South Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Spiranthes diluvialis	Ute ladies' tresses	C	G2	S2	LT		

*EO = element occurrence

CURRENT STATUS: A portion of the site, with about 20% of the total orchid population, is owned by Colorado State University and grazed throughout the summer. In 1995 CSU fenced

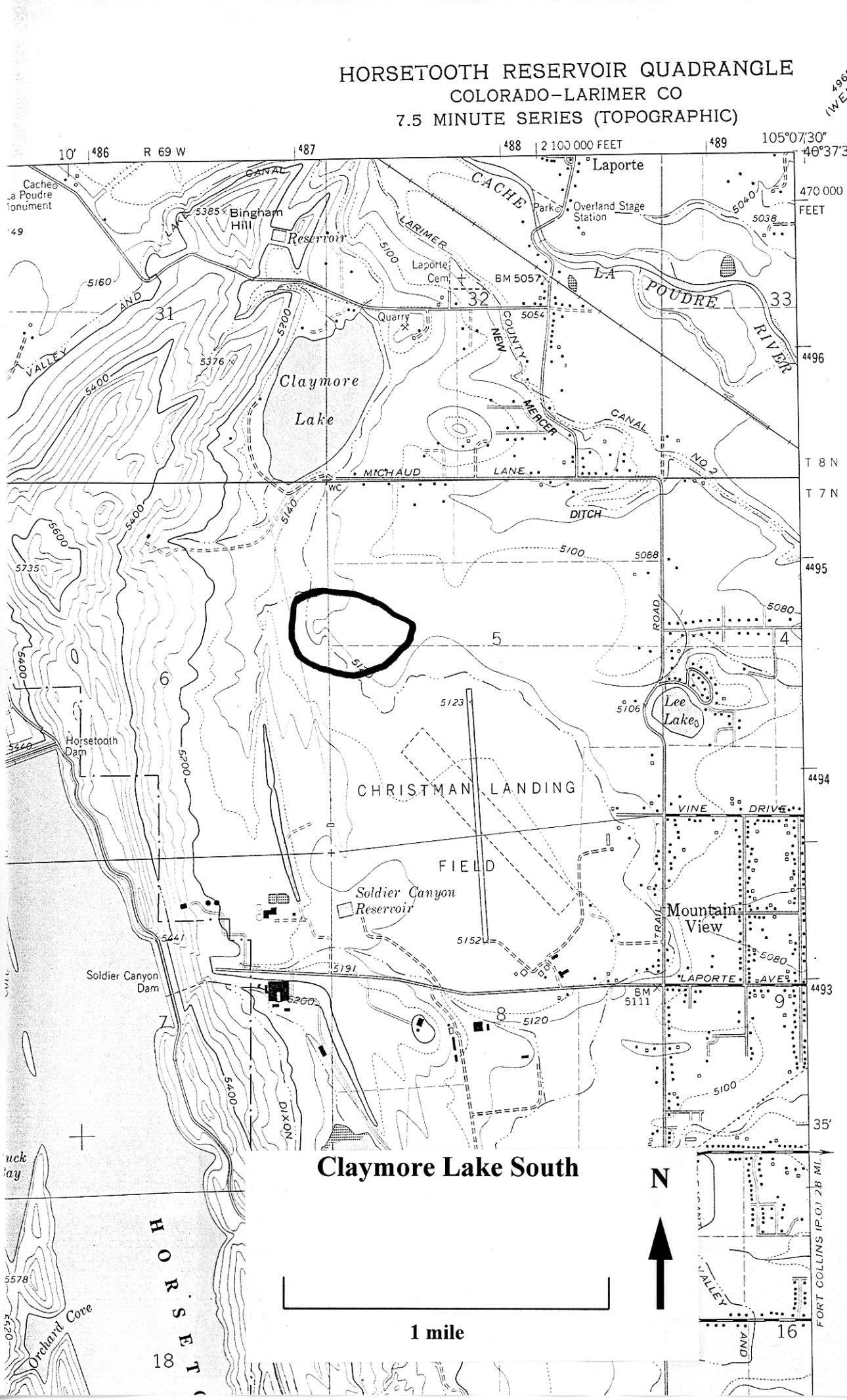
off a small piece of the orchid habitat to exclude cattle. The remainder of the site is privately owned; for most of the summer this area is not grazed, but it is winter grazed.

BOUNDARY JUSTIFICATION: The boundary includes the contiguous wetland habitat containing the orchid, suitable nearby habitat, plus a 100 foot buffer to protect from direct impacts. This boundary may have to be extended below the reservoir if it is later determined that the area near Overland Trail Road is suitable orchid habitat.

PROTECTION CONSIDERATIONS: The cattle management recommended for this site may be more resource intensive than CSU is willing to undertake, whereas the private land use seems to not hinder the orchid population. A conservation easement on the site would suffice for protection, with restrictions on development and grazing.

MANAGEMENT CONSIDERATIONS: Cattle should be excluded from the site while the orchid is growing, flowering, and developing fruit (from approximately early May to mid September). During fall, winter, and early spring, the plant may benefit from intensive grazing to reduce litter build up.

Because the wetland may derive much of its water from the irrigation ditch, there may be a relationship between the status of the orchid population and the use of the ditch. This relationship is currently unknown, but should be investigated.


HORSETOOTH RESERVOIR QUADRANGLE
COLORADO–LARIMER CO
7.5 MINUTE SERIES (TOPOGRAPHIC)
4965 II NE
(WELLINGTON)
105°07'30"
40°37'30"
2 100 000 FEET
R 69 W
Laporte
Bingham Hill
Reservoir
CACHE
LA POUDRE
RIVER
Park
Overland Stage Station
LARIMER
Laporte Cem.
BM 5057
Quarry
NEW
COUNTY
Claymore Lake
MERCER
CANAL
NO 2
MICHAUD
LANE
DITCH
ROAD
Lee Lakes
Horsetooth Dam
CHRISTMAN LANDING
FIELD
VINE
DRIVE
Soldier Canyon Reservoir
Mountain View
TRAIL
LAPORTE
AVE
Soldier Canyon Dam
BM 5111
DIXON
Orchard Core
HORSETOOTH
FORT COLLINS (P.O.) 2B MI.
T 8 N
T 7 N
470 000 FEET
4496
4495
4494
4493
35'
16
18
31
32
33
5
6
7
8
9
4
Claymore Lake South
N
1 mile

Culver Gulch

SIZE: Approximately 50 acres.

BIODIVERSITY RANK: B3 - High significance. Fair quality occurrence of a globally imperiled plant species.

PROTECTION URGENCY RANK: Protection urgency unknown.

MANAGEMENT URGENCY RANK: M2 - New management action may be needed within 5 years to prevent loss of element occurrences.

LOCATION: Shale hogback 2 miles east of Carter Lake. Carter Lake Reservoir Quadrangle. Township 4 North, Range 70 West, section 35.

GENERAL DESCRIPTION: The site occurs on a shale hogback with sparse shrublands dominated by mountain mahogany (*Cercocarpus montanus)* and intermixed grasslands. To the north this hogback has been and is being developed extensively with houses, associated landscaping, and roads.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: This site includes an C-ranked occurrence of Bell's twinpod *(Physaria bellii)*.

Table 3. Natural Heritage Elements at the Culver Gulch Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Physaria bellii	Bell's twinpod	C	G2	S2			

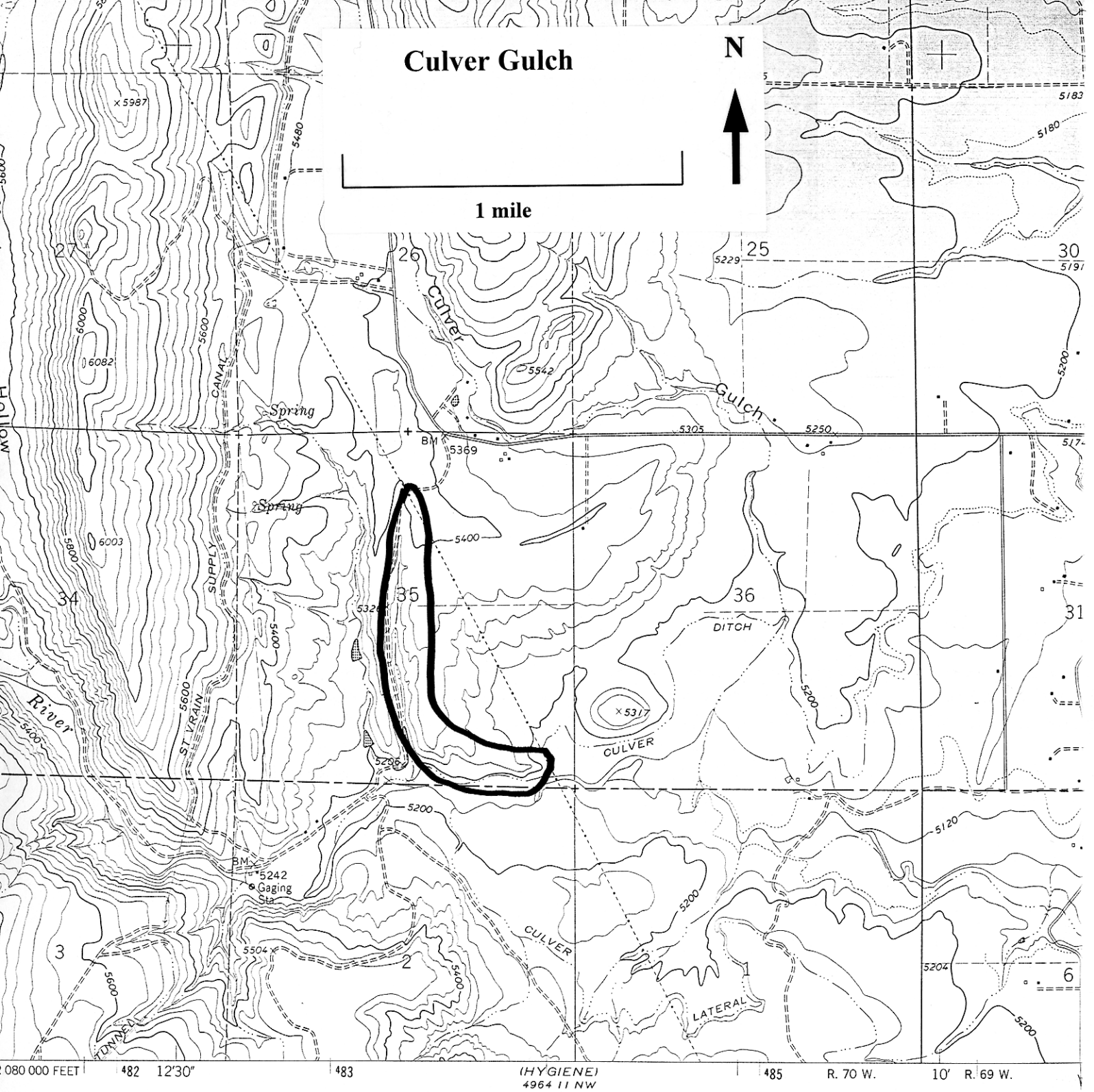
*EO = element occurrence

CURRENT STATUS: This site is owned by a local cement company. Mining operations and/or residential development may threaten this site in the future.

BOUNDARY JUSTIFICATION: Includes the occurrence and a narrow buffer to protect from direct disturbances. The shale barren community is relatively resistant to heavy weedy invasion.

PROTECTION CONSIDERATIONS: This site is partially owned by Colorado Cement Company. There is an extensive limestone mining operation on the next hogback to the west and extensive residential development to the north, but plans for this hogback are unknown.

MANAGEMENT CONSIDERATIONS: There is an old road through the occurrence which may spread roadside weeds. Plans should be discussed with the owners and a management plan/agreement instated. It may become necessary to control the spread of invasive non-native plant species though the shale hogbacks are relatively resistant to heavy weed invasion.



Curtis Lake Ridge

SIZE: Approximately 550 acres.

BIODIVERSITY RANK: B3 - High significance. A fair quality occurrence of a globally imperiled plant species.

PROTECTION URGENCY RANK: P3 - Definable threat but not within 5 years.

MANAGEMENT URGENCY RANK: M4 - Management may be needed in the future to maintain the current quality of the element occurrences. Future reclamation activities should consider potential impacts to this species.

LOCATION: North of Ft. Collins along Highway 287. Laporte Quadrangle. Township 8 North, Range 69 West, sections 8, 17, and 20.

GENERAL DESCRIPTION: This site is a shale hogback which is now covered with mine tailings. This area is bordered to the south by Highway 287.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: Although this site has been heavily altered from its natural state it supports one of the largest populations of a narrow Colorado endemic, Bell's twinpod *(Physaria bellii)*. The entire site is disturbed from historic dumping of mine tailings which would normally result in a poor quality ranking. Because the plant is present in such large numbers the site is ranked as fair.

Table 27. Natural Heritage Elements at the Curtis Lake Ridge Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Physaria bellii	Bell's twinpod	C	G2	S2			

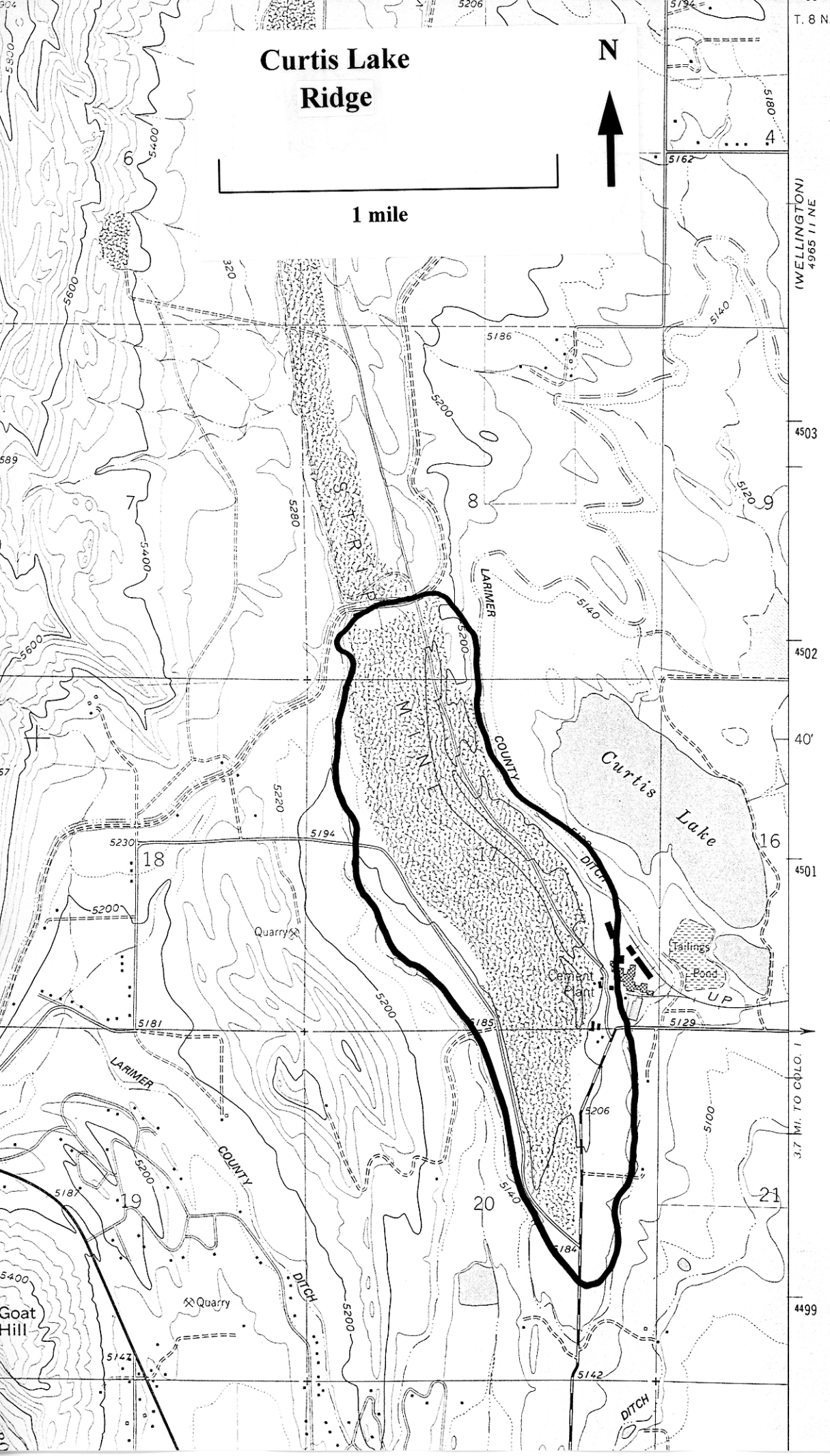
*EO = element occurrence

CURRENT STATUS: This site is privately owned by a local cement company. The site is not currently threatened but is not protected. The primary threat for the future is renewal of work at the cement company.

BOUNDARY JUSTIFICATION: The boundary protects the occurrence and provides adjacent habitat to serve as a buffer from direct disturbances. A larger boundary may need to be considered to protect the occurrence from indirect disturbances and roadside herbicide spraying.

PROTECTION CONSIDERATIONS: Renewed mining or dumping of tailings could disturb the population.

MANAGEMENT CONSIDERATIONS: Insure that the highway department's road maintenance activities are not affecting the occurrence.


Curtis Lake Ridge
N
1 mile
T. 8 N.
(WELLINGTON)
4965 II NE
Curtis Lake
LARIMER COUNTY DITCH
Quarry
Cement Plant
Tailings Pond
UP
3.7 MI. TO COLO. I
Goat Hill
Quarry
DITCH
LARIMER COUNTY
4503
4502
4501
4499
40'

Hertha Reservoir Ridge

SIZE: Approximately 450 acres.

BIODIVERSITY RANK: B3 - High significance. A fair quality occurrence of a globally imperiled plant species.

PROTECTION URGENCY RANK: P1 - Portions of this site are currently being irreversibly altered by residential development, to the detriment of the element occurrence. The remainder of the occurrence must be immediately protected.

MANAGEMENT URGENCY RANK: M3 - Management may be needed within 5 years to maintain the current quality of the element occurrence.

LOCATION: Shale outcrops from just west of Hertha Reservoir extending south about 2 miles along Niobrara Formation hogback. Carter Lake Reservoir Quadrangle. Township 4 North, Range 70 West, sections 12, 13; 24.

GENERAL DESCRIPTION: A small hogback ridge of exposed limestone and shale. The ridge is bisected by a county road. A new housing development is now built on the ridge and has substantially impacted the habitat.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: This site contains a population of Bell's twinpod (*Physaria bellii)* which is a narrow endemic to the Front Range of Colorado. The site is being developed currently and the viability of the population is declining. Due to access restrictions this site was not adequately surveyed in 1996. The last thorough survey of the area was in the mid-1980s, and the occurrences of Bell's twinpod were ranked very highly. Since then portions of the site have been highly altered, and the current quality of the occurrence is uncertain. Before proceeding with protection actions at this site, a thorough assessment of the site should be performed.

Table 29. Natural Heritage Elements at the Hertha Reservoir Ridge Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Physaria bellii	Bell's twinpod	C	G2	S2			

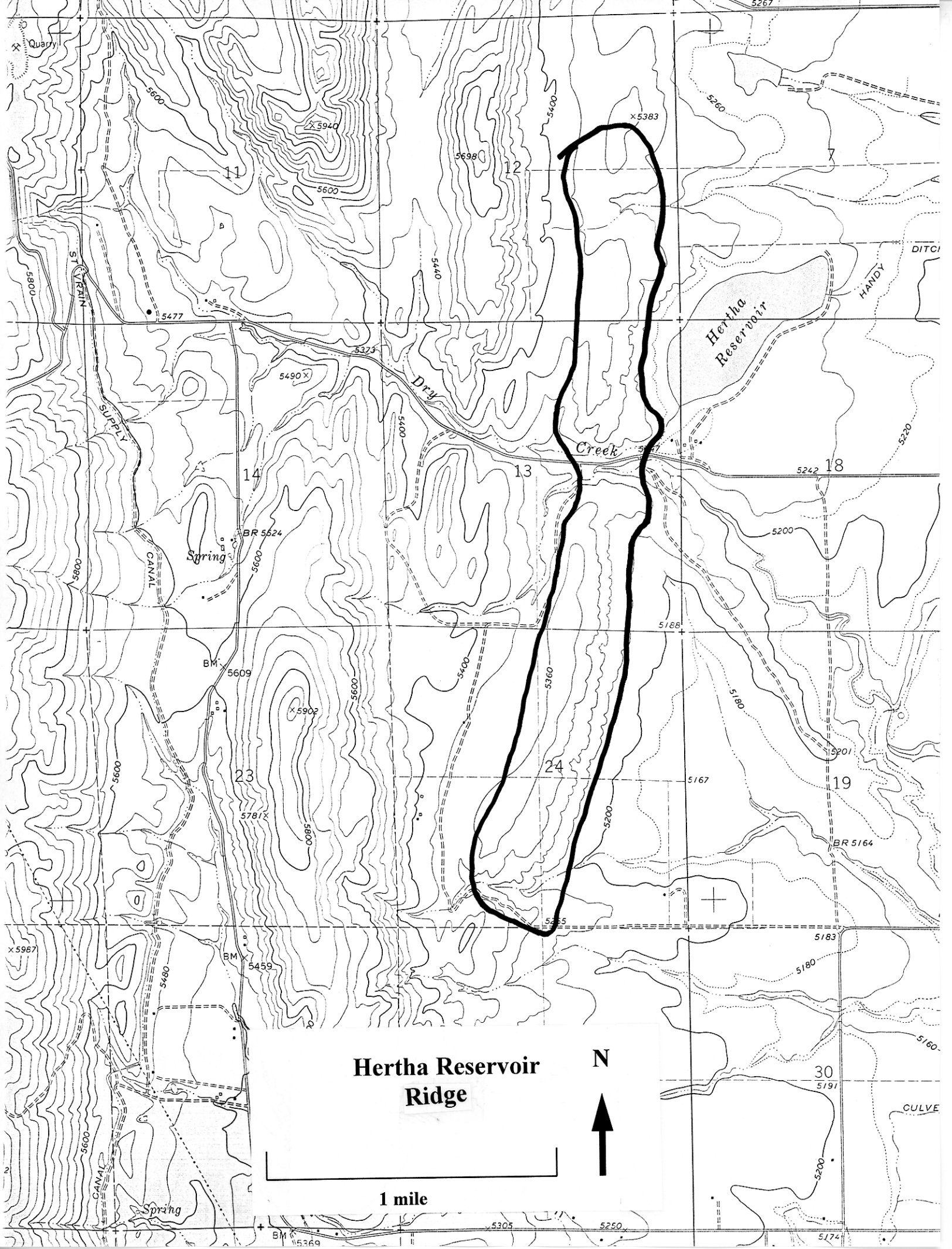
*EO = element occurrence

CURRENT STATUS: The site is currently privately owned and development is taking place.

BOUNDARY JUSTIFICATION: Includes the occurrence and adjacent slopes on the hogback.

PROTECTION CONSIDERATIONS: Subdivision development, including the associated road building and landscaping, is ongoing and is a strong threat to the element.

MANAGEMENT CONSIDERATIONS: If possible, work with the homeowners to protect what is left of the population. Individual management agreements and/or subdivision design considerations could minimize fragmentation and direct impacts.


Hertha Reservoir Ridge
N
1 mile
Hertha Reservoir
Dry Creek
ST VRAIN SUPPLY CANAL
HANDY DITCH
Spring
Spring
Quarry
BR 5624
BR 5164
BM 5609
BM 5459
BM 5369
5940
5902
5781
5987
5383
5698
5477
5490
5373
5267
5242
5188
5167
5135
5305
5250
5174
5191
5201
5183
5160
5180
5220
5200
5400
5600
5800
5480
5440
5360
11
12
13
14
18
19
23
24
30
7

Hook and Moore Glade

SIZE: Approximately 440 acres.

BIODIVERSITY RANK: B3 - High significance. A fair quality occurrence of a globally imperiled element.

PROTECTION URGENCY RANK: P4 - No threat known for foreseeable future.

MANAGEMENT URGENCY RANK: M3 - Control of non-native plant species may be needed within 5 years to maintain the current quality of the element occurrences.

LOCATION: Approximately 1 mile north of the intersection of Highways 14 and 287 to the east of Highway 287. Laporte Quadrangle. Township 8 North, Range 70 West, sections 1 and 12; Township 9 North, Range 70 West, section 36.

GENERAL DESCRIPTION: The site is characterized by a large sandstone hogback that parallels Highway 287. Elevations range from 5380 feet to 5665 at the top of the hogback.

The vegetation is characterized by mountain mahogany (*Cercocarpus montanus)* shrublands on the steep slopes with scattered ponderosa pine (*Pinus ponderosa*) and Rocky Mountain juniper (*Juniperus scopulorum*). The valley between the hogbacks is dominated by grasslands that are somewhat degraded by the invasion of non-native species.

The North Poudre Supply Canal runs through the site and in a tunnel under the hogback. Many weedy plant species have become established around this canal probably because of recent disturbance. Much of the hogback north of this site has been either heavily mined or disturbed by residential development.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The site supports an occurrence of the mountain mahogany/new Mexico feathergrass (*Cercocarpus montanus/Stipa neomexicana)* foothills shrubland. This occurrence is fairly small and although in good condition, considered lower quality because of the impacts to the adjacent grasslands and the hogback further north.

Table 30. Natural Heritage Elements at the Hook and Moore Glade Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Cercocarpus montanus/ Stipa neomexicana	Foothills shrubland	C	G2G3	S2S3			

*EO = element occurrence

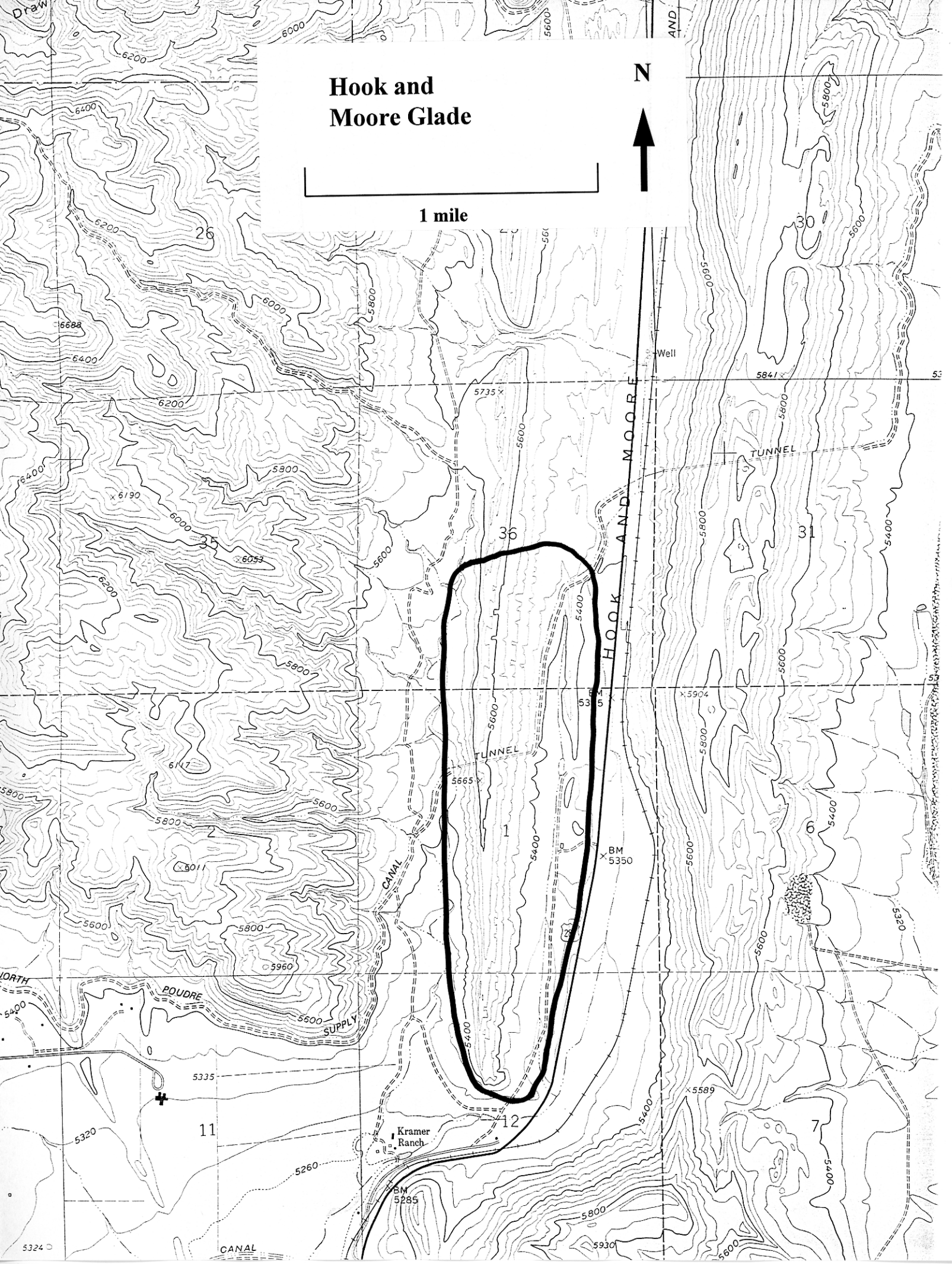
CURRENT STATUS: Part of the site is owned by the Northern Colorado Water Conservancy District and part is owned by the State Land Board. No formal protection is provided.

BOUNDARY JUSTIFICATION: The boundary is intended to protect the occurrence from direct disturbance and provide some buffer. The boundary to the north excludes the area heavily disturbed by quarrying. The lower valleys to the west and east of the hogback have been

degraded by livestock operations and the building of the highway, but still may provide corridors for animal migration from the mountains to the plains.

PROTECTION CONSIDERATIONS: Further mining and residential development would destroy the remaining part of the community which at one time probably extended several miles to the north. Protection efforts would need to consider limiting further fragmentation of the landscape by mining or development.

MANAGEMENT CONSIDERATIONS: Weed control may be needed especially in the valleys between hogbacks which are have been invaded to some extent by toadflax (*Linaria dalmatica*), leafy spurge (*Euphorbia esula*), and cheatgrass (*Bromus tectorum*). Grazing or fire management could be used as a tool to reduce the dominance of the cheatgrass and increase the proportion of native species but more intensive management may be necessary to decrease the dominance of the toadflax and the leafy spurge (see discussion of the problems of non-native species). Further increase of non-native species may decrease the biodiversity significance of the site by altering the native floral and faunal species composition (Bock and Bock 1988).


Hook and
Moore Glade
N
1 mile
HOOK AND MOORE
TUNNEL
TUNNEL
Well
BM
5350
BM
5335
BM
5285
Kramer
Ranch
CANAL
CANAL
POUDRE
SUPPLY
Draw
26
35
36
31
30
1
2
6
7
11
12
5841
5735
5904
5665
5589
5960
6011
6053
6190
6117
6688

Horsethief Pass

SIZE: Approximately 2600 acres

BIODIVERSITY RANK: B3 - High significance. Poor quality occurrences of two globally imperiled plant communities.

PROTECTION URGENCY RANK: P2 - Threat expected within 5 years. The site is not known to be currently threatened but pit mining and landscape rock mining have occurred in the area and may be expanded.

MANAGEMENT URGENCY RANK: M2 - New management action may be needed within 5 years to prevent loss of element occurrences.

LOCATION: Immediately east of Highway 287 south of the Owl Canyon Road. Livermore and Laporte Quadrangles. Township 9 North, Range 69 West, sections 5, 6, 7, 8, 17, 18, 19, 20.

GENERAL DESCRIPTION: The steep slopes and ridges are mainly composed of Dakota Group, and Morrison and Sundance Formation sandstones, siltstones, shales and mudstones. The elevations at the site range from approximately 5600 to 6250 feet. The vegetation is dominated by mountain mahogany (*Cercocarpus montanus*) shrublands on steep rocky slopes and grasslands on level areas and at the base of the slopes.

An inactive mine and associated access road are located within the site and a shooting range is present at the north end of the site.

The views from Horsethief Pass are exceptional; to the east the vast expanses of the Great Plains and to the west the high peaks of the Rocky Mountains.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The mountain mahogany/needle and thread grass *(Cercocarpus montanus/Stipa comata*) foothills shrubland is globally imperiled. Almost all known occurrences are highly degraded by invasion of the non-native cheatgrass (*Bromus tectorum*). The occurrence at this site is small and has been invaded by an abundance of cheatgrass and toadflax (*Linaria dalmatica*).

The mountain mahogany/Griffith's wheatgrass (*Cercocarpus montanus/Elymus lanceolata X Pseudoroegneria spicata*) foothills shrubland has only been documented along the northern Front Range of Colorado and apparently occurs in southeastern Wyoming. This occurrence has been degraded by invasion of cheatgrass and toadflax.

The degree of imperilment of the mountain mahogany/mountain muhly (*Cercocarpus montanus/Muhlenbergia montana*) foothills shrubland is unknown at this time. Few occurrence have been documented suggesting that it may be somewhat rare. The occurrence has been invaded by the non-native species toadflax.

The mountain mahogany-skunkbush/big bluestem (*Cercocarpus montanus-Rhus trilobata/Andropogon gerardii)* foothills shrubland has been documented from few locations. The occurrence at this site is small and has been invaded by toadflax and crested wheatgrass (*Agropyron cristatum*).

Table 31. Natural Heritage Elements at the Horsethief Pass Site.

Element	Common Name	EO*	Global	State	Federal	State	Federal

		Rank	Rank	Rank	Status	Status	Sens.
Cercocarpus montanus/Stipa comata	Foothills shrubland	D	G2	S2			
Cercocarpus montanus-Rhus trilobata/Andropogon gerardii	Foothills shrubland	C	G2G3	S2S3			
Cercocarpus montanus/ Muhlenbergia montana	Foothills shrubland	C	GU	S2			
Cercocarpus montanus/ Elymus lanceolata x Pseudoroegneria spicata	Foothills shrubland	D	G3	S3			

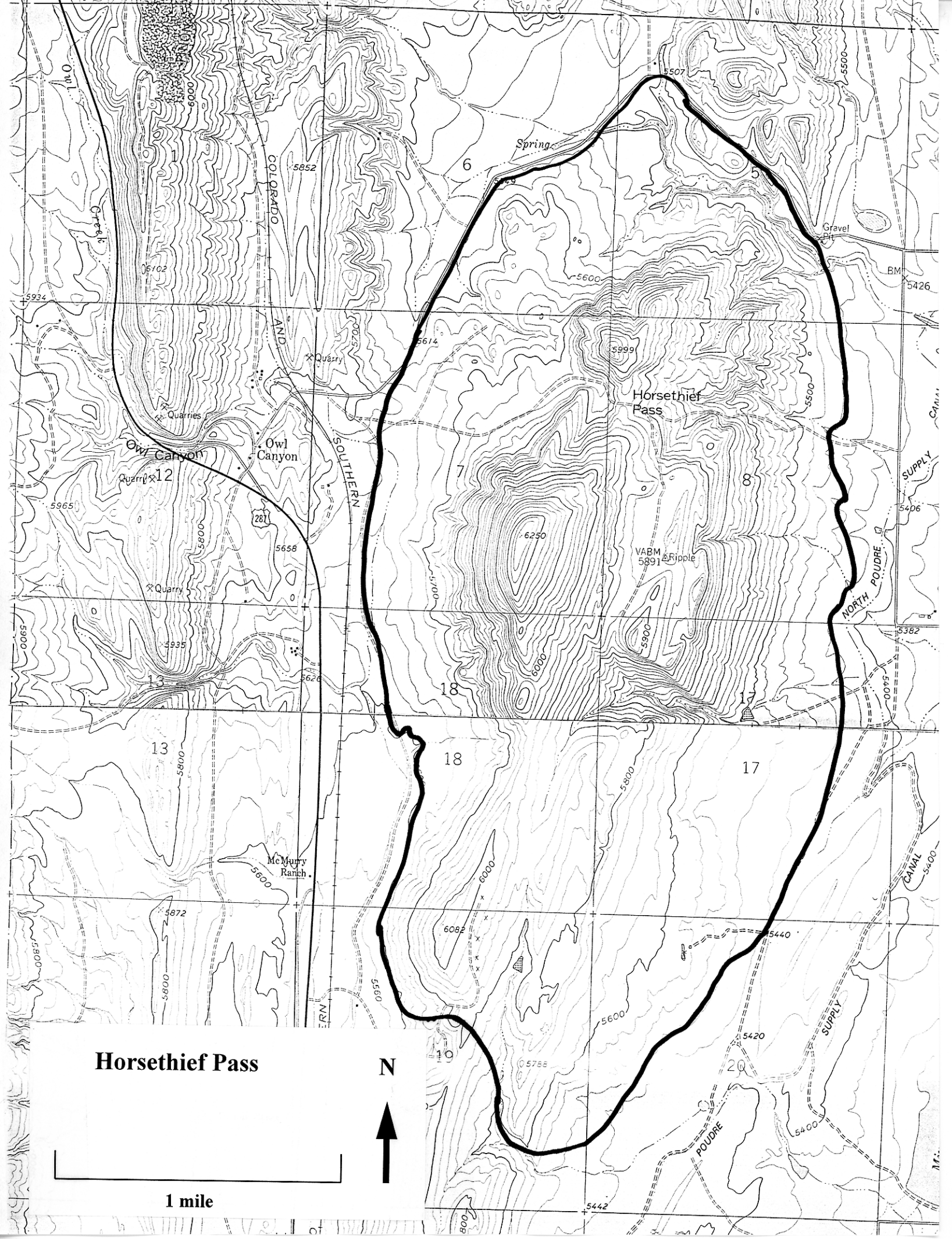
*EO = element occurrence

CURRENT STATUS: Most of the site is owned by a private landowner but one small parcel (300 acres) is owned by a local mining company and another by a rod and gun club.

BOUNDARY JUSTIFICATION: The boundary is intended to encompass the mountain mahogany shrublands and some adjacent grasslands as a buffer against direct impact.

PROTECTION CONSIDERATIONS: Further mine expansion could impact the elements at the site by physically destroying habitat or by further introduction of non-native species.

MANAGEMENT CONSIDERATIONS: Mining has occurred within the site and numerous non-native species have been used in reclamation efforts. Cheatgrass and Japanese brome (*Bromus japonicus)* are common. Grazing or fire management could be used as a tool to reduce the dominance of these species and increase the proportion of native species. Management may be needed to prevent the spread of the toadflax and Canadian thistle (*Cirsium arvense*) which are common on other parts of the site. Further increase of non-native species may decrease the biodiversity significance of the site by altering the native floral and faunal species composition (Bock and Bock 1988) (see discussion of the problems of non-native species, p. 17).


Horsethief Pass
N
1 mile
Horsethief Pass
Owl Canyon
Owl Canyon
Quarry
Quarries
Quarry
Quarry
Spring
Gravel Pit
BM 5426
VABM 5891 Ripple
McMurry Ranch
COLORADO AND SOUTHERN
NORTH POUDRE SUPPLY CANAL
POUDRE
5507
5852
5934
6102
5614
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6000
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6400
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12
13
17
18
20
281

Horsetooth Supply

SIZE: Approximately 75 acres.

BIODIVERSITY RANK: B3 - High significance. This site contains an unranked occurrence of a globally imperiled plant species. This site was not visited in 1996. The information about the occurrence came from an herbarium specimen. Current status of this site should be confirmed before taking any conservation action.

PROTECTION URGENCY RANK: P2 - Threats from residential development expected within 5 years.

MANAGEMENT URGENCY RANK: M3 - Management action may be needed within 5 years if further development occurs.

LOCATION: Horsetooth Reservoir Quadrangle. Township 6 North, Range 70 West, section 11.

GENERAL DESCRIPTION: The site includes a shale outcrop on the west bank of Redstone Creek.

NATURAL HERITAGE RESOURCE SIGNIFICANCE:

Table 32. Natural Heritage Elements at the Horsetooth Supply Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Physaria bellii	Bell's twinpod	?	G2	S2			

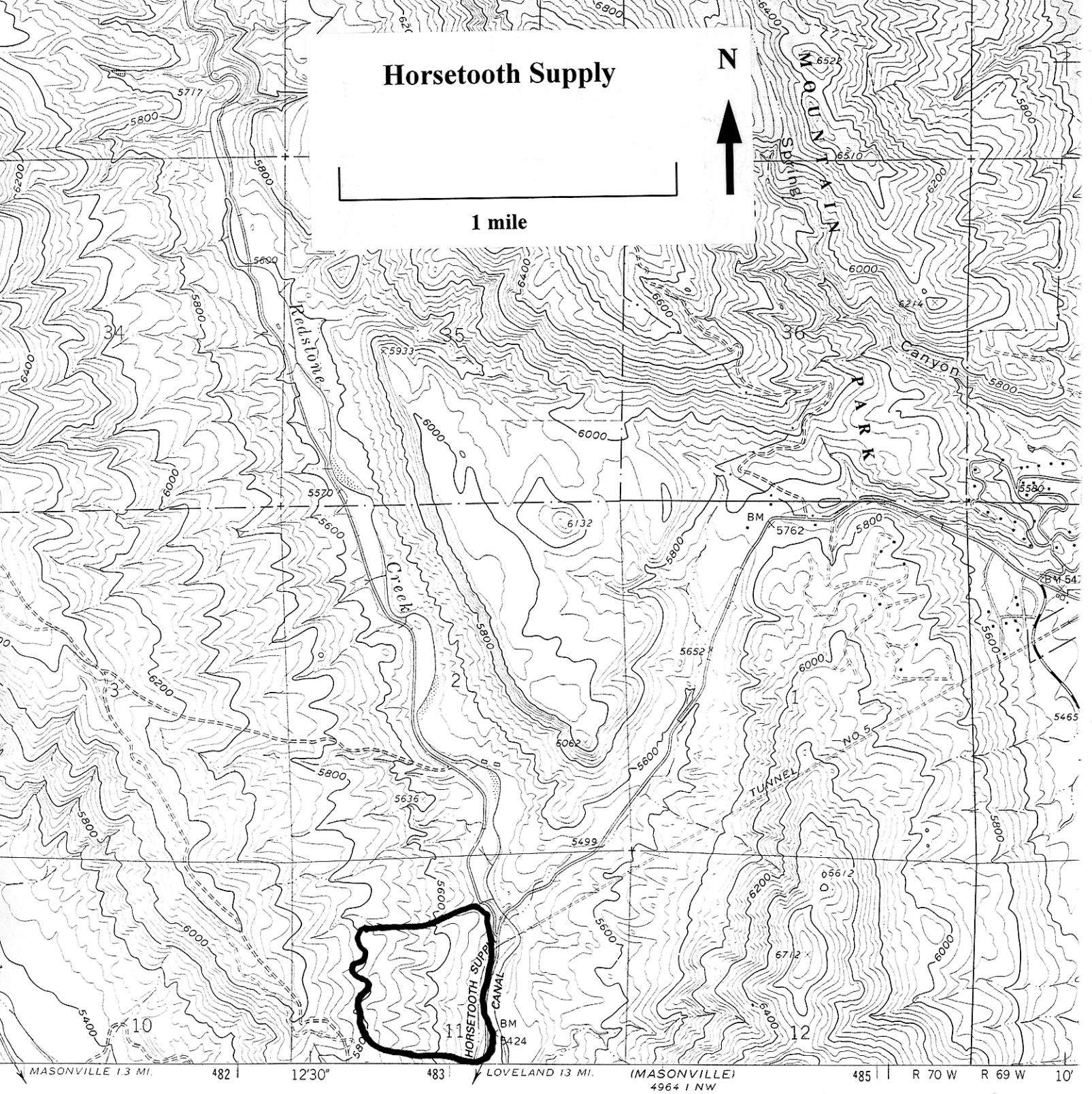
*EO = element occurrence

CURRENT STATUS: This site is immediately southwest of the Milner Mountain Northwest site. Both sites are privately owned and some residential development is taking place in the area.

BOUNDARY JUSTIFICATION: Includes the occurrence and a small buffer on all sides (except along the road).

PROTECTION CONSIDERATIONS: This site and the Milner Mountain Northwest site should be consider together for conservation action.

MANAGEMENT CONSIDERATIONS: Recreational activity should be restricted from the Bell's twinpod habitat.



SCALE 1:24 000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER

CONTOUR INTERVAL 40 FEET

DOTTED LINES REPRESENT 20-FOOT CONTOURS

NATIONAL GEODETIC VERTICAL DATUM OF 1929

GN MN

0°07' 2 MILS

13½° 240 MILS

UTM GRID AND 1971 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS

FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092

A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

sions shown in purple compiled from aerial photographs
1971. This information not field checked

Jimmy Creek at Frenchwoman Creek (R/W)

SIZE: Approximately 85 acres.

BIODIVERSITY RANK: B3 - High significance. Site contains a fair quality occurrence of a globally imperiled plant species.

PROTECTION URGENCY RANK: P3 - Definable threat but not within the next 5 years..

MANAGEMENT URGENCY RANK: M4 - Management may be needed in the future to maintain current quality of element occurrences.

LOCATION: West of the Laramie River, southwest of Bull Mountain, along Jimmy Creek, approx. 0.4 miles above the confluence with Frenchwoman Creek. Crazy Mountain Quadrangle. Township 11 North, Range 76 West, section 22.

GENERAL DESCRIPTION: Jimmy Creek is a perennial creek flowing at the west base of low, sedimentary mountains and along the eastern edge of a large, relatively flat river terrace that was probably formed at the end of the last ice age (around 13,000 years ago at the close of the Pleistocene). Several creeks flow out of the mountains into Jimmy Creek, and the creek is also fed by spring flow out of the ancient river terrace on the west side of the creek. The creek is separated by a low ridge from several shallow ponds (both permanent and ephemeral) that are fed by ground water seeping to the surface, the same ground water that feeds the creek. West of the creek and upstream are irrigated fields used to grow non-native grasses. The pale blue-eyed grass is found in a wet meadow fed by overflow from Jimmy Creek, ground water from the creek, and especially ground water seeping to the surface from the river terrace to the west.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: This site is one of twenty locations of the pale blue-eyed grass (*Sisyrinchium pallidum*) in Colorado. The site is in fair condition, containing mostly native species, but with much evidence of past and current agricultural use.

Table 33. Natural Heritage Elements at the Jimmy Creek at Frenchwoman Creek Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Sisyrinchium pallidum	Pale blue-eyed grass	C	G2G3	S2			

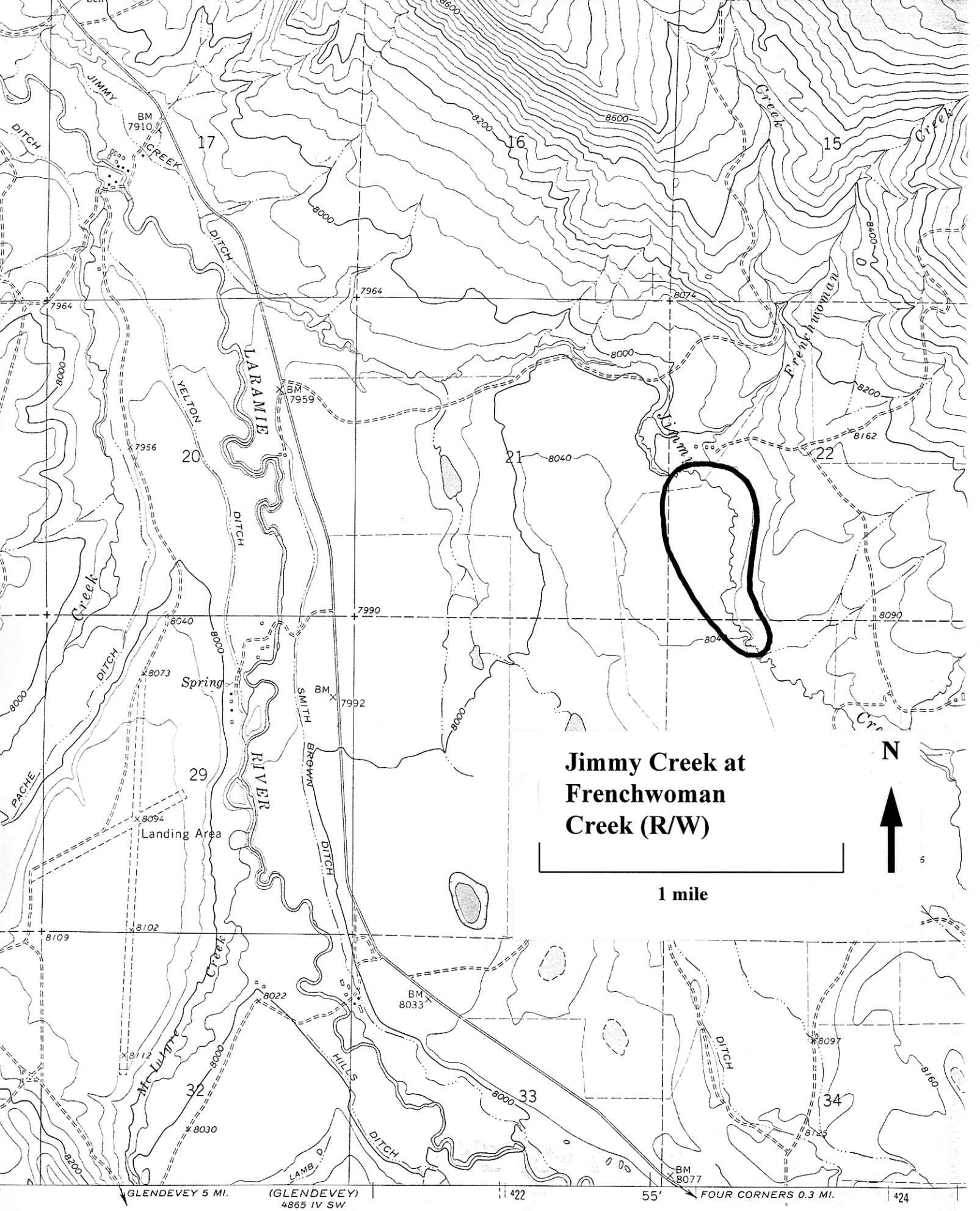
*EO = element occurrence

CURRENT STATUS: Most of Jimmy Creek in the area of this occurrence is privately owned, but portions of the creek are on U.S. Forest Service land. The Forest Service currently provides no formal protection for this area.

BOUNDARY JUSTIFICATION: The site boundary includes the known location of the element, adjacent natural wet meadows, the creek itself, and a buffer of approximately 500 feet to protect from direct impacts to the plant. This boundary should be considered tentative until a flowering season inventory of the element is conducted. The element could occur along a much larger stretch of Jimmy Creek.

PROTECTION CONSIDERATIONS: Residential development should be kept away from this site.

MANAGEMENT CONSIDERATIONS: With an irrigated hay field to the west, and grazing all around the site, agricultural activities may be affecting the element. However, it is not clear if the effects are positive or negative. Irrigation can change the water regime of the wetland. While this may adversely affect portions of the habitat, it may also add to the wetland area. In South Park, creation of wet meadows through irrigation have extended the habitat of the pale blue-eyed grass. Grazing can be particularly heavy in riparian areas where cattle congregate. Heavy amounts of trampling and grazing of *Sisyrinchium* plants would probably lessen their growth and reproductive success. However, moderate levels of grazing do not appear to have a deleterious effect on the plant.


Jimmy Creek at Frenchwoman Creek (R/W)
1 mile
N
GLENDEVEY 5 MI.
(GLENDEVEY)
4865 IV SW
FOUR CORNERS 0.3 MI.
SCALE 1:24000
1 MILE
7000 FEET
1 KILOMETER

Leslie Road Hogback

SIZE: Approximately 80 acres.

BIODIVERSITY RANK: B3 - High significance. A fair quality occurrence of a globally imperiled plant species.

PROTECTION URGENCY RANK: P3 - Definable threat from residential development but not within 5 years.

MANAGEMENT URGENCY RANK: M4 - Management of livestock and hiking may be needed in the future to maintain the current quality of the element occurrence.

LOCATION: West of Loveland near the mouth of the Big Thompson Canyon. Masonville Quadrangle. Township 5 North, Range 70 West, sections 13 and 24.

GENERAL DESCRIPTION: The dominant feature of this site is an outcrop of the Morrison Formation including sandstone and white shale. The sandstone is heavily inlaid with nodules of calcium carbonate. The vegetation at the site is characterized by mountain mahogany *(Cercocarpus montanus), s*kunkbush *(Rhus aromatica),* needle-and-thread grass *(Stipa comata),* and Indian ricegrass *(Oryzopsis hymenoides)*. Species associated with the globally imperiled Bell's twinpod *(Physaria bellii)* include three awn grass *(Aristida purpurea),* and snakeweed *(Gutierrezia sarothrae).*

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The site contains a small occurrence of Bell's twinpod in a housing subdivision. This species occurs on the ridges and slopes adjacent to the housing development. While known form more than 20 populations many of the populations of the Bell's twinpod have been impacted or destroyed by development, mining, or road building.

Table 34. Natural Heritage Elements at the Leslie Road Hogback Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Physaria bellii	Bell's twinpod	C	G2	S2			

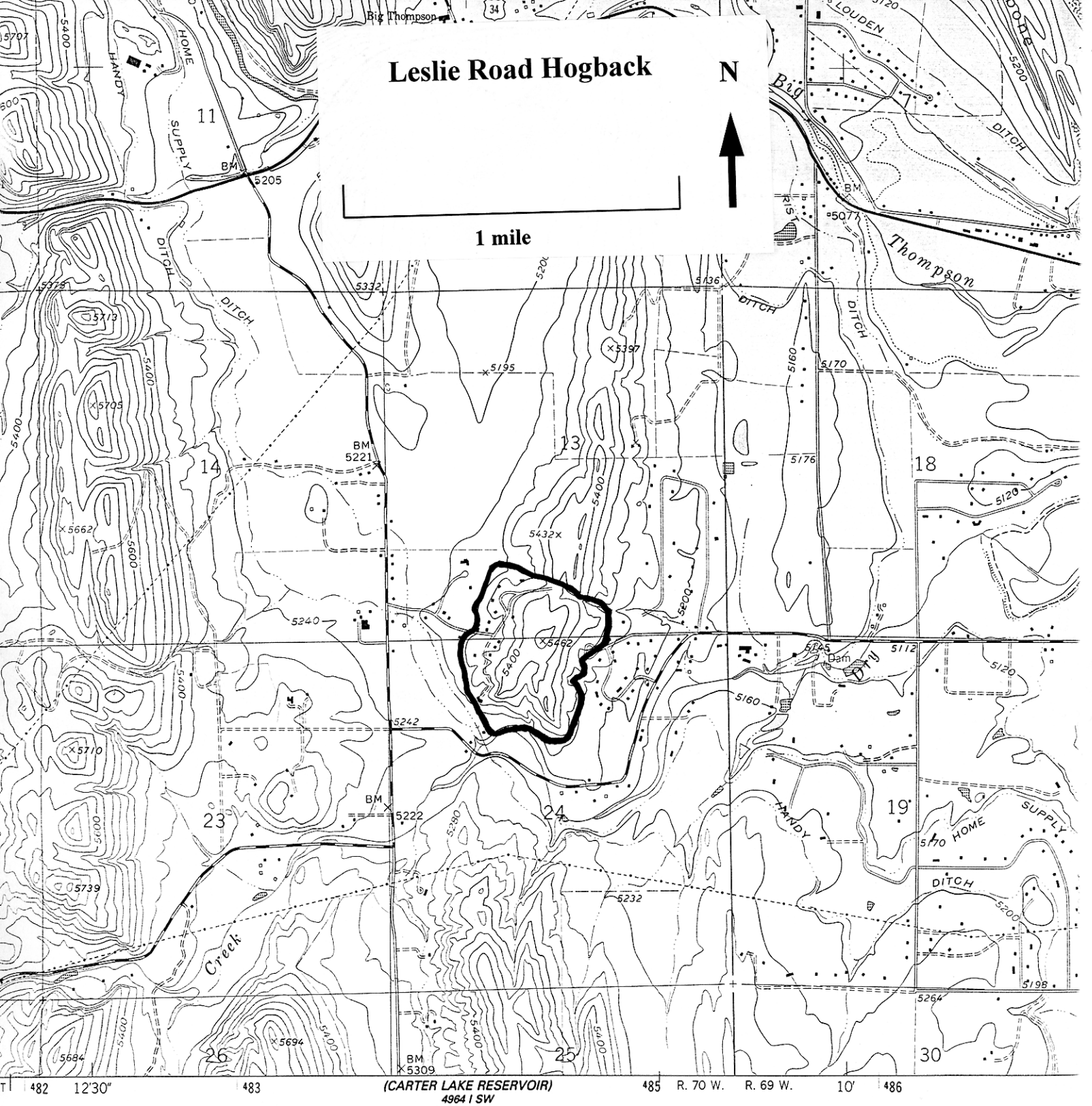
*EO = element occurrence

CURRENT STATUS: This proposed site is privately owned. The site is not highly threatened. This status could change if the top of the ridge is disturbed.

BOUNDARY JUSTIFICATION: The site includes the occurrence and a small continuation of the slope to deter direct disturbance and erosion.

PROTECTION CONSIDERATIONS: The slope which supports the occurrence of Bell's twinpod is in a private homeowners backyard. The slope is not likely to be developed or to be landscaped. In the event that the top of the ridge is developed in the future, this would directly impact the population.

MANAGEMENT CONSIDERATIONS: There is a trail on top of the ridge. Trampling by humans, or cattle may disturb the population. The homeowner should be contacted regarding a management agreement to assure the long-term protection of Bell's twinpod at this site.



T 482 12'30" 483 (CARTER LAKE RESERVOIR) 4964 I SW 485 R. 70 W. R. 69 W. 10' 486

SCALE 1:24 000

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1 .5 0 1 KILOMETER

CONTOUR INTERVAL 40 FEET

DOTTED LINES REPRESENT 20-FOOT CONTOURS

NATIONAL GEODETIC VERTICAL DATUM OF 1929

2° MILS

ETIC NORTH OF SHEET

QUADRANG

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS

FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092

A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

Revisions shown in purp
taken 1978 and other s
field checked. Map ed

Little Hohnholz Lake (R/W)

SIZE: Approximately 200 acres.

BIODIVERSITY RANK: B3 - High significance. A good occurrence of a globally imperiled plant species.

PROTECTION URGENCY RANK: P4 - No threat known for foreseeable future.

MANAGEMENT URGENCY RANK: M2 - New management action to control invasive non-native vegetation may be needed within 5 years to prevent loss of element occurrences.

LOCATION: 1 mile west of Laramie River. Crazy Mountain Quadrangle. Township 11 North, Range 77 West, sections 1,2,11, and 12.

GENERAL DESCRIPTION: The Little Hohnholz Lake site is a wetland along a reservoir shore surrounded by poor to good condition sagebrush plains. The wetlands are alkaline and support Nebraska sedge *(Carex nebrascensis)*, sedge *(Carex simulata)*, spikerush *(Eleocharis quinqueflora)*, pale blue-eyed grass *(Sisyrinchium pallidum)*, arrowgrass *(Triglochin* sp.), and lousewort *(Pedicularis crenulata)*. The reservoir is naturally spring fed, and the springs support small but good condition wetland habitat. The sagebrush shrublands surrounding the reservoir are dominated by big sagebrush *(Artemisia tridentata)*, milkvetch *(Astragalus* sp.), and mixed graminoids, as well as larch-leaf beardtongue *(Penstemon laricifolius* ssp. *exilifolius)*.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: A narrow band of wetland vegetation along the edge of a man-made reservoir dominated by *Carex*, *Juncus*, and *Pedicularis* supports a B-ranked occurrence of a G2G3/S2 plant species and a rare community. The surrounding sagebrush plains support two occurrences of a G4T3/S1 plant species. The natural hydrology at the inlet of the reservoir and the reservoir itself provides foraging habitat for great blue heron, white-faced ibis, and white pelican.

Table 35. Natural Heritage Elements at the Little Hohnholz Lake Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Sisyrinchium pallidum	Pale blue-eyed grass	B	G2G3	S2			
Penstemon laricifolius ssp *exilifolius*	Larch-leaf beardtongue	B	G4T3	S1			
Penstemon laricifolius ssp *exilifolius*	Larch-leaf beardtongue	C	G4T3	S1			
Eleocharis quinqueflora - Triglochin spp.	Alkaline spring	B	GU	SU			

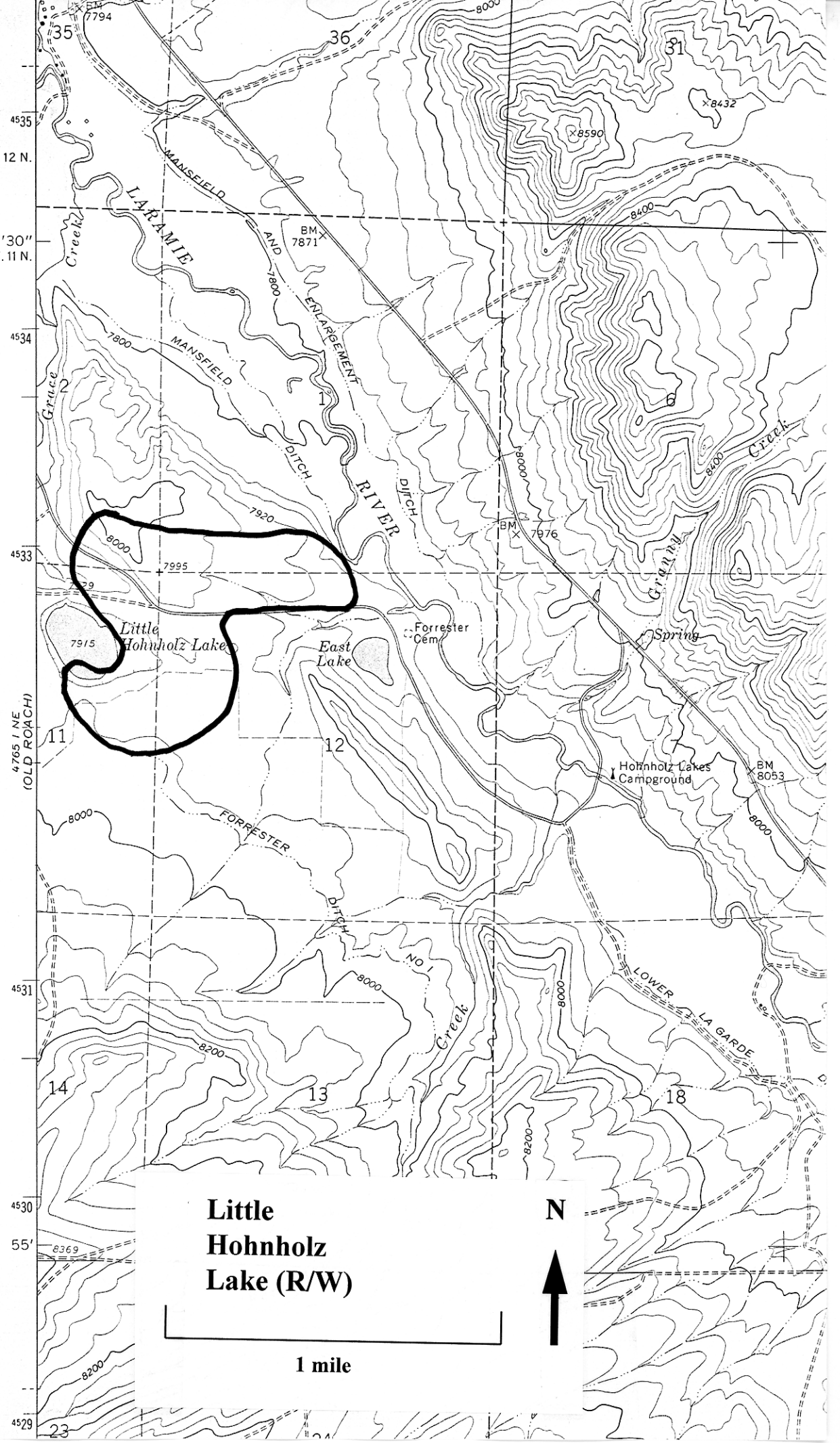
*EO = element occurrence

CURRENT STATUS: The Colorado Division of Wildlife owns and manages most of this site and the rest is privately owned. Recreational uses and the associated increase in non-native plant species may threaten the occurrences, especially the pale blue-eyed grass.

BOUNDARY JUSTIFICATION: The boundary includes populations of two vulnerable plant species and a vulnerable community. Included in this area is a buffer for these elements to protect the hydrology and to ensure against erosion. It is important to note that hydrologic modifications (e.g., wells, diversions) to the north, west, and south of the site *may* affect the hydrology of the site even if the occur beyond the site boundaries.

PROTECTION CONSIDERATIONS: No known threats imminent.

MANAGEMENT CONSIDERATIONS: Sweetclover *(Melilotus officinale)* is established within the occurrence of the pale blue-eyed grass and should be pulled before it spreads. At least one area of Kentucky bluegrass *(Poa pratensis)* was observed; red clover *(Trifolium pratense)*, Yarrow *(Achillea lanulosa)*, and Canada Thistle *(Cirsium arvense)* were also noted. The CDOW should be contacted and encouraged to develop a management plan to protect the imperiled plant species from spread of competing non-native plant species as well as trampling by fisherman and boaters. Site is used primarily by fisherman who pose a threat of trampling. A sign should be placed at the edge of the parking lot asking visitors to refrain from walking along the south and east reservoir shores in to protect the sensitive plant habitat. The hydrology of the site should be maintained. There appears to be old irrigation ditches on the north side of the reservoir. This may have been an old hay meadow before the reservoir was created. Effects of grazing on the growth and reproduction of the larch-leaf beardtongue on the private lands adjacent to the CDOW lands should be investigated.


Little
Hohnholz
Lake (R/W)
N
1 mile
Little Hohnholz Lakes
East Lake
Forrester Cem
Hohnholz Lakes Campground
BM 7794
BM 7871
BM 7976
BM 8053
×8432
×8590
MANSFIELD AND ENLARGEMENT DITCH
LARAMIE RIVER
Grace Creek
Grant Spring
FORRESTER DITCH NO. 1
LOWER LA GARDE Creek
4765 I NE (OLD ROACH)
T. 12 N.
T. 11 N.
57'30"
55'
35
36
31
1
2
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23
7915
7995
7920
8000
8200
8400
8369

Lower Jimmy Creek Spring (R/W)

SIZE: Approximately 750 acres.

BIODIVERSITY RANK: B3 - High significance. A fair quality occurrence of a globally imperiled plant species.

PROTECTION URGENCY RANK: P3 - Definable threat but not within 5 years.

MANAGEMENT URGENCY RANK: M2 - New management oflivestock grazing may be needed within 5 years to prevent loss of element occurrences.

LOCATION: Near Sand Creek Pass in the Laramie River Valley. Sand Creek Pass Quadrangle. Township 11 North, Range 76 West section 36; Township 11 North, Range 75 West section 29, 30, 31.

GENERAL DESCRIPTION: This site is in a small valley in the Laramie River drainage that is surrounded by rolling hills dominated by sagebrush and grassland communities with a diverse assemblage of native forbs. The soil is red and sandy, with gravel that appears to be high in quartz. The valley bottom consist of a sedge (*Carex)* dominated wetland. There are large hummocks in the wetland that are the result of heavy grazing. Elevations at the site range from 8600 to 9000 feet.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: This site is one of twenty locations of the pale blue-eyed grass (*Sisyrinchium pallidum*) in Colorado, and also includes an excellent population of larch-leaf beardtongue *(Penstemon laricifolius* ssp. *exilifolius)*. The site is in fair condition, containing mostly native species, but with much evidence of past and current agricultural use.

Table 36. Natural Heritage Elements at the Lower Jimmy Creek Spring Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Sisyrinchium pallidum	Pale blue-eyed grass	C	G2G3	S2			FS
Penstemon laricifolius ssp *exilifolius*	Larch-leaf beardtongue	A	G4T3	S1			

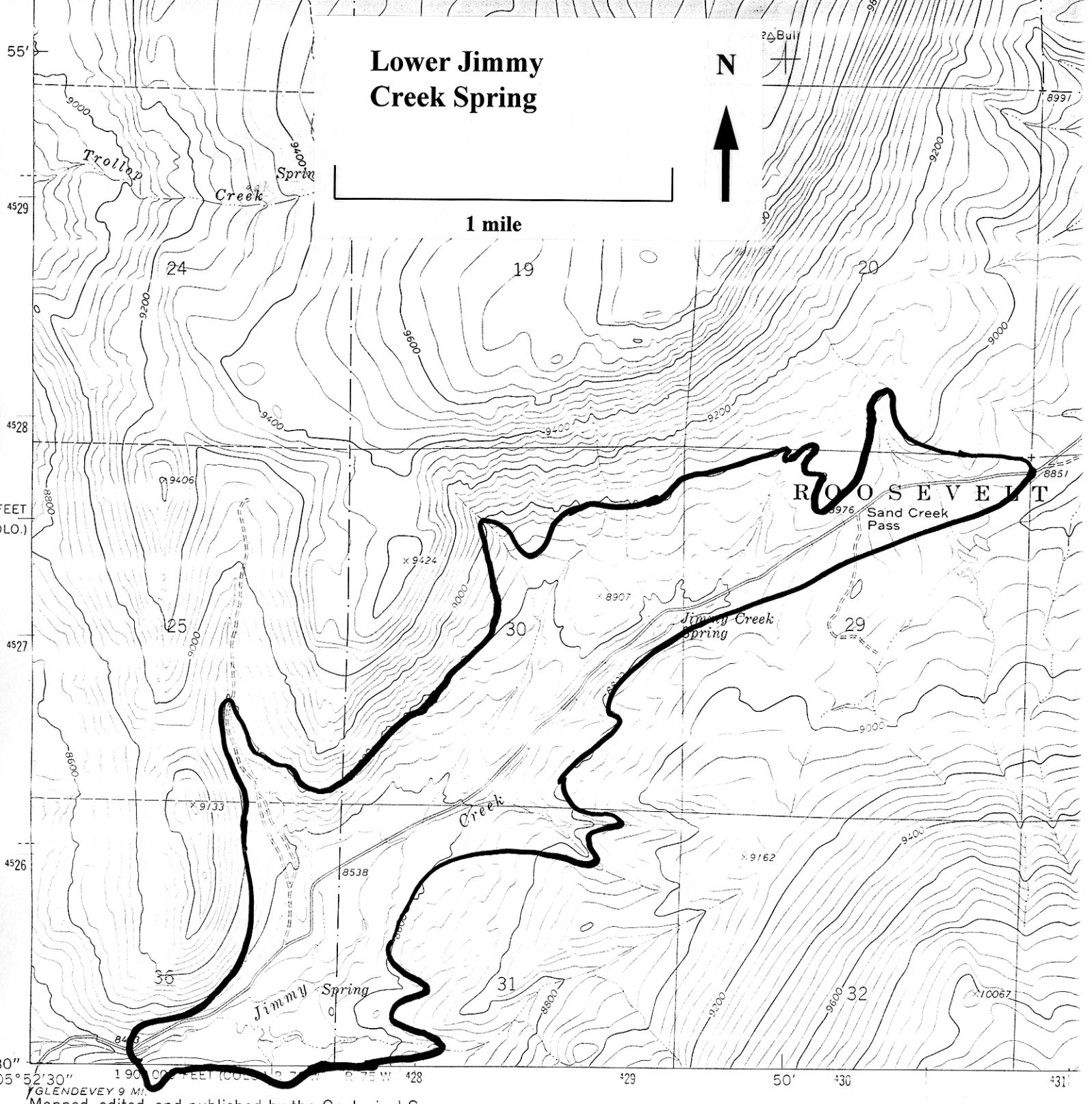
*EO = element occurrence

CURRENT STATUS: The proposed site includes private lands, State Land Board lands, and lands owned by the U. S. Forest Service. There is currently no formal protection for this area.

BOUNDARY JUSTIFICATION: The boundary includes the two occurrences and buffer of around 100 ft. to prevent direct impacts from vehicles.

PROTECTION CONSIDERATIONS: Work with the land owners to assure long-term protection of the site. The wetland and the pale blue-eyed grass should be the highest priority for protection at this site.

MANAGEMENT CONSIDERATIONS: Heavy grazing may threaten the occurrence of pale blue-eyed grass. A grazing rotation system could be set up to allow the imperiled species time during each growing season to produce seed. The Colorado Department of Transportation should be informed of the significance of the site as road maintenance may also impact the elements.



Mapped, edited, and published by the Geological Survey

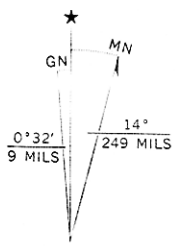
Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1966. Field checked 1967

Polyconic projection. 1927 North American datum
10,000-foot grids based on Colorado coordinate system, north zone and Wyoming coordinate system, east zone
1000-meter Universal Transverse Mercator grid ticks, zone 13, shown in blue

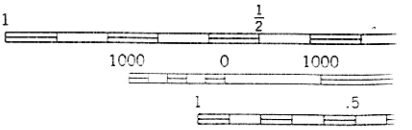
Fine red dashed lines indicate selected fence lines

T. 12 N., Sixth Principal Meridian, is duplicated in Colorado and Wyoming



UTM GRID AND 1967 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

There may be private inholdings within the boundaries of the National or State reservations shown on this map



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Meadow Hollow

SIZE: Approximately 175 acres.

BIODIVERSITY RANK: B3 - High significance. A good occurrence of a globally imperiled plant species.

PROTECTION URGENCY RANK: P2 - Threat expected from reservoir expansion within 5 years.

MANAGEMENT URGENCY RANK: M3 - Management of non-native plants may be needed within 5 years to maintain the current quality of the element occurrences.

LOCATION: South of Carter Lake Reservoir where Meadow Hollow meets the Little Thompson River drainage. Carter Lake Reservoir Quadrangle. Township 4 North, Range 70 West, section 34.

GENERAL DESCRIPTION: This site is characterized by open shrublands dominated by mountain mahogany *(Cercocarpus montanus)* and mixed grasses and forbs. Some areas are heavily grazed but some sandstone outcrops are in good to excellent condition and dominated by native species in the understory such as fringed sage *(Artemisia frigida)* and Indian ricegrass *(Oryzopsis hymenoides)*. Bottomlands support *Populus* spp., coyote willow *(Salix exigua)*, and patches of cattails *(Typha* sp.). The geology appears to be part of the Fountain Formation which includes sandstone, siltstone, limestone, and shales. The sandstone cliffs in the narrow bend of Meadow Hollow are dramatic and may provide nest sites for birds of prey. A great horned owl is seen regularly in this area.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: This site includes an occurrence of a plant species which is a narrow Colorado endemic. Nearly all of the known locations of this species are highly threatened by the increasing development on the Front Range. This specific location is also of great importance because the substrate is red sandstone. There are only three other known locations of this species on this substrate. The number of individuals found here are lower than many of the other occurrences. The sandstone cliffs in the narrow bends of Meadow Hollow are dramatic and may provide nest sites for birds of prey. A great horned owl is seen regularly in this area.

Table 37. Natural Heritage Elements at the Meadow Hollow Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Physaria bellii	Bell's twinpod	C	G2	S2			

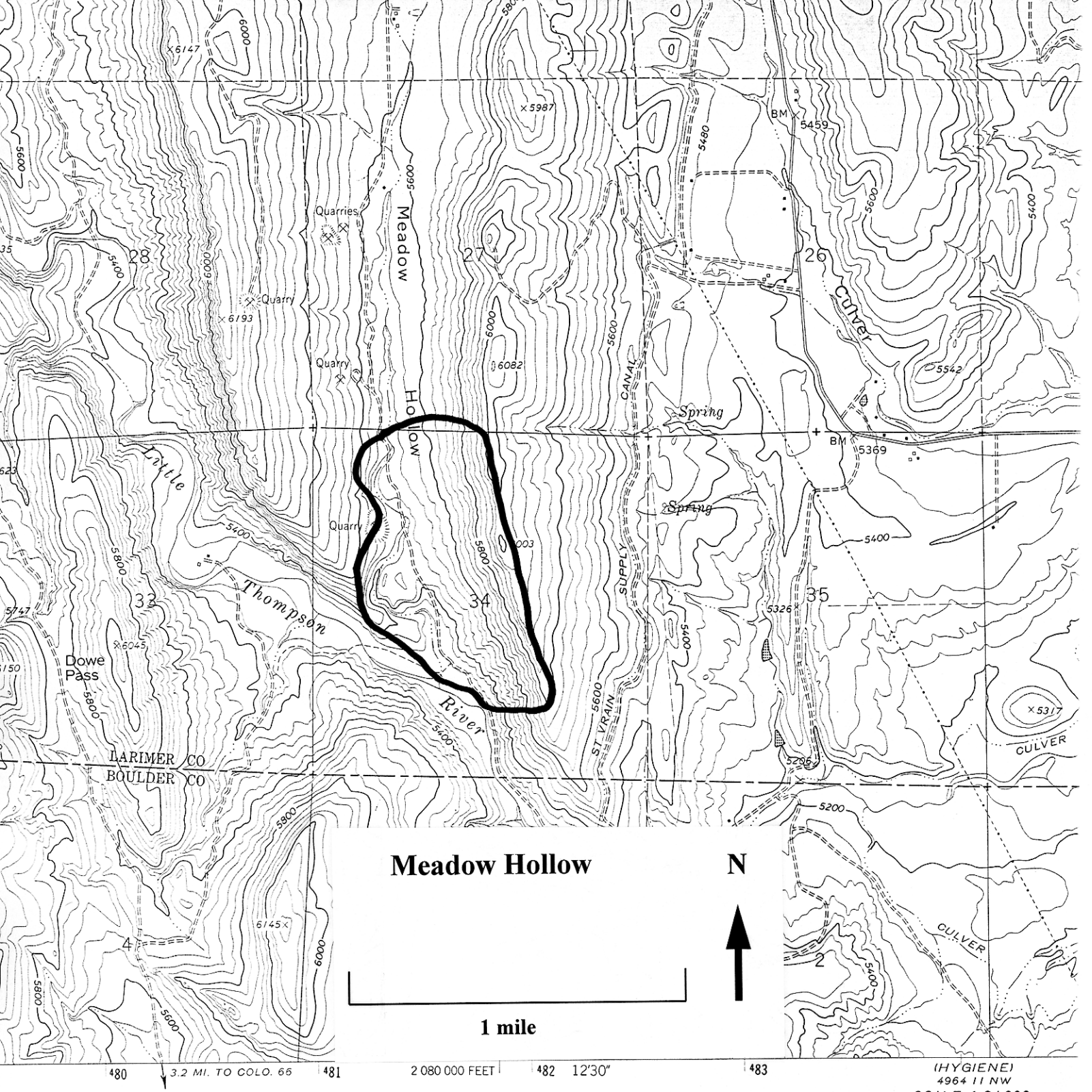
*EO = element occurrence

CURRENT STATUS: The site is owned by multiple private owners. The expansion of Carter Lake Reservoir would destroy this site.

BOUNDARY JUSTIFICATION: Includes the occurrence of Bell's twinpod and adjacent high quality mountain mahogany (*Cercocarpus montanus)* uplands, as well as the sandstone cliffs in Meadow Hollow just north of the occurrence. The site continues to the top of the slope to protect from erosion due to human impacts. The boundary includes a buffer zone to protect from direct and indirect disturbance.

PROTECTION CONSIDERATIONS: This site is threatened from the expansion of Carter Lake Reservoir which may begin in about 5 years. The dam will likely flood this occurrence.

MANAGEMENT CONSIDERATIONS: The site seems to be in good enough condition to support the twinpod population. The owners are aware of the population and are excited to be involved in its protection. Preventing the spread of weeds on to sandstone areas that support *Physaria bellii* is important. The Meadow Hollow drainage is degraded with patches of Russian thistle (*Salsola australis*), spotted knapweed (*Acosta maculosa*), and great mullein *(Verbascum thapsus)*. Control of these species, especially knapweed, should be undertaken. Areas upstream are more degraded than at this site. Management should consider the possibility of negative impacts from cattle grazing to the occurrence.



480 3.2 MI. TO COLO. 66 481 2 080 000 FEET 482 12'30" 483 (HYGIENE) 4964 II NW

published by the Geological Survey

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Field checked 1962

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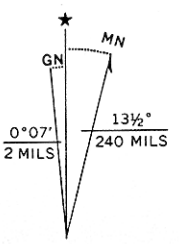

UTM GRID AND 1971 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24000

1 ½ 0
1000 0 1000 2000 3000 4000
1 .5 0

CONTOUR INTERVAL 40 FEET
DOTTED LINES REPRESENT 20-FOOT CONT
DATUM IS MEAN SEA LEVEL

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DENVER, COLORADO 80225, OR RESTON, \
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS

Milner Mountain Northwest

SIZE: Approximately 240 Acres.

BIODIVERSITY RANK: B3 - High significance. A fair occurrence of a globally imperiled plant species.

PROTECTION URGENCY RANK: P2 - Threat from urban expansion expected within 5 years.

MANAGEMENT URGENCY RANK: M3 - Management of non-native plants may be needed within five years to maintain the current quality of the occurrence.

LOCATION: The site is located along both sides of county road 38E from the Horsetooth Mountain open space parking lot, west to Redstone Canyon Road (25E). Horsetooth Reservoir Quadrangle. Township 6 North, Range 70 West, sections 1, 2, 11, 12.

GENERAL DESCRIPTION: This site includes the lower west-facing slopes of Milner Mountain and a similar landform on the west side of Road 38E. These slopes are composed of a red sandy soil with small to medium rocks of white and red sandstone. The local geology appears to be the Fountain Formation which is composed of sandstone, siltstone, limestone, and shales. The dominant vegetation cover is sunflower *(Helianthus pumilus*), mountain mahogany *(Cercocarpus montanus),* three-awn *grass (Aristida purpurea)*, prickly pear cactus *(Opuntia* sp.), blue grama *(Bouteloua gracilis)*, fringed sage *(Artemisia frigida)*, skunk brush *(Rhus trilobata*), Rocky Mountain juniper *(Juniperus scopulorum)*, yucca (Y*ucca glauca)*, Indian rice grass *(Oryzopsis hymenoides)*, and snakeweed *(Gutierrezia sarothrae)*. Total vegetation cover varies from 20-90%. A two lane county road (38E) bisects the site. There is a new housing development on Milner Mountain which is encroaching more and more onto suitable habitat for Bell's twinpod *(Physaria bellii)*.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: This site includes a large occurrence of Bell's twinpod which is currently being destroyed by residential development. This population is unusual because it occurs on red sandstone. Bell's twinpod was previously thought to occur solely on Niobrara shale.

Table 38. Natural Heritage Elements at the Milner Mountain Northwest Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Physaria bellii	Bell's twinpod	C	G2	S2			

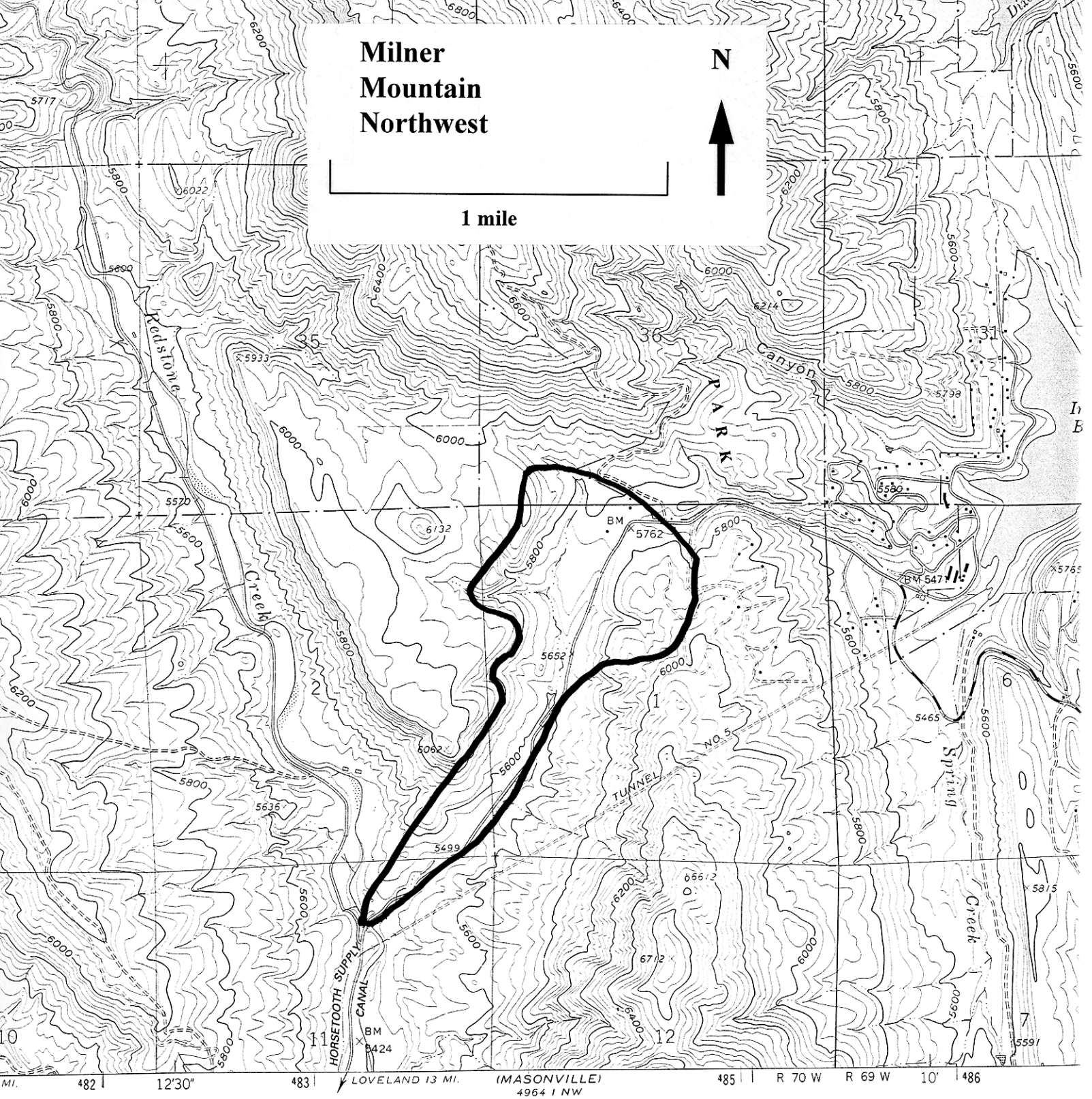
*EO = element occurrence

CURRENT STATUS: This site is within a private housing development. Residential development and many of the associated activities (i.e., trampling, road construction, and landscaping) threaten the occurrence.

BOUNDARY JUSTIFICATION: Includes the occurrences and small buffer up and down slope to protect against erosion and direct disturbance. The pollination biology for the Bell's twinpod is currently unknown, therefore the proposed boundaries could change with the addition of this information.

PROTECTION CONSIDERATIONS: The high development pressures play a large role in the continued existence of Bell's twinpod. The entire range of this species occurs on the Front Range in Colorado. Almost every population of this species is threatened by developed. The new Milner Mountain Ranch development may destroy half of this occurrence. On the other side of Road 38E (north side) the land is undeveloped but highly threatened as real estate signs are posted.

MANAGEMENT CONSIDERATIONS: The site is generally weed free and in good condition though cheatgrass *(Bromus tectorum)*, hound's tongue *(Cynoglossum officinale)*, yellow sweet clover *(Melilotus officinale)*, and thistles *(Cirsium* spp.) were noted on roadsides and in some of the drainages. Notification and education of the property owners may increase the chances for long-term survival of *Physaria bellii* at this site.



SCALE 1:24000

1 MILE

7000 FEET

1 KILOMETER

CONTOUR INTERVAL 40 FEET

DOTTED LINES REPRESENT 20-FOOT CONTOURS

NATIONAL GEODETIC VERTICAL DATUM OF 1929

GN MN

0°07'
2 MILS

13½°
240 MILS

AND 1971 MAGNETIC NORTH
ON AT CENTER OF SHEET

QUAD

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS

FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092

A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

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Map photoinspe
No major cultur

North Fork Cache la Poudre River at Trails End (R/W)

SIZE: Approximately 300 acres.

BIODIVERSITY RANK: B3 - High significance. A good quality ranked occurrence of vulnerable plant community.

PROTECTION URGENCY RANK: P4 - No threat known for foreseeable future.

MANAGEMENT URGENCY RANK: M3 - Management of non-native plant species may be needed in the next 5 years to maintain the current quality of the element occurrence.

LOCATION: East of Cherokee Park, immediately downstream of Trails End on the North Fork of the Cache la Poudre River. Cherokee Park (4010584) Quadrangle. Township 11 North, Range 72 West, sections 22, 23, 26, 27 and 28.

GENERAL DESCRIPTION: Granitic rocks form a steep canyon through which the river runs. Elevations at the site range from 6800 to 7200 feet. The river bottom is an average of 40 meters wide.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: This site supports a good condition occurrence of the thinleaf alder/bluejoint reedgrass (*Alnus incana / Calamagrostis canadensis)* montane riparian shrubland which is thought to be uncommon globally (G3). This site is important because many riparian plant communities are rare or imperiled because of past use and few occurrences of this plant community have been documented in good condition.

Table 39. Natural Heritage Elements at the North Fork Cache la Poudre River at Trails End Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Alnus incana/Calamagrostis canadensis	Montane riparian shrubland	B	G3	S2S3			

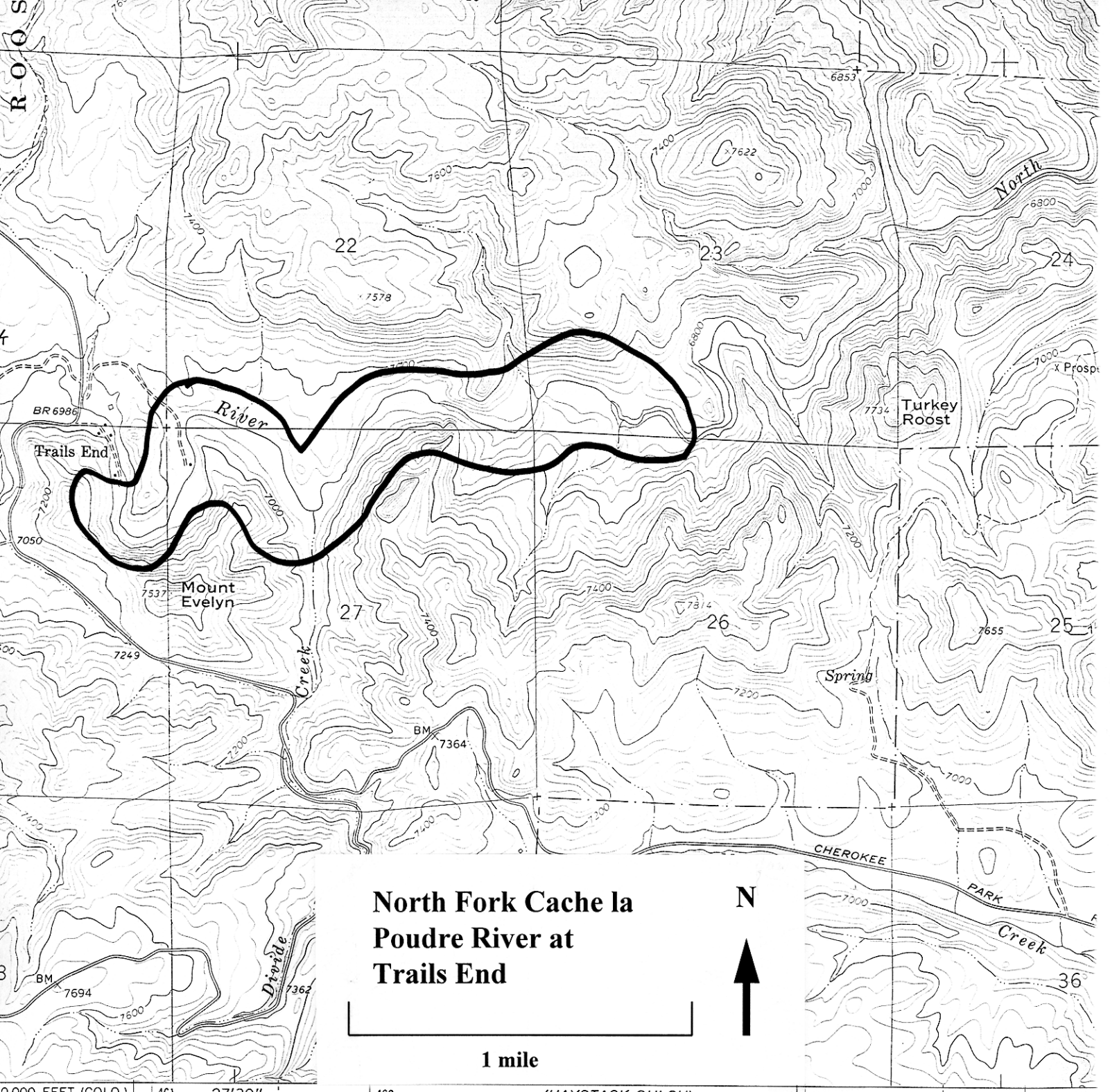
*EO = element occurrence

CURRENT STATUS: The land ownership at this site is a mixture of U.S. Forest Service, Colorado Division of Wildlife, and private land.

BOUNDARY JUSTIFICATION: The boundary includes the riparian area and an approximately 300 meter buffer to protect from direct disturbance. Modifications to the upstream hydrology should be avoided as this may affect the hydrologic regime with which this plant community is dependent on.

PROTECTION CONSIDERATIONS: The valley is fairly rugged so that uses are naturally restricted. We do not perceive any major threats.

MANAGEMENT CONSIDERATIONS: The site is used for recreation and may need to be monitored so that the area is not degraded by excessive erosion or weed invasion along trails. Horse trails and a campsite occur within the proposed boundaries. Smooth brome (*Bromus inermis)* has become established along the flats above the stream and may need to be controlled. Further increase of non-native species may decrease the biodiversity significance of the site by altering the native floral and faunal species composition (Bock and Bock 1988).



0 000 FEET (COLO.) | 461 | 27'30" | 462 | (HAYSTACK GULCH) 4965 IV SW | 464 | 25' | 465

SCALE 1:24 000

1 1/2 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 5 0 1 KILOMETER

CONTOUR INTERVAL 40 FEET

DATUM IS MEAN SEA LEVEL

GN MN

0°17' 5 MILS

13½° 240 MILS

GRID AND 1967 MAGNETIC NORTH
ECLINATION AT CENTER OF SHEET

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR WASHINGTON, D. C. 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

Nunn Creek (R/W)

SIZE: Approximately 900 acres.

BIODIVERSITY RANK: B3 - High significance. A good quality occurrence of a globally vulnerable element along with a collection of state rare elements.

PROTECTION URGENCY RANK: P4 - No threat known for foreseeable future.

MANAGEMENT URGENCY RANK: M4 - Management of non-native species may be needed in the future to maintain the current quality of the element occurrences.

LOCATION: East side of Middle Mountain; the entire area of interest includes 2.5 mi. of Nunn creek from where it begins to flow north, as well as a portion of Porter Creek in the same valley. The site also includes Lily Pond Lake to the south of Porter Creek. Deadman and Boston Peak Quadrangles. Township 009 North, Range 076 West, Sections 1,12,13,24, and Township 009 North, Range 075W, Sections 6,7,18

GENERAL DESCRIPTION: The site consists primarily of a willow/sedge complex along a 2nd order stream. The basin has been extensively shaped by glacial processes. One of the elements (Manna grass (*Glyceria borealis*) plant association) occurs only in two small ponds (toward the north end of the site on the east side of Nunn creek. The valley is moderately wide (up to 100 m) and beavers are very active throughout the riparian zone.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The Nunn Creek site includes several state rare elements and a globally vulnerable plant community. The condition and quality of the willow carrs along Nunn Creek are among the highest quality montane riparian areas in Larimer County.

In at least one spot there is significant alkaline groundwater seepage; this hosts an uncommon bladderwort (*Utricularia minor*) and perhaps a state rare plant (*Carex scirpoidea*--identification could not be confirmed during the visit). State rare willows may be expected, but were not seen during our site visit. A state rare alkaline seep plant association (*Eleocharis quinqueflora-Triglochin* spp.) occurs in this small area.

Table 40. Natural Heritage Elements at the Nunn Creek Site.							
Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Salix geyeriana-Salix monticola/Calamagrostis canadensis	Montane riparian shrubland	B	G3	S3			
Salix geyeriana-Calamagrostis canadensis	Montane riparian shrubland	B	G5	S2			
Carex utriculata	Wet meadow	B	G5	S3			
Glyceria borealis	Wet meadow	B	G3	S2			
Eleocharis quinqueflora-Triglochin spp.	Alkaline seep community	C	GU	S2			
Rana sylvatica	Wood frog	?	G5	S3			T

*EO = element occurrence

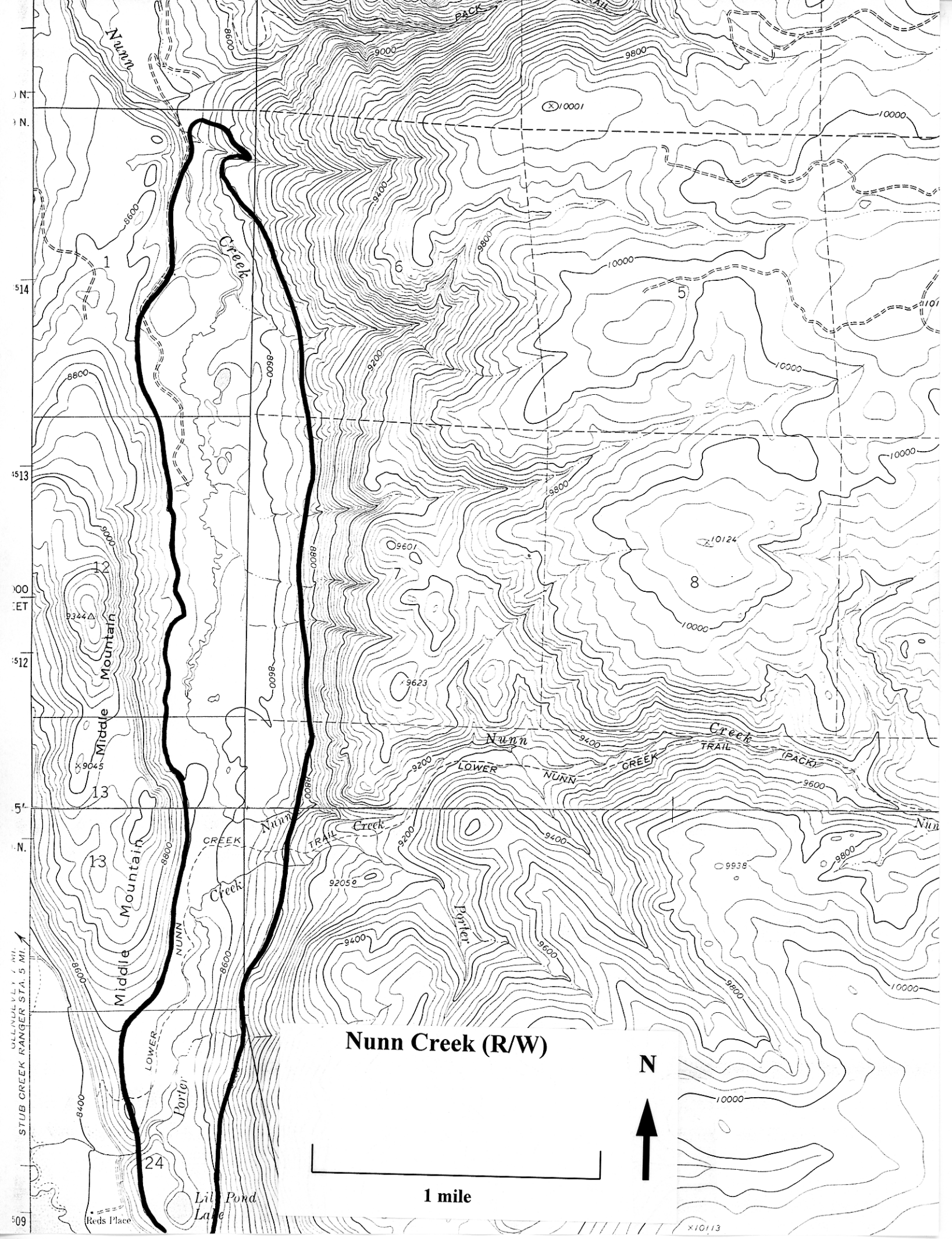
CURRENT STATUS: Mostly privately owned; not intensively utilized. The southern end of the site (including Lily Pond Lake) and much of the site edges are USFS land.

BOUNDARY JUSTIFICATION: Includes all the elements at the site, the entire bottom of the valley, and a 300 ft. buffer extending back from the riparian area. The valley bottom is included to insure that natural riverine processes can continue. The small buffer is included to protect from adverse indirect effects of runoff from logging, road building, etc.

PROTECTION CONSIDERATIONS: A conservation easement that minimizes domestic grazing and prevents extensive development would be appropriate for this site.

MANAGEMENT CONSIDERATIONS: Many alien grass species present, but generally low to moderate cover. These should not be a problem and do not need to be managed. A small amount of Canadian thistle is also present. It should be controlled before it spreads further.

Diversions and damming of water should be avoided at this site to allow natural riverine processes. The ditch above Porter Creek should be cut off if not required for an agricultural activity.


Nunn Creek (R/W)
N
1 mile
Middle Mountain
Nunn Creek
LOWER NUNN CREEK TRAIL (PACK)
Porter
Lily Pond Lake
Reds Place
STUB CREEK RANGER STA. 5 MI.

Poison Lake Site

SIZE: Approximately 100 acres.

BIODIVERSITY RANK: B3 - High significance. A fair quality occurrence of a globally imperiled plant species.

PROTECTION URGENCY RANK: P2 - Threat from residential development expected within 5 years.

MANAGEMENT URGENCY RANK: M3 - Management actions may be needed within 5 years to maintain the current quality of the element occurrence.

LOCATION: About 2.5 miles east of north end of Carter Lake Reservoir. Carter Lake Reservoir Quadrangle. Township 5 North, Range 69 West, section 31.

GENERAL DESCRIPTION: This site encompasses a shale and limestone outcrop at the interface of the Great Plains and Rocky Mountain foothills. The vegetation is a shrub and grassland complex which is relatively sparsely vegetated.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The site includes a fair quality occurrence of Bell's twinpod *(Physaria bellii)*, a globally rare plant species.

Table 41. Natural Heritage Elements at the Poison Lake Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Physaria bellii	Bell's twinpod	C	G2	S2			

*EO = element occurrence

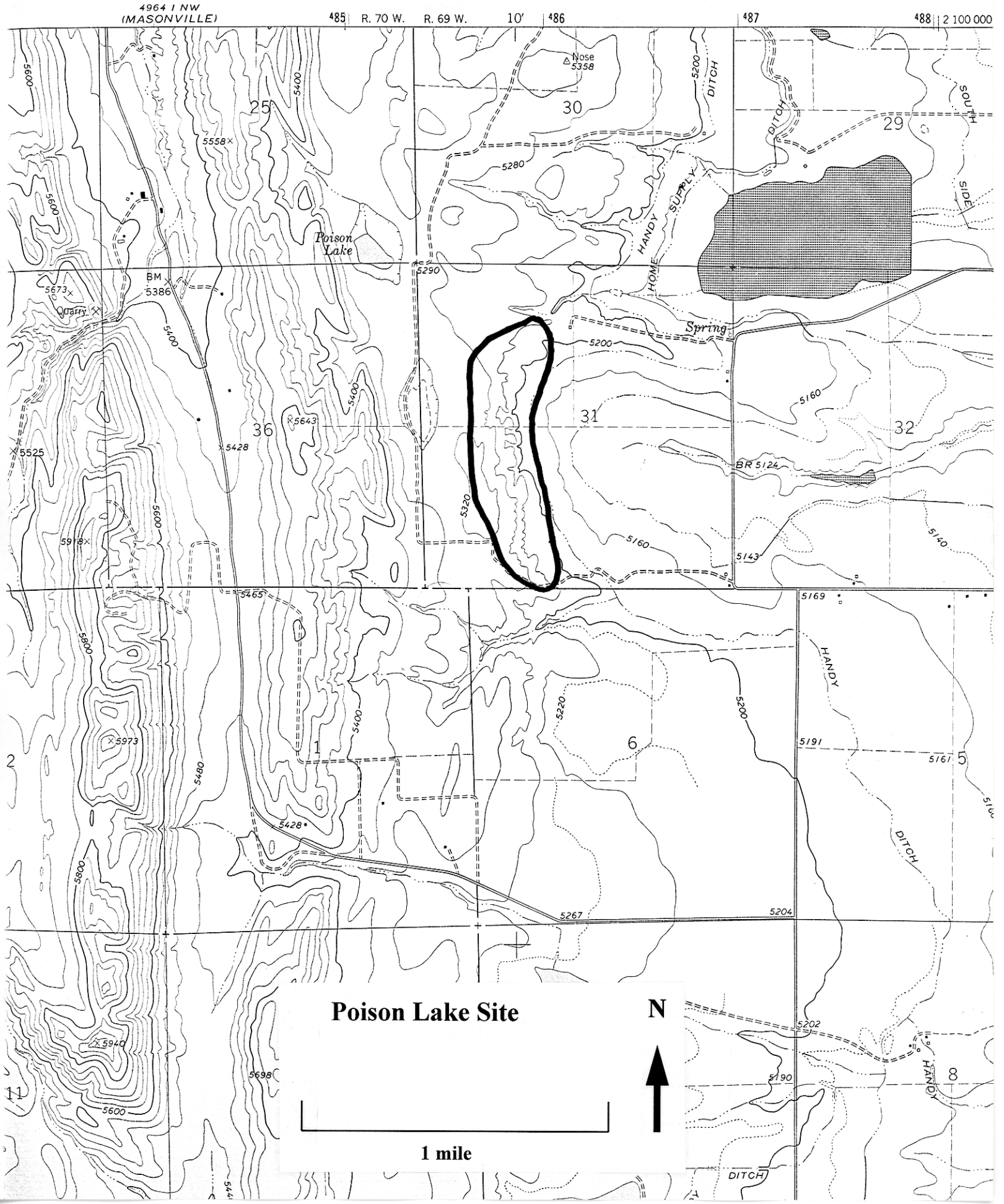
CURRENT STATUS: The site is privately owned. Development and associated activities threaten this occurrence. There is currently no formal protection of this site.

BOUNDARY JUSTIFICATION: The boundary includes the occurrence and most of the exposed substrate.

PROTECTION CONSIDERATIONS: Subdivision expansion is ongoing, posing a significant threat to this occurrence. Site construction, lawn planting, and infrastructure development displace plants and destroy habitat.

MANAGEMENT CONSIDERATIONS: Landowners should be contacted and encouraged to protect the occurrence from direct disturbances and to institute a management plan.

CARTER LAKE RES
COL
7.5 MINUTE SER



Salt Cabin Park

SIZE: Approximately 1000 acres.

BIODIVERSITY RANK: B3 - high significance. Occurrences of two globally imperiled plant communities.

PROTECTION URGENCY RANK: P4 - No threat known for foreseeable future, however this rank could upgrade if future timber sales are planned.

MANAGEMENT URGENCY RANK: M3 - Management concerning livestock operations may be needed within 5 years to maintain the current quality of the element occurrences.

LOCATION: Approximately 3 miles south of Rustic. Rustic (4010565) Quadrangle. Township 8 North, Range 73 West, sections 10, 11, 14, 15, 16.

GENERAL DESCRIPTION: The site is a mosaic of grasslands, shrublands, and forests within a matrix of ponderosa pine (*Pinus ponderosa)* and Douglas fir (*Pseudotsuga menziesii)*. The western edge of the site is dissected by a roadway.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The site supports occurrences of two globally imperiled plant communities. The antelope bitterbrush/mountain muhly (*Purshia tridentata/Muhlenbergia montana)* foothills shrubland is globally imperiled. The occurrence at this site has to some extent been invaded by the non-native species Kentucky bluegrass (*Poa pratensis)*. The mountain muhly-needle and thread grass (*Muhlenbergia montana-Stipa comata)* montane grassland is only known to occur in northern Colorado. Few occurrences of this plant community have been documented. This occurrence has been heavily degraded by invasion of Kentucky bluegrass.

Table 42. Natural Heritage Elements at the Salt Cabin Park Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Purshia tridentata/ Muhlenbergia montana	Foothills shrubland	C	G2	S2			
Muhlenbergia montana-Stipa comata	Mountain muhly-needle and thread grass	D	G2	S2			

*EO = element occurrence

CURRENT STATUS: Most of the lands at this site are owned by the U.S. Forest Service but small private inholdings occur.

BOUNDARY JUSTIFICATION: The boundary includes the occurrences, nearby forest openings that probably include the extended occurrence (based on aerial photo interpretation), and buffers of approximately 500 feet into adjacent habitats.

PROTECTION CONSIDERATIONS: Protection of the inholdings and management agreements with the Forest Service would insure protection of the elements.

MANAGEMENT CONSIDERATIONS: The site has been heavily grazed and grazing exclosures may be needed. Further increase of non-native species may decrease the biodiversity significance of the site by altering the native floral and faunal species composition (Bock and Bock 1988). The Forest Service is burning for elk habitat and future timbering activity is possible.


NATIONAL FORES
Dadd
Gulch
DADD
GULCH
Bennett
Creek
Salt Cabin
Park
Spring
JEEP
CROWN
POINT
(PACK)
FLOWERS
Bennett
△9059
Bedsprings
Spring
14
21
22
23
26
28
Salt Cabin Park
N
1 mile

Soapstone Hills

SIZE: Approximately 6000 acres

BIODIVERSITY RANK: B3 - High significance. A fair quality occurrence of a globally imperiled plant community.

PROTECTION URGENCY RANK: P3 - Definable threat, but not in the next 5 years. Not currently threatened but could be valuable development land in the long term.

MANAGEMENT URGENCY RANK: M3 - Management actions such as control of non-native species and rest-rotation grazing may be needed within 5 years to maintain the current quality of the element occurrences.

LOCATION: Approximately 8 miles west of Interstate 25 along the Wyoming state line. Round Butte and Table Mountain Quadrangles. Township 12 North, Range 69 West, sections 19-30.

GENERAL DESCRIPTION: The Soapstone Hills site is characterized by rolling prairies and washes at the base of a series of steep hills. The hills are part of the Ogallala Formation and consist mainly of sandstones and conglomerates which are exposed in some places. Some steep ridges and cliffs are present and are used as nest sites by raptors. Elevations at the site range from about 6400 feet at the base of the hills to about 7200 feet at the western point of the site overlooking the Big Hole.

Most of the steep hills are dominated by Mountain mahogany (*Cercocarpus montanus*) shrublands. Small valleys and ravines are dominated by scattered mesic shrubs such as chokecherry (*Prunus virginiana*), current (*Ribes* spp.), rose (*Rosa* sp.), and snowberry (*Symphoricarpos* sp.). Grasslands are common on broad ridges. Most of the washes were dry in mid-summer. The site is surrounded in all directions by landscapes generally dominated by natural plant communities.

Pronghorn (*Antilocapra americana*) are common in the area as are numerous raptors. Cattle currently graze the site from spring to the beginning of August when they are moved to pastures in Wyoming. Numerous two-track roads cross the site.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The site supports occurrences of two significant elements. The mountain mahogany/needle and thread grass *(Cercocarpus montanus/Stipa comata*) foothills shrubland is globally imperiled. Almost all known occurrences are highly degraded by invasion of the non-native cheatgrass (*Bromus tectorum*) as is the case at this site.

The mountain mahogany/Griffith's wheatgrass (*Cercocarpus montanus/Elymus lanceolata X Pseudoroegneria spicata*) foothills shrubland has only been documented along the northern Front Range of Colorado and apparently occurs in southeastern Wyoming. This occurrence has been degraded by invasion of non-native species.

Although the occurrences are somewhat degraded the fact that both of these plant communities occur in very large patches in a relatively natural landscape may allow ecological

processes (wildlife migration, fire, etc.) to function more naturally and may increase the ecological value.

Table 43. Natural Heritage Elements at the Soapstone Hills Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Cercocarpus montanus/Stipa comata	Foothills shrubland	C	G2	S2			
Cercocarpus montanus/Elymus lanceolata x Pseudoroegneria spicata	Foothills shrubland	C	G3	S3			

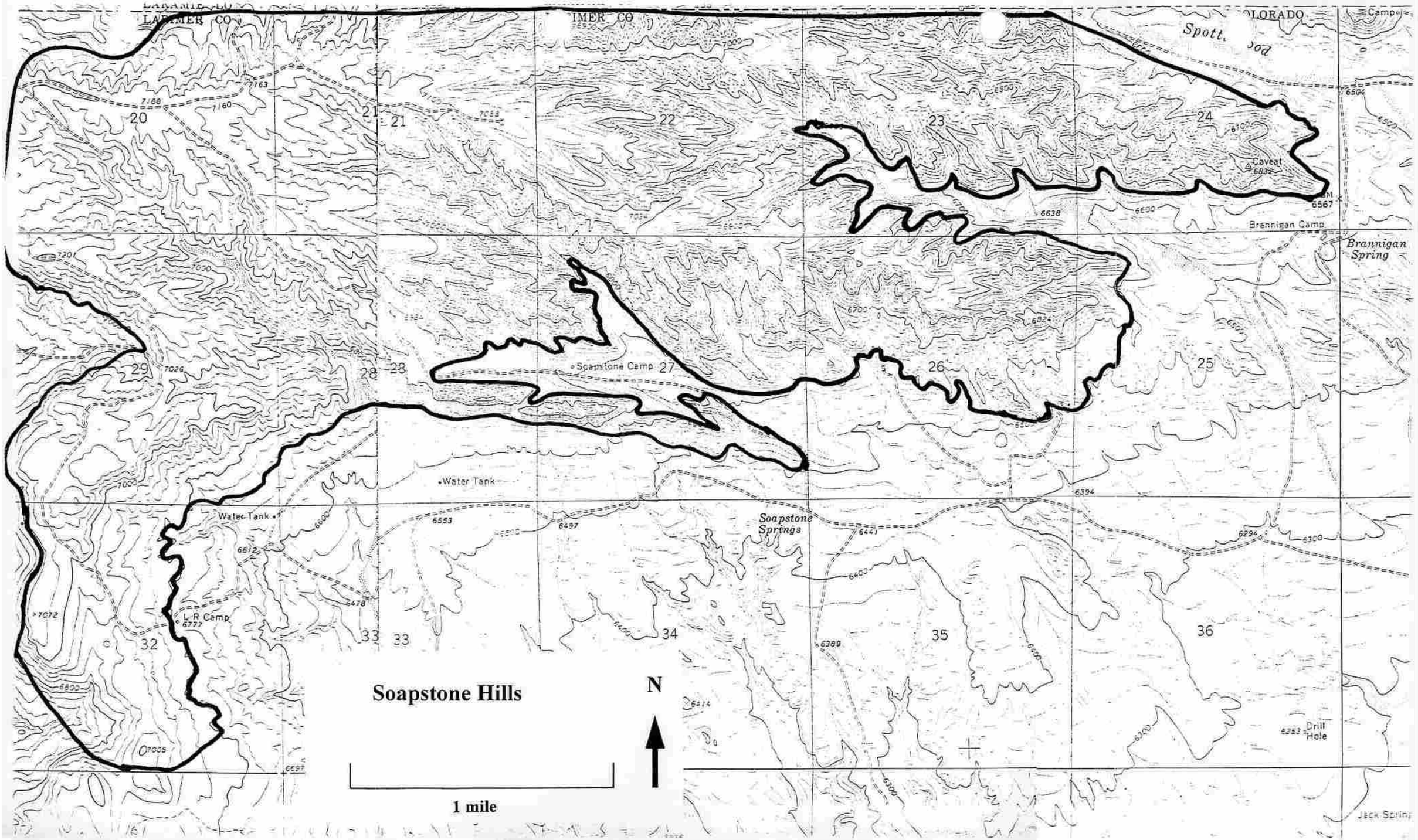
*EO = element occurrence

CURRENT STATUS: The site is currently privately owned by a grazing association with multiple members.

BOUNDARY JUSTIFICATION: The boundary is intended to encompass the mountain mahogany shrublands and some adjacent grasslands as a buffer against direct impact. The size of the site and its context in a natural landscape should allow natural ecological processes (fire, wildlife migration, etc.) to function or to be restored if necessary.

PROTECTION CONSIDERATIONS: The site is currently owned by a grazing association with multiple members. This may make consensus on management or conservation issues more difficult and increase the chances that the site could be split up into smaller parcels in the future. The agreements and principles by which the grazing association operates are not currently known.

MANAGEMENT CONSIDERATIONS: The non-native plant species, cheatgrass and Japanese brome (*Bromus japonicus)* are common on the ridges with the mountain mahogany and in swales on the grasslands. Further increase of non-native species may decrease the biodiversity significance of the site by altering the native floral and faunal species composition (Bock and Bock 1988). Grazing or fire management could be used as a tool to reduce the dominance of these species and increase the proportion of native species (see discussion of the problems of non-native species, p. 17).


Soapstone Hills
N
1 mile
Soapstone Camp
Water Tank
Water Tank
L-R Camp
Soapstone Springs
Brannigan Camp
Brannigan Spring
Caveat
Drill Hole
Jack Spring
LARIMER CO
COLORADO

Steinhoff Hills

SIZE: Approximately 1100 acres.

BIODIVERSITY RANK: B3 - High significance. A fair quality occurrence of a globally imperiled plant community.

PROTECTION URGENCY RANK: P4 - No threat known for foreseeable future.

MANAGEMENT URGENCY RANK: M4 - Management of non-native species and fire regimes may be needed in the future to maintain the current quality of the element occurrences.

LOCATION: Approximately 5 miles west of Livermore north of the Red Feather Lakes Road. Livermore Mountain Quadrangle. Township 10 North, Range 71 West, sections 25, 26, 34, 35, 36.

GENERAL DESCRIPTION: The Steinhoff Hills site is characterized by rounded hills that lie between Rabbit Creek to the north and Pine Creek to the south. The hills are formed by ancient Poudre River gravels which overly sandstones. Small drainages flow from the hills. Elevations range from around 6000 feet to 6500 feet near the top of the hills.

The vegetation is dominated by a mosaic of mountain mahogany (*Cercocarpus montanus*) shrublands along the middle and lower slopes and intermixed grasslands. This site has a very diverse assemblage of plant communities in a relatively small geographic area.

Part of the site is managed as a Wildlife Area by the state and part is used for livestock pasture.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The site supports occurrence of several imperiled plant communities.

The mountain mahogany/needle and thread grass *(Cercocarpus montanus/Stipa comata*) foothills shrubland is globally imperiled. Almost all known occurrences are highly degraded by invasion of the non-native cheatgrass (*Bromus tectorum*) as is the case at this site.

The mountain mahogany/Griffith's wheatgrass (*Cercocarpus montanus/Elymus lanceolata X Pseudoroegneria spicata*) foothills shrubland has only been documented along the northern Front Range of Colorado and apparently occurs in southeastern Wyoming. This occurrence has been degraded by invasion of non-native species.

The mountain mahogany/New Mexico feathergrass (*Cercocarpus montanus/Stipa neomexicana*) foothills shrubland was first documented from the area near Livermore in 1994. The occurrence at this site is in good condition but very small.

The mountain mahogany/Scribner's needlegrass (*Cercocarpus montanus/Stipa scribneri)* foothills shrubland appears to be relatively uncommon but its status unknown to date. The occurrence at this site is in good condition, and although fairly small, is typical for this community in Larimer County.

The needle and thread grass-blue gramma (*Stipa comata-Bouteloua gracilis)* mixed grass prairie is common globally but uncommon in Colorado (G5/S2S3). The occurrence at this site is in fairly good condition but relatively small compared to others known from the adjacent area.

Table 44. Natural Heritage Elements at the Steinhoff Hills Site.							
Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Cercocarpus montanus/Stipa comata	Foothills shrubland	C	G2	S2			
Cercocarpus montanus/Stipa neomexicana	Foothills shrubland	C	G2G3	S2S3			
Cercocarpus montanus/ Elymus lanceolata x Pseudoroegneria spicata	Foothills shrubland	C	G3	S3			
Cercocarpus montanus/Stipa scribneri	Foothills shrubland	B	GU	SU			
Stipa comata-Bouteloua gracilis	Mixed grass prairie	C	G5	S2S3			

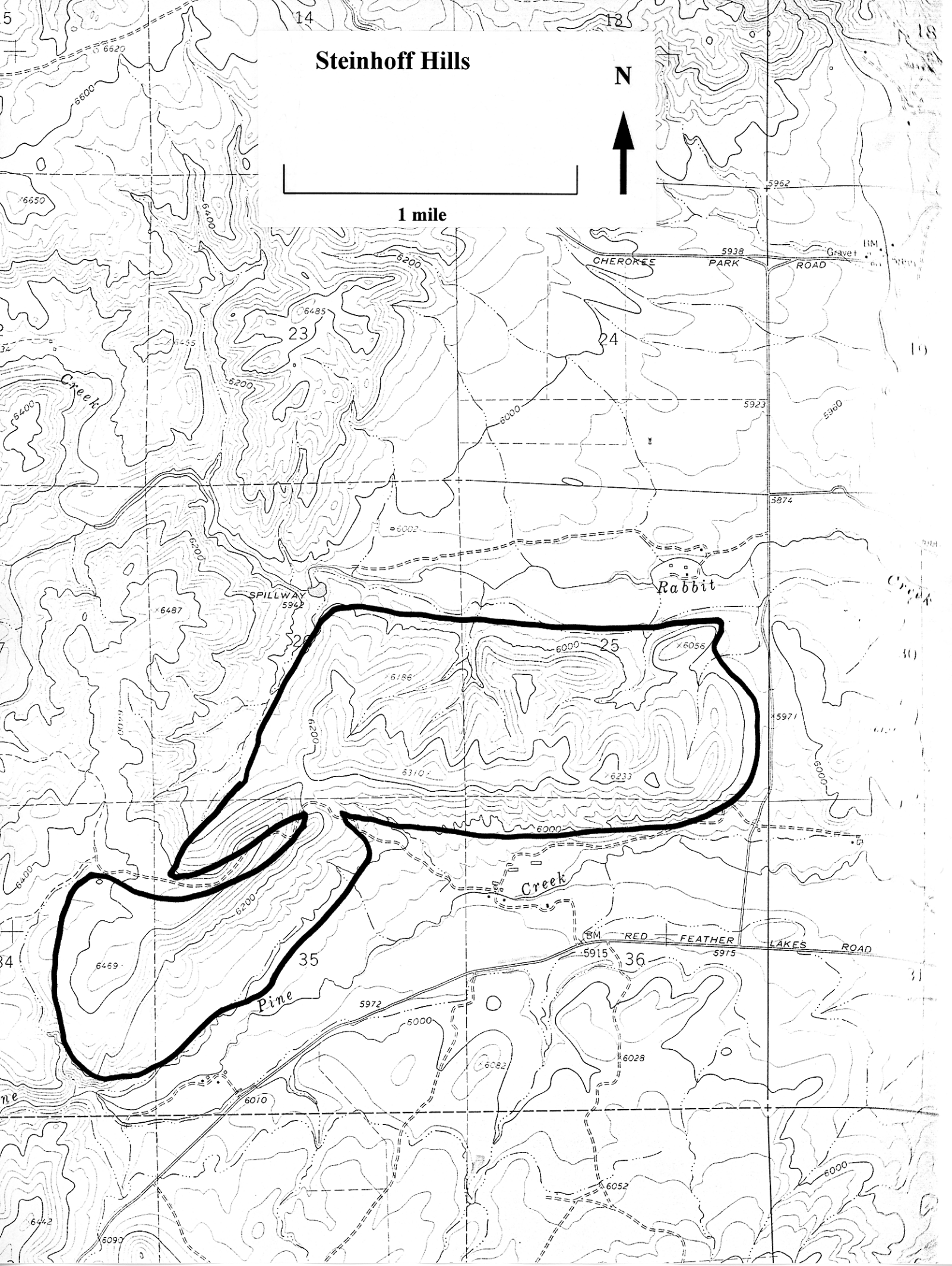
*EO = element occurrence

CURRENT STATUS: Part of the site is leased from the State Land Board and managed as a Wildlife Area by the Division of Wildlife and part is privately owned and used for livestock pasture. There is no formal protection for the significant biologic features.

BOUNDARY JUSTIFICATION: The boundary includes the slopes of the hills and a buffer down to the valley bottoms to the north and south. Much of the land surrounding this site is heavily altered from its natural state.

PROTECTION CONSIDERATIONS: Part of this site appears to be owned by the Bureau of Land Management and leased by the Division of Wildlife for hunting.

MANAGEMENT CONSIDERATIONS: Smooth brome (*Bromus inermis*) is present at the site and may need to be controlled. Cheatgrass and Japanese brome (*Bromus japonicus)* are common on the ridges with the mountain mahogany and in swales on the grasslands. Further increase of non-native species may decrease the biodiversity significance of the site by altering the native floral and faunal species composition (Bock and Bock 1988). Grazing or fire management could be used as a tool to reduce the dominance of these species and increase the proportion of native species (see discussion of the problems of non-native species, p. 17).


Steinhoff Hills
N
1 mile
CHEROKEE PARK ROAD
RED FEATHER LAKES ROAD
Rabbit Creek
Pine Creek
SPILLWAY
Gravel PM
23
24
25
35
36

Waverly

SIZE: Approximately 100 acres.

BIODIVERSITY RANK: B3 - High significance. A poor quality occurrence of a globally imperiled plant species.

PROTECTION URGENCY RANK: P4 - No threat known for foreseeable future.

MANAGEMENT URGENCY RANK: M3 - Management of grazing may be needed within 5 years to maintain the current quality of the element occurrence.

LOCATION: 12 miles north of Ft. Collins; east of Waverly. Wellington Quadrangle Township 9 North, Range 69 West, sections 13 and 24.

GENERAL DESCRIPTION: Exposed Niobrara shale outcrops along Ditch Creek on red clay soils. The geology appears to be the Fountain Formation which contains sandstone, siltstone, limestone, and shales. Vegetation cover includes smooth brome *(Bromus inermis)*, fringed sage *(Artemisia frigida)*, and milkvetch *(Astragalus* sp.).

NATURAL HERITAGE RESOURCE SIGNIFICANCE: A small occurrence of a globally imperiled plant species, Bell's twinpod (*Physaria bellii*).

Table 45. Natural Heritage Elements at the Waverly Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Physaria bellii	Bell's twinpod	D	G2	S2			

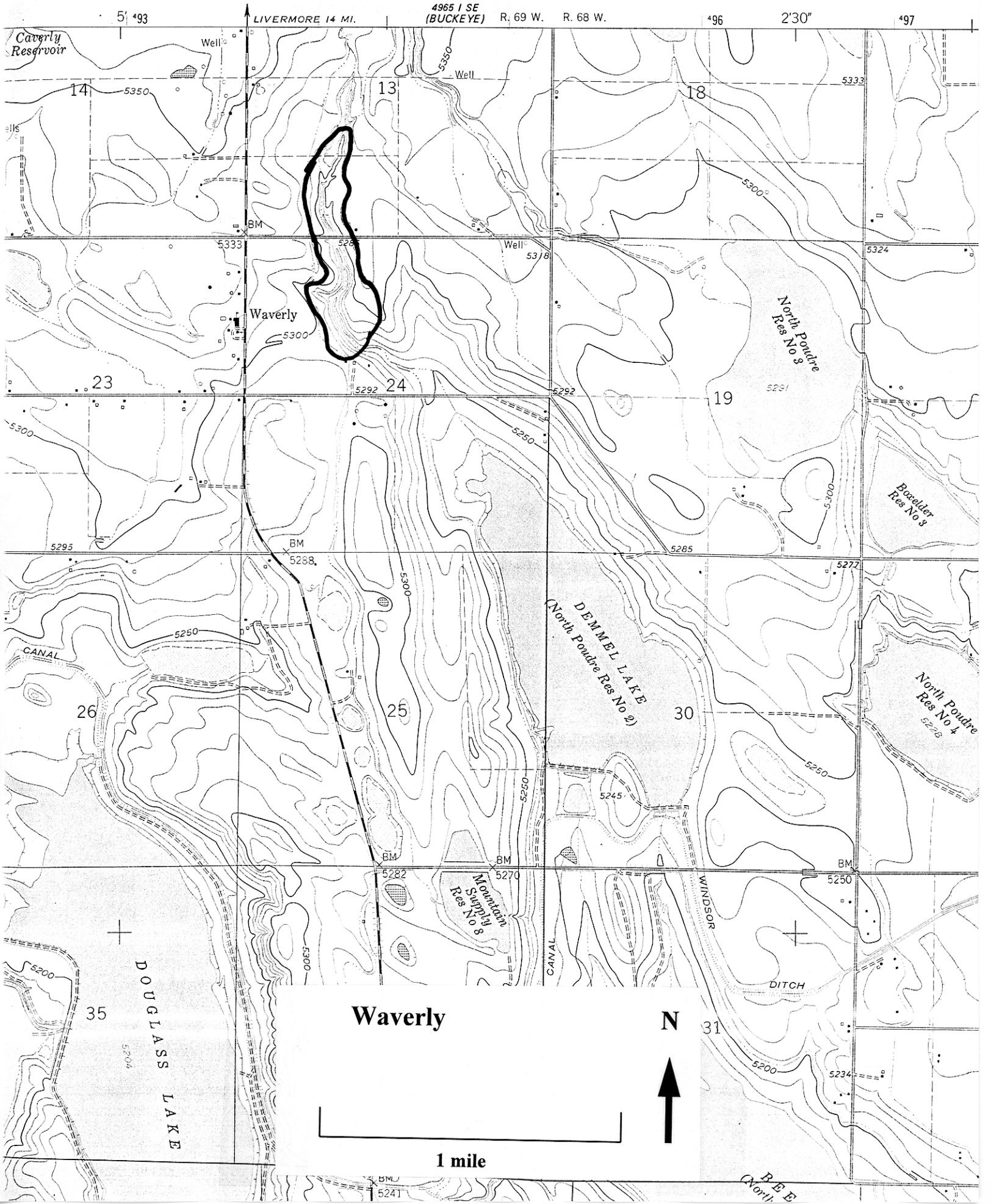
*EO = element occurrence

CURRENT STATUS: This occurrence is on private land with no formal protection. Grazing and the associated threats (trampling and the increase of non-native plant species) could affect this site.

BOUNDARY JUSTIFICATION: The site includes the occurrence and a small buffer to protect from direct and indirect disturbance.

PROTECTION CONSIDERATIONS: This occurrence has been known here for 15 years.

MANAGEMENT CONSIDERATIONS: Landowner should be contacted and encouraged to agree on management plans that will allow for the long-term, survival of Bell's twinpod at this site. Trampling from livestock is threatening the population. Smooth brome (*Bromus inermis*) is present at the site and may need to be controlled.


Waverly
N
1 mile
LIVERMORE 14 MI.
4965 I SE
(BUCKEYE)
R. 69 W.
R. 68 W.
Caverly Reservoir
Waverly
DEMMEL LAKE
(North Poudre Res No 2)
North Poudre Res No 3
Boxelder Res No 3
North Poudre Res No 4
Mountain Supply Res No 8
DOUGLASS LAKE
CANAL
DITCH
WINDSOR
BM
Well

Wetland Sites Ranked "B4" - Moderate Significance

Cache La Poudre Macrosite (R/W)

SIZE: approx. 2,700 acres

BIODIVERSITY RANK: B4 - Moderate significance. This site contains many elements of statewide concern.

PROTECTION URGENCY RANK: P2 - Threat expected within five years. The area along and near the river is developing at a rapid pace with no comprehensive plan for protecting the corridor's most sensitive features.

MANAGEMENT URGENCY RANK: M3 - Management actions may be needed within 5 years to maintain the current quality of the element occurrences. Efforts to maintain high water quality in the river should be continued and strengthened.

INCLUDED SITES: The sites include in the Cache la Poudre Macrosite are: the Laporte site, along the length of the river from Bellvue to I-25; the Arrowhead Site, in the Fort Collins natural area east of the river and north of Prospect Avenue; the Cache la Poudre at the Environmental Learning Center (ELC) site, which includes the cottonwood forest in and near the ELC.

LOCATION: Along the Cache la Poudre River from Bellvue to I-25, including a broad section of riparian area near Prospect Avenue.

GENERAL DESCRIPTION: This site includes approximately 13 miles of the Cache la Poudre River. Immediately north and south of Prospect Road the site widens to include much of the current and historic floodplain of the River. The river along the entire site is essentially channelized, and many areas in the floodplain have been mined for gravel. Immediately north of Prospect Road on the east end of the site are two abandoned oxbow ponds that indicate the former extent of the river's meandering across its floodplain. A similar oxbow is apparent north of Fort Collins (T8N R69W S34 SE4). Immediately south of Prospect Road near the river is an old gravel pond that is being restored to a functioning riparian system. This restoration area is used extensively by migrating shorebirds and waterfowl.

Most of the area immediately adjacent to the river consists of mature riparian forest, comprising both native cottonwoods (*Populus* spp.) and a large, non-native willow (*Salix fragilis*). Patches of a shrubby native willow (*Salix exigua*) occur along the length of the site. The understory in this forested area consists of almost entirely non-native species (e.g., *Bromus inermis, Phalaris arundinacea*). Open areas of the site, such as the area near Prospect Road, contain small occurrences of a few common native wetland plant associations (e.g., *Typha* spp., *Scirpus pungens*), but they also contain large stands of non-native, weedy vegetation.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: This site contains a concentration of elements that are vulnerable in Colorado (see table below). The site also potentially contains Preble's meadow jumping mouse, a candidate for listing under the U.S. Endangered Species Act. Although this species has not recently been found on the site, a specimen was once collected from this vicinity (CNHP 1996).

The plains topminnow that occurs in the river associated with this wetland complex was a former candidate for listing under the U.S. Endangered Species Act. This species and the Iowa darter are Species of Special Concern for the Colorado Division of Wildlife. The relationship between the wetlands and the fish population in the river is unclear. The degree of development within the watershed may make long term survival for some of the fish species questionable. The common shinner and brassy minnow have nearly been extirpated from the river.

Table 46. Natural Heritage Elements at the Cache la Poudre Macrosite.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Eustoma russellianum	Showy prairie gentian	C	G5	S3			
Fundulus sciadicus	Plains topminnow	?	G4	S2		SC	FS
Etheostoma exile	Iowa darter	?	G5	S2		SC	
Etheostoma nigrum	Johnny darter	?	G5	S3			
Satyrodes eurydice fumosa	Smoky-eyed brown butterfly	?	G5T3T4	S1			
Euphyes bimacula	Two-spotted skipper	?	G4	S1			
Ardea herodias	Great blue heron	?	G5	S3B,SZN			
Butorides striatus	Green heron	?	G5	S3B,SZN			
Nycticorax nycticorax	Black-crowned night heron	?	G5	S3B,SZN			
Pandion haliaetus	Osprey	?	G5	S1B, SZN			FS

*EO = element occurrence

CURRENT STATUS: The river corridor includes a mixture of public and private land.

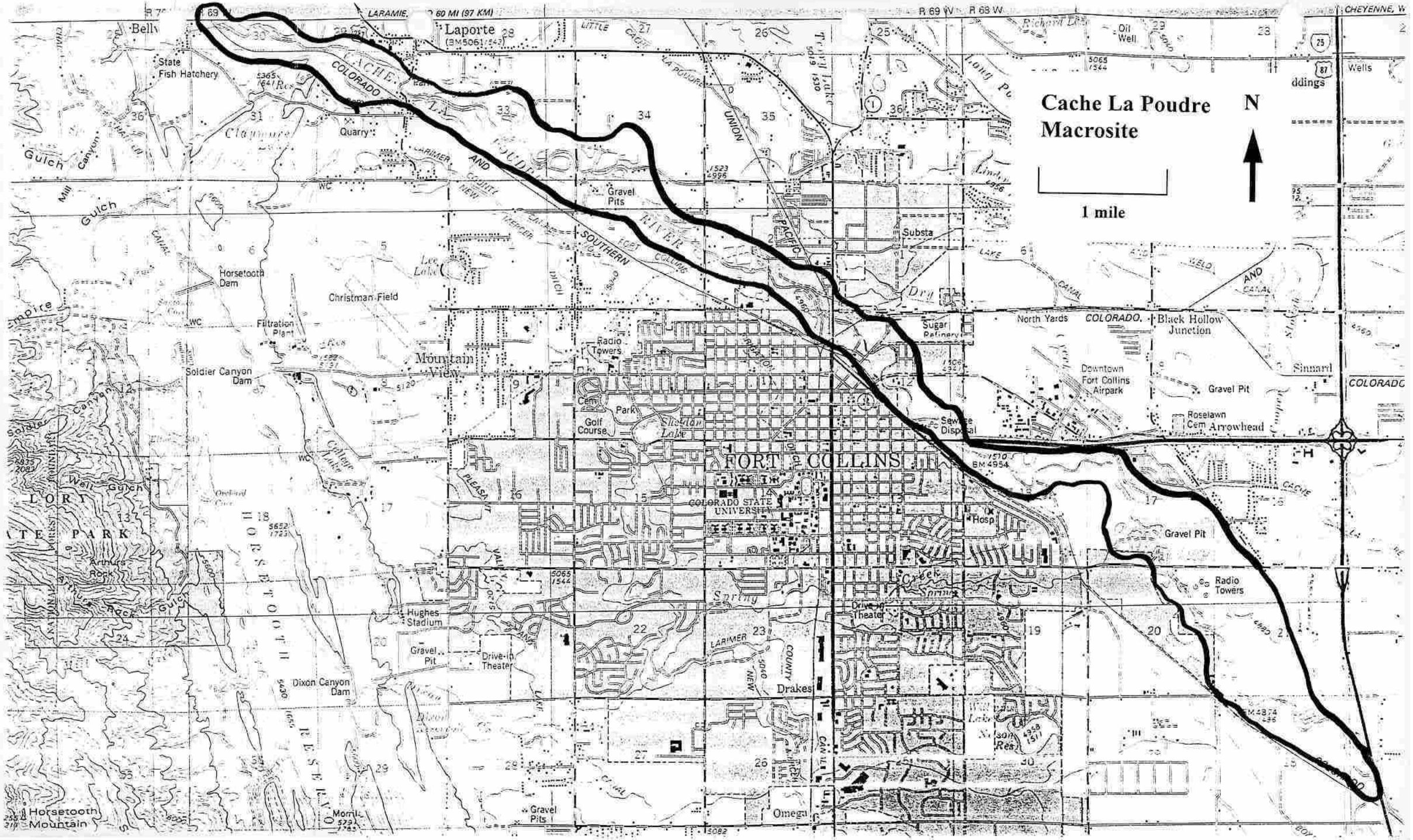
BOUNDARY JUSTIFICATION: The site boundary contains all of the known and potential occurrences along this stretch of river, the old gravel pits associated with these occurrences, and much of the contiguous current and former floodplain. The boundaries as currently drawn are approximate. The borders of this site should be refined to avoid permanent, existing structures along the river corridor. In order to protect the elements associated with the site, the final boundaries of the site should contain as much of the former floodplain as possible. Extensive parcel specific boundary considerations will be necessary to ensure adequate protection.

PROTECTION CONSIDERATIONS: Protection should include as much of the floodplain of the river in this section as possible. The City of Fort Collins and Larimer County should assure that strong consideration of floodplain protection is given to development proposals. Because both small and large scale activities can affect the fish populations, a watershed management plan would need to be developed to insure protection of the aquatic elements. Examples of local activities that may help protect the fishes include leaving downed trees in the river to provide habitat and developing grazing management plans for the river corridor. Large scale activities would include (but are not limited to) insuring somewhat of a natural streamflow and protecting water quality.

MANAGEMENT CONSIDERATIONS: Development and the resulting siltation have impacted the fish populations in this area. Streamflow alterations and decreases often allow silt to build up in the channel. Because the habitat for the fishes has been drastically altered

restocking may be necessary to restore the natural fish community. Stocking of non-native fish should be discouraged.

Trails should be maintained to avoid the known occurrences, and to minimize fragmentation of the narrow riparian vegetation patches. Any restoration activities should avoid known occurrences, especially of *Eustoma grandiflora*. In the short term, riparian/wetland restoration efforts should concentrate near Prospect Road, where a restoration project is already in progress. In this area, restoration efforts should at a minimum sculpt pond borders to create better wetland habitat in steep-sided abandoned ponds. An effort should be made to replace the non-native, weedy plant species with native species. The intact oxbow ponds on the east end of the site north of Prospect Avenue should be maintained in their natural state and should be incorporated into the site. This site would be an interesting area to experiment with allowing natural flood processes, e.g., channel meandering, to take place as much as possible in order to create a more diverse wetland/riparian mosaic. Management plans (for trails, weed control, etc.) should consider natural river processes. Habitat for vulnerable wetland-dependent butterflies (mainly sedge meadows) should be given strong preference in restoration projects.


Cache La Poudre
Macrosite
N
1 mile
Laporte
State Fish Hatchery
Quarry
Horsetooth Dam
Christman Field
Filtration Plant
Soldier Canyon Dam
Mountain View
Radio Towers
Golf Course
Sheldon Lake
FORT COLLINS
COLORADO STATE UNIVERSITY
Hughes Stadium
Gravel Pit
Drive-In Theater
Dixon Canyon Dam
Horsetooth Mountain
Gravel Pits
Drakes
Omega
Substa
Sugar Refinery
North Yards
COLORADO.
Black Hollow Junction
Downtown Fort Collins Airpark
Gravel Pit
Roselawn Cem
Arrowhead
Sewage Disposal
Hosp
Gravel Pit
Radio Towers
Oil Well
Wells
Sinnard
COLORADO
Arthurs Rock
Lee Lake
Dry
Spring
Creek
Lake
CACHE LA POUDRE
COLORADO
RIVER
SOUTHERN
PACIFIC
UNION
LARIMER AND WELD COUNTY CANAL
LARIMER COUNTY CANAL NO. 2
LARIMER COUNTY NEW
WELD COUNTY CANAL NO. 2
LAKE CANAL
FORT COLLINS PIPE
PLEASANT VALLEY
Mill Gulch
Soldier Canyon
Well Gulch
Rock Gulch
Trail Lake
Richard Lake
Long Pond
Lindy Lake
Sheldon Lake
College Lake
Orchard Place
Meadow Springs Ranch
R 69 W
R 68 W
CHEYENNE, W
LARAMIE, 60 MI (97 KM)

Fossil Creek Reservoir (R/W)

SIZE: Approximately 1700 acres.

BIODIVERSITY RANK: B4- Moderate significance. This site provides habitat for several state imperiled birds and fair quality examples of two common wetland plant communities.

PROTECTION URGENCY RANK: P2 - Threat expected within five years. Development is imminent on at least the north side of the reservoir.

MANAGEMENT URGENCY RANK: M4 - Management may be needed in the future to maintain the current quality of the element occurrences.

LOCATION: In and around Fossil Creek Reservoir, west of I-25 and mostly north of County Road 32. Mostly Loveland and Windsor Quadrangles, but also small parts of Timnath and Fort Collins. Township 6 North, Range 68 West, sections 8,9,10,15,16,17,18,20,22.

GENERAL DESCRIPTION: Most of the site is a Great Plains reservoir that stores water for irrigation. Construction of the reservoir created extensive wetlands as well as has habitat for trees. On the southeast corner of the reservoir and especially on the west end of the reservoir are extensive stands of cattail (*Typha latifolia* and *Typha angustifolia*). West of County Rd. 11 (Timberline Rd.) is a relatively extensive area of shallow marsh dominated primarily by saltgrass (*Distichlis spicata*). Along the north and south sides of the reservoir are small to large stands of plains cottonwoods (*Populus deltoides*) that provide sites for nesting herons (*Ardea herodias*) and roosting bald eagles (*Haliaeetus leucocephalus*). Surrounding land is presently mostly cultivated fields with some cattle grazing. The east and south shores of the reservoir serve as trailer parks and campgrounds. Access to the reservoir is restricted.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: This site contains a concentration of state imperiled birds, including a great blue heron nesting site and a roosting site for bald eagles in winter. The wetlands that provide habitat for these elements are not natural, and this type of wetland has probably increased over the past century, thus the number of occurrences of the birds in particular may have increased over that same time period. The plant communities listed in Table 47 appear to be the largest examples of these types in Larimer County. They are significant mainly in that they provide important habitat for the birds listed below, as well as many other migrating waterfowl and shorebirds that do not stay at the site all summer.

Table 47. Natural Heritage Elements at the Fossil Creek Reservoir Site.							
Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Haliaeetus leucocephalus	Bald eagle	D	G4	S1B, S3N	LT	T	
Ardea herodias	Great blue heron	C	G5	S3			
Podiceps nigricollis	Eared greebe		G5	S3S4B, SZN			
Cistothorus palustris	Marsh wren	B	G5	S3B, SZN			
Circus cyaneus	Northern harrier	C	G5	S3S4B, S4N			
Typha latifolia plant association	Emergent wetlands (marsh)	C	G5	S4			
Distichlis spicata plant association	Wet meadow	C	G3G5	S3			

*EO = element occurrence

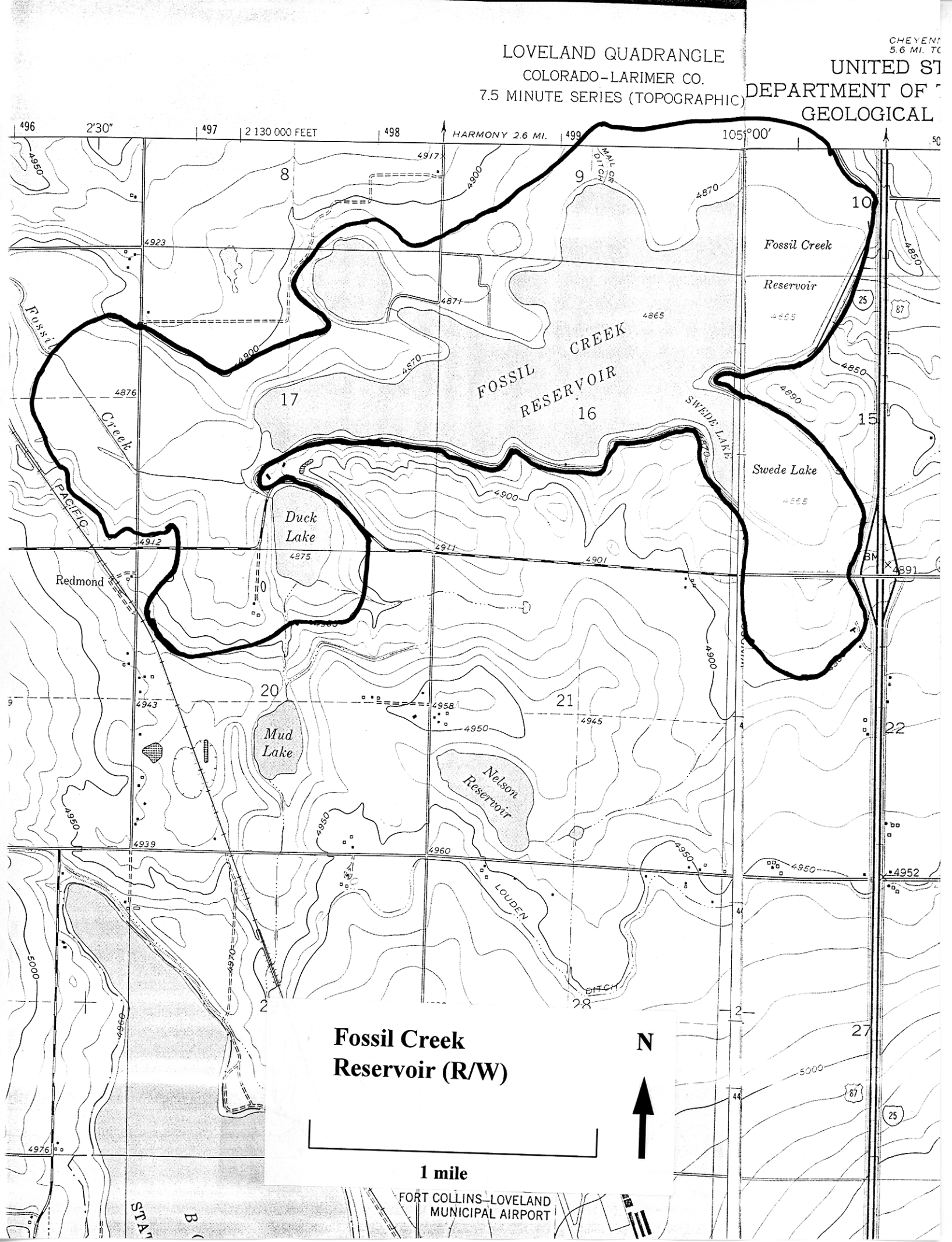
CURRENT STATUS: The west end of the reservoir east of Co. Rd. 11, a right-of-way around the reservoir, and some areas on the east end of the reservoir are owned by the North Poudre Irrigation Company. A portion of the area west of Co. Rd. 11 is owned by Fort Collins. Aside from a section of state land on the south side of the reservoir, most of the remaining land is privately owned.

BOUNDARY JUSTIFICATION: The boundary includes all of the elements, all wetlands contiguous with the reservoir, and a buffer. A buffer of approximately 1000 ft. is necessary on the north end of the reservoir to protect the great blue heron rookery and the bald eagle roost site from disturbance. A buffer of 300-500 ft. around the cattail and saltgrass marshes should be adequate to protect the bird habitat. Very little buffer is designated on the south and east ends of the reservoir because there are no elements in these areas, and the reservoir itself should provide sufficient buffer for the elements on the north and west end of the reservoir.

PROTECTION CONSIDERATIONS: To protect the most sensitive values of the marshes, development should occur outside of a 300-500 ft. buffer around the marsh and shoreline. Although disturbed, the marshes around the reservoir are valuable pieces of Larimer County's natural heritage.

MANAGEMENT CONSIDERATIONS: Pollutants and sediment in Fossil Creek may be a concern as they increase with increasing land disturbing activities in adjacent areas. Cats and dogs from nearby residential areas can cause harm to bird populations as far as one mile from their home. The maintenance of the current hydrological control patterns of the reservoir are necessary to retain the habitat for the elements.

When the heron rookeries are active, there should be a seasonal closure of areas within 500 ft. (Erwin 1989, Graul 1981).


LOVELAND QUADRANGLE
COLORADO–LARIMER CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
UNITED ST
DEPARTMENT OF
GEOLOGICAL
CHEYEN
5.6 MI. TO
496
2'30"
497
2 130 000 FEET
498
HARMONY 2.6 MI.
499
105°00'
MAIL OR DITCH
Fossil Creek Reservoir
FOSSIL CREEK RESERVOIR
Swede Lake
SWEDE LAKE
Fossil Creek
Duck Lake
Mud Lake
Nelson Reservoir
Redmond
PACIFIC
LOUDEN DITCH
FORT COLLINS–LOVELAND MUNICIPAL AIRPORT
Fossil Creek Reservoir (R/W)
N
1 mile

Sand Creek (R/W)

SIZE: 585 acres

BIODIVERSITY RANK: B4 - Moderate significance. This site contains a fair quality occurrence of a globally vulnerable plant community.

PROTECTION URGENCY RANK: P2 - Threat expected within 5 years from continued expansion of housing on 35 acre lots.

MANAGEMENT URGENCY RANK: M2 - Ongoing, recurring management of non-native species must occur over next five years to prevent the loss of the element.

LOCATION: The site is along Sand Creek, beginning at the Sand Creek Pass Road and continuing north for four miles. Sand Creek Pass and Eaton Reservoir Quadrangles. Township 11 North, Range 75 West, sections 1,2,3,10,11; Township 12 North, Range 75 West, section 36; Township 12 North, Range 74 West, sections 30,31.

GENERAL DESCRIPTION: The Sand Creek Site consists of a relatively narrow but dense, very wet willow thicket surrounded by grasslands and low sagebrush shrublands along the southern two miles of the site; the northern two miles consists of a drier and narrower band of willows running through a canyon. The site has been traditionally used for a cattle operation, including an irrigated hay meadow on the west side of the creek. Recently most of the site has been divided into 35-40 acre parcels. The owners of the parcels in the Sand Creek Landowners Association all have common access to the creek.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The site contains a good example of a globally common but locally uncommon (especially at lower elevations) riparian shrubland, plus another riparian community in fair condition that is representative of the area. Excluding the area that formerly served as a hay meadow, the adjacent uplands contain threetip sagebrush shrublands in good condition. A pair of state threatened greater sandhill cranes has nested along Sand Creek for the past two or three years (local resident, pers. comm.).

Table 48. Natural Heritage Elements at the Sand Creek Site

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status
Salix geyeriana/ Carex utriculata	Montane riparian shrubland	B	G5	S2		
Salix geyeriana-S. monticola/ Calamagrostis canadensis	Montane riparian shrubland	C	G3	S3		
Grus canadensis tabida	Greater sandhill crane	D	G5T4	S2B, S4N		T

*EO = element occurrence

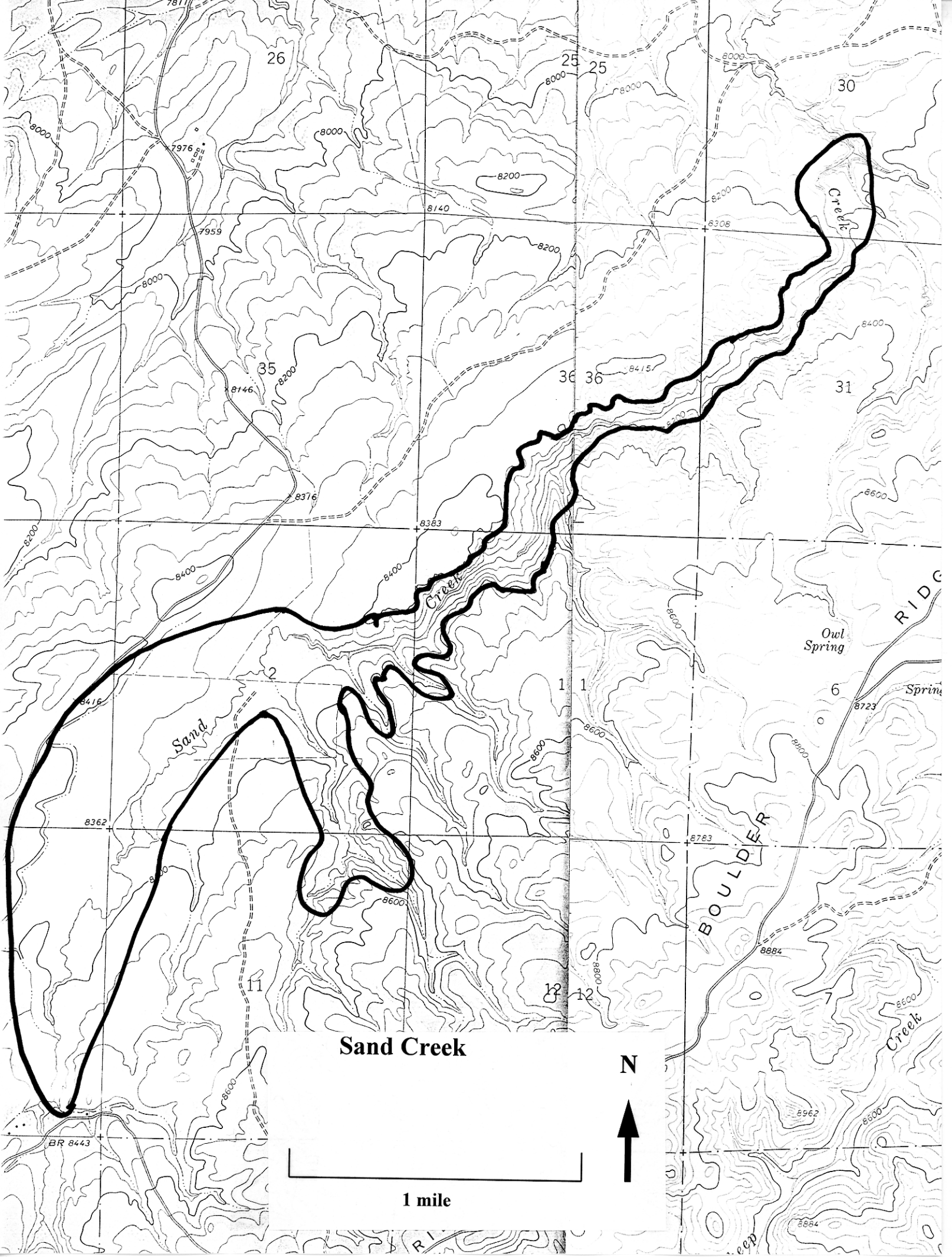
CURRENT STATUS: The southern half of the Sand Creek site is currently parceled into 35-40 acre lots, each owned by different individuals, all members of the Sand Creek Landowners

Association. The portion of the site in section 36 is on state land. There is currently no formal protection provided to this site or its elements.

BOUNDARY JUSTIFICATION: The boundary drawn includes the riparian elements, the adjacent sagebrush shrublands in good condition, and a small buffer (approximately 300 ft.). The buffer is designed to protect the elements and associated plants and animals from habitat disturbance and weed invasion. The boundary as drawn is only approximate, as is the area calculated from this boundary. A general rule of keeping the buffer 300 feet from the shrublands should be used as a guide for determining the boundary on the site.

PROTECTION CONSIDERATIONS: Given that most of the site has already divided into ranchettes, protection actions should directed toward the landowners association. Perhaps the association can be persuaded to adopt the above boundary recommendation. The state land (section 36) should remain intact. Removal of cattle from the riparian area would provide maximum benefit to the elements.

MANAGEMENT CONSIDERATIONS: The Colorado Division of Wildlife should be consulted to determine a buffer distance to avoid disturbance to the cranes during nesting. Landowners should be discouraged from planting non-native, potential invasive species in their landscaping projects, especially non-native willow species.


Sand Creek
N
1 mile
Sand Creek
Owl Spring
BOULDER
RIDG
BR 8443

Terrace Ponds (R/W)

SIZE: Approximately 775 acres.

BIODIVERSITY RANK: B4 - Moderate significance. Two occurrences of good quality, state imperiled communities.

PROTECTION URGENCY RANK: P3 - Definable threat but not within the next 5 years. All the similar ponds in the vicinity have had their wetland plant communities destroyed by heavy grazing.

MANAGEMENT URGENCY RANK: M2 - New management action may be needed within 5 years to prevent loss of element occurrences. The location of the marsh community is currently very well managed. However, similar ponds nearby have been heavily impacted by grazing.

LOCATION: One mile east of the Laramie River, 1.5 miles north of Four Corners. Crazy Mountain quadrangle. Township 011 North, Range 076 West, sections 21, 28, 33.

GENERAL DESCRIPTION: The area east of the Laramie River just north of Four Corners is apparently a large river terrace formed during the Ice Age (the Pleistocene). The area is mostly flat with shallow depressions (probably formed by wind erosion) and gentle slopes rising from the wet, low areas. The depressions intercept a high water table, forming a few permanent shallow water bodies. Most of the permanent water bodies appear heavily impacted by cattle, but one appears to contain very robust emergent communities in excellent condition. The wet (often flooded) meadow between the ponds contains both native and non-native communities. The native communities consist largely of species that succeed under intense grazing (Nebraska sedge, *Carex nebrascensis*, and Baltic rush, *Juncus balticus*), while foxtail barley (*Hordeum jubatum*) completely dominates some areas.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The two communities at this site are globally secure and widespread across North America, but in Colorado they are uncommon and considered imperiled (as are many wetland communities). Good examples of these communities are quite rare in Colorado, and very rare in Larimer County. Terrace Ponds contains by far the best example of both of these communities in Larimer County.

These wetlands also have high value for migrating and nesting waterfowl and shorebirds.

Table 49. Natural Heritage Elements at the Terrace Ponds Site.						
Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status
Scirpus tabernaemontani-Scirpus acutus	Emergent wetland (marsh)	B	G5	S2S3		
Scirpus maritimus	Emergent wetland (marsh)	B	G5	S2		

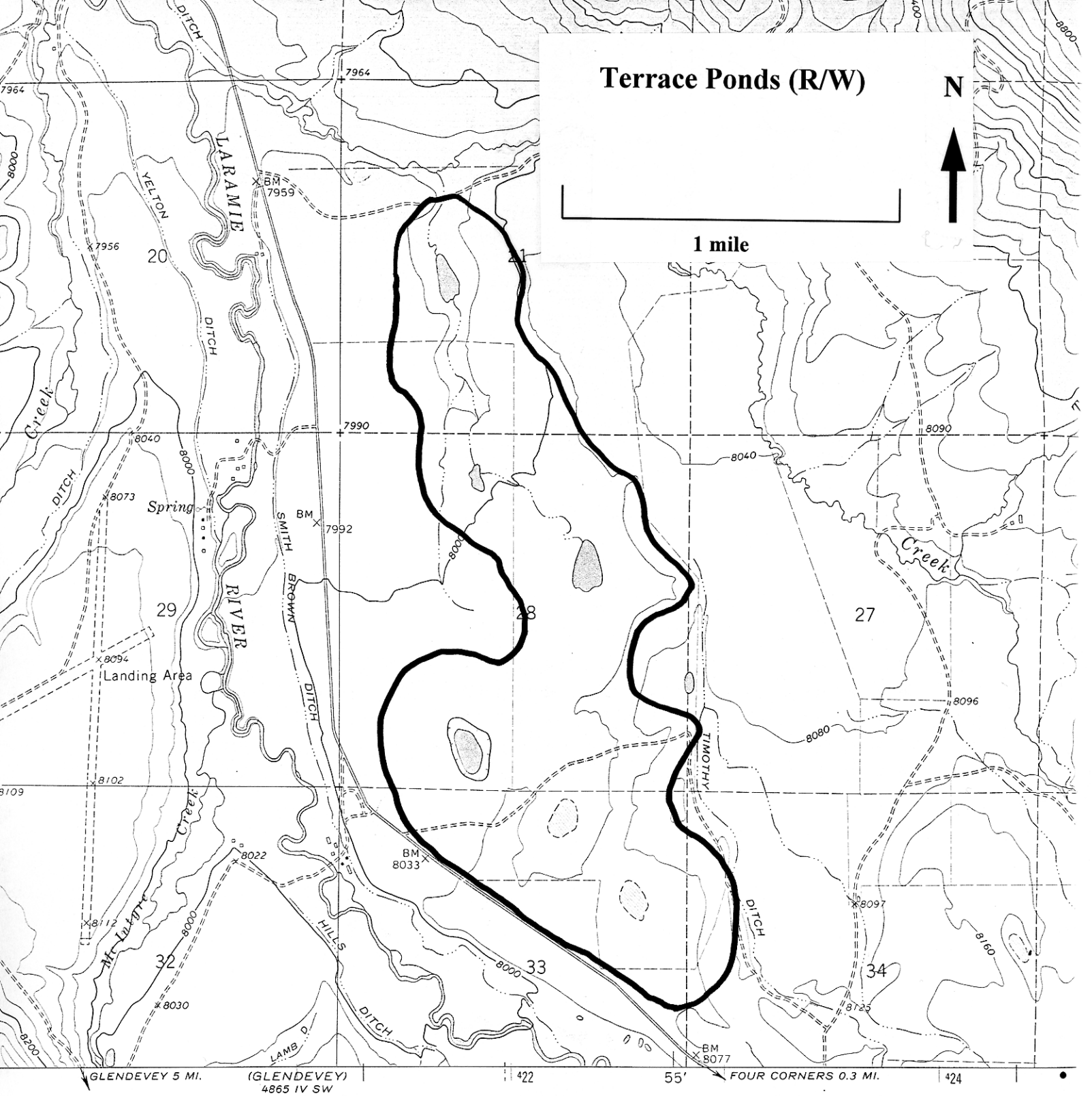
*EO = element occurrence

CURRENT STATUS: Privately owned and used for livestock (bison?). We are not aware of any formal protection provided to the wetlands.

BOUNDARY JUSTIFICATION: The boundary encompasses all the ponds on this one large terrace and all contiguous wetlands. A buffer of 300 ft. or slightly more is designated to protect the wetlands from direct impacts from vehicles, grazing animals, etc., as well as indirect impacts from water runoff from disturbed areas. The buffer is designed to also provide security for nesting and migrating waterfowl and shorebirds.

PROTECTION CONSIDERATIONS: Conservation tools such as management agreements or conservation easements could be used to maintain the quality of the site. Protection cannot be considered complete without recognizing that these wetlands may be strongly linked to off-site hydrology, and that hydrologic modifications beyond the site boundary could effect the wetlands on the site.

MANAGEMENT CONSIDERATIONS: Heavy grazing and trampling of shoreline plant communities will destroy the value of this site. On the other hand, restricted grazing for a few years could revitalize the wetland because the hydrology appears essentially intact. Perhaps one or two ponds could be managed as livestock production areas while greatly reducing grazing around the others.



SCALE 1:24000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

Light-c

COLORADO

QUADRANGLE LOCATION

C

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR WASHINGTON, D. C. 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

Wetland Sites Ranked "B5" - Low Significance

Arrowhead Site (R/W)

SIZE: 135 acres

BIODIVERSITY RANK: B5 - Local Significance. Contains a good quality occurrence of a globally secure but state vulnerable plant, the prairie gentian (*Eustoma russellianum = E. grandiflorum*). This is the only known, existing occurrence of this plant in Larimer County.

PROTECTION URGENCY RANK: P5 - No protection actions needed. The known prairie gentian habitat is all on Fort Collins city open space.

MANAGEMENT URGENCY RANK: M3 - Management of non-native plant species and recreational activities may be needed within 5 years to maintain the element.

LOCATION: Just east of the Cache la Poudre River (on the old floodplain) and immediately north of Prospect Road (Hwy. 14). Fort Collins Quadrangle. Township 7 North, Range 68 West, sections 16,17.

GENERAL DESCRIPTION: This state vulnerable plant grows in the moist bottoms of old gravel pits. Closer to the river are larger pits that are filled with water throughout the year. The wetlands are quite alkaline, a site characteristic possibly preferred by the prairie gentian. As evidenced by the gravel operations, this entire area as formerly part of the Cache la Poudre River floodplain and meander plain (the area throughout which the river winds back and forth over centuries). Included in the site are two large, mostly natural oxbow ponds to the east of the gravel pits (between the ponds and the homes on the east side, just north of Prospect Road). While the current location of the prairie gentian is highly altered, it is likely that wet meadows such as those around this natural floodplain ponds were formerly habitat for the gentian. Currently these ponds appear too heavily grazed to support the prairie gentian, but they should be incorporated into the existing natural area if only as now rare examples of natural oxbow ponds along the river.

Many of the plants on the site are alien species. However, most of the alien wetland plants do not seem to be posing a large threat to the gentian with one exception: Russian olive. Also, tamarisk (*Tamarix ramosissima*) is also present in small amounts at the site. This noxious weed should be controlled before it becomes a prominent feature of the landscape.

The site is currently a city-owned natural area. Trails extend throughout the area, but are concentrated near the ponds adjacent to the river.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: This site contains Larimer County's only known location of the prairie gentian (*Eustoma russellianum*). The site as drawn also contains a rare floodplain feature that was formerly common in Fort Collins area: oxbow ponds. While the plant communities currently growing in these ponds are common types, these types of ponds have been largely destroyed by channelization of the river, gravel mining, and development of the floodplain. The wet meadows around these ponds could provide habitat for the gentian. The ponds also provide habitat for migratory waterfowl.

Table 50. Natural Heritage Elements at the Arrowhead Site

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status
Eustoma russellianum	Showy prairie gentian	B	G5	S3		

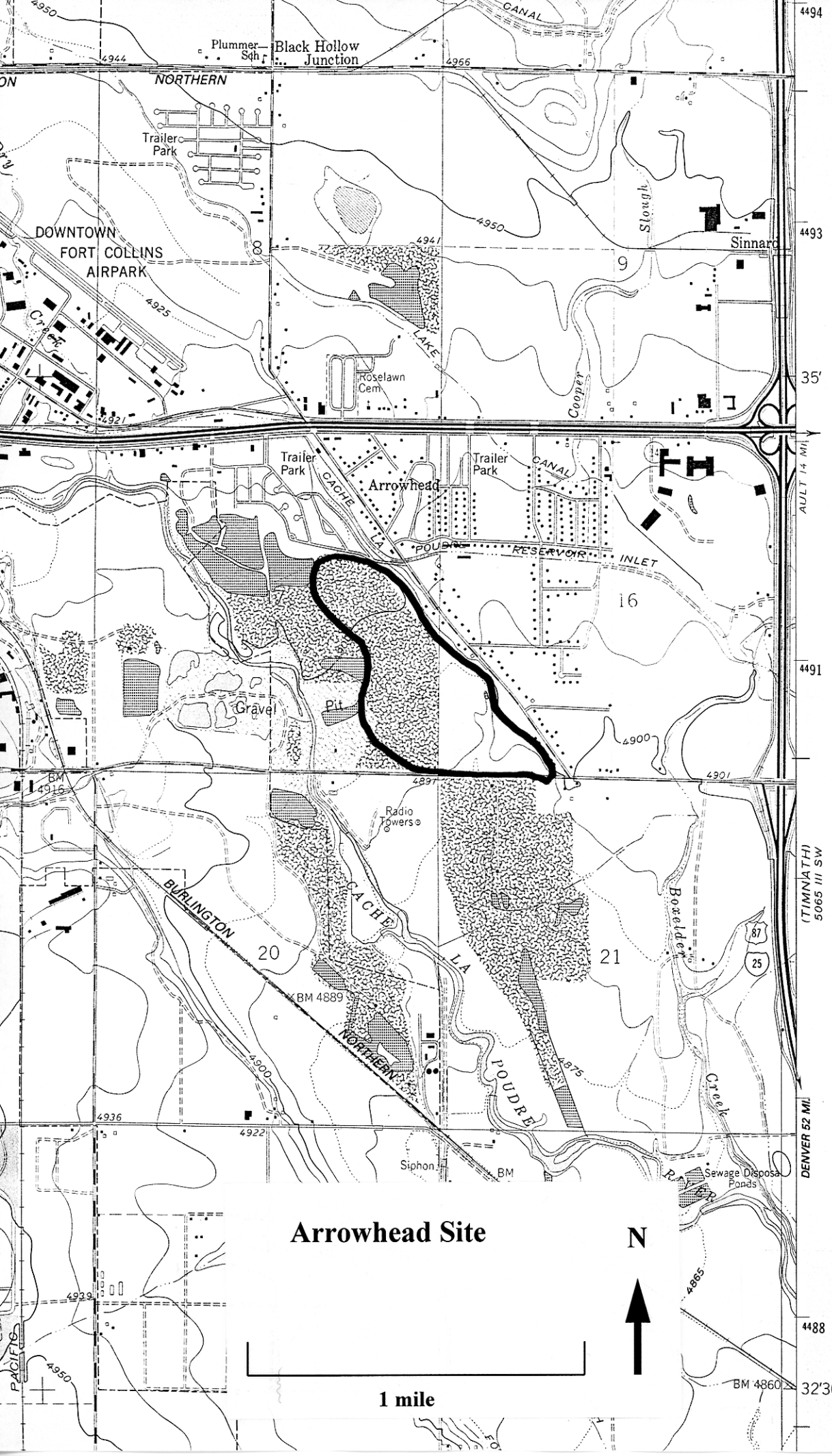
*EO = element occurrence

CURRENT STATUS: Most of the west portion of the site is Fort Collins open space; the oxbow ponds are privately owned. The extent of Fort Collins natural area should be checked against the occurrence of the showy prairie gentian to insure that the gentian is adequately protected from development.

BOUNDARY JUSTIFICATION: The site includes all known locations of the plant, all contiguous, suitable habitat, and the adjacent, natural oxbow ponds that provide potential habitat and represent the historic environment. With adequate management, this boundary should insure that the gentian persists.

PROTECTION CONSIDERATIONS: The oxbow ponds on the east end of the site should be incorporated into the site, either through tools such as a conservation easement or fee purchase (the structure of these ponds should not be altered by development, gravel mining, or any other means).

MANAGEMENT CONSIDERATIONS: Established trails should avoid the main groups of gentians. Non-native plant species are a problem at the site in that they are replacing native wetland species. Russian olive (*Elaeagnus angustifolia*) is expanding at the site and could eventually shade out the gentian; this noxious species should be removed from the site. Tamarisk (*Tamarix ramosissima*) is just beginning to colonize the site. This species has great potential to become a huge problem; it should be eliminated now while the problem is still manageable.


Arrowhead Site
N
1 mile
Black Hollow Junction
Plummer—Sch
NORTHERN
Trailer Park
DOWNTOWN FORT COLLINS AIRPARK
Roselawn Cem
Sinnard
Slough
Cooper
LAKE
CANAL
Arrowhead
CACHE LA POUDRE RESERVOIR INLET
Gravel Pit
Radio Towers
BURLINGTON NORTHERN
CACHE LA POUDRE
Boulder Creek
Siphon
Sewage Disposa Ponds
BM 4889
BM 4916
BM 4860
AULT 14 MI
(TIMNATH) 5065 III SW
DENVER 52 MI
4494
4493
4491
4488
35'
32'30"

Brannigan Springs Site (R/W)

SIZE: Approximately 990 acres.

BIODIVERSITY RANK: B5 - Local significance. Contains examples of globally secure but locally imperiled wetland communities.

PROTECTION URGENCY RANK: P4 - No threat known for foreseeable future.

MANAGEMENT URGENCY RANK: M3 - Management actions may be needed within 5 years to maintain the current quality of the element occurrences. Moderate to heavy grazing will likely change plant composition in these wetlands. A change in grazing patterns is recommended.

LOCATION: Just south of the Wyoming border, 5 to 8 miles west of I-25, from Graves Camp to Brannigan Spring. Township 12 North, Range 68 West, sections 19,20,21,30.

GENERAL DESCRIPTION: The Brannigan Springs site contains several natural springs dominated by native wetland plant communities. One of these communities represent one of the lowest known occurrences of what is typically a montane and subalpine plant community, which is probably present because of a cold air drainage through the area. The springs are relatively alkaline. In several small areas an unstable mat of vegetation one-half meter thick is supported by a layer of water issuing forth at the spring. Sedimentary bedrock capped by a thin layer of Pleistocene alluvium underlies and surrounds the site. The type of bedrock has resulted in a variegated landscape that is dominated by short and mid grass prairie.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The wetlands at the Brannigan Springs site probably represent a type of wetland that was once quite common across the Great Plains portion of Larimer County. It's reasonable to assume that many of our current reservoirs were built upon natural marshes and wet meadows, many of which probably contained springs such as the Jack Springs. The Brannigan Springs Site and the Jack Springs Site are the only natural Great Plains wetlands in Larimer County that can be assumed to be largely representative of pre-settlement conditions. The Brannigan Springs Site contains not only the westernmost Great Plains spring-fed wet meadows, but also contains a surprisingly low occurrence of a beaked sedge community, which typically grows in the montane and subalpine zones.

Table 51. Natural Heritage Elements at the Brannigan Springs Site.							
Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Catabrosa aquatica-Mimulus glabratus plant association	Spring wetland	C	GU	S2			
Carex nebrascensis plant association	Wet meadow	C	G5	S4			
Carex utriculata plant association	Wet meadow	C	G5	S3			

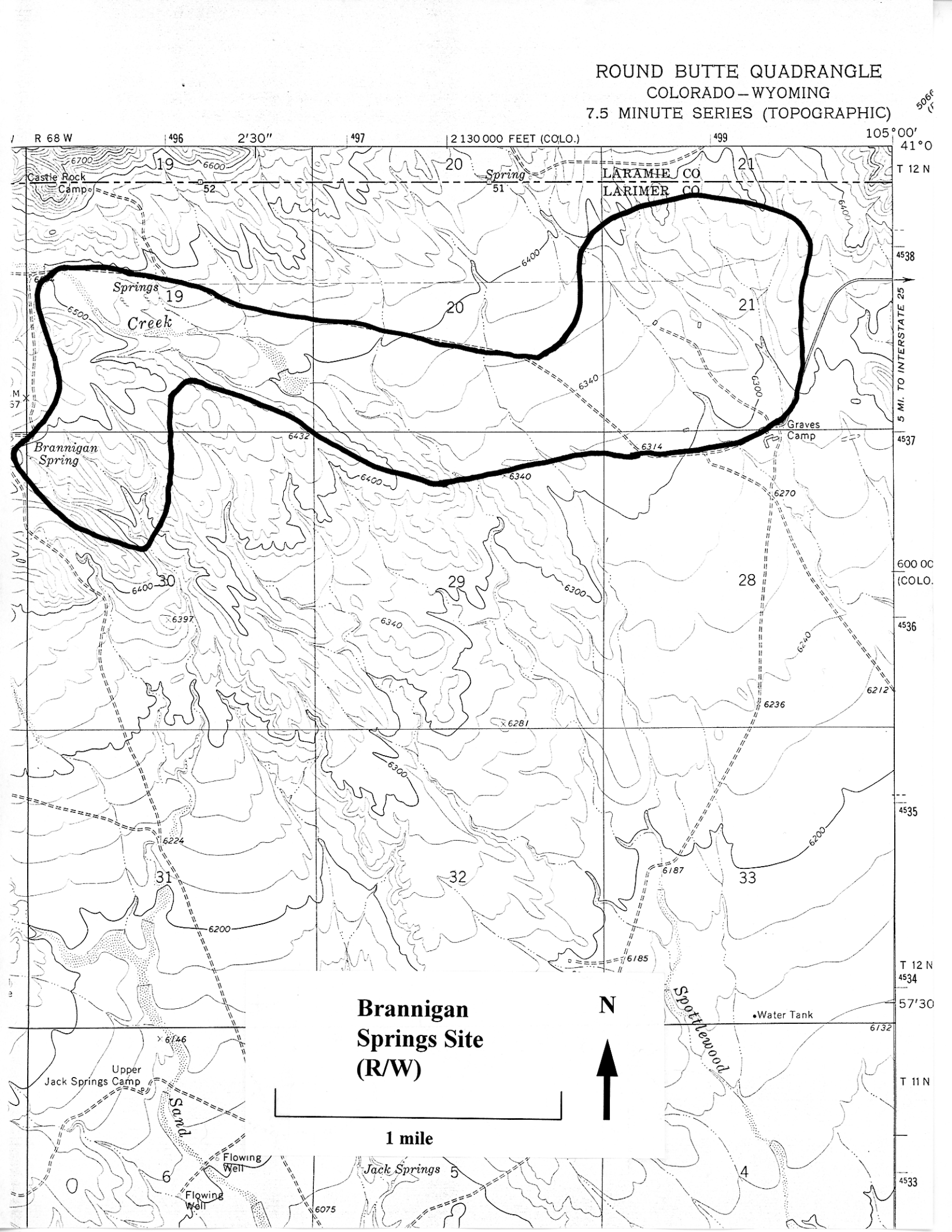
*EO = element occurrence

CURRENT STATUS: The Soapstone Grazing Association owns this site. They use it for moderate to heavy grazing; as elsewhere, the cattle are especially fond of the wetland and riparian areas. There is no formal protection of this area.

BOUNDARY JUSTIFICATION: The site contains all the major wetlands and springs as well as a small buffer (300 ft.) to protect form direct impacts from vehicles, etc. Incorporating all the wetlands into one site is useful to protect the values of the wetlands and for more flexible management of the area.

PROTECTION CONSIDERATIONS: In the near term there are no envisioned changes in ownership and/or legal protection of the site. However, the corridor between Fort Collins and Cheyenne could conceivably grow and develop in the future. Perhaps now is the time to secure long term protection of these sites, before there is more pressure from urban and suburban expansion in the area.

MANAGEMENT CONSIDERATIONS: Ideally this site would be intensively grazed only in the winter when the ground is frozen, possibly allowing a year's rest every third year. Grazing on frozen ground is preferable because the wet ground of this site is particularly vulnerable to trampling. Other regimes may also work to minimize the detriment to the native plant communities such as a rotational grazing system. With respect to the health of the native plants, mid to late summer are the least favorable times for grazing, because this is the time when plants are most actively producing seed and new shoots.


ROUND BUTTE QUADRANGLE
COLORADO—WYOMING
7.5 MINUTE SERIES (TOPOGRAPHIC)
R 68 W
2'30"
2 130 000 FEET (COLO.)
105°00'
41°0
T 12 N
LARAMIE CO
LARIMER CO
Castle Rock Camp
Spring
Springs Creek
Brannigan Spring
Graves Camp
5 MI. TO INTERSTATE 25
Upper Jack Springs Camp
Sand
Flowing Well
Flowing Well
Jack Springs
Spottlewood
Water Tank
T 12 N
T 11 N
Brannigan Springs Site (R/W)
N
1 mile

Cache la Poudre River at the Environmental Learning Center (R/W)

SIZE: 260 acres

BIODIVERSITY RANK: B5 - Local significance. Site contains fair quality occurrences of state imperiled bird species.

PROTECTION URGENCY RANK: P2 - Threat expected within 5 years. The future of the entire riparian corridor in and near Fort Collins is uncertain.

MANAGEMENT URGENCY RANK: M3 - Management of grazing and recreation may be needed within 5 years to maintain the elements.

LOCATION: The most important portion of the site includes the heron rookery immediately to the south of the Environmental Learning Center (ELC), on the west side of the river between the water treatment plant and the railroad tracks. The site also includes the forested portion of the ELC as potential breeding habitat. Fort Collins Quadrangle. Township 7 North, Range 68 West, sections 21, 28.

GENERAL DESCRIPTION: Most of the site is covered by riparian cottonwood forest in the current and former floodplain of the Cache la Poudre River. The understory of this forest consists almost entirely of alien species, especially smooth brome (*Bromus inermis*) and reed canary grass (*Phalaris arundinacea*). The southwest corner of the site is active cattle pasture containing scattered cottonwoods and a low understory of alien grasses. The noxious weed leafy spurge (*Euphorbia esula*) grows commonly across the site. Russian olive (*Elaeagnus angustifolia*) and tamarisk (*Tamarix ramosissima*) are both found on the site and could become problems in the future.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: Great blue herons are known to nest in the southern portion of this site (although this rookery appears to be declining). Green herons and black-crowned night herons frequent the site and probably nest there. The ELC as been used to raise and release osprey (*Pandion haliaetus*).

Table 52. Natural Heritage Elements at the Cache la Poudre at the Environmental Learning Center Site.							
Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Ardea herodias	Great blue heron	C	G5	S3B SZN			
Butorides striatus	Green heron	?	G5	S3B SZN			
Nycticorax nycticorax	Black-crowned night heron	?	G5	S3B SZN			
Pandion haliaetus	Osprey	D	G5	S1B SZN			

*EO = element occurrence

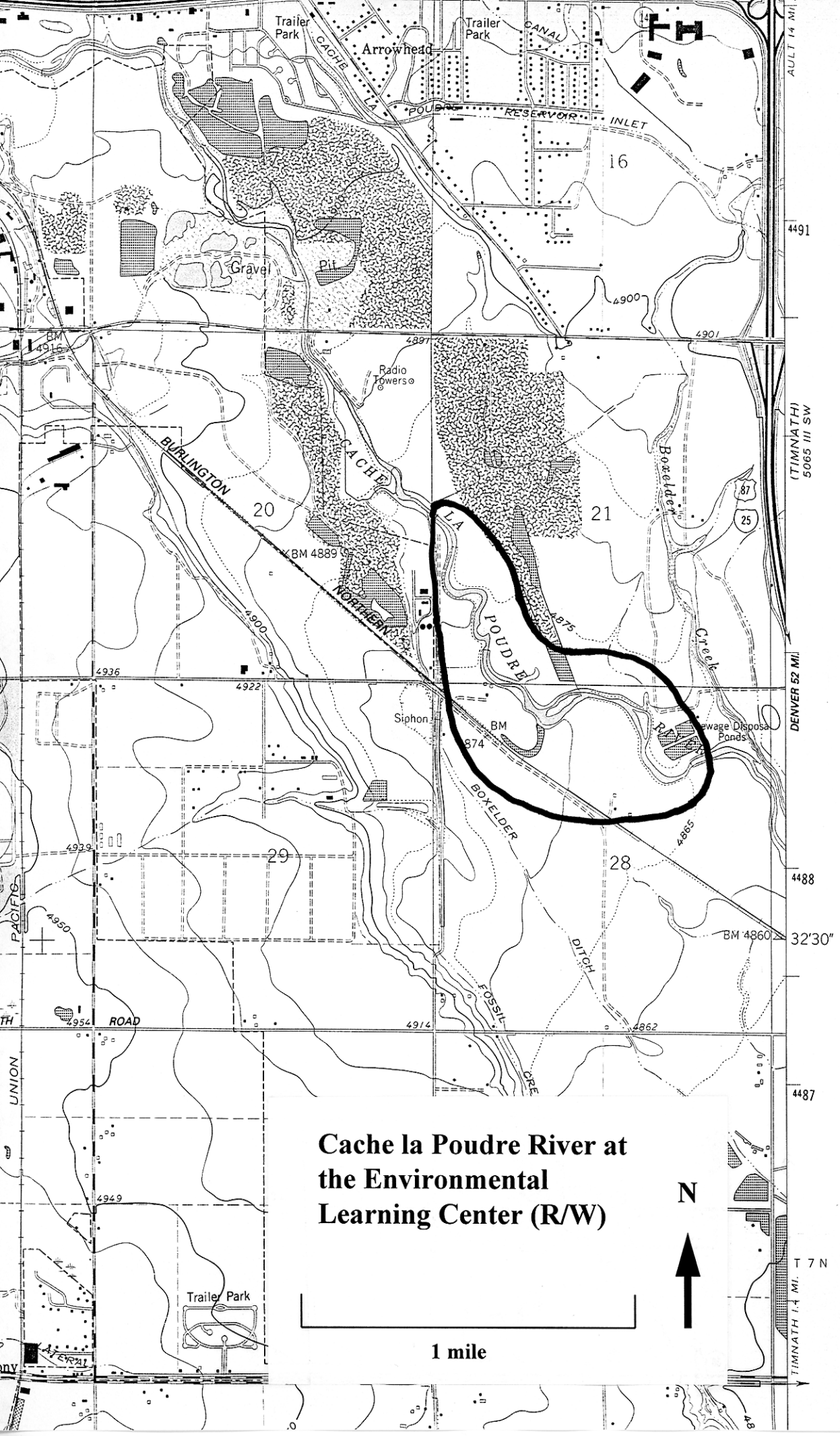
CURRENT STATUS: The ownership of the area where the rookery occurs is uncertain. The northern portion of the site (the ELC) is owned and maintained by Colorado State University.

BOUNDARY JUSTIFICATION: The site contains the known location of the heron rookery, and a quarter mile buffer (where possible) to protect from development and destruction of habitat. The site also contains potential habitat for nesting herons in adjacent riparian forest along with a 300 ft. buffer to protect this potential habitat from destruction.

PROTECTION CONSIDERATIONS: The entire extent of the rookery should be brought under a conservation program. Protection of shallow water wetlands throughout the Fort Collins area is one of the most important actions that could support this rookery by means of protecting foraging habitat. Also, it should be recognized that great blue heron rookeries move periodically.

MANAGEMENT CONSIDERATIONS: Trails for public use should not come within 300 ft. of a tree containing a heron nest. Use of roads adjacent to the rookery should be discontinued.

When the heron rookeries are active, there should be a seasonal closure of areas within 500 ft. (Erwin 1989, Graul 1981).



Cache la Poudre River at the Environmental Learning Center (R/W)

N

1 mile

Jack Springs Site (R/W)

SIZE: Approximately 250 acres.

BIODIVERSITY RANK: B5 - Local significance. Contains examples of globally secure but locally imperiled wetland communities.

PROTECTION URGENCY RANK: P4 - No threat known for foreseeable future.

MANAGEMENT URGENCY RANK: M3 - Management actions may be needed within 5 years to maintain the current quality of the element occurrences. Moderate to heavy grazing is likely to change plant composition in these wetlands. A change in grazing patterns is recommended.

LOCATION: At Jack Springs and along the old railroad grade on the western portion of Meadow Springs Ranch. Between Spottlewood Creek and Sand Creek, feeding into Sand Creek. Township 11 North, Range 68 West, sections 5,8.

GENERAL DESCRIPTION: The Jack Springs site contains several natural springs dominated by native wetland plant communities. The springs are relatively alkaline. In several small areas an unstable mat of vegetation one-half meter thick is supported by a layer of water issuing forth at the spring. Sedimentary bedrock capped by a thin layer of Pleistocene alluvium underlies and surrounds the site. The type of bedrock has resulted in a variegated landscape that is dominated by short and mid grass prairie.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The wetlands at Jack Springs probably represent a type of wetland that was once quite common across the Great Plains portion of Larimer County. It's reasonable to assume that many of our current reservoirs were built upon natural marshes and wet meadows, many of which probably contained springs such as the Jack Springs. Along with the Brannigan Springs Site, the Jack Springs are the only natural Great Plains wetlands in Larimer County that can be assumed to be largely representative of pre-settlement conditions.

Table 53. Natural Heritage Elements at the Jack Springs Site.							
Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Carex simulata	Wet meadow	C	G5	S3			
Carex nebrascensis	Wet meadow	C	G5	S4			

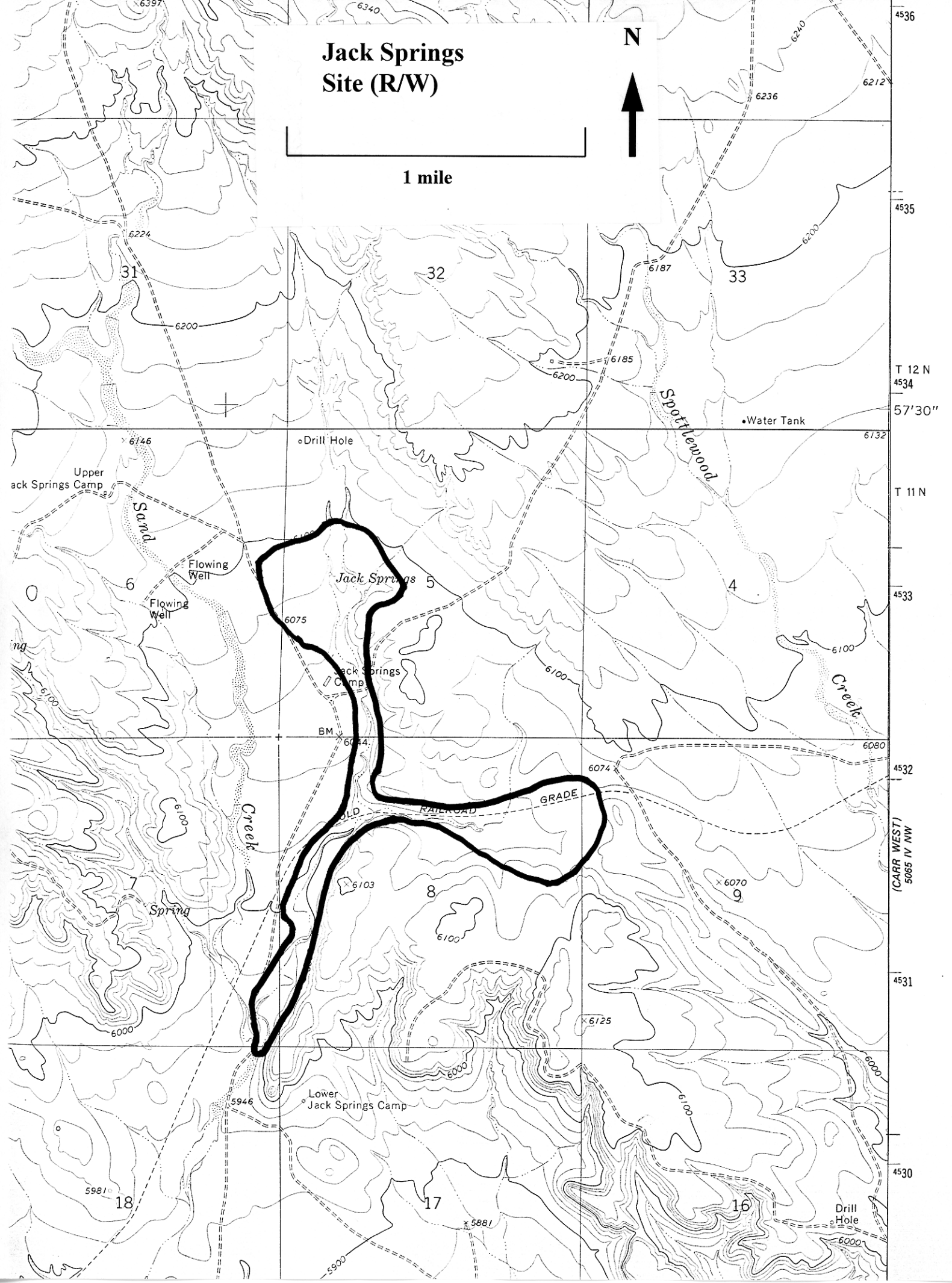
*EO = element occurrence

CURRENT STATUS: Ownership of the site is shared by the City of Fort Collins at their Meadow Springs Ranch and the Soapstone Grazing Association. Both entities use the area for moderate to heavy grazing; as elsewhere, the cattle are especially fond of the wetland and riparian areas. Fort Collins uses the Meadow Springs Ranch for sludge disposal, but the wetland areas are carefully avoided. There is no formal protection of the natural communities that this report documents.

BOUNDARY JUSTIFICATION: The site contains all the contiguous wetlands and springs as well as a small buffer (approx. 300 ft.) to protect form direct impacts from vehicles, etc.

PROTECTION CONSIDERATIONS: There are no threats currently known for this site. However, the corridor between Fort Collins and Cheyenne could conceivably grow and develop in the future. Perhaps now is the time to secure long term protection of these sites, before there is more pressure from urban and suburban expansion in the area.

MANAGEMENT CONSIDERATIONS: Ideally this site would be intensively grazed only in the winter when the ground is frozen, possibly allowing a year's rest every third year. Grazing on frozen ground is preferable because the wet ground of this site is particularly vulnerable to trampling. Other regimes may also work to minimize the detriment to the native plant communities such as a rotational grazing system. With respect to the health of the native plants, mid to late summer are the least favorable times for grazing, because this is the time when plants are most actively producing seed and new shoots.


Jack Springs
Site (R/W)
N
1 mile
6397
6340
6240
6212
6236
4536
4535
6224
31
32
33
6200
6187
6185
T 12 N
4534
57'30"
Spottlewood
Water Tank
Drill Hole
6146
6132
Upper
ack Springs Camp
Sand
T 11 N
Flowing
Well
Flowing
Well
Jack Springs
6
5
4
6075
6100
Creek
4533
Jack Springs
Camp
BM
6044
6080
6074
4532
OLD
RAILROAD
GRADE
Creek
6103
8
9
6070
7
Spring
6100
6000
6125
4531
Lower
Jack Springs Camp
5946
5981
18
17
16
5881
Drill
Hole
6000
5900
4530
(CARR WEST)
5065 IV NW

Laporte (R/W)

SIZE: approx. 1900 acres

BIODIVERSITY RANK: B5 - Local significance. The Laporte site contains three fair quality occurrences of state imperiled fish and two fair quality occurrences of state imperiled butterflies.

PROTECTION URGENCY RANK: P2 - Threat expected within five years from development in and near the floodplain.

MANAGEMENT URGENCY RANK: M3 - Definable threat but not within the next five years. Several non-native plant species are present in the site and are probably spreading; their extensive spread could seriously degrade the habitat.

LOCATION: Along the Cache la Poudre River from Bellvue to I-25. This site is included in the Cache la Poudre Macrosite and makes up about 90% of the macrosite.

GENERAL DESCRIPTION: This site includes approximately 13 miles of the Cache la Poudre River. The river along the entire site is essentially channelized, and many areas in the floodplain have been mined for gravel. Immediately north of Prospect Road on the east end of the site are two abandoned oxbow ponds that indicate the former extent of the river's meandering across its floodplain. A similar oxbow is apparent north of Fort Collins (T8N R69W S34 SE4).

Most of the area immediately adjacent to the river consists of a mature riparian forest of both native cottonwoods (*Populus* spp.) and a large, non-native willow (crack willow, *Salix fragilis*). Patches of the native, shrubby sandbar willow (*Salix exigua*) occur along the length of the site. The understory in this forested area consists of almost entirely non-native species (e.g., smooth brome, *Bromus inermis*; reed canary grass, *Phalaris arundinacea*). Open areas of the site, such as the area near Prospect Road, contain small occurrences of a few common native wetland plant associations (e.g., cattail, *Typha* spp.; bulrush, *Scirpus pungens*), but they also contain large stands of non-native, weedy vegetation.

NATURAL HERITAGE SIGNIFICANCE: This site contains several elements that are imperiled in Colorado (see table below). The site also potentially contains Preble's meadow jumping mouse, a candidate for listing under the U.S. Endangered Species Act. Although this species has not recently been found on the site, a specimen was once collected from this vicinity (CNHP 1996).

The plains topminnow that occurs in the river associated to this wetland complex was a former candidate for listing under the U.S. Endangered Species Act. This species and the Iowa darter are Species of Special Concern for the Colorado Division of Wildlife. The relationship between the wetlands and the fish population in the river is unclear.

Table 54. Natural Heritage Elements at the Laporte Site.

Element	Common Name	EO* Rank	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Fundulus sciadicus	Plains topminnow	?	G4	S2			
Etheostoma exile	Iowa darter	?	G5	S2			
Etheostoma nigrum	Johnny darter	?	G5	S3			
Euphyes bimacula	Two-spotted skipper	?	G4	S1			
Satyrodes eurydice	Smoky-eyed brown butterfly	?	G5T3T4	S1			

*EO = element occurrence

BOUNDARY JUSTIFICATION: The site boundary contains all of the known and potential occurrences along this stretch of river and much of the contiguous current and former floodplain. The boundaries as currently drawn are approximate. The borders of this site should be refined to avoid permanent, existing structures along the river corridor. In order to protect the elements associated with the site, the final boundaries of the site should contain as much of the former floodplain as possible.

Watershed scale processes must be addressed in addition to protecting the land and water within the site boundary. Water quality and quantity as well as flow regime must be managed appropriately for the aquatic elements in the site.

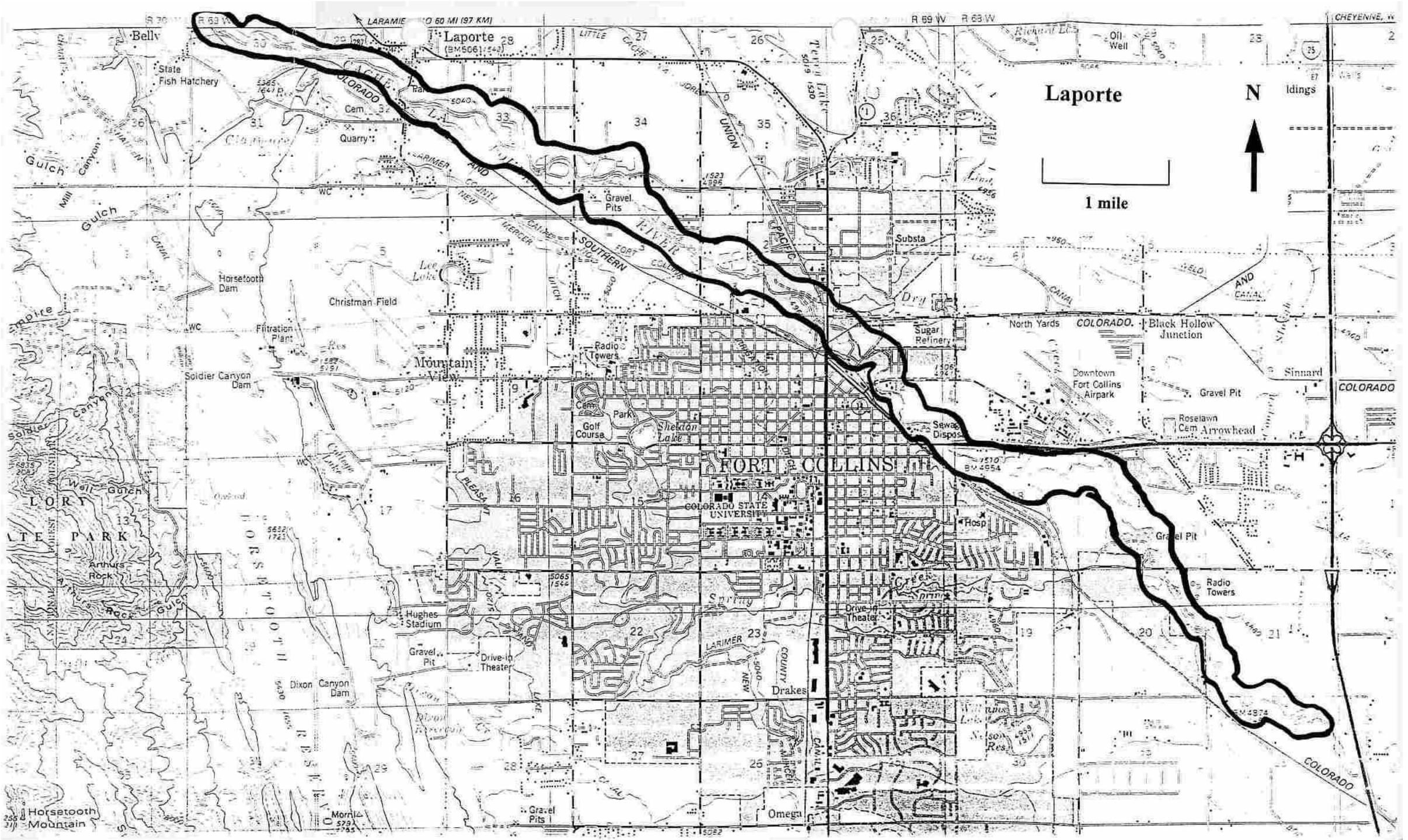
PROTECTION CONSIDERATIONS: Protection should include as much of the floodplain along this stretch of as possible. The City of Fort Collins and Larimer County should assure that strong consideration of floodplain protection is given to development proposals. Because both small and large scale activities can affect the fish populations, a watershed management plan would need to be developed to insure protection of the aquatic elements. Examples of local activities that may help protect the fishes include leaving downed trees in the river to provide habitat and developing grazing management plans for the river corridor. Large scale activities would include (but are not limited to) insuring somewhat of a natural streamflow and protecting water quality.

MANAGEMENT CONSIDERATIONS: Development and the resulting siltation have impacted the fish populations in this area. Streamflow alterations and decreases often allow silt to build up in the channel. Because the habitat for the fishes has been drastically altered restocking may be necessary to restore the natural fish community. Stocking of non-native fish should be discouraged.

Trails should also be place so that fragmentation of the narrow riparian vegetation patches is avoided. This can be done by placing trails along the edges of forest patches rather than cutting the trail through forest patches.

An effort should be made to replace the non-native, weedy plant species with native species. Where possible natural river processes (e.g., channel meandering) to take place as much as possible in order to create a more diverse wetland/riparian mosaic. Management plans (for trails, weed control, etc.) should consider natural river processes. Habitat for vulnerable wetland-dependent butterflies (mainly sedge meadows) should be given strong preference in restoration projects.

This site would benefit from a comprehensive floodplain management plan to guide decisions of both Larimer County and the City of Fort Collins.


Laporte
N
1 mile
Bellv
State Fish Hatchery
Laporte
(BM5061542)
Oil Well
Quarry
Gulch
Canyon
Mill Gulch
Gravel Pits
Substa
Horsetooth Dam
Christman Field
Lee Lake
Filtration Plant
Soldier Canyon Dam
Mountain View
Radio Towers
Sugar Refinery
North Yards
COLORADO.
Black Hollow Junction
Sinnard
COLORADO
Downtown Fort Collins Airpark
Gravel Pit
Roselawn Cem
Arrowhead
Golf Course
Park
Sheldon Lake
Sewage Disposal
FORT COLLINS
COLORADO STATE UNIVERSITY
Hosp
Gravel Pit
Radio Towers
Drive-in Theater
Hughes Stadium
Gravel Pit
Drive-in Theater
Dixon Canyon Dam
Drakes
Horsetooth Mountain
Gravel Pits
Omega
COLORADO
Arthurs Rock
Well Gulch
SOUTHERN
UNION
PACIFIC
LARIMER AND WELD COUNTY CANAL
LARIMER COUNTY CANAL NO. 2
COLORADO

Other Sites Ranked "B4" - Moderate Significance

Bull Run Creek

SIZE: Approximately 3000 acres.

BIODIVERSITY RANK: B4 - Moderate significance

PROTECTION URGENCY RANK: P2 - Threat/Opportunity within 5 years

MANAGEMENT URGENCY RANK: M2 - Essential within five years to prevent loss

LOCATION:
From State Line at Chimney Rock drive south 0.7 miles. Turn right. Drive 2 miles to site. Site continues for approximately 2 miles along the road.
USGS Quadrangle name(s):SAND CREEK PASS
Townrange and section:012N075W
011N075W 32,33,34,29,28,27
3,4

GENERAL DESCRIPTION:
Rolling hills with sandstone outcrops dominated by Cercocarpus montanus. Scattered Pinus flexilis occur on hills. Swales and valleys are dominated by Artemisia tripartita/grassland. Numerous stream channels exist in the site, most are ephemeral. Bull Mountain to the west is dominated by stands of aspen and Doug-fir on steep east to north facing slopes. Sand Creek to the southeast is dominated by willows and some hay meadows with A. tripartita/Festuca idahoensis on adjacent uplands. The area has been subdivided and numerous cabins and trailers, along with access roads, are scattered throughout the site. Adjacent lands are mostly cattle ranches or federal land with livestock grazing.

NATURAL HERITAGE RESOURCE SIGNIFICANCE:
An A occurrence of a G4T3 plant species.

SCIENTIFIC NAME:	COMMON NAME:	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	FOREST SENS
PENSTEMON LARICIFOLIUS SSP. EXIFOLIUS	LARCH-LEAF BEARDTONGUE	G4T3	S1			
CERCOCARPUS MONTANUS/ PSEUDOREGNERIA SPICATA	MIXED MONTANE SHRUBLAND	G4	S3			

CURRENT STATUS:

BOUNDARY JUSTIFICATION:
The site includes the element occurrences and a slight buffer to protect from direct disturbance. Protection of the site and sections adjacent to

Forest Service and BLM land would allow natural processes and landscape connectedness to remain intact. Several good examples of common communities would be included.

PROTECTION CONSIDERATIONS:
A new housing development is being built currently on the private land. BLM land should be protected.

MANAGEMENT CONSIDERATIONS:
The roadside populations should be protected from herbicide spraying. A management agreement should be reached with the homeowners and road crews, and BLM.
Home building and horse ranchettes may degrade natural communities and introduce non-native species.
Protect from spread of non-native plant species.
Low density residential development is taking place.

Chambers Lake Campground (R/W)

SIZE: Approximately 3000 acres.

BIODIVERSITY RANK: B4 - Moderate significance

PROTECTION URGENCY RANK: P2 - The area around Lost Lake is heavily threatened by recreational use.

MANAGEMENT URGENCY RANK: M2 - Recreational trails need to be developed to concentrate activities.

LOCATION: USGS Quadrangle name(s):CHAMBERS LAKE
Townrange and section:007N075W 4,5,6,7,8,9

GENERAL DESCRIPTION: The site includes Chambers Lake, Lost Lake, Laramie Lake, and several smaller ponds and wetlands in a mosaic of coniferous forests. This area forms the headwaters for the Laramie and Cache la Poudre Rivers.

NATURAL HERITAGE RESOURCE SIGNIFICANCE:

SCIENTIFIC NAME:	COMMON NAME:	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	FOREST SENS
BUFO BOREAS POP 1	BOREAL TOAD (SOUTHERN ROCKY MOUNTAIN POPULATION)	G5T2Q	S1	C	E	FS
BUFO BOREAS POP 1	BOREAL TOAD (SOUTHERN ROCKY MOUNTAIN POPULATION)	G5T2Q	S1	C	E	FS
RANA SYLVATICA	WOOD FROG	G5	S3		T	FS

CURRENT STATUS: Most of the site is owned by the U.S. Forest Service. The is no formal protection but the Forest Service is aware of the locations of the sensitive elements.

BOUNDARY JUSTIFICATION: The boundary includes numerous lakes, ponds, and wetlands within the area and includes a buffer on the adjacent slopes. This is intended to protect riparian and wetland vegetation and adjacent forests for the amphibians. However, there are likely to be forces outside of this boundary that will impact site quality. In addition, the non-breeding individuals of the element may travel outside of the site boundaries.

PROTECTION CONSIDERATIONS: The area around Lost Lake is threatened by heavy recreational use. This is being addressed in the current Forest Plan revision. There are no known threats for the rest of the site which is close to wilderness and other areas not very suitable for logging.

MANAGEMENT CONSIDERATIONS: [USFS, Bustos 1995:] Restrictive time for these species is breeding season (early spring). There are not many impacts from recreation at this time. This site may not protect the elements from indirect recreational impacts associated with boating and other activities. The maintenance of high water quality may be necessary for the long-term protection of this site. Construction of a trail system would help concentrate activities and reduce soil compaction and impacts to the vegetation over much of the site

Cheley Camp West

SIZE: Approximately 140 acres.

BIODIVERSITY RANK: B4 - Moderate significance. Due to its low priority, this site was not visited in 1996. Its current status should be verified before taking any conservation action.

PROTECTION URGENCY RANK: Protection urgency unassigned

MANAGEMENT URGENCY RANK: Management urgency unassigned

LOCATION: South of Estes Park. USGS Quadrangle name(s):LONGS PEAK. Townrange and section: 004N073W 12

GENERAL DESCRIPTION: The site is a montane woodland area on a north facing slope.

NATURAL HERITAGE RESOURCE SIGNIFICANCE:

SCIENTIFIC NAME:	COMMON NAME:	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	FOREST SENS
CYPRIPEDIUM PUBESCENS	YELLOW LADY'S-SLIPPER	G5	S2			

CURRENT STATUS:

BOUNDARY JUSTIFICATION:
Includes the occurrence and a small buffer to provide vegetation integrity. The site includes the local ecological processes believed to be important for the element.

PROTECTION CONSIDERATIONS:

MANAGEMENT CONSIDERATIONS:
Work with land owner manager to assure that camp activities and trail development do not disturb orchid habitat.

Chimney Rock

SIZE: Approximately 1900 acres.

BIODIVERSITY RANK: B4 - Moderate significance

PROTECTION URGENCY RANK: P1 - Immediately threatened

MANAGEMENT URGENCY RANK: M2 - Essential within five years to prevent loss.

LOCATION: On Colorado County Rd 89, drive south from Wyoming/Colorado State line at Chimney Rock. Site continues on the road for approximately 6 miles. USGS Quadrangle name(s):SAND CREEK PASS. Townrange and section: 011N075W, 012N075W 3,4,9,10 19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36

GENERAL DESCRIPTION: The Sand Creek Basin south of Chimney Rock forms a wide open valley of rolling hills supporting grasslands of native grasses and mountain mahogany shrublands. Dominant grasses are Festuca idahoensis, Pseudoroegneria and Stipa comata, with some scattered Artemisia tridentata. Unfortunately this "mountain park" is already plated for subdivision with construction of homes on many 35 acre lots. Sand Creek flows north into Wyoming. The geology is red sandstone with sandy-gravely soil.

NATURAL HERITAGE RESOURCE SIGNIFICANCE:

SCIENTIFIC NAME:	COMMON NAME:	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	FOREST SENS
PENSTEMON LARICIFOLIUS SSP. EXIFOLIUS	LARCH-LEAF BEARDTONGUE	G4T3	S1			

CURRENT STATUS:

BOUNDARY JUSTIFICATION: Habitat for Penstemon laricifolius ssp. exilifolius in context of a high quality grassland.

PROTECTION CONSIDERATIONS: Area is already plated and is currently being developed.

MANAGEMENT CONSIDERATIONS: The increase in roads associated with the development will spread non-native species which will degrade the grassland. Melilotus is dense in small areas but the Penstemon does not seem to occur with it. Bromus inermis. Kochia along roads in a few places. Drainages are degraded containing much Canada thistle.

Gleneyre School

SIZE: Approximately 700 acres.

BIODIVERSITY RANK: B4 - Moderate significance

PROTECTION URGENCY RANK: P4 - No threat or special opportunity

MANAGEMENT URGENCY RANK: M3 - Needed within five years to maintain quality

LOCATION:
Drive approximately 4 miles north on County Road 103 from Four Corners. The site is .3 miles before Gleneyre School. On the east side of the road. USGS Quadrangle name(s):CRAZY MOUNTAIN, Townrange and section:011N076W 8,17

GENERAL DESCRIPTION:
Sagebrush flats rising to a steep mesa. Small hills rolling in the foreground. Hillsides covered with Cercocarpus montanus, Artemisia tridentata, with limber pine scattered throughout. The understory consists of grasses, Eriogonum sp., Arenaria sp., Aster and Gutierrezia sarothrae. The geology and soils seem to vary tremendously in this area from granite to sandstone and white chalky clays to deep red and purple fine sands.

NATURAL HERITAGE RESOURCE SIGNIFICANCE:
An A ranked occurrence of a G4T3 plant species.

SCIENTIFIC NAME:	COMMON NAME:	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	FOREST SENS
PENSTEMON LARICIFOLIUS SSP. EXIFOLIUS	LARCH-LEAF BEARDTONGUE	G4T3	S1			

CURRENT STATUS:

BOUNDARY JUSTIFICATION:
The occurrence and surrounding habitat which will buffer the site from direct disturbance.

PROTECTION CONSIDERATIONS:
Owner is starting a guest ranch. Other than horse use and associated trampling plants should not be threatened.

MANAGEMENT CONSIDERATIONS:
Work with the owner for an management agreement. Protect from trampling, and the spread of non-native species.

Hermit Park

SIZE: Approximately 80 acres.

BIODIVERSITY RANK: B4 - Moderate significance. A fair quality occurrence of a globally imperiled plant species.

PROTECTION URGENCY RANK: P4 - No threat known for foreseeable future.

MANAGEMENT URGENCY RANK: M4 - Management of recreation may be needed in the future to maintain the current quality of the element occurrences.

LOCATION: Granite outcrops southeast of Estes Park. Panorama Peak Quadrangle. Township 4 North, Range 72 West, sections 4 and 5.

GENERAL DESCRIPTION: This site contains granitic outcrops surrounded by heavily forested slopes. These forests range from ponderosa pine *(Pinus ponderosa)* at the lowest elevations up to ponderosa pine and Douglas fir (*Pseudotsuga menziesii)* and finally to lodgepole pine *(Pinus contorta)* at the highest elevations. These forests are broken up by small pockets of Aspen *(Populus tremuloides)*. The most common and widespread plant association is ponderosa pine-Douglas fir/mountain muhly *(Muhlenbergia montana)*. Big and Grizzly Gulches flow through the site. A wet meadow consisting of emergent vegetation and montane grasses occurs along Big Gulch. *Deschampsia caespitosa* is the most common species in this wetland. Hay grasses such as timothy *(Phleum pratense)* also occur frequently here. Signs of fire from lightening strikes were observed. Hewlett Packard, however, suppresses fires as much as possible because the area has been managed as a recreation area for Hewlett Packard employees since the late 1960's.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: This site contains a fair quality occurrence of Rocky Mountain cinquefoil (*Potentilla effusa* var. *rupincola*). It should however be noted that the individuals at this particular location of Rocky Mountain cinquefoil may be more closely related to the common *Potentilla effusa* var. *effusa* than the other locations in Larimer County. Please contact the CNHP for further information regarding this taxonomic problem.

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Potentilla effusa var. rupincola	Rocky Mountain cinquefoil	G3G5T2	S2			FS

CURRENT STATUS: This site is privately owned. Recreational use is the only potential threat to the occurrence, though the current level of use is not likely to pose significant problems.

BOUNDARY JUSTIFICATION: The site includes the occurrence and a buffer to the top of the ridges to protect from erosion due to human disturbance.

PROTECTION CONSIDERATIONS: Hewlett Packard is interested in maintaining the overall natural quality of the Park. Options for protection of the site should be explored with HP. Tools such as management agreements or easements may be applicable.

MANAGEMENT CONSIDERATIONS: Current management appears to be adequate. Hewlett Packard should be informed about the specific location of the plant population, and a management plan should be developed. Protect plants from direct disturbances from hiking and other recreational uses. Many hay meadow grasses are in the meadows and there are other non-natives plant species along the road, but the site is mostly weed free.

Parvin Lake Site

SIZE: Approximately 300 acres.

BIODIVERSITY RANK: B4 - Moderate significance

PROTECTION URGENCY RANK: Protection urgency unassigned

MANAGEMENT URGENCY RANK: Management urgency unassigned

LOCATION:

USGS Quadrangle name(s):RED FEATHER LAKES
Townrange and section:010N073W 34,35

GENERAL DESCRIPTION:
Impounded lake on permanent montane stream.

NATURAL HERITAGE RESOURCE SIGNIFICANCE:

SCIENTIFIC NAME:	COMMON NAME:	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	FOREST SENS
PANDION HALIAETUS	OSPREY	G5	S2S3B			FS
ONCORHYNCHUS CLARKI STOMIAS	GREENBACK CUTTHROAT	G4T2	S2	LT	T	
ETHEOSTOMA EXILE	IOWA DARTER	G5	S2		SC	

CURRENT STATUS:

BOUNDARY JUSTIFICATION:
Encompasses lake and immediate uplands includes occurrence and small buffer to aid in maintenance of local water quality.

PROTECTION CONSIDERATIONS:

MANAGEMENT CONSIDERATIONS: The Colorado Division of Wildlife should be contacted to determine the appropriate buffer distances and times of year necessary to avoid disturbing the osprey nest.

Timnath Site (R/W)

SIZE: Approximately 1000 acres.

BIODIVERSITY RANK: B4 - Moderate significance

PROTECTION URGENCY RANK: Protection urgency unassigned

MANAGEMENT URGENCY RANK: Management urgency unassigned

LOCATION:

USGS Quadrangle name(s):TIMNATH
Townrange and section:007N068W
006N068W 34
2,3,11

GENERAL DESCRIPTION:
The site incorporates approximately 1.5 river miles of the Cache la Poudre River, a piedmont stream. Interstate 25 crosses the upstream portion of the site. Some riparian forest occupies the area. Much of the adjacent area is agricultural and has been so for many years.

NATURAL HERITAGE RESOURCE SIGNIFICANCE:
Unranked occurrence of globally rare (G5T2) subspecies.

SCIENTIFIC NAME:	COMMON NAME:	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	FOREST SENS
FUNDULUS SCIADICUS	PLAINS TOPMINNOW	G4	S2		SC	FS
FUNDULUS SCIADICUS	PLAINS TOPMINNOW	G4	S2		SC	FS
ETHEOSTOMA NIGRUM	JOHNNY DARTER	G5	S3			
ETHEOSTOMA NIGRUM	JOHNNY DARTER	G5	S3			
BOLORIA SELENE SABULOCOLLIS	SANDHILL FRITILLARY	G5T2	S1S2			

CURRENT STATUS:

BOUNDARY JUSTIFICATION:
Includes 1.5 miles of river where the fish are known to occur and the adjacent riparian habitats. The upland buffer is from .25 to .5 miles. although these boundaries may protect the integrity of the immediate site, watershed factors outside of the site boundary will determine long term viability. Such factors as water quality, hydrological regime, and instream flow will be of major concern.

PROTECTION CONSIDERATIONS:

MANAGEMENT CONSIDERATIONS: Because both small and large scale activities can affect the fish populations, a watershed management plan would need to be developed to insure protection of the aquatic elements. Examples of local activities that may help protect

the fishes include leaving downed trees in the river to provide habitat and developing grazing management plans for the river corridor. Large scale activities would include (but are not limited to) insuring somewhat of a natural streamflow and water quality.

Other Sites Ranked "B5" - Low Significance

Big Thompson at Loveland (R/W)

SIZE: Approximately 3000 acres.

BIODIVERSITY RANK: B5 - Local significance for the concentrations of state rare species.

PROTECTION URGENCY RANK: P3: Protection of the last undeveloped parts of the floodplain is warranted.

MANAGEMENT URGENCY RANK: M3 - management will be necessary in the next 5 years to maintain the quality of the elements.

LOCATION: Quadrangle name(s):WINDSOR, LOVELAND. Townrange and section: 005N068W 15,22.

GENERAL DESCRIPTION: The site includes a portion of creek and surrounding riparian areas and wetlands along the shore and neighboring ponds. In some places strip mines and tailings occur along river's sides. Residential housing and livestock use are common along the floodplain.

NATURAL HERITAGE RESOURCE SIGNIFICANCE:

SCIENTIFIC NAME:	COMMON NAME:	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	FOREST SENS
NOTROPIS CORNUTUS	COMMON SHINER	G5	S2		SC	
FUNDULUS SCIADICUS	PLAINS TOPMINNOW	G4	S2		SC	FS
FUNDULUS SCIADICUS	PLAINS TOPMINNOW	G4	S2		SC	FS
ETHEOSTOMA EXILE	IOWA DARTER	G5	S2		SC	
ETHEOSTOMA EXILE	IOWA DARTER	G5	S2		SC	
ETHEOSTOMA NIGRUM	JOHNNY DARTER	G5	S3			
ETHEOSTOMA NIGRUM	JOHNNY DARTER	G5	S3			

CURRENT STATUS: Ownership of the floodplain is highly fragmented. There is little formal protection although the planning department discourages occupation of the 100 year floodplain.

BOUNDARY JUSTIFICATION: Includes all occurrences and small buffer up and down stream. Additional portions of river beyond site boundary may be necessary for long-term protection of elements.

PROTECTION CONSIDERATIONS: Because both small and large scale activities can affect the fish populations, a watershed management plan would need to be developed to insure protection of the aquatic elements. Examples of local activities that may help protect the fishes include leaving downed trees in the river to provide habitat and developing grazing management plans for the river corridor. Large scale activities would include (but are not limited to) insuring somewhat of a natural streamflow and protecting water quality.

MANAGEMENT CONSIDERATIONS: A watershed management plan should be developed. The plan should reinforce the maintenance of high water quality, natural flooding, and a natural flow regime. Streamside management should include the maintenance of a 100-300 foot buffer

of native and structurally diverse vegetation. Also, habitat diversity within the stream should be created, restored, and protected by permitting fallen trees to remain in the river, minimizing siltation, and eliminating barriers to fish movements. Introduction of non-native fish should be prohibited. Monitoring of the fish is being done by the Colorado Division of Wildlife and should be continued.

Boulder Ridge

SIZE: Approximately 900 acres.

BIODIVERSITY RANK: B5 - Local significance.

PROTECTION URGENCY RANK: P3 - Definable threat/opportunity, but not within 5 years

MANAGEMENT URGENCY RANK: Management urgency unassigned

LOCATION:
Along Boulder Ridge Road (Co. Rd. 87C) in north-central Larimer County.
USGS Quadrangle name(s):EATON RESERVOIR
Townrange and section:012N074W 26, 27, 28, 33, 34

GENERAL DESCRIPTION:
The area is characterized by open sagebrush/grassland stands with patches of mixed conifers (Pseudotsuga menziesii, Pinus ponderosa, P. contorta, P. flexilis) and some aspen stands. Sagebrush dominates the rolling hills. Conifers occur on rocky ridges and steep slopes. Granitic ridges (faults) run northwest to southeast in the area and these are generally dominated by stands of mixed conifers and narrow bands of the Pinus flexilis. Numerous access roads exist in the area, possibly leading to subdivided parcels. The land appears to be used mostly for cattle grazing.

NATURAL HERITAGE RESOURCE SIGNIFICANCE:
A C-ranked occurrence of a G4 community.

SCIENTIFIC NAME:	COMMON NAME:	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	FOREST SENS
PINUS FLEXILIS/LEUCOPOA KINGII	MONTANE WOODLAND	G4	S2S3			

CURRENT STATUS:

BOUNDARY JUSTIFICATION:
The boundary incorporates numerous faults which are habitat for the community and will protect the occurrence from direct disturbance. If fire is a necessary component of this ecosystem boundaries may need to be enlarged.

PROTECTION CONSIDERATIONS:
The area is being subdivided and increased residential development may occur in the near future.

MANAGEMENT CONSIDERATIONS:
No problem exotics seen.

Dry Creek at Boettcher (R/W)

SIZE: Approximately 360 acres.

BIODIVERSITY RANK: B5 - Local significance.

PROTECTION URGENCY RANK: Protection urgency unassigned

MANAGEMENT URGENCY RANK: Management urgency unassigned

LOCATION:

USGS Quadrangle name(s):BUCKEYE
Townrange and section:008N069W 15,22

GENERAL DESCRIPTION:
Ephemeral plains creek with patches of riparian forest. Diverted by numerous canals in area.

NATURAL HERITAGE RESOURCE SIGNIFICANCE:

SCIENTIFIC NAME:	COMMON NAME:	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	FOREST SENS
FUNDULUS SCIADICUS	PLAINS TOPMINNOW	G4	S2		SC	FS

CURRENT STATUS: There is currently no formal protection provided for this site or for the plains topminnow.

BOUNDARY JUSTIFICATION:
Boundary encompasses the occurrence and less than a mile of stream up and downstream from the approximate point of observation.

PROTECTION CONSIDERATIONS: Protection of backwater areas is important for the topminnow.

MANAGEMENT CONSIDERATIONS: Periodic monitoring by the Colorado Division of Wildlife (or another entity) should continue.

Dry Creek At North Poudre Canal (R/W)

SIZE: Approximately 320 acres.

BIODIVERSITY RANK: B5 - Local significance.

PROTECTION URGENCY RANK: P3 - Definable threat/opportunity, but not within 5 years

MANAGEMENT URGENCY RANK: M4 - Not needed now; No current threats; May need in future

LOCATION:
About 1 mile south-southeast of the North Poudre Reservoir No. 15.
USGS Quadrangle name(s):BUCKEYE
Townrange and section:009N069W 9,10

GENERAL DESCRIPTION:
A rather extensive plains cottonwood forest surrounded by agricultural land with limited residential areas nearby.

NATURAL HERITAGE RESOURCE SIGNIFICANCE:
The site contains an unranked occurrence of a G5S3 element.

SCIENTIFIC NAME:	COMMON NAME:	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	FOREST SENS
ARDEA HERODIAS	GREAT BLUE HERON	G5	S3			

CURRENT STATUS:

BOUNDARY JUSTIFICATION:
The boundary includes the heron rookery and a 1/4 mile buffer. The buffer is designed to protect the rookery from disturbance caused by development and other encroachment on the habitat as well as indirect effects of noise and human activity.

PROTECTION CONSIDERATIONS:
Definable threat from development, but probably not within the next five years.

MANAGEMENT CONSIDERATIONS:
Management may be needed in the future to maintain quality of the element.

Fossil Creek at Portner Reservoir (R/W)

SIZE: Approximately 400 acres.

BIODIVERSITY RANK: B5 - Local significance.

PROTECTION URGENCY RANK: P2 - Threat/Opportunity within 5 years

MANAGEMENT URGENCY RANK: M3 - Needed within five years to maintain quality

LOCATION:
Along Fossil Creek and Mail Creek above their confluence; on the northwest side of Portner Reservoir.
USGS Quadrangle name(s):FORT COLLINS
Townrange and section:006N069W 1,12

GENERAL DESCRIPTION:
The site consists of linear stretches of wetland and riparian area in a rapidly developing area of Fort Collins.

NATURAL HERITAGE RESOURCE SIGNIFICANCE:
An unranked occurrence of a G4S1 butterfly.

SCIENTIFIC NAME:	COMMON NAME:	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	FOREST SENS
EUPHYES BIMACULA	TWO-SPOTTED SKIPPER	G4	S1			

CURRENT STATUS:

BOUNDARY JUSTIFICATION:
The site includes the entire known habitat of the element and a three hundred foot buffer. The buffer is expected to protect the habitat from direct impacts due to development.

PROTECTION CONSIDERATIONS:
This site appears to be in urgent need of protection through purchase or an easement.

MANAGEMENT CONSIDERATIONS:
Management of the site may be need to protect the wetland vegetation from weeds and hydrological alterations.
Any future water diversion on upper Fossil Creek or Mail Creek should be assessed for impacts on the wetlands that provide habitat for the element.
Noxious weeds, especially purple loosestrife (Lythrum salicaria) must be kept out of the wetlands.

Glendevey

SIZE: Approximately 200 acres.

BIODIVERSITY RANK: B5 - Local significance.

PROTECTION URGENCY RANK: Protection urgency unassigned

MANAGEMENT URGENCY RANK: Management urgency unassigned

LOCATION:
Just inside the National Forest just south of the cabins at Glendevy on the southwest side of the road on a northeast facing slope. 20 miles north of Chambers Lake.
USGS Quadrangle name(s):GLENDEVEY
Townrange and section:010N076W 28,29
GENERAL DESCRIPTION:
Northeast-facing slope in lodgepole pine forest.

NATURAL HERITAGE RESOURCE SIGNIFICANCE:
Unranked occurrence of a state rare plant.

SCIENTIFIC NAME:	COMMON NAME:	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	FOREST SENS
CYPRIPEDIUM FASCICULATUM	PURPLE LADY'S-SLIPPER	G4	S3			FS

CURRENT STATUS: There is currently no formal protection for this site.

BOUNDARY JUSTIFICATION:
The boundary is drawn to protect the occurrence from surface disturbances and to provide a small buffer of similar habitat.

PROTECTION CONSIDERATIONS:

MANAGEMENT CONSIDERATIONS:
Survey of surrounding areas is needed to determine full extent of this population's distribution and size.

Hewlett Gulch

SIZE: Approximately 340 acres.

BIODIVERSITY RANK: B5 - Local significance.

PROTECTION URGENCY RANK: Protection urgency unassigned

MANAGEMENT URGENCY RANK: Management urgency unassigned

LOCATION:
USGS Quadrangle name(s):LIVERMORE MOUNTAIN
Townrange and section:009N071W 25,35

GENERAL DESCRIPTION:
Small lower montane stream with forested and open uplands.

NATURAL HERITAGE RESOURCE SIGNIFICANCE:

SCIENTIFIC NAME:	COMMON NAME:	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	FOREST SENS
PLECOTUS TOWNSENDII	TOWNSEND'S BIG-EARED BAT	G4	S3			FS
ARCHILESTES GRANDIS	GREAT SPREADWING	G5	S3			

CURRENT STATUS: There is currently no formal protection for this site.

BOUNDARY JUSTIFICATION:
Boundary encompasses the occurrences and less than a mile of stream up and downstream from the approximate point of observation. Also included is a narrow upland buffer to help prevent direct disturbances to the aquatic habitat.

PROTECTION CONSIDERATIONS:

MANAGEMENT CONSIDERATIONS:
In addition to its breeding habitat in the stream, the spreadwing (*A. grandis*) requires foraging areas adjacent to the stream.

Hourglass Reservoir

SIZE: Approximately 300 acres.

BIODIVERSITY RANK: B5 - Local significance.

PROTECTION URGENCY RANK: P5 - No action needed on this site

MANAGEMENT URGENCY RANK: M5 - Not needed; No threats anticipated

LOCATION:

USGS Quadrangle name(s):COMANCHE PEAK
Townrange and section:007N074W
007N073W 12,13
7,18

GENERAL DESCRIPTION:
The site includes entire reservoir and surrounding forested shoreline and neighboring creek to the north.

NATURAL HERITAGE RESOURCE SIGNIFICANCE:
Unranked occurrence of a state rare breeder.

SCIENTIFIC NAME:	COMMON NAME:	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	FOREST SENS
PANDION HALIAETUS	OSPREY	G5	S2S3B			FS

CURRENT STATUS:

BOUNDARY JUSTIFICATION:
The boundary encompasses the lake and includes a small forested buffer extending into the surrounding slopes. This should be sufficient to prevent degradation or direct alteration of nesting and foraging habitat.

PROTECTION CONSIDERATIONS:
No known threats.

MANAGEMENT CONSIDERATIONS:
[USFS, Bustos 1995:] there is no boating at this site, this site may not protect the occurrence from indirect recreational impacts from pack trail use and associated activities.
Last observation was 1990; need to verify if nest is still there. The Colorado Division of Wildlife should be consulted to help determine the appropriate buffer area needed to avoid disturbance of the osprey.

Park Creek at Dry Creek (R/W)

SIZE: Approximately 200 acres.

BIODIVERSITY RANK: B5 - Local significance.

PROTECTION URGENCY RANK: Protection urgency unassigned

MANAGEMENT URGENCY RANK: Management urgency unassigned

LOCATION:

USGS Quadrangle name(s):WELLINGTON
Townrange and section:009N069W 16,21,22

GENERAL DESCRIPTION:
The site includes Dry Creek Reservoir and a portion of Park Creek upstream from reservoir. Also, surrounding shoreline along all water.

NATURAL HERITAGE RESOURCE SIGNIFICANCE:

SCIENTIFIC NAME:	COMMON NAME:	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	FOREST SENS
HYBOGNATHUS HANKINSONI	BRASSY MINNOW	G5	S3			

CURRENT STATUS:
There is currently no formal protection for this site or for the minnow.

BOUNDARY JUSTIFICATION:
Includes occurrence and 0.5 miles buffer up and down stream including entire reservoir downstream. Additional portions of Park Creek and adjacent Dry Creek beyond site boundary may be necessary for long-term element protection.

PROTECTION CONSIDERATIONS:

MANAGEMENT CONSIDERATIONS:
A basin-wide management plan is desirable for this species.

Park Creek Reservoir # 2 (R/W)

SIZE: Approximately 150 acres

BIODIVERSITY RANK: B5 - Local significance. Site contains an unranked occurrence of a state imperiled fish and an unranked occurrence of a state vulnerable species.

PROTECTION URGENCY RANK: Unknown

MANAGEMENT URGENCY RANK: Unknown

LOCATION: Approximately 2.5 miles west of the town of Buckeye. Livermore Quadrangle. Township 10 North, Range 69 West, section 17, 20.

GENERAL DESCRIPTION: The site encompasses a small reservoir and part of a permanent Great Plains stream upstream of the reservoir. The elevations at the site range from approximately 5600 to 5720 feet. Adjacent uplands are dominated by grasslands and steep, rocky slopes dominated by mountain mahogany (*Cercocarpus montanus)*. The hydrology of the stream is altered from its natural state by upstream and downstream dams.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The site includes the stream which supports an occurrence of the Iowa darter (*Etheostoma exile*) and the Johnny darter (*Etheostoma nigrum*).

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Etheostoma exile	Iowa darter	G5	S2		SC	
Etheostoma nigrum	Johnny darter	G5	S3			

CURRENT STATUS: The site is privately owned.

BOUNDARY JUSTIFICATION: The boundary includes habitat for the rare fish, the reservoir and 1 mile upstream to Park Creek Reservoir.

PROTECTION CONSIDERATIONS: Existing land use appears to support the Iowa and Johnny darters.

MANAGEMENT CONSIDERATIONS: The Park Creek reach and its fish community would benefit from improved riparian management. Such possible actions include restricting livestock access to a few points and permitting stream and streamside vegetation to recover. Darters are known to move from deeper to shallow water for breeding, however we do not know the specific the locations. Instream flows from Park Creek should be guaranteed to maintain fish populations.

Reservoir No. 3 (R/W)

SIZE: Approximately 100 acres.

BIODIVERSITY RANK: B5 - Local significance.

PROTECTION URGENCY RANK: Protection urgency unassigned

MANAGEMENT URGENCY RANK: Management urgency unassigned

LOCATION:

USGS Quadrangle name(s):WELLINGTON
Townrange and section:009N068W 18,19

GENERAL DESCRIPTION:
The site is the northern end of a great plains reservoir. A cottonwood woodland dominates the terrestrial landscape.

NATURAL HERITAGE RESOURCE SIGNIFICANCE:

SCIENTIFIC NAME:	COMMON NAME:	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	FOREST SENS
ARDEA HERODIAS	GREAT BLUE HERON	G5	S3B,SZ			

CURRENT STATUS:

BOUNDARY JUSTIFICATION:
Includes the occurrence, the cottonwood woodland at the north end of the reservoir, a terrestrial buffer, and the adjacent waters of the lake for a buffer from disturbance.

PROTECTION CONSIDERATIONS:
Formal protection can be sought from owners and lesees.

MANAGEMENT CONSIDERATIONS:
When the heron rookeries are active, there should be a seasonal closure of areas within 500 ft. (Erwin 1989, Graul 1981).

Roberts Ranch House

SIZE: Approximately 60 acres.

BIODIVERSITY RANK: B5 - Local significance.

PROTECTION URGENCY RANK: P5 - No protection action needed.

MANAGEMENT URGENCY RANK: M5 - No serious management needs known or anticipated.

LOCATION:

USGS Quadrangle name(s):LIVERMORE
Townrange and section:010N070W 27

GENERAL DESCRIPTION:
Riparian forest and forested grove planted around a historic ranch house. Some of the planted trees included Colorado blue spruce.

NATURAL HERITAGE RESOURCE SIGNIFICANCE:

SCIENTIFIC NAME:	COMMON NAME:	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	FOREST SENS
BOMBYCILLA CEDRORUM	CEDAR WAXWING	G5	S3B,S5			

CURRENT STATUS: There is currently no formal protection for this site.

BOUNDARY JUSTIFICATION:
Boundary encompasses occurrence and adjacent contiguous habitat that includes forested grove associated with ranch house.

PROTECTION CONSIDERATIONS:
Protection activities are probably not necessary as long as front yard conifers are present.

MANAGEMENT CONSIDERATIONS:
Monitoring of the targeted elements should occur at least every other year.

Timnath Reservoir (R/W)

SIZE: Approximately 600 acres.

BIODIVERSITY RANK: B5 - Local significance.

PROTECTION URGENCY RANK: Protection urgency unassigned

MANAGEMENT URGENCY RANK: Management urgency unassigned

LOCATION:

USGS Quadrangle name(s):TIMNATH
Townrange and section:007N068W
007N067W 24,25
30

GENERAL DESCRIPTION:
This site is part of a great plains reservoir. Much of the adjacent land is in agriculture or livestock production.

NATURAL HERITAGE RESOURCE SIGNIFICANCE:

SCIENTIFIC NAME:	COMMON NAME:	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	FOREST SENS
ARDEA HERODIAS	GREAT BLUE HERON	G5	S3B,SZ			

CURRENT STATUS:

BOUNDARY JUSTIFICATION:
The site includes the upstream third of the reservoir which incorporates the rookery and adjacent cottonwood forest as well as some terrestrial buffer. Adjacent open waters are necessarily included for management for disturbance. Feeding areas are not considered limiting.

PROTECTION CONSIDERATIONS:

MANAGEMENT CONSIDERATIONS:

NATURAL HERITAGE METHODOLOGY

Overview

The Natural Heritage Methodology operates at several different levels. First, **elements of natural diversity** are ranked according to their rarity and/or degree of imperilment. These **elements** consist of rare or imperiled species, subspecies and significant natural communities. The relative rarity of the various elements is based upon the scientific biological information and population locations known currently. As new information is acquired, element ranks can be modified.

The second level of the Natural Heritage Methodology is the ranking of the populations or **occurrences** of a particular element. Since it is frequently impossible to protect all populations of a particular species, subspecies, or natural community, attempts are made to evaluate the relative quality of various occurrences of these elements so that conservation efforts can be focused on the best representatives of the elements and the healthiest, most viable populations.

The third level of the Natural Heritage Methodology is the delineation of potential conservation sites and the ranking of these sites. This ranking is based on the rarity and quality of the element occurrences contained within the sites. This enables conservation efforts to focus on assemblages of rare elements as well as on the elements themselves. A comprehensive, scientific approach to protecting species results when these three levels of Natural Heritage Methodology are applied.

Element Ranking

CNHP uses an element ranking system emphasizing the number of occurrences at distinct localities as an index of known biological rarity. The primary criterion for ranking elements is the number of occurrences because an element found in one place is more imperiled than an element found in twenty places. Also of importance is 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. Each element is assigned a rank that indicates its relative degree of imperilment on a five point scale:

1 = critically imperiled because of extreme rarity; five or fewer occurrences;

2 = imperiled because of rarity; 6 to 20 occurrences;

3 = very rare or vulnerable; generally found in a restricted range; 21-100 occurrences;

4 = apparently secure but may be declining; and

5 = demonstrably secure.

Element imperilment ranks are assigned in terms of imperilment within Colorado, the state rank, and the element's imperilment over its entire range, the global rank. The global rank, or G-rank, sets the overall priorities. The state rank, or S-rank, is used in discerning local, regional, and state priorities. For example, an element with a rank of G3/S2 will receive higher priority than an element with a rank of G5/S1 due to its global rank. Together these two ranks provide an instant picture of an element's degree of imperilment or rarity. It should be noted that

an element can never be more common within a state than it is globally. Therefore, the element's S-rank will always be as rare as the global ranking, i.e., G3/S2 not G2/S3.

Elements that receive a rank of S1, S2 and S3 are used to set species protection priorities. Elements with a ranking of S3S4 are "watchlisted"; data is collected and periodically analyzed to determine if more active tracking is warranted. Any element more common than a "watchlisted" element, with an S-rank of S4 or S5, is not monitored. Accepted subspecies are also included on the CNHP list (with associated trinomial ranks, or T-ranks), but they receive less priority than an equivalently ranked or imperiled species.

This single ranking system identifies all imperiled elements except those that are migratory. When ranking migratory elements it is necessary to distinguish between breeding, non-breeding, and resident species. A rank followed by a "B", e.g., S1B, indicates that the rank applies only to the status of breeding occurrences. Ranking followed by an "N", e.g., S1N, refers to non-breeding status, typically during migration and winter. Elements without this notation are believed to be year-round residents within the state. A complete description of each of the Natural Heritage global and state ranks is provided in Tables 55 and 56, respectively.

Table 55. Definition of Natural Heritage Global Rarity Ranks.

Global Rank (G): Based on the range-wide status of a species.

G1	Critically imperiled globally because of extreme rarity (5 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).
G2	Imperiled globally because of rarity (6 to 20 occurrences), or because of other factors demonstrably making it very vulnerable to extinction throughout its range. (Endangered throughout its range).
G3	Vulnerable throughout its range or found locally in a restricted range (21 to 100 occurrences).
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.

Table 56. Definitions of Natural Heritage State Rarity Ranks.

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 (5 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 (6 to 20 occurrences), or because of other factors demonstrably making it very vulnerable to extirpation from the state. (Endangered or threatened in state).

S3 Vulnerable in state (21 to 100 occurrences).

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 > 15 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.

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 57 defines the special status assigned by these agencies and provides a key to the abbreviations used by CNHP.

Table 57. Federal and State Agency Designations.

Federal Status:

1. U.S. Fish and Wildlife Service (58 Federal Register 51147, 1993)

    LE Endangered; taxa formally listed as endangered.

    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.

2. 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:

    a. Significant current or predicted downward trends in population numbers or density.

    b. Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.

3. 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.

State Status:

1. Colorado Division of Wildlife
    - E Endangered
    - T Threatened
    - SC Special Concern

Element Occurrence Ranking

Actual locations of elements, whether they be single organisms, populations, or communities, are referred to as element occurrences. The element occurrence is considered the most fundamental unit of conservation interest and is at the heart of the Natural Heritage Methodology. In order to prioritize element occurrences for a given species, an element occurrence rank (EO-Rank) is assigned according to their ecological quality whenever sufficient information is available. This ranking system is designed to indicate which occurrences are the healthiest and ecologically the most viable, thus focusing conservation efforts where they will can be most successful. The EO-Rank is based on 4 factors:

Quality -- the representativeness of the occurrence as compared to element occurrence (EO) specifications including maturity, size, and numbers. The element occurrence specifications are set by a consensus of experts regarding the element in question;

Condition -- how much has the site and EO been damaged or altered from its optimal condition and character;

Viability -- the long term prospects for continued existence of this occurrence;

Defensibility -- the extent to which the occurrence can be protected from extrinsic human factors that might otherwise degrade or destroy it.

Each of these factors are rated on a scale of A through D, with A representing an excellent grade and D representing a poor grade. These grades are then averaged to determine an appropriate EO-Rank for the occurrence. Possible EO-Ranks and their appropriate definitions are as follows:

A -- Excellent
B -- Good
C -- Fair
D -- Poor
E -- Verified extant but has not been given an EO-Rank
O -- Obscure, not found at the site reported from but not thoroughly searched for; more searching needed.
X -- Extirpated from the site, not located by repeated reasonably intensive field searches by qualified field people at the right time of year, or habitat is significantly altered and no longer suitable for maintenance of the element.
H -- Historical, no recent field information.

If there is insufficient information available to rank an element occurrence, an EO-Rank is not assigned.

Conservation Sites

In order to successfully protect populations or occurrences, it is necessary to delineate conservation sites. These conservation sites focus on capturing the ecological processes that are necessary to support the continued existence of a particular element of natural heritage significance. Conservation sites may include a single occurrence of a rare element or a suite of rare elements or significant features.

The goal of the process is to identify a land area that can provide the habitat and ecological processes upon which a particular element or suite of elements depends for their continued existence. The best available knowledge of each species' life history is used in conjunction with information about topographic, geomorphic, and hydrologic features, vegetative cover, as well as current and potential land uses. The proposed boundary does not automatically exclude all activity. It is a hypothesis that some activities will prove degrading to the element or the process on which they depend, while others will not. Consideration of specific activities or land use changes proposed within or adjacent to the preliminary conservation planning boundary should be carefully considered and evaluated for their consequences to the element on which the conservation unit is based.

Preliminary Conservation Planning Boundaries

Once the presence of rare or imperiled species or significant natural communities has been confirmed, the first step towards its protection is the delineation of a preliminary conservation planning boundary. In general, the preliminary conservation planning boundary is an estimate of the landscape that supports the rare elements as well as the ecological processes that allow them to persist. In developing such boundaries, CNHP staff considered a number of factors that include, but are not limited to:

- the extent of current and potential habitat for the elements present, considering the ecological processes necessary to maintain or improve existing conditions;
- species movement and migration corridors;
- maintenance of surface water quality within the site and the surrounding watershed;
- maintenance of the hydrologic integrity of the groundwater, e.g., by protecting recharge zones;
- land intended to buffer the site against future changes in the use of surrounding lands;
- exclusion or control of invasive exotic species;
- land necessary for management or monitoring activities.

As the label "conservation planning" indicates, the boundaries presented here are for planning purposes. They delineate ecologically sensitive areas where land-use practices should be carefully planned and managed to ensure that they are compatible with protection goals for natural heritage resources and sensitive species. All land within the conservation planning boundary should be considered an integral part of a complex economic, social, and ecological landscape that requires wise land-use planning at all levels.

Off-Site Considerations

Furthermore, it is often the case that all relevant ecological processes cannot be contained within a site of reasonable size. Taken to the extreme, the threat of ozone depletion could expand every site to include the whole globe. The boundaries illustrated in this report signify the immediate, and therefore most important, area in need of protection. Continued landscape level conservation efforts are needed. This will involve county-wide efforts as well as coordination and cooperation with private landowners, neighboring land planners, and state and federal agencies.

Ranking of Conservation Sites

One of the strongest ways that the CNHP uses these element and element occurrence ranks is to assess the overall biodiversity significance of a site, which may include one or many element occurrences. Based on these ranks, each site is assigned a **biodiversity** (or B-) **rank**:

B1 Outstanding Significance: only site known for an element or an excellent occurrence of a G1 species.

B2 Very High Significance: one of the best examples of a community type, good occurrence of a G1 species, or excellent occurrence of a G2 or G3 species.

B3 High Significance: excellent example of any community type, good occurrence of a G3 species, or a large concentration of good occurrences of state rare species.

B4 Moderate or Regional Significance: good example of a community type, excellent or good occurrence of state-rare species.

B5 General or Local Biodiversity Significance: good or marginal occurrence of a community type, S1, or S2 species.

Protection Urgency Ranks and Management Urgency Ranks

The Protection Urgency Rank and the Management Urgency Rank are two mechanisms used to prioritize conservation action related to potential conservation areas. These two ranks summarize the urgency of the need for action and apply a timeline to focus action planning. Urgency ranks are based on current knowledge, but are not always known for a particular area. When this information is not available every effort is made to obtain it as soon as possible.

Protection Urgency Ranks

The urgency for protection rating reflects the need to take legal, political, or other administrative measures to alleviate threats that are related to land ownership or designation. The following codes are used to indicate the rating which best describes the urgency to **protect** the area:

P1 - Immediately threatened by severely destructive forces, within 1 year of rank date; **protect now or never!**

P2 - Threat expected within 5 years.

P3 - Definable threat but not in the next 5 years.

P4 - No threat known for foreseeable future.

P5 - Land protection complete or adequate reasons exists not to protect the site; do not act on this site.

A protection action involves increasing the current level of legal protection accorded one or more tracts at a potential conservation area. It may also include activities such as educational or public relations campaigns or collaborative planning efforts with public or private entities to minimize adverse impacts to element occurrences at a site. It does not include management actions, i.e., any action requiring stewardship intervention.

Threats that may require a protection action are as follows:

1) Anthropogenic forces that threaten the existence of one or more element occurrences at a site, e.g., (a) development that would destroy, degrade or seriously compromise the long-term viability of an element occurrence; and (b) timber, range, recreational, or hydrologic management that is incompatible with an element occurrence's existence;

2) The inability to undertake a management action in the absence of a protection action, e.g., obtaining a management agreement; and

3) In extraordinary circumstances, a prospective change in ownership management that will make future protection actions more difficult.

Management Urgency Rank

The urgency for management rating focuses on land use management or land stewardship action required to maintain element occurrences at the potential conservation area. The following codes are used to indicate the action needed to be taken at the area:

M1 - (a) Management action required immediately or element occurrences could be lost or irretrievably degraded within one year.

(b) Ongoing annual management action must continue or element occurrences could be lost or irretrievably degraded within one year.

M2 - (a) New management action will be needed within 5 years to prevent the loss of element occurrences.

(b) Ongoing, recurring management action must continue within 5 years to prevent loss of element occurrences.

M3 - (a) New management action will be needed within 5 years to maintain current quality of element occurrences.

(b) Ongoing, recurrent management action must continue within 5 years to maintain current quality of element occurrences.

M4 - Although not currently threatened, management may be needed in the future to maintain the current quality of element occurrences.

M5 - No serious management needs known or anticipated at the site.

A management action may include biological management (prescribed burning, removal of exotics, mowing, etc.) or people and site management (building barriers, rerouting trails, patrolling for collectors, hunters, or trespassers, etc.). Management action does not include legal, political, or administrative measures taken to protect a potential conservation area.

INVENTORY METHODS

The methods for assessing and prioritizing conservation needs over a large area are necessarily diverse. This study follows a general method that the Colorado Natural Heritage Program has and continues to develop specifically for this purpose. The Natural Heritage Inventory was conducted in several steps summarized below.

Information collection phase

CNHP databases were updated with information regarding the known locations of species and significant natural communities within Larimer County. A variety of information sources were searched for this information. The Colorado State University museums and herbarium were searched, as were plant and animal collections at the University of Colorado, Western State, Rocky Mountain Herbarium, and local private collections. The Colorado Division of Wildlife provides extensive data on the fishes of Larimer County as well as information regarding the status of the plains sharp-tailed grouse. The Breeding Bird Atlas was helpful in providing a list of all birds detected in the county through their work. Both general and specific literature sources were incorporated into CNHP databases as either locational information or as biological data pertaining to a species in general. Other information was gathered to help locate additional occurrences of natural heritage resources. Such information covers basic species and community biology including range, habitat, phenology (timing), food sources, and substrates. This information was entered into CNHP databases.

Identify rare or imperiled species and significant natural communities with potential to occur in Larimer County

The information collected in the previous step was used to refine the potential element list and to refine our search areas. In general, species and natural communities that have been recorded from Larimer County, or from adjacent counties, are included in this list. Species or natural communities which prefer habitats that are not included in this study area were removed from the list. This primarily included those that prefer higher elevations, such as those found in western Larimer County on public lands.

The following list of elements includes those elements currently monitored by CNHP that were thought to potentially to occur in Larimer County, and were therefore targeted in CNHP field inventories. Over 225 rare species and significant natural communities were targeted in these surveys.

The amount of effort given to the inventory for each of these elements is prioritized according to the element's rank. Globally rare (G1 - G3) elements are given highest priority, state rare elements are second.

Table 58. Rare and imperiled plants and animals and significant natural communities known or potentially occurring in Larimer County.

Scientific Name	Common Name	Global Rank	State Rank	Fed. Status	State Status	Fed. Sens.
Amphibians						
Acris crepitans blanchardi	Blanchard's cricket frog	G5T5	S2		SC	
Bufo boreas boreas	boreal toad (southern rocky mountain population)	G5T2Q	S1	C	E	FS
Rana pipiens	northern leopard frog	G5	S3		SC	FS
Rana sylvatica	wood frog	G5	S3		T	FS
Birds						
Accipiter gentilis	northern goshawk	G5	S3B,SZN			FS
Aegolius funereus	boreal owl	G5	S2B			FS
Ardea albus	great egret	G5	S1B			
Ardea herodias	great blue heron	G5	S3B,SZN			
Aythya valisineria	canvasback	G5	S2B,SZN			
Bombycilla cedrorum	cedar waxwing	G5	S3B,S5N			
Buteo regalis	ferruginous hawk	G4	S3B,S4N		SC	FS
Charadrius montanus	mountain plover	G2	S2B,SZN	C	SC	FS
Coccothraustes vespertinus	evening grosbeak	G5	S3B,S5N			
Coccyzus americanus americanus	eastern yellow-billed cuckoo	G5TU	S3B			
Coccyzus erythropthalmus	black-billed cuckoo	G5	S2B			
Cypseloides niger	black swift	G4	S3B			FS
Dendroica pensylvanica	chestnut-sided warbler	G5	S2B,SZN			
Dolichonyx oryzivorus	bobolink	G5	S3B,SZN			
Egretta thula	snowy egret	G5	S2B,SZN			
Empidonax minimus	least flycatcher	G5	S1B,SZN			
Falco peregrinus anatum	American peregrine falcon	G4T4	S2B,SZN	LE	T	
Haliaeetus leucocephalus	bald eagle	G4	S1B,S3N	LT	T	
Himantopus mexicanus	black-necked stilt	G5	S3B,SZN			
Lanius ludovicianus	loggerhead shrike	G4G5	S3B,SZN			FS
Loxia leucoptera	white-winged crossbill	G5	S1B,SZN			
Numenius americanus	long-billed curlew	G5	S2B,SZN		SC	FS
Nycticorax nycticorax	black-crowned night-heron	G5	S3B,SZN			
Pandion haliaetus	osprey	G5	S2S3B			FS
Pelecanus erythrorhynchos	American white pelican	G3	S1B,SZN		SC	
Plegadis chihi	white-faced ibis	G5	S2B,SZN			FS
Tympanuchus cupido pinnatus	greater prairie chicken	G4TU	S3		T	FS
Tympanuchus phasianellus jamesi	plains sharp-tailed grouse	G5T5	S1		E	
Fish						
Carpiodes carpio	river carpsucker	G5	S2			
Couesius plumbeus	lake chub	G5	S1			
Etheostoma exile	Iowa darter	G5	S2		SC	
Etheostoma nigrum	Johnny darter	G5	S3			
Fundulus sciadicus	plains topminnow	G4	S2		SC	FS
Hybognathus hankinsoni	brassy minnow	G5	S3			
Hybognathus placitus	plains minnow	G5	SH		SC	
Notropis cornutus	common shiner	G5	S2		SC	
Noturus flavus	stonecat	G5	S1		SC	
Oncorhynchus clarki stomias	greenback cutthroat	G4T2	S2	LT	T	

Phenacobius mirabilis	suckermouth minnow	G5	S3		SC	
Phoxinus eos	northern redbelly dace	G5	S1		SC	
Mammals						
Felis lynx canadensis	lynx	G5	S1		E	FS
Gulo gulo	wolverine	G4	S1		E	FS
Mustela nigripes	black-footed ferret	G1	SH	LE	E	
Plecotus townsendii	townsend's big-eared bat	G4	S3			FS
Sorex hoyi montanus	pygmy shrew	G5T2T3	S1			FS
Sorex merriami	Merriam's shrew	G5	S2			
Thomomys talpoides macrotis	plains pocket gopher subsp.	G5T?	S1			
Tropidoclonion lineatum	lined snake	G5	S3			FS
Ursus arctos	grizzly or brown bear	G4	SX	LT	E	
Vulpes velox	swift fox	G3	S3	C		FS
Zapus hudsonius preblei	Preble's meadow jumping mouse	G5T2	S2		SC	FS
Invertebrates						
Acroloxus coloradensis	Rocky Mountain capshell	G?	S2		SC	FS
Aeshna eremita	lake darner	G5	S1?			
Aeshna verticalis	green-striped darner	G5	S?			
Amblyscirtes simius	Simius roadside skipper	G4	S3			
Anodonta grandis	giant floater	G5	S1			
Anodontoides ferussacianus	cylindrical papershell	G5	S2			
Aphaenogaster huachucana	an ant	G2?	S?			
Archilestes grandis	great spreadwing	G5	S3			
Argia sedula	blue-ringed dancer	G5	S2			
Atrytone arogos	arogos skipper	G3G4	S2			
Atrytonopsis hianna	dusted skipper	G4G5	S2			
Boloria selene sabulocollis	sandhill fritillary	G5T2	S1S2			
Callophrys mossii schryveri	Moss's elfin	G4T3	S2S3			
Calopteryx aequabilis	river jewelwing	G5	SH			
Celastrina sp 1	hop-feeding azure	G2	S2			
Coloradia luski	a buckmoth	G?	S1?			
Cordulia shurtleffi	American emerald	G5	S1?			
Enallagma basidens	double-striped bluet	G5	S1			
Erebia theano	theano alpine	G4	S3			
Erynnis martialis	mottled dusky wing	G4	S2S3			
Euphilotes rita coloradensis	Colorado blue	G4T2T3	S2			
Euphyes bimacula	two-spotted skipper	G4	S1			
Euproserpinus wiesti	Wiest's sphinx moth	G3G4	S2			
Formica laeviceps	an ant	G3	S2			
Hesperia ottoe	Ottoe skipper	G3?	S2			
Lycaena editha	Edith's copper	G5	S2S3			
Oarisma edwardsii	Edward's skipperling	G4	S3			
Oeneis jutta reducta	Rocky Mountain arctic jutta	G5TU	S1			
Paratrytone snowi	Snow's skipper	G4	S3			
Physa utahensis	banded physa	G1	S1			
Polites origenes	cross-line skipper	G5	S3			
Promenetus exacuous	sharp sprite	G?	S2			
Promenetus umbilicatellus	umbilicate sprite	G?	S3			
Pyrgus ruralis	two-banded skipper	G4	S3			
Satyrodes eurydice fumosa	smoky eyed brown butterfly	G5T3T4	S1			
Somatochlora hudsonica	hudsonian emerald	G5	S2S3			

Somatochlora minor	ocellated emerald	G5	S1			
Speyeria egleis	Egleis fritillary	G5	S2			
Speyeria idalia	regal fritillary	G3	S1			FS
Stigmatomma pallipes	an ant	G5	S1			
Sympetrum vicinum	yellow-legged meadowfly	G5	S?			
Sympheidole elecebra	an ant	G1?	S1			
Communities						
Abies lasiocarpa/ Senecio triangularis	montane riparian forests	G2G3	S2S3			
Alnus incana/ Calamagrostis canadensis	montane riparian shrublands	G3	SU			
Alnus incana/ Equisetum arvense	montane riparian shrublands	GQ	S2S3			
*Alnus incana/*mesic graminoid	montane riparian shrubland	G2G3	SU			
Andropogon gerardii-Schizachyrium scoparium	xeric tallgrass prairies	G2	S2			
Andropogon gerardii-Sorghastrum nutans	wet prairies	G1	S1?			
Artemisia tridentata wyomingensis/ Leymus ambiguus	mixed foothill shrublands	G3	S2			
Artemisia tridentata wyomingensis/ Pseudoroegneria spicata	xeric sagebrush shrublands	G5	S3?			
Artemisia tripartita/ Festuca idahoensis	mixed foothill shrublands	G4G5	S1?			
Atriplex canescens/ Bouteloua gracilis	shortgrass prairies	G3	S3			
Betula occidentalis/ mesic forb	foothills riparian shrubland	G2G3	S2			
Calamagrostis canadensis	montane wet meadows	GU	S?			
Calamagrostis canadensis-Carex scopulorum-Mertensia ciliata	mesic alpine meadows	GU	S?			
Caltha leptosepala- Sedum rhodanthum	montane wet meadows	GU	SU			
Carex diandra	quaking fen	G?	S?			
Cercocarpus montanus- Rhus trilobata/ Andropogon gerardii	foothills shrubland	GU	SU			
Cercocarpus montanus/ Stipa comata	foothills shrubland	G2	S2			
Cercocarpus montanus/ Stipa neomexicana	foothills shrubland	G2G3	S2S3			
Cercocarpus montanus/ Stipa scribneri	foothills shrubland	GU	SU			
Danthonia parryi	montane grasslands	G2?	S2?			
Distichlis spicata var *stricta*	great plains salt meadows	G4	S3			
Eleocharis quinqueflora-Triglochin spp.	montane wetland	GU	SU			
Glyceria borealis	montane emergent wetland	G3?	S2			
Juniperus scopulorum/ Cercocarpus montanus	foothills juniper woodlands	G2	S2			
Juniperus scopulorum/	foothills pinyon-juniper	G2	S2			

Purshia tridentata	woodlands					
Juniperus scopulorum/ Schizachyrium scoparium	scarp woodlands	G3	S2S3			
Muhlenbergia montana-Danthonia parryi	montane grasslands	G3G4	S2?			
Muhlenbergia montana-Stipa comata	montane grasslands	G2	S2			
Phippsia algida	alpine wetlands	GU	SU			
Picea engelmannii/ Calamagrostis canadensis	montane riparian forests	G3	SU			
Picea pungens/ Alnus incana	montane riparian forests	G3	S3			
Picea pungens/ Alnus incana phase *corylus cornuta*	foothills riparian forest	GU	SU			
Picea pungens/ Cornus sericea	montane riparian forest	G4	S2			
Pinus contorta/ Vaccinium scoparium	seral lodgepole pine forests	G5	S4			
Pinus ponderosa/ Carex inops	foothills ponderosa pine savannas	G3	S2			
Pinus ponderosa/ Cercocarpus montanus/Andropogon gerardii	foothills ponderosa pine scrub woodlands	G2	S2?			
Pinus ponderosa/ Leucopoa kingii	foothills ponderosa pine savannas	G3	S3			
Populus angustifolia/ Alnus incana	narrowleaf cottonwood riparian forests	G?	S?			
Populus angustifolia/ Prunus virginiana	narrowleaf cottonwood/ common chokecherry	G2?	S1?			
Populus angustifolia/ Salix exigua	narrowleaf cottonwood riparian forests	G3	S3			
Populus angustifolia / Salix irrorata	Foothills cottonwood riparian forests	GU	SU			
Populus angustifolia/ Symphoricarpos albus	riparian forest	GU	SU			
Populus deltoides / Distichlis spicata	Plains cottonwood riparian forest	G2	S2			
Populus deltoides-(Salix amygdaloides)/Salix exigua	plains cottonwood riparian woodland	G2G3	S2S3			
Populus tremuloides/ Corylus cornuta	montane riparian forests	G3?	S1			
Pseudoroegneria spicata-Poa secunda	montane grasslands	G4	S1			
Pseudotsuga menziesii/Corylus cornuta	riparain forest	GU	S2			
Purshia tridentata/ Artemisia frigida/Stipa comata	mixed foothill shrublands	G1G2	S1S2			
Purshia tridentata/ Muhlenbergia montana	mixed foothill shrublands	G2	S2			
Ribes cereum/Leymus ambiguus	mixed foothill shrublands	G2	S2?			
Salix drummondiana-Salix planifolia/ Calamagrostis	lower montane willow carrs	G2	S2			

canadensis						
Salix drummondiana/mesic forb	Drummond's willow/mesic forb	G3	S3			
Salix geyeriana-Salix monticola/ Calamagrostis canadensis	montane willow carrs	G3	S3			
Salix geyeriana/ Calamagrostis canadensis	montane willow carr	GU?	SU?			
Salix geyeriana/ Carex utriculata	Geyer's willow/beaked sedge	G5	S2			
Salix monticola/ Calamagrostis canadensis	montane willow carr	GU	SU			
Salix planifolia/ Calamagrostis canadensis-Carex aquatilis	montane willow carrs	G2G4	S2S4			
Salix planifolia/Caltha leptosepala	montane willow carrs	GU	SU			
Salix planifolia/Carex aquatilis	montane willow carrs	GU	S?			
Scirpus maritimus	emergent wetland (marsh)	G4	S?			
Scirpus tabernaemontani-Scirpus acutus	great plains marshes	GU	S?			
Sporobolus airoides-Distichlis spicata	great plains salt marshes	G3G5	SU			
Stipa comata - east	great plains mixed grass prairies	G2	S2			
Stipa comata-Bouteloua gracilis	montane grasslands	G5	S2S3			
Stipa neomexicana	great plains mixed grass prairies	G2	S2			
Typha latifolia	great plains marshes	G5	S3?			
Plants						
Acorus calamus	sweet flag	G5	S1			
Agastache foeniculum	lavender hyssop	G4G5	S1			
Aletes humilis	larimer aletes	G2G3	S2S3			FS
Amorpha nana	dwarf wild indigo	G5	S2S3			
Apios americana	American groundnut	G5	S2			
Aquilegia saximontana	Rocky Mountain columbine	G3	S3			
Aristida basiramea	forktip three-awn	G5	S1			
Asclepias uncialis	dwarf milkweed	G1G2	S1S2			FS
Asplenium adiantum-nigrum	black spleenwort	G5	S1			
Botrychium echo	reflected moonwort	G2	S2			FS
Botrychium hesperium	western moonwort	G3	S2			
Botrychium lanceolatum var *lanceolatum*	lance-leafed moonwort	G5T4	S2			
Botrychium lineare	moonwort	G1	S1			FS
Botrychium lunaria	moonwort	G5	S2			
Botrychium minganense	mingan moonwort	G4	SRF			
Botrychium multifidum	leathery grape fern	G5	S1			
Botrychium pallidum	pale moonwort	G2	S2			FS
Carex diandra		G5	S1			
Carex lasiocarpa	slender sedge	G5	S1			

Carex limosa	mud sedge	G5	S2			
Carex livida	livid sedge	G5	S1			FS
Carex oreocharis	a sedge	G3	S1			
Carex peckii	peck sedge	G4G5	S1?			
Carex saximontana	Rocky Mountain sedge	G5	S1			
Carex sychnocephala	many-headed sedge	G4	S1?			
Carex torreyi	Torrey sedge	G4	S1			
Chionophila jamesii	Rocky Mountain snowlover	G4?	S3S4			
Crataegus chrysocarpa	yellow hawthorn	G5	S1S2			
Crepis nana	dwarf hawksbeard	G5	S2			
Cryptantha cana	mountain cat's-eye	G5	S2			
Cypripedium fasciculatum	purple lady's-slipper	G4	S3			FS
Cypripedium pubescens	yellow lady's-slipper	G5	S2			
Draba exunguiculata	clawless draba	G3	S3			
Draba fladnizensis	arctic draba	G4	S2S3			
Draba grayana	Gray's peak whitlow-grass	G2	S2			
Draba porsildii	Porsild draba	G3	S1			
Draba streptobrachia	Colorado divide whitlow-grass	G3	S3			
Dryopteris expansa	spreading wood fern	G5	S1			
Eustoma russellianum	showy prairie gentian	G5	S3			
Festuca hallii	hall fescue	G3	S1			FS
Gaura neomexicana ssp *coloradensis*	Colorado butterfly weed	G4T2	S1	C		FS
Isoetes echinospora	spiny-spored quillwort	G5	S2			
Juncus tweedyi	Tweedy rush	G3	S1?			
Juncus vaseyi	Vasey bulrush	G3G5	S1			
Liatris ligulistylis	gay-feather	G5?	S1S2			
Ligusticum tenuifolium	slender-leaf ligusticum	G5	S1?			
Lilium philadelphicum	wood lily	G5	S3			
Listera borealis	northern twayblade	G4	S2			
Listera convallarioides	broad-leaved twayblade	G5	S2			
Lycopodium annotinum var *pungens*	stiff clubmoss	G5TU	SU			
Malaxis brachypoda	white adder's-mouth	G4	S1			FS
Mimulus gemmiparus	Weber monkey-flower	G2	S2			FS
Oxytropis parryi	Parry oxytrope	G5	S1			
Papaver lapponicum ssp *occidentale*	alpine poppy	G4T4	S2			
Parnassia kotzebuei	Kotzebue grass-of-parnassus	G4	S1			
Parthenium alpinum	Wyoming feverfew	G3	S1			FS
Pellaea atropurpurea	purple cliff-brake	G5	S2S3			
Penstemon laricifolius ssp *exilifolius*	larch-leaf beardtongue	G4T3	S1			
Phippsia algida	snow grass	G5	S2			
Physaria bellii	Bell's twinpod	G2	S2			
Polypodium hesperium	western polypody	G5	S1S2			
Potentilla ambigens	southern Rocky Mountain cinquefoil	G3	S1S2			
Potentilla effusa var *rupincola*	Rocky Mountain cinquefoil	G3G5T2	S2			FS
Pyrola picta	pictureleaf wintergreen	G4G5	S2			
Ranunculus karelinii	tundra buttercup	G4G5	S2			
Rhododendron albiflorum	white-flowered azalea	G4	S2			

Rorippa coloradensis	Colorado watercress	GX	SX			
Rotala ramosior	toothcup	G5	S1?			
Salix candida	hoary or silver willow	G5	S2			
Salix serissima	autumn willow	G4	S1			FS
Saxifraga cespitosa ssp *monticola*	tundra saxifrage	G5T5	S1			
Scirpus saximontanus	rocky mountain bulrush	G5	S1			
Sisyrinchium pallidum	pale blue-eyed grass	G2G3	S2			
Solidago ptarmicoides	prairie goldenrod	G5	S2S3			
Spiranthes diluvialis	Ute ladies' tresses	G2	S2	LT		
Subularia aquatica	water awlwort	G5	S1			
Viola pedatifida	prairie violet	G5	S2			
Viola selkirkii	Selkirk violet	G5?	SH			FS
Woodsia neomexicana	New Mexico cliff fern	G4?	S2			

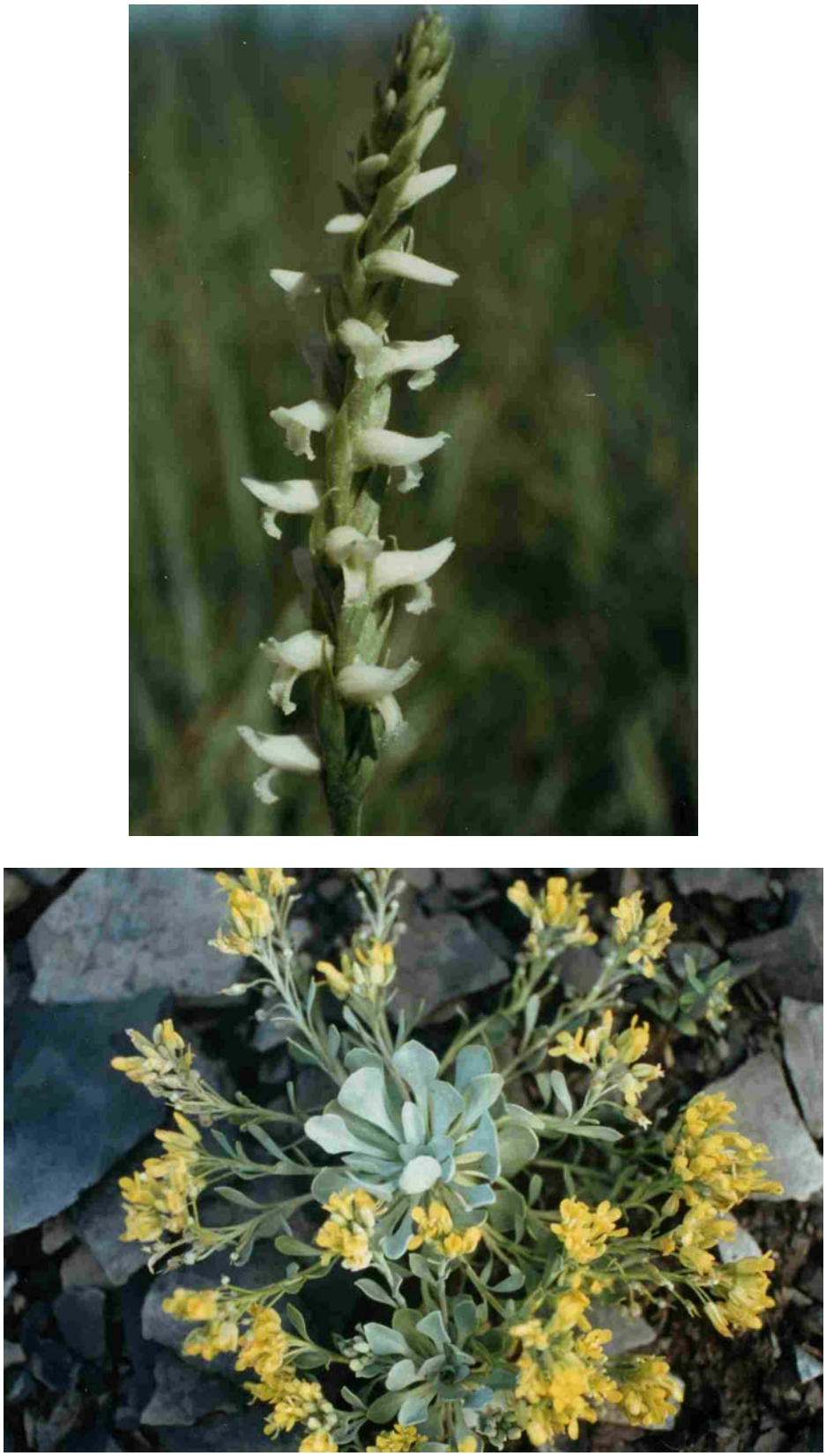


Figure 4. Examples of imperiled plants which occur in Larimer County. Top: Ute ladies' tresses orchid (*Spiranthes diluvialis*). Bottom: Bell's twinpod (*Physaria bellii*).

Identifying targeted inventory areas

Survey sites were chosen based on their likelihood of harboring rare or imperiled species or significant natural communities. Known locations were targeted, and additional potential areas were chosen using a variety of information sources. Precisely known element locations were always included so that they could be verified and updated. Many locations were not precisely known due to ambiguities in the original data, i.e., "headwaters of Boxelder Creek." In such cases, survey sites for that element were chosen in likely areas in the general vicinity. Areas with potentially high natural values were chosen using aerial photographs, geology maps, vegetation surveys, personal recommendations from knowledgeable local residents, and numerous roadside surveys by our field scientists. Aerial photography is perhaps the most useful tool in this step of the process. High altitude infrared photographs at 1:24,000 scale (NHAP 85) were used for this project and are ideally suited for assessing vegetation types and, to some extent, natural conditions on the ground.

Using the biological information stored in the CNHP databases, these information sources were analyzed for sites that have the highest potential for supporting specific elements. General habitat types can be discerned from the aerial photographs, and those chosen for survey sites were those that appeared to be in the most natural condition. In general, this means those sites that are the largest, least fragmented, and relatively free of visible disturbances such as roads, trails, fences, quarries, etc.

The above information was used to delineate over 200 survey areas that were believed to have relatively high probability of harboring natural heritage resources. These areas are illustrated on the map of Targeted Inventory Areas (folded inside back cover). These areas vary in size from less than 10 to several thousand acres and include all major habitat types in the study area.

Roadside surveys were useful in further resolving the natural condition of these areas. The condition of grasslands is especially difficult to discern from aerial photographs, and a quick survey from the road can reveal such features as weed infestation or overgrazing. Similar information was attained by flying low over the study area in a small aircraft.

Because of the overwhelming number of potential sites and limited resources, surveys for all elements were prioritized by the degree of imperilment. For example, all species with Natural Heritage ranks of G1-G3 were the primary target of our inventory efforts. Although species with lower Natural Heritage ranks were not the main focus of inventory efforts, many of these species occupy similar habitats as the targeted species, and were searched for and documented as they were encountered. Because of the low number of globally rare animals potentially in the County, the zoological inventories concentrated on the most imperiled species, the mountain plover and the Preble's meadow jumping mouse.

Landowner Contact

Attaining permission to conduct surveys on private property was essential to this project. Once survey sites were chosen, land ownership of these areas was determined using records at the Larimer County assessor's office. Landowners were then either contacted by phone or mail or in person. If landowners could not be contacted, or if permission to access the property was denied, this was recorded and the site was not visited. **Under no circumstances were properties surveyed without landowner permission.**

Field Surveys

Survey sites where access could be attained were visited at the appropriate time as dictated by the phenology of the individual elements. It is essential that surveys take place during a time when the targeted elements are detectable. For instance, breeding birds cannot be surveyed outside of the breeding season and plants are often not identifiable without flowers or fruit which are only present during certain times of the season.

The methods used in the surveys necessarily vary according to the elements that were being targeted. In most cases, the appropriate habitats were visually searched in a systematic fashion that would attempt to cover the area as thoroughly as possible in the given time. Some types of organisms require special technique in order to capture and document their presence. These are summarized below:

Amphibians: visual or with aquatic nets
Reptiles: visual or with hook
Mammals: small mammals only, Sherman live traps or gopher traps
Birds: visual or by song/call, evidence of breeding sought
Fish: aquatic nets
Insects: aerial net
Plants: visual
Natural communities: visual, collect qualitative or quantitative composition data

When necessary and permitted, voucher specimens were collected and deposited in local university museums and herbaria.

When a rare species or significant natural community was discovered its precise location and known extent was recorded on 1:24,000 scale topographic maps. Other data recorded at each occurrence included numbers observed, breeding status, habitat description, disturbance features, observable threats, and potential protection and management needs. The overall significance of each occurrence, relative to others of the same element, was estimated by rating the quality (size, vigor, etc.) of the population or community, the condition or naturalness of the habitat, the long-term viability of the population or community, and the defensibility (ease or difficulty of protecting) of the occurrence. These factors are combined into an element occurrence rank, useful in refining conservation priorities. See the section on Natural Heritage Methodology for more about element occurrence ranking.

Delineate Preliminary Conservation Planning Boundary

Finally, since the objective for this inventory is to prioritize specific areas for conservation efforts, a preliminary conservation planning boundary was delineated. Such a boundary is an estimation of the minimum area needed to assure persistence of the element. Primarily, in order to insure the preservation of an element, the ecological processes that support that occurrence must be preserved. The preliminary conservation planning boundary is meant to include features on the surrounding landscape that provide these functions. Data collected in the field are essential to delineating such a boundary, but other sources of information such as aerial photography are also used. These boundaries are considered preliminary and additional information about the site or the element may call for alterations of the boundaries.

LARIMER COUNTY WETLAND AND RIPARIAN AREAS

Project Background and Purpose

Until recently, most people viewed wetlands as a hindrance to productive land use. As a result of this attitude, many wetlands across North America have been both purposefully and unintentionally destroyed. Kelly et al. (1993) state that wetlands in the United States are still being lost at a rate of 260,000 acres/year (105,218 ha./yr.). In Colorado an estimated 1 million acres of wetlands (50% of the state's total) were lost prior to 1980 (Dahl 1990).

Although the rate of wetland loss in Larimer County is difficult to quantify, it is clear that many of the County's wetlands, especially in the Partnership Land Use System (PLUS)[3] planning area in the southeast part of the County, have been lost or profoundly altered from their pre-settlement state. Throughout the County agriculture, grazing, and water diversions have had tremendous impacts on wetlands. Fertile soils and available water for irrigation attracts agriculture to floodplains. In arid climates, such as that which prevails across most of Larimer County, grazing animals tend to concentrate around wetlands and riparian areas, often heavily impacting the vegetation. Since the nineteenth century hydrologic diversions have been developed for irrigation and for drinking water supplies, resulting in the removal of water from some wetlands, and creation of other wetlands very different from those present in the County prior to European settlement. In the PLUS planning area commercial and residential development has profoundly affected many small wetlands along the foothills and vast stretches of wetlands along the Cache la Poudre and the Big Thompson Rivers. It is clear that with the current rate of development in the County and the lack of comprehensive wetland protection programs, that wetlands will continue to be lost and dramatically altered.

In order to learn more about Larimer County's wetlands, CNHP evaluated 165 wetland sites that fall within the purview of the Larimer County government. The sites profiled in this report are the best examples of most of the various wetland types present in the study area. Two significant wetland types--"playa" lakes (shallow ponds in natural depressions that are not always wet) and alkaline seeps along the base of the foothills are not represented in this report because they are not known to contain imperiled plants or animals, and their natural communities have been essentially destroyed. CNHP believes the sites profiled in this report include those Larimer County wetlands that most merit conservation efforts.

CNHP simultaneously recognizes that protecting only these sites in no way adequately protects all the values associated with Larimer County wetlands. While this report presents the wetlands with the most significance for biodiversity, there are other wetlands with importance for wildlife, water quality, and flood control. The type of work done on wetlands in the PLUS area by Cooper and Merritt (1996) (mapping and evaluating all wetlands within a region of high development pressure) is a valuable complement to the identification of sites with high natural heritage significance.

[3] The Partnership Land Use System (PLUS) is a comprehensive land planning and management program being designed by the Larimer County Government. It covers the southeast corner of the County where approximately 95% of the County residents live.

What is a Wetland?

Wetlands are places where soils are inundated or saturated with water often enough, and for long enough, to significantly affect the plants and animals that live and grow there. This type of general definition suffices for most ecologists, but wetland regulators and our judicial system require a more precise definition.

The U.S. Army Corps of Engineers (the Corps) has primary responsibility for regulating activities in wetlands. According to the Corps, wetlands are "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstance do support, a prevalence of vegetation typically adapted for life in saturated soil condition." For Corps' programs, the wetlands boundary must be determined according to the mandatory technical criteria described in the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987). In order for an area to be classified as a jurisdictional wetland (i.e., a wetland subject to federal regulations), it must have all three of the following: (1) wetland plants (plants that tolerate flooded soils); (2) wetland hydrology (flooded or saturated soils for a significant part of the growing season); and (3) hydric soils (soils that show evidence of regular or sustained saturation).

The U.S. Fish and Wildlife Service has no regulatory role relative to wetlands, but it is responsible for The National Wetlands Inventory (NWI). The NWI uses a less restrictive definition of wetlands, as presented in *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979). This definition states that "wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water . . . wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes (wetland plants); (2) the substrate is predominantly un-drained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year." This definition only requires that an area meet only one of the three criteria (vegetation, soils, and hydrology) in order to be classified as a wetland.

The Colorado Natural Heritage Program prefers the wetland definition used by the U.S. Fish and Wildlife Service, because it recognizes that some areas display many of the attributes of wetlands without exhibiting all three characteristics required to fulfill the Corps criteria. Additionally, riparian areas (the land along streams and rivers), while often technically not wetlands, should be included in a wetland conservation or regulation program. Riparian areas perform many of the same functions as do wetlands, including maintenance of water quality, storage of floodwaters, and enhancement of biodiversity, especially in the western United States (National Research Council 1995).

Figure 5. Examples of wetlands in the montane region of Larimer County.

Wetland Functions and Values

Many physical and biological functions and values associated with wetlands provide a benefit to society. The Colorado Natural Heritage Program is most interested in the role of wetlands as habitat for rare and imperiled plants, animals, and natural communities. For example, the southern Rocky Mountain population of the boreal toad (*Bufo boreas boreas*), a wetland and riparian species, is known from twelve to fifteen breeding populations in the state (M. Sherman, CNHP, pers. comm.). The Colorado Division of Wildlife lists the boreal toad as a state endangered species, while the U.S. Fish and Wildlife Service has designated it a candidate for listing under the Endangered Species Act.

Wetlands perform many functions beyond simply providing habitat for plants and animals. It is commonly known that wetlands act as natural filters, helping to protect water quality, but it is less well known that wetlands perform other important functions. Adamus and Stockwell (1991) list the following functions performed by wetlands[4]:

Table 59. Wetland functions and related values.

FUNCTION	EFFECTS & SOCIETAL VALUE
Ground water recharge	Wetlands replenish below ground aquifers, maintaining a source for residential and agricultural wells and providing a source of water for springs.
Ground water discharge	Ground water comes to the surface in wetlands, providing water for streams and the wetlands themselves, maintaining fish and wildlife habitat.
Floodflow alteration	Wetlands store flood waters in the short and long term, decreasing flood peak and saving land and property from flood damage.
Sediment stabilization	Vegetation in wetlands protect stream banks and lake shores from erosion, helping to preserve land and maintain water quality.
Sediment/toxicant retention	Wetlands remove suspended sediment from the water, along with toxic substances that may be attached to the sediment, maintaining water quality.
Nutrient removal/transformation	Plants and bacteria in wetlands remove excess nutrients from the water, in particular nitrogen and phosphorous, maintaining water quality.
Production export	Wetlands supply organic material (dead leaves, etc.) to the base of the food chain, which is essential for healthy fisheries and wildlife.
Aquatic diversity/abundance	Wetlands provide habitat for non-game and sport fish, and for invertebrates that are important fish and waterfowl food.
Wildlife diversity/abundance	Wetlands provide cover, nesting, and feeding areas for a wide assortment of birds and wildlife.
Recreation	People enjoy the use of wetlands for hunting, fishing, birding, and scenery.
Uniqueness/heritage value	Certain wetlands are unique because of their geology or water chemistry, while others provide important habitat for rare and imperiled plants and animals.

[4] See Appendix 1 for a more complete description of the functions and values associated with wetlands.

Wetland Regulation

Wetlands in Larimer County are currently regulated only by the U.S. Army Corps of Engineers under the authority of the federal Clean Water Act. A permit issued by the Corps is required before placing fill in a wetland (e.g., building up a site before constructing home), and before dredging, ditching, or channelizing a wetland. The Clean Water Act exempts certain filling activities, such as normal agricultural activities.

The 404(b)(1) guidelines, prepared by the Environmental Protection Agency in consultation with the Corps, are the federal environmental regulations for evaluating projects that will impact wetlands. Under these guidelines, the Corps is required to determine if alternatives exist for minimizing or eliminating impacts to wetlands. When unavoidable impacts occur, the Corps requires mitigation of the impacts. Mitigation may involve creation or restoration of similar wetlands in order to achieve an overall goal of no net loss of wetland area.

It is important to understand that the Corps wetlands program is not a wetlands *protection* program, even though many wetlands are protected through implementation of these regulations (B. Clairain, pers. comm.). Rather, the Corps wetlands permit review process is a means to insure that the societal value of wetlands (i.e., the value of flood control, water quality maintenance, etc.) is considered whenever wetlands will be impacted by development activities. Under the Corps program most wetland permit applications are approved, thus the wetlands impacted, but after the impacts have been minimized or mitigated in the project plan.

The U.S. Fish and Wildlife Service's National Wetlands Inventory mapped Larimer County's wetlands on 1:24,000 scale maps in the early 1980s. These maps have no regulatory use. They can be used to gain an understanding of the general types of wetlands in the County and their distribution; however, these maps should be used with caution (C. Elliot, pers. comm.). They were compiled using black and white, 1:80,000 scale aerial photos taken in 1979. Black and white photos at such a small scale do not allow accurate interpretation of many wetlands present in the County. The color infrared photos used by Cooper and Merritt (1996) for mapping wetlands in the PLUS area show wetland much more clearly than the black and white photos.

The County is currently incorporating wetlands into the land use planning process in the PLUS area, but no final guidelines or regulations with respect to wetlands have yet been issued. Aside from the Corps wetland regulations, there are no other government entities in Larimer County currently involved in wetland regulation, including municipalities, County government, and state government.

Colorado's state government has developed no guidelines or regulations concerning the management, conservation, and protection of wetlands, but a few county and municipal governments have, including the City of Glenwood Springs, the City of Boulder, Boulder County, and San Miguel County. As an example of a positive approach to wetland management, the portion of the San Miguel County land use code that addresses wetlands is presented in Appendix 2.

The Hydrogeomorphic (HGM) Approach to Wetland Function Assessment

Few people argue about the value of wetlands for water quality maintenance, flood regulation, and wildlife habitat, but when wetlands occur on private land, regulation for public good provokes controversy. In an effort to provide a more consistent and logical basis for regulatory decisions about wetlands, the *hydrogeomorphic* approach is rapidly being developed. In Colorado, the hydrogeomorphic, or HGM, approach to wetland function assessment is being developed by the Colorado Geological Survey, with help from the U.S. Army Corps of Engineers, other government agencies, academic institutions, the Colorado Natural Heritage Program, and representatives from private consulting firms.

This approach is based on a classification of wetlands according to their hydrology (water source and direction of flow) and geomorphology (landscape position and shape of the wetland) and called "hydrogeomorphic" classification (Brinson 1993). There are four hydrogeomorphic classes present in Larimer County (Table 60). Within a geographic region, HGM wetland classes are further subdivided into "subclasses." A subclass includes all those wetlands that have essentially the same characteristics and perform the same functions. Based on our field experience, we tentatively propose eight subclasses for Larimer County (Table 60). All of these subclasses are present along the entire Front Range of Colorado. Their descriptions and characterizations may have to change as the definition of each subclass is extended to the entire area.

Using the HGM method, wetland functions are evaluated only with respect to other wetlands in the same subclass, because different subclasses often perform very different functions. For example, a montane kettle pond may provide habitat for rare plant communities never found on a large, Great Plains river, but it has little flood control value. On the other hand, the wetlands along the Cache la Poudre perform important flood control functions.

One of the fundamental goals of the HGM approach is to create a system whereby every wetland is evaluated according to the same standard. In the past, wetland function assessments typically were on a site by site basis, with little ability to compare functions or assessments between sites. The HGM approach allows for consistency first through the use of a widely applicable classification, then through the use of *reference wetlands*. Reference wetlands are chosen to encompass the known variation of a subclass of wetlands. A subset of the reference wetlands are *reference standards*, wetlands that correspond to the highest level of functioning of the ecosystem across a suite of functions (Brinson and Rheinhardt 1996).

The hydrogeomorphic approach to wetland function assessment assumes that highest, sustainable functional capacity is achieved in wetland ecosystems and landscapes that have not been subject to long-term anthropogenic disturbance. Under these conditions, the structural components and physical, chemical, and biological processes in the wetland and surrounding landscape reach the dynamic equilibrium necessary to achieve highest, sustainable functional capacity (Smith et al. 1995, p. 28). In general reference standards, against which all other wetlands in a subclass will be compared, meet this condition. The need to find reference standards overlaps with CNHP's efforts to identify those wetlands with the highest biological significance, in that the least disturbed wetlands will often be those with the highest significance. Several of the wetland sites profiled in this report can probably serve as reference wetlands.

Table 60. Hydrogeomorphic wetland classes in Larimer County.

Class	Geomorphic setting	Water Source	Water Movement	SUBCLASS	EXAMPLES
Riverine	In riparian areas along rivers and streams.	Overbank flow from channel	One-directional and horizontal (downstream) .	1. High-order, meandering river, broad flood plain; forested wetlands. 2. Low-order stream, willow carr wetlands.	1. Cottonwood forest wetland along the Cache la Poudre and Big Thompson Rivers. 2. Willow shrublands along Nunn Creek (Laramie River Valley) and throughout the montane.
Slope	At the base of slopes, e.g., along the base of the foothills; also, places where a porous bedrock overlying a non-porous bedrock intercepts the ground surface.	Groundwater	One-directional, horizontal (to the surface from groundwater).	3. Low-elevation (Great Plains and foothills), often alkaline, springs on sedimentary rock. 4. Montane wet meadows. 5. Montane and subalpine fens.	3. Great Plains spring wetlands at Jack Springs and Brannigan Springs 4. Tufted hairgrass meadows throughout the montane and subalpine. 5. Sedge peatlands at Boston Creek Fen.
Depressional	In depressions cause by glacial action (in the mountains) or wind erosion (on the plains) or human activity (e.g., gravel pits in floodplains).	Shallow ground water	Generally two-directional, vertical: flowing into and out of the wetland in the bottom and sides of the depression.	6. Great plains "playas." 7. Montane and subalpine kettle ponds.	6. Seasonally saturated depressions near Windsor. 7. Kettle ponds at the Lake Pasture site.
Lacustrine	Along the edges of reservoirs.	Flow between deep water and shallow water areas	Two-directional, horizontal: flowing into/out of shallow water wetlands as reservoirs rise/fall.	8. Seasonally saturated forested wetlands. 9. Permanently flooded marshes	8. Cottonwood forests along the north side of Fossil Creek reservoir. 9. Cattail marshes on west end of Fossil Creek reservoir.

Wetland Regions in the Study Area

A general description of the study area is given in another section of this report. In this section we discuss briefly wetlands in various portions of the County.

The Partnership Land Use System (PLUS) Planning Area

Wetlands in the PLUS planning area (the southeast corner of the County) have been greatly altered. Dating back to 1860, agricultural development, especially alteration of hydrology via canals and reservoirs, has altered these wetlands (Moreland 1980). Canals divert water out of the riparian area and away from associated wetlands. Not only wetlands contiguous with the rivers are affected; diversion of water may result in lack of groundwater replenishment and drying of wetlands away from the river as well. Also, the major rivers and some streams have been essentially channelized by development encroaching on their sides, directly destroying many wetlands and cutting off the water source for others. More recently urban and suburban development is having a profound effect on wetlands of the area, both directly and indirectly. Direct effects include the filling, draining, and ponding. Indirect effects include encroachment, spread of weeds, effects due to pets, etc.

It should be noted that irrigation canals have also caused the formation of wetlands, but these wetlands are almost invariably of much lower biodiversity significance than natural wetlands. They contain only a handful of species that occur in every wetland of this type. The hydrology is usually unpredictable, depending on the needs of the agricultural community.

Our field experience suggests that many of the multitude of reservoirs that now occur in the PLUS planning area were formerly springs or marshes, with possibly some open water for varying periods of time from spring extending into summer. With the changes described above, many of the species that historically depended on these wetlands lost much of their habitat. A small number of imperiled plants and animals managed to maintain a toehold in the area. Ute ladies' tresses (*Spiranthes diluvialis*) and prairie gentian (*Eustoma russellianum*) are two plants that manage to grow in profoundly altered wetlands, or in wetlands actually created by irrigation canals (e.g., Ute ladies' tresses grows at the Claymore Lake South and the prairie gentian grows at the Arrowhead Site). However, known populations of prairie gentian (*Eustoma russellianum*), sweetflag (*Acorus calamus*), and lavender hyssop (*Agastache foeniculum*) have apparently been extirpated as a result of development. If possible, surveys for these plants should be done in wetlands slated for destruction or profound alteration. Sites where these plants are found should be protected if at all possible.

While the PLUS area has been altered profoundly and has few areas of high significance from the perspective of known element occurrences, it is an area that deserves the most intensive efforts at a comprehensive wetlands protection program. The work of Cooper and Merritt (1996) offers an excellent foundation for such a program.

Great Plains north of Wellington

The rolling prairie north of Wellington contains the closest thing we have to "natural" Great Plains wetlands in Larimer County. The area has many small and large springs (as we

suspect the PLUS area did before all the reservoirs and diversions), intermittent streams, and a few perennial, slow, shallow streams. The spring systems are the most unusual feature in this area. Because of their unusual nature, and because they represent a wetland no longer present elsewhere in Larimer County, we are recommending protection of the large spring systems in this area. There is a good chance that these spring systems either do or can support the globally rare and imperiled Colorado butterfly weed (*Gaura neomexicana* ssp. *coloradensis*).

Laramie Foothills

The "Laramie Foothills" includes the grasslands and shrublands in the area bounded by the Great Plains on the east, Wyoming on the north, and the forested Laramie Mountains on the west and south. Wetlands in this area are common but small. Most occur along streams, or in spring areas at the headwaters of streams. Most have been heavily impacted by grazing, but many good examples of common wetland types still occur. These wetlands include primarily sedge meadows (e.g., *Carex nebrascensis* communities) and small patches of willows, and in some cases cottonwoods that line streams. With the exception of an uncommon riparian community in Boxelder Canyon, there are no wetlands in this area that stand out as having conservation value. On the other hand, these wetlands are very important collectively for wildlife, fish, possibly aquatic invertebrates, and for many of the other functions listed in Table 59. By keeping large parcels of land in their natural state (i.e., ranches), most of the wetland types in the area should support viable populations of many native species. In areas that are slated for development, every effort should be made to keep development and roads sufficiently far from wetlands (minimum 300 ft., preferably more) to not adversely impact the wetland systems.

Montane areas

The montane portions of Larimer County are largely in federal ownership, with the exception of significant amounts of small inholdings, the Red Feather Lakes area, and the Estes Valley area. The concentrated developments around Red Feather Lakes and in Estes Park have largely eliminated the possibility of sites of biodiversity significance in those immediate areas (with a few moderately significant exceptions). Small inholdings, on the other hand, may (and in some cases certainly do) contain significant elements. However, most elements known on inholdings are better represented, and in some cases protected on adjacent public land. For this reason, wetlands in the montane part of the County were given a lower level of inventory priority, following the assumption that most montane wetland types are either protected within Rocky Mountain National Park, or are under the U.S. Forest Service or Bureau of Land Management jurisdiction. Some inventory was done in this area and one site of significance was discovered. This site, the Lake Pasture Site, is the best example of a mid-montane glacial kettle pond wetland system in Larimer County and perhaps on the entire Front Range. It is the only kettle pond system visited in Larimer County (including public and private lands) that retains its natural character.

Laramie River Valley

The Laramie River Valley, including the many streams that feed the river, is the most extensive area of wetlands that retain high levels of natural character, defensibility, and viability. There exists large tracts of land under single ownership with essentially intact hydrologic regimes and well represented natural plant communities. The only significant impacts to the area

have been haying and grazing operations, neither of which, in most cases, irreversibly alters the wetlands. Although areas along the Laramie River are identified as potential conservation sites, any portion of this river would serve to represent the significant riparian wetlands of the area. The Terrace Ponds are a series of seeps and ponds in the Laramie River Valley unlike any other area in the County. The Laramie River Valley is also the only region of the County that has habitat for the globally rare and imperiled pale blue eyed grass (*Sisyrinchium pallidum*). This member of the Iris family is associated with alkaline seeps present at two known locations along Jimmy Creek (Jimmy Creek at Frenchwoman Creek and Lower Jimmy Creek Spring).

The tributaries to the Laramie River contain the best known examples of lower elevation willow carrs in Larimer County. The willow carrs emanating from the Rawah Mountains along MacIntyre Creek are good examples of these, whereas the best examples are at Nunn Creek. The Laramie River Valley above 8,000 feet elevation is the only place in Larimer County where the state rare wood frog (*Rana sylvatica*) is found.

KNOWN AND POTENTIAL WETLAND ELEMENTS IN LARIMER COUNTY

The Colorado Natural Heritage Program maintains records of the following wetland and riparian elements from the study area. This list does not necessarily represent all rare and imperiled plants, animals, and plant communities, but it is a complete list of known occurrences (CNHP 1996). While wetland protection efforts should consist of a comprehensive program incorporating consideration of all wetlands, conservation resources should be directed to these sites first, in order of their biodiversity rank.

Wetland and Riparian Plant Communities

Existing studies on plant communities (Kittel 1994, Kittel et al. 1996) as well as information in the Biological and Conservation Data System (CNHP 1996) were used to develop a preliminary list of wetland plant communities in Larimer County. This list was further developed with information gathered during field surveys. Since this study was intended to identify the wetland sites of highest conservation value, and not a classification project, we do not presume the following list of plant communities is a complete list of Larimer County wetland and riparian plant communities. Nonetheless, we think this is an accurate portrayal of the wetland and riparian plant communities present in the County.

The plant communities are presented in the context of both The Nature Conservancy hierarchical classification (Bourgeron and Engelking 1994) and the U.S. Fish and Wildlife Service's wetland classification (Cowardin et al. 1979). The U.S. Fish and Wildlife Service classification units (Palustrine system and forested, scrub-shrub, emergent, and aquatic bed classes) will be useful for anyone familiar with the National Wetlands Inventory maps that use this classification.

Table 61. Riparian and Wetland Plant Communities of Larimer County[5]

Scientific Name	Common Name	Global[6] Rank	State Rank
Evergreen Forested Riparian Communities			
Picea engelmannii / Calamagrostis canadensis	Montane riparian forests	G3	SU
Picea pungens/Alnus incana	Montane riparian forests	G3	S3
Picea pungens/Cornus sericea	Montane riparian forests	G4	S2
Deciduous Forested Riparian Communities			
Scientific Name	**Common Name**	**Global Rank**	**State Rank**
Populus angustifolia/Salix irrorata	Foothills riparian forest	GU	SU
Populus angustifolia/Alnus incana	Montane riparian forest	G?	S?
Populus angustifolia/Prunus virginiana	Montane riparian forest	G2?	S1?
Populus angustifolia/Salix exigua	Montane riparian forest	G3	S3
Populus angustifolia/ Symphoricarpos rotundifolia	Montane riparian forest	GU	SU
Populus deltoides/Bromus inermis	Plains cottonwood riparian woodland	Human Induced	
Populus deltoides-(Salix amygdaloides) / Salix exigua	Plains cottonwood riparian woodland	G2G3	S2S3
Populus deltoides/Distichlis spicata	Plains cottonwood riparian woodland	G2	S2
Deciduous Scrub-Shrub Communities			
Alnus incana/Equisetum arvense	Montane riparian shrubland	G3	S2S3
Salix drummondiana/Mesic forb	Montane riparian shrubland	G3	S3
Salix exigua/Barren soil	Low-elevation riparian shrubland	G5	S5
Salix geyeriana-S. monticola/ Calamagrostis canadensis	Montane riparian shrubland	G2	S2
Salix geyeriana/Carex utriculata	Montane willow carr	G5	S2
Salix lasiandra ssp. *caudata*	Riparian slough shrubland	GU	SU
Salix monticola/ Calamagrostis canadensis	Montane willow carr	GU	SU
Salix planifolia/ Carex aquatilis	Montane willow carr	GU	SU
Salix planifolia/ Calamagrostis canadensis - Carex aquatilis	Montane willow carr	G2G4	S2S4

[5] Plant communities have no federal or state status, so these are not indicated in the tables below.
[6] Global Rank and State Rank are defined in the section on Natural Heritage Methodology,p 220.

Table 61. Riparian and Wetland Plant Communities of Larimer County (continued).

Palustrine Emergent Communities			
Scientific Name	**Common Name**	**Global Rank**	**State Rank**
Calamagrostis canadensis	Montane wet meadows	GU	SU
Caltha leptosepala-Sedum rhodanthum	Montane wet meadows	GU	SU
Carex nebrascensis	Low elevation wet meadows	G4	SU
Carex simulata	Wet meadows	G3	S3
Carex utriculata	Montane wet meadows	G5	S3
Catabrosa aquatic--Mimulus glabratus	Spring wetland	GU	SU
Distichlis spicata var *stricta*	Low elevation salt meadows	G4	S3
Eleocharis palustris	Emergent wetland (marsh)	G5	S4
Eleocharis quinqueflora--Triglochin spp.	Alkaline spring wetland	GU	S2
Glyceria borealis	Emergent wetland (marsh)	G3	S2
Juncus balticus	Wet meadows	G4G5	SU
Nuphar polysepala	Floating/submergent wetlands	G4	SU
Phalaris arundinacea	Wet meadow	Human induced	
Polygonum amphibium	Floating/submergent wetlands	GU	SU
Scirpus maritimus	Emergent wetland (marsh)	G4	SU
Scirpus pungens	Emergent wetland (marsh)	GU	SU
Scirpus tabernaemontanii--Scirpus validus	Emergent wetland (marsh)	GU	SU
Sparganium angustifolium	Floating/submergent wetland	GU	SU
Sparganium emergsum	Floating/submergent wetland	GU	SU
Typha latifolia	Emergent wetland (marsh)	G5	S4
Aquatic Bed Communities			
Potamogeton natans	Floating/submergent wetlands	GU	S1
Potamogeton pectinatus	Floating/submergent wetlands	GU	S4
Utricularia vulgaris	Floating/submergent wetlands	GU	S2

Rare and imperiled wetland plants

Wetlands in Larimer County provide habitat for many rare and imperiled plants (Table 62). Only a few of these species are currently or were historically known to occur on private lands (see Table 62). These species were the focus of inventory efforts for both the wetlands work and for the GOCO funded County-wide inventory. Most of the Larimer County wetland plant species are known only from federal and state lands (mostly National Park and National Forest lands, see Table 62). No new occurrences of these species were found. These species are included on the list because they may occur in montane and subalpine wetlands on private lands within the matrix of federal lands.

CNHP found new occurrences for only one of these species (pale blue eyed grass, *Sisyrinchium pallidum*). This species's global distribution includes only central Colorado and southern Wyoming. Larimer County has three known occurrences of this species, all in the Laramie River valley. This species is considered imperiled because of its limited distribution and its need for a particular type of wetland.

For the following plant species known historically in Larimer County, CNHP did not re-discover any occurrences: sweetflag (*Acorus calamus*), lavender hyssop (*Agastache foeniculum*), and Colorado butterfly weed (*Gaura neomexicana* ssp. *coloradensis*). Pockets of these species may still exist, or all three species may now be extinct in Larimer County due to alteration of hydrology, development, and/or over-grazing of wetlands.

Only one plant species in Larimer County, the Ute ladies's tresses orchid (*Spiranthes diluvialis*), receives protection under the federal Endangered Species Act. This species is listed as Threatened. Only one location of this plant is known in Larimer County. No new locations were found during this survey. This species has been documented in Montana, Nevada, Utah, and Wyoming.

Table 62. Rare and imperiled wetland plants of Larimer County, including public and private lands.

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Acorus calamus [H]	Sweet flag	G5	S1			
Agastache foeniculum [H]	Lavender hyssop	G4G5	S1			
Botrychium hesperium [P]	Western moonwort	G3	S2			
Botrychium lanceolatum [P]	Lance-leaved moonwort	G5T4	S2			
Botrychium lunaria [P]	Moonwort	G5	S2			
Carex diandra [P]	Lesser pannicled sedge	G5	S1			
Carex lasiocarpa [P]	Slender sedge	G5	S1			
Carex limosa [P]	Mud sedge	G5	S2			
Carex livida [P]	Livid sedge	G5	S1			FS
Carex peckii [P]	Peck sedge	G4G5	S1?			
Carex saximontana [H]	Rocky mountain sedge	G5	S1			
Comarum palustre [P]	Marsh cinquefoil	G5	S1S2			
Eustoma russellianum	Showy prairie gentian	G5	S3			
Gaura neomexicana ssp. *coloradensis* [H]	Colorado butterfly weed	G4T2	S1	C		FS
Isoetes echinospora [P]	Spiny-spored quillwort	G5	S2			
Juncus tweedyi [P]	Tweedy rush	G3G5	S1			
Juncus vaseyi [P]	Vasey bulrush	G3G5	S1			
Listera borealis [P]	Northern twayblade	G4	S2			
Listera convallarioides [P]	Broad-leaved twayblade	G5	S2			
Parnassia kotzebuei [P]	Kotzebue grass-of-parnassus	G4	S1			
Salix candida [P]	Sageleaf willow	G5	S2			
Salix serissima [P]	Autumn willow	G4	S1			FS
Sisyrinchium pallidum	Pale blue-eyed grass	G2G3	S2			
Spiranthes diluvialis	Ute ladies' tresses	G2	S2	LT		
Subularia aquatica [P]	Waterawlwort	G5	S1			FS
Viola selkirkii [P H]	Selkirk violet	G5?	SH			

[P] = This species occurs primarily on public land in the montane, subalpine, or alpine.
[H] = This species was known to occur in the study area in the past, but no existing populations are currently known.

Rare and imperiled mammals associated with wetlands

No rare or imperiled mammals associated with wetlands in Larimer County are known to occur on non-federal land, but one, the Preble's meadow jumping mouse (*Zapus hudsonius preblei*) is expected to occur in the County. This mouse has been found both south and north of Larimer County, in Boulder County and in Laramie County, Wyoming. Preble's meadow jumping mouse lives primarily in riparian wetland habitats with good shrub structure. Three thousand trap nights targeting the mouse in seemingly appropriate habitat yielded no new discoveries. Locations of this mouse, as with most rare species, are difficult to predict. The most likely location for the species is along perennial streams and rivers from the base of the foothills to the eastern edge of the County. The riparian areas of both the Cache la Poudre and Big Thompson Rivers are both possible locations of the mouse, providing another reason why the entire floodplains of these waterways should be considered for protection.

The pygmy shrew (*Sorex hoyi montanus*) lives in wetlands and meadows in subalpine forests. It may occur in higher elevation private inholdings within national forest lands.

Table 63. Rare and imperiled mammals associated with wetlands in Larimer County.

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Sorex hoyi montanus [P]	Pygmy shrew	G5T2T3	S1			FS
Zapus hudsonius preblei [H]	Preble's meadow jumping mouse	G5T2	S2		SC	FS

[P] = This species occurs primarily on public land in the montane, subalpine, or alpine.
[H] = This species was known to occur in the study area in the past, but no existing populations are currently known.

Rare and imperiled amphibians of Larimer County wetlands

Two amphibians of concern are found in Larimer County (Table 64). The boreal toad (*Bufo boreas boreas*) is listed Endangered in Colorado by the Colorado Division of Wildlife, and the wood frog (*Rana sylvatica*) is listed Threatened. These listings by the Division of Wildlife indicate that capturing or handling this species requires a special permit, but they have no implications for land management. The boreal toad is a candidate for listing under the federal Endangered Species Act.

Both of these amphibians are generally found above 8,000 ft. (Livo 1995), although the wood frog is occasionally found lower. Most known occurrences of these species are on federal land, but it can be expected in ponds and lakes on private inholdings in the matrix of federal lands above 8,000 ft.

According to Pettus (1993), northern leopard frogs (*Rana pipiens*) were formerly common in the Fossil Creek Reservoir area. Presently no confirmed locations of this amphibian are registered with the CNHP. The species is still relatively common, but it has experienced major population declines in some areas (Jankovsky-Jones 1996, Pettus 1993). The cause of these population declines, which have occurred for many amphibians, is not yet known. Presently, the best option for protection of these species is to protect breeding habitat, especially high quality wetlands within its range and the adjacent non-breeding areas.

Table 64. Rare and imperiled amphibians of Larimer County wetlands.

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Bufo boreas	Boreal toad	G5T2Q	S1	C	E	FS

	(southern rocky mountain population)					
Rana sylvatica	Wood frog	G5	S3	-	T	FS
Rana pipiens	Northern leopard frog	G5	S3	-	SC	FS

Rare and imperiled fish

Six rare or imperiled fish are known to occur in Larimer County (Table 65). Only one--a subspecies of the greenback cutthroat trout (*Oncorhynchus clarki stomias*)--is globally imperiled. The greenback cutthroat is listed as Threatened under the federal Endangered Species Act and listed as Threatened in Colorado by the Division of Wildlife. This fish inhabits cool montane streams and rivers. In Larimer County it is known almost exclusively from streams and lakes on public land, but it may occur in streams that traverse inholdings of private land. The most important factor in the decline of this species is the introduction of non-native fish, specifically rainbow, brook, and brown trout. Habitat alteration from development, heavy grazing, etc. has also been a factor in the decline.

The remaining five fish are considered state rare or imperiled, most of them are listed as species of concern by the Colorado Division of Wildlife. These fish live in a variety of habitats at low elevations, mostly east of the foothills. The largest concentration of these fish live in the Cache la Poudre and in the Big Thompson Rivers. Several occurrences of these fish are also known from smaller streams. Several factors have likely influenced the decline of these species in Colorado, including habitat alteration, water quality declines, and changes in the natural flow regimes of streams and rivers.

The wetlands in the floodplain along the major rivers that run through the southeast portion of the County may play an important role in sustaining the populations of these fish. Wetlands provide organic input as food, shelter from heat and predators, temperature regulation, and breeding habitat for some species. These fish are one of many reasons that wetlands along the length of both of these major rivers and their larger tributaries should not be destroyed.

Table 65. Rare and imperiled fish of Larimer County.

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Etheostoma exile	Iowa darter	G5	S2		SC	
Etheostoma nigrum	Johnny darter	G5	S3			
Fundulus sciadicus	plains topminnow	G4	S2	(C2)	SC	FS
Hybognathus hankinsoni	brassy minnow	G5	S3			
Notropis cornutus	common shiner	G5	S2		SC	
Oncorhynchus clarki stomias [P]	greenback cutthroat	G4T2	S2	LT	T	

[P] = This species occurs primarily on public land in the montane, subalpine, or alpine.

Rare and imperiled wetland and aquatic invertebrates of Larimer County

Fourteen rare and imperiled invertebrates associated with wetlands are known to occur in Larimer County. This group includes butterflies and moths (order Lepidoptera), dragonflies and damselflies (order Odonata), and one bivalve (*Anodonta grandis*, order Unionoida). Most occur at low elevations, mostly in the foothills and on the plains. They are found occasionally in and near streams (perennial and intermittent), rivers, lakes, and reservoirs. Certain butterflies and

moths depend on wetlands because their larvae feed on wetland plants, especially species of sedge (*Carex*). For many species of moth and butterfly, such as the smoky-eyed brown butterfly which has historically been found along the Cache la Poudre River, we do not know which species of plant(s) they depend upon. Therefore protecting intact wetland systems is the only way to work towards species protection. Dragonflies and damselflies depend directly on emergent and aquatic wetland plant communities for reproduction, shelter, and support of much of their food base. The requirements of the bivalve are not known.

As with the native fish, the distribution and in many case the precise requirements for their survival are poorly known. The best way to insure their continued survival in the County is to maintain natural wetland ecosystems wherever possible, strive to maintain high levels of water quality in County surface waters, and limit the spread of invasive wetland plant species (especially purple loosestrife *Lythrum salicaria*).

Table 66. Rare and imperiled wetland and aquatic invertebrates of Larimer County.

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status	Federal Sensitive
Aeshna eremita	lake darner (Odonata)	G5	S1?			
Anodonta grandis	giant floater	G5	S1			
Archilestes grandis	great spreadwing	G5	S3			
Boloria selene sabulocollis	sandhill fritillary	G5T2	S1S2			
Celastrina sp. 1	hop-feeding azure	G2	S2			
Coloradia luski	a buckmoth	G?	S1?			
Cordulia shurtleffi [P]	American emerald	G5	S1?			
Enallagma basidens	double-striped bluet	G5	S1			
Euphilotes rita coloradensis	Colorado blue	G4T2T3	S2			
Euphyes bimacula	two-spotted skipper	G4	S1			
Satyrodes eurydice fumosa	smoky eyed brown butterfly	G5T3T4	S1			
Somatochlora hudsonica [P]	Hudsonian emerald	G5	S2S3			
Somatochlora minor	ocellated emerald	G5	S1			
Sympetrum vicinum	yellow-legged meadowfly	G5	S?			

[P] = This species occurs primarily on public land in the montane, subalpine, or alpine.

Rare And Imperiled Wetland Associated Birds

Seven rare or imperiled wetland associated birds are known or strongly suspected to breed in Larimer County. All but one, the great blue heron (*Ardea herodias*) are known from three or fewer locations. The great blue heron is known to breed in at least eight distinct locations. Note that for most migratory birds CNHP records only breeding locations; migratory birds are otherwise too unpredictable in their locations. However, the Natural Heritage Program does track predictable locations of migratory birds such as winter roosts of bald eagles and staging areas for greater sandhill cranes.

Despite the focus on predictable locations, it should be clearly recognized that many bird species depend heavily on wetlands if only for nourishment during their long migrations. A recent riparian restoration project along the Cache la Poudre River shows how appropriate wetlands can attract many species of birds. However, compared to historic levels, few wetlands in Larimer County provide appropriate resting, feeding, and nesting habitat for dependent species. Schroeder (1993) states that fifteen species listed as Species of Special Concern in Colorado by the Colorado Wildlife Workshop (Winternitz and Crumpacker 1985) use wetlands around Fossil Creek Reservoir. A U.S. Fish and Wildlife Service planning document (1987) lists non-game birds of management concern, due to declining or small populations, or dependence on restricted habitats. The first contains 30 total species, of which four occur in the Fossil Creek area (Schroeder 1993).

Table 67. Rare and imperiled wetland associated birds of Larimer County

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status	Federal Sens.
Ardea herodias	great blue heron	G5	S3B, SZN			
Butorides striatus	green heron	G5	S3B, SZN			
Dolichonyx oryzivorus	bobolink	G5	S3B, SZN			
Grus canadensis tabida	greater sandhill crane	G5T4	S2B, S4N		T	FS
Haliaeetus leucocephalus	bald eagle	G4	S1B, S3N	LT	T	
Himantopus mexicanus	black-necked stilt	G5	S3B, SZN			
Nycticorax nycticorax	black-crowned night heron	G5	S3B, SZN			
Pandion haliaetus	osprey	G5	S1B, SZN			FS

METHODOLOGY FOR WETLAND AND RIPARIAN AREA SURVEY

Some of the information in this section repeats the methodology for the county-wide natural heritage inventory. The approaches to surveys in wetlands vary in some ways from other surveys, however, so the wetland methodology is explicitly stated here.

Survey Site Selection

Initial site selection was accomplished by examining available maps and aerial photographs of the County combined with automobile tours through the entire County to ascertain aerial photo signatures. High-altitude color infrared photo's were used, in conjunction with U.S. Fish and Wildlife Service National Wetland's Inventory base maps and U.S.G.S. topographic maps of comparable scale (1:24,000), to distinguish areas worthy of field survey. A flight over the entire County was provided by the non-profit organization Project Lighthawk; this flight provided an opportunity to view the entire county as a whole, and to exclude inferior site included during the photo interpretation, and to include high quality sites that were missed. Existing known locations of elements also guided site selection.

The main goal driving site selection was to visit the best examples of all the different wetland types in Larimer County. Wetlands *per se* are not classified, but the plant communities in each wetland and riparian system are classified. Plant communities reflect the broader nature of the wetlands in the study area (i.e., willow carr, sedge meadow, etc.), while also reflecting the local nature of the wetlands in Larimer County. Most other classifications applied to wetlands in Colorado and across the nation (including the classification used for mapping purposes in Larimer County) classifies wetlands based mainly on the physiognomy (structure) of the vegetation. Unfortunately, these structural classes can be applied across virtually all wetlands, and they generally do not reflect the importance or singularity of Larimer County's wetlands.

Having mapped known locations of elements and identified the range of wetland types in the county, survey site selection was based upon: 1) overall size and complexity (i.e., vegetation structure and/or composition) of the wetland; 2) land-use on and around the site, including grazing, development, agriculture, etc. and considering also roads, buildings, and other structures; and 3) apparent hydrologic modifications, including proximate irrigation canals the probable extent of human-induced modification and/or disturbance. One hundred and sixty-five wetland/riparian sites were identified as Targeted Inventory Areas (TIAs).

Site Assessments

Site assessments included assessments of the natural heritage elements at the site, and a wetland function assessment. Site visits and assessments were conducted on three levels as follows:

1) Roadside or adjacent land assessment: Many of the sites initially identified during the Target Inventory Analysis could be viewed at a distance from a public road or from adjacent, easily accessible public land. While on the ground the field scientist can see, even from a distance, many features not apparent on maps and aerial photos. The majority of the sites selected during the TIA analysis were rejected from consideration as potential conservation sites without even requesting an on-site visit because the roadside assessment indicated excessive landscape alteration in terms of heavy grazing, major hydrologic alterations, excessive weed cover (especially noxious weeds), or new construction that greatly affects the wetland. Sites with these characteristics were immediately rejected as potential conservation sites. No extensive data were gathered at these sites.

2) On-site assessments: This was the preferred method, the only assessment technique that can yield high-confidence statements concerning the known or potential presence of rare and imperiled elements or excellent examples of common plant communities. On site assessments are also the most resource intensive because they require landowner contact and intensive field efforts. In several cases where on-site assessments were desired, they could not be conducted either because the field crews were denied access to the property by the landowner, or we were unable to contact the landowner in the available time.

3) Off-site assessments. This is the least preferred method because of the low confidence in the results. In cases where access to a property is not possible, off-site assessments are made when there are indications that the site contains an element or a good example of a natural community. Off-site assessments general include intensive analysis of aerial photos, surveys of the property from the nearest publicly accessible point, aerial flyovers, survey of similar sites on nearby public land, and assessment of existing data in the Biological and Conservation Data Base (BCD).

For the sites that were visited, the following general information was noted:

- A sketch of the site layout, with distribution of community types indicated. This was generally done on the 7.5' USGS topographic map, but occasionally for clarity a separate map was drawn on the site survey form.
- elevation (from 7.5 min. USGS topographic maps).
- current and historic land use (e.g., grazing, logging, recreational use) when apparent.
- notes on geology and geomorphology.
- reference photos of the site.
- signs of disturbance such as logging, grazing, flooding, etc.
- a list of elements known or expected from the site, and notes on their status.

The treatment of the various wetland elements present in Larimer County and the wetland function assessment are described below.

Plant communities

Plant communities, as detailed indicators of the varied types of wetlands present in Larimer County, were the main focus of this survey. The plant community is a collection of plants that often grow together in response to complex environmental factors. The plant community is a useful indicator of wetland attributes that may be difficult to measure or poorly understood. Plant community level conservation promotes conservation efforts beyond the individual species, to include processes as well as biotic element that are little known or poorly understood (for example, invertebrate species).

Because plant communities are such useful integrators of site conditions, the TIA analysis attempted to identify potential sites for the full range of plant communities present in the study area. A moderate amount of information about riparian and wetland communities associated with streams and rivers was already present in the BCD, but little information was available about wetlands not associated with riparian areas. CNHP did have available information from plant communities in other parts of Colorado, in Wyoming, and elsewhere that had the potential to occur in Larimer County. When visiting a site, the following information about plant communities was gathered:

- a list of all plant communities in the wetland complex, including the amount of wetland area covered by that community. In almost all cases, plant communities were immediately placed in the existing classification. However, on rare occasion a plant community was encountered that could not be easily classified based on stands sampled previously.
- Vegetation data for each major plant community in the wetland were collected using rough ocular estimates in a representative portion of the plant community.
- hydrologic information, including water source and hydroperiod (i.e., perennially flooded, seasonally saturated, etc.).
- soil descriptions based on a shallow pit or an augured sample within each plot. Thickness, texture (via hand-texturing), color, mottling/gleying, structure, matrix color, coarse fragments, and parent material when possible were noted for each soil horizon.
- notes on unusual features, alkali deposits, unusual microtopography, beaver activity, etc.

For every site where an element occurrence was located, the above information was entered into the BCD.

Plants

Most rare and imperiled wetland plants of Larimer County that are known occur in montane and subalpine areas, which consist of mostly public land (i.e., mostly federal land) (see Table 62). Locations of the few plant species that do occur in the areas targeted during this study are very difficult to predict. The CNHP focuses on high quality occurrences of elements, so most degraded or highly altered sites are not even included in the inventory. However, some elements (e.g., Ute ladies' tresses orchid - *Spiranthes diluvialis*) are known to occur in sites that have been highly altered hydrologically and by weeds. Given limited resources to cover a wide range of wetland elements, it was impossible to inventory all potential sites for wetland plants. These plants were therefore searched for in all wetlands visited, but it is conceivable that some occurrences were not found. Only two new sites of a rare and imperiled wetland plant were found. Several historic occurrences were considered extirpated based on simply roadside assessments. Known sites for a globally rare plant (*Spiranthes diluvialis)* and a state rare plant (*Eustoma russellianum*) were confirmed.

Animals

Given limited resources and the scope of the task, animal elements were not targeted as part of the wetland survey. Nonetheless, some new animal element locations were discovered in the course of the wetland survey, including one or more new locations for wood frogs, greater sandhill cranes, and great blue herons.

As part of the general county inventory, attempts were made to locate new locations of Preble's meadow jumping mouse. Although this species was formerly captured along the Cache la Poudre River, no Larimer County locations are currently known, and no new locations were found during this study.

Although animal inventory was limited, considerable animal information was considered and incorporated into the assessment of Larimer County wetlands. We relied on the Biological and Conservation Data System for the locations of these elements. Information about the elements and their locations has been provided to CNHP from a variety of sources including past biological surveys (for example, studies done by graduate students), museum records, anecdotal information, and information from the Colorado Division of Wildlife given to CNHP under a cooperative agreement funded by Great Outdoors Colorado.

Since no globally rare wetland associated animals are known to occur in Larimer County, no animal locations drive the biodiversity rank of any site. However, several sites do contain state rare elements. A few sites contain concentrations of these elements.

Function and Value Assessment

Function and value assessment was based on Cooper (1988), which employed a modified methodology developed by Adamus and Stockwell (1983). Cooper's methodology was modified slightly to place it more in line with Adamus's modified methodology, known as the Wetland Evaluation Technique (W.E.T.; Adamus et al. 1987). The function and value assessment rates eleven functions performed by each wetland. It also rates the confidence in the assessment of each function as high, medium, or low. For example, a wetland that looks like it provides good wildlife diversity and abundance may be rated high because it has good, diverse plant growth, plentiful shelter and food sources. However, if no direct signs of wildlife were seen (e.g., sightings, scat, prints) then the confidence would be rated 'b' because we were not certain the wildlife were present in the good habitat.

The technique developed by Adamus et al. (1987) has not been adequately regionalized to local conditions in the western United States, but the method does provide an accurate framework for evaluating wetland functions. The ratings, however, are base on the Best Professional Judgment of wetland ecologists from the Colorado Natural Heritage Program. The wetland characteristics included in the function and value assessment are described in Appendix 1.

The ratings for each function are not based on quantitative data, and only a limited amount of data on these functions is available. Some of the functions (e.g., groundwater recharge) are very difficult to assess accurately in a rapid manner. Also, the scientific understanding of many of these functions as performed in the Rocky Mountains is based on sparse and disparate data from many sources, often for eastern or Pacific Coast wetlands. In performing this study we were aware of these limitations, but we are confident that the function and value assessments as presented provide a solid foundation on which to base wetland protection efforts.

Absolute assessments of the functions of Larimer County wetlands can be known only after extensive (generally multi-year) data has been collected at a site. County government is encouraged to support such research efforts. Such research may be possible as reference sites are developed for the hydrogeomorphic approach to wetland function assessment.

Mapping

The Larimer County planning department already has a complete copy of the U.S. Fish and Wildlife Service's National Wetlands Inventory maps. These maps are useful from a general planning perspective (they allow planners to see the distribution of wetlands in a given area). Unfortunately, the NWI maps for Larimer County were done at a time when black and white photos were used. For certain wetland types (e.g., wet meadows) it is difficult to ascertain the presence or lack of presence of a wetland from black and white photos. As a result, these maps should be used for general planning, trend analysis, and related tasks. In areas of intensive development, detailed maps created using true color or color infrared aerial photos should be developed. This type of work was done by Cooper and Merritt in the PLUS area. Regardless of the type of general wetland mapping, jurisdictional boundaries (precise wetland boundaries, as defined by the U.S. Army Corps of Engineers) can be identified only on the ground on a project by project basis.

It was not the intent of this project to map wetland boundaries. Where approximate wetland boundaries were desired, we referred to existing maps, as described above. We did concern ourselves with mapping sites. The mapped site boundaries in profiled sites indicate the area we believe is necessary to adequately protect the element at the site. The total area covered by wetlands designated as sites was determined by using a planimeter (a mechanical device used to calculate area on a map). For all sites stated areas should be interpreted as only approximate.

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APPENDIX 1. WETLAND FUNCTIONS AND THEIR INDICATING CHARACTERISTICS

This appendix contains descriptions of the wetland functions evaluated during this study, a list of important indicators of each function, and the actually evaluations for the important wetland sites profiled earlier in this report (B2 and B3 sites, as well as B4 and B5 wetland sites). The information on wetland functions is taken largely from Adamus et al. (1991) and Cooper (1988).

Ground Water Recharge

Groundwater recharge is the (usually downward) movement of surface water into the groundwater system. Ground water recharge is important for maintaining the underground aquifer levels. All wells, including agricultural, commercial, and residential depend on the level of this aquifer. The underground aquifer may also support other wetlands at a distance, and provide water for natural springs (and artesian wells). The ground water discharge function is a very difficult function to estimate in a single visit, although there are several indicators of ground water recharge. They are:

- Porous underlying strata. Ground water moves best through coarse sands or gravels and successively more slowly through organic soils (peats) and clays.
- A densely vegetated basin that slows movement of water.
- A constricted outlet, such a dam occurring on the waterway at the wetland location
- Surface water inflow greater than surface water outflow. This is sometimes quite obvious where a stream disappears beneath coarse sediments in the stream bed, but otherwise it is difficult to assess.
- Location high in the basin or in a "perched" situation above the water table.
- Wetland is irregularly shaped with high wetland edge to wetland area ratio

Ground Water Discharge

Groundwater discharge is the movement of ground water onto the surface (e.g., springs). This function can be difficult to assess without intensive data collection. Springs on a mountain side are obvious, easy to see discharge areas, but many groundwater discharge areas occur below the water surface, i.e., at the bottom of a stream or lake. Indicators of ground water discharge that can be seen on a single visit include:

- Wet slopes where there is not obvious surface water contribution to the wetness.
- Location low in the watershed, increasing the chances of ground water recharge above the wetland.
- Geologically diverse. Discharge areas often occur where a rock type that conducts water readily contacts a rock type that does not.
- A dam upstream, also increasing the chances of ground water recharge above the wetland.
- The basin is not dominated by fine sediments. Fine sediments can clog pores where water would otherwise discharge.

Floodflow Alteration

Flood storage is the process by which peak flows are reduced. This function includes flood de-synchronization, where potential flood waters are stored in many wetlands throughout the watershed then gradually released in a staggered manner. This function can be particularly valuable in highly developed areas, since development increases the rate of runoff from upland areas. Characteristics of wetlands that alter flood flow include:

- Location along a small stream high in the watershed.
- High water marks indicated that the size of the wetland increases greatly in floods
- The basin is large and deep.
- A low gradient.
- A substrate of porous material (e.g., cobbles) that is not permanently saturated.
- A rough surface with many small and large depressions.
- A naturally or artificially restricted outlet. Dams are well known for their floodflow alteration potential, although it is not generally recognized that this highly developed function comes at the cost of almost all other wetland functions.
- Dense vegetation, which slows the flow of water.
- High amounts of coarse woody debris on the ground.
- Not filled by development activities. Filling reduces the area available for storage.

Sediment Stabilization

Sediment stabilization refers mainly to the maintenance of soil at the water's edge or in shallow water by plant species with fibrous roots. It also includes the dissipation of erosive forces, and may include long-term accretion of sediment and/or peat. Characteristics indicating this function include:

- High vegetation density.
- Vegetation with strong, dense root masses. Woody vegetation anchors best, followed by sedges. A woody overstory and sedge understory is the best combination.
- Location along open water (lakes, rivers, and streams).

Sediment/Toxicant Retention

Sediment/toxicant retention is the process by which suspended solids and chemical contaminants attached to them are retained and deposited within the wetland. Deposition of sediments can ultimately lead to removal of toxicants through burial, chemical breakdown, or assimilation into plant tissues. Wetland characteristics indicating this function include:

- Constricted outlet. This slows or stops water and promotes settling of suspended sediments.
- Surface water input exceeds surface water output.
- Dense vegetation which slows flowing water, thus increasing chances for deposition of sediment.
- Gently sloping wetland edges.

- Deposits of mud or organic matter, indicating deposition of sediments.
- Large watershed area above the wetland, which may contribute more sediments.
- Activities above the wetland, such as construction activity or mining, that may contribute sediments to the runoff.
- Lack of bottom feeding fishes (e.g., carp), aquatic invertebrates, and birds that may re-suspend sediments.

Nutrient Removal/Transformation

Nutrient retention/transformation is the storing of nutrients within the sediment or vegetation of wetlands, the transformation of inorganic nutrients to their organic forms, and the transformation and subsequent removal of one nutrient (nitrogen) as a gas (the process is called "denitrification"). Nutrient removal/transformation involves trapping nutrients before they reach deep water, are carried downstream, or are transported to underlying aquifers. Particular attention is focused on processes involving nitrogen and phosphorus, as these nutrients are usually of greatest importance to wetland systems. Wetland characteristics indicating nutrient retention include:

- High sediment trapping function. Nutrients are often attached to sediments.
- Organic matter accumulation.
- Constricted outlet, which increases the sediment trapping capacity.
- Flooded permanently or semi-permanently (this creates reducing soil conditions which support active populations of denitrification bacteria and also minimizes the oxidation or organics which facilitates peat accumulation). Denitrification proceeds most rapidly with fluctuations between or in proximity to aerobic and anaerobic conditions.
- Presence of free-floating, emergent, and submerged vegetation.
- High net biological productivity which removes nutrients on a short-term basis. Productive woody vegetation removes nutrients for a longer term than herbaceous vegetation.
- Non-acid.

Production Export

Production export refers to the flushing of relatively large amounts of organic material (especially carbon, but may refer to other nutrients) from the wetland to downstream or adjacent deeper waters. This organic material supports the base of the food chain. For example, leaf litter from willows provides food for aquatic invertebrates which then become food for trout. The material leaving a wetland may be in the form of particulate organic matter (leaf litter), dissolved organic matter (leached from both living and dead algae and plant tissues), or even whole, mobile organisms such as insects, fish, and birds. Wetland characteristics indicating downstream food chain support include:

- An outlet.
- Non-acidic waters.
- Substrate with accumulated organic material.

- Only seasonally flooded (not permanently flooded); productivity is highest when the soil is at least occasionally aerobic.
- Dense and diverse vegetation with high sustained productivity.
- Not stagnant, which limits oxygen and nutrient availability, thus plant growth.
- Good flushing flows to wash accumulated organic material down stream.
- Vegetation overhanging the water.

Wildlife diversity/abundance

Wetland maintain habitat for many different types of wildlife, including game and non-game species. Wetlands provide food, cover, and nesting areas. Habitat that is good for one species is not necessarily good for another, so there is no single indicator of high rating for this function. Wetland characteristics that indicate wildlife diversity/abundance include:

- Good edge ratio.
- Islands, to provide protection from predators.
- High plant diversity, to provide diversity in structure and food sources.
- Large, sinuous, and irregular basin.
- No artificial water level fluctuations.
- Some open water.
- Not urban or deep water.
- Not channelized or farmed.
- Undisturbed by humans.
- Good food sources.
- Sign of several different animal species, including scat, prints, shelters.

Aquatic Diversity/Abundance

This function is performed by wetlands that have physical and chemical factors which foster the metabolism, attachment, and predator avoidance of the adult or larval forms of fish and macroinvertebrates. Wetland physical and chemical characteristics that are good for one species are not necessarily good for another species, thus there are few indicators of good habitat for aquatic animals in general. Wetland characteristics indicating good aquatic habitat include:

- Some deep, open water.
- Non-acidic, clear water.
- No barriers to migration and movement.
- Well-mixed water (with high oxygen content).
- No artificial fluctuations.
- Sufficient but not excessive nutrient supplies.
- Not subject to extreme or non-natural fluctuations.
- Cool water temperatures with some shade (overhanging vegetation or undercut banks).

Recreation

Recreation refers to recreational activities which take place in, or are dependent on wetlands. They include, but are not limited to, hunting, boating, bird watching, and fishing. Wetlands provide this function if they have:

- Convenient public access.
- Good habitat for animals and fish.
- High diversity.
- Evidence of actual use.

Uniqueness/Heritage

Wetlands support important natural heritage elements. They provide habitat for rare species, maintenance of the gene pool, protect geologically unique features, and maintenance of historic sites. Wetland characteristics indicating this function include:

- High ranked occurrence of a high-ranked element.
- Presence of rare plants or animals.
- Landscape diversity.
- Rare or unusual wetland types.
- Natural setting.

Site Evaluations

The functional evaluations for the highest priority wetland sites follow (in alphabetical order). Eleven function were evaluated on a scale from 1 to 5. One indicates that the wetland does not perform that function. Five indicates that the wetland performs the function to the highest degree. 'Confidence' indicates the certainty with which we made the judgment based on the indicators present. 'C' indicates we were very confident in our judgment. 'A' indicates that the judgment was based on weak indicators because no strong indicators were present.

Arrowhead Site

Function/Value	Rating	Confidence	Comments
Ground Water Recharge	4	b	perennial ponds help maintain low flows
Ground Water Discharge	4	c	lots of seepy areas here
Floodflow Alteration	3	b	has potential, but the ponds and basins are effectively cut off from the river
Sediment Stabilization	3	c	well vegetation pond banks, but little disturbance along these shores, low potential for stabilization compared to wetlands more directly associated with river
Sediment/Toxicant Retention	4	b	probably removes pollutants from runoff from nearby developments
Nutrient Removal/Transformation	3	c	overall not especially productive, but high opportunity
Production Export	2	c	very little outflow from this site
Wildlife Diversity/Abundance	4	c	important waterfowl migration stopover; great blue heron feeding grounds
Aquatic Diversity/Abundance	2	c	in general poor aquatic habitat
Recreation	5	c	well used by the public; valuable open space
Uniqueness/Heritage Value	4	c	*Eustoma russellianum* habitat

Ratings: 1=no; 2=low; 3=medium; 4=high; 5=very high Confidence in Rating: a=low; b=medium; c=high

Boxelder Canyon

Function/Value	Rating	Confidence	Comments
Ground Water Recharge	3	b	many pools store water; porous surface
Ground Water Discharge	2	b	no evidence seen, but very possible
Floodflow Alteration	3	b	microtopographically diverse, but narrow
Sediment Stabilization	4	c	vigorous riparian vegetation
Sediment/Toxicant Retention	4	c	much sign of sedimentation; not much opportunity for toxicant retention
Nutrient Removal/Transformation	3	c	only small strips and patches of wetland with anaerobic soils
Production Export	4	c	productive riparian plant communities and good flow through
Wildlife Diversity/Abundance	4	c	deer sign, probably much more
Aquatic Diversity/Abundance	4	c	fish seen, but species i.d. uncertain
Recreation	2	c	scenic, but access restricted
Uniqueness/Heritage Value	4	c	a good occurrence of a possible G3 community

Ratings: 1=no; 2=low; 3=medium; 4=high; 5=very high Confidence in Rating: a=low; b=medium; c=high

Brannigan Springs

Function/Value	Rating	Confidence	Comments
Ground Water Recharge	2	b	little water storage on site

Ground Water Discharge	5	c	extensive areas of strong ground water discharge
Floodflow Alteration	2	b	minimal water storage in seasonally saturated soils
Sediment Stabilization	3	c	some stabilization along small streams
Sediment/Toxicant Retention	1	b	no in flow
Nutrient Removal/Transformation	3	b	wetlands probably remove some nutrients from cattle operation
Production Export	2	b	minimal out flow
Wildlife Diversity/Abundance	2	c	watering spot for some birds and antelope
Aquatic Diversity/Abundance	2	c	little open water and virtually no aquatics
Recreation	1	c	very limited access
Uniqueness/Heritage Value	4	c	limited extent in Larimer County and along Front Range for this kind of wetland

Ratings: 1=no; 2=low; 3=medium; 4=high; 5=very high Confidence in Rating: a=low; b=medium; c=high

Cache la Poudre River at the Environmental Learning Center

Function/Value	Rating	Confidence	Comments
Ground Water Recharge	2	b	water stored in ponds may temporarily recharge adjacent groundwater
Ground Water Discharge	3	b	floodplains wetlands may contribute minimally to river in late summer and winter
Floodflow Alteration	4	c	riparian wetlands and old gravel ponds store water in spring
Sediment Stabilization	5	c	robust vegetation adjacent to river
Sediment/Toxicant Retention	4	b	riparian wetlands are very important for removing pollutants from urban areas.
Nutrient Removal/Transformation	4	c	productive riparian vegetation facilitates removal of nutrients
Production Export	4	c	productive riparian vegetation
Wildlife Diversity/Abundance	4	c	migratory stopover; nesting herons; beaver;
Aquatic Diversity/Abundance	3	c	aquatic environments are dominated by non-natives; but note the native minnows.
Recreation	5	c	much visitation; valuable open space
Uniqueness/Heritage Value	4	c	a concentration of state rare elements and potential Preble's mouse; nesting great blue heron.

Ratings: 1=no; 2=low; 3=medium; 4=high; 5=very high Confidence in Rating: a=low; b=medium; c=high

Claymore Lake--South

Function/Value	Rating	Confidence	Comments
Ground Water Recharge	3	b	reservoir likely allows recharge
Ground Water Discharge	5	c	site is driven by groundwater discharge
Floodflow Alteration	2	b	not a significant drainage
Sediment Stabilization	2	c	cattail, threesquare, and other emergents provide some shoreline stabilization
Sediment/Toxicant Retention	1	c	no surface water input
Nutrient Removal/Transformation	4	c	wetland vegetation probably removes significant amounts of nutrients, esp. from cattle
Production Export	2	b	little outflow
Wildlife Diversity/Abundance	3	c	some waterfowl use
Aquatic Diversity/Abundance	2	b	invertebrates only
Recreation	2	c	private--inaccessible; vistas from nearby public land
Uniqueness/Heritage Value	4	c	location of Ute's ladies's tresses orchid, a federally listed threatened species

Ratings: 1=no; 2=low; 3=medium; 4=high; 5=very high Confidence in Rating: a=low; b=medium; c=high

Fossil Creek Reservoir

Function/Value	Rating	Confidence	Comments
Ground Water Recharge	5	b	nearly continuous high water; very constricted outlet
Ground Water Discharge	4	b	much apparent ground water discharge on the west end of the reservoir
Floodflow Alteration	5	c	as with all reservoirs, stores water well
Sediment Stabilization	5	c	robust shoreline vegetation and much woody vegetation
Sediment/Toxicant Retention	5	b	probably plays and important in removing urban pollutants in water from Fossil Creek
Nutrient Removal/Transformation	4	b	a very productive wetland, but not very diverse
Production Export	2	c	restricted outlet retains most sediment and organic material
Wildlife Diversity/Abundance	5	c	good shorebird and waterfowl habitat
Aquatic Diversity/Abundance	2	b	apparently highly eutrophic and oxygen poor; many carp
Recreation	3	c	good for non-motorized recreation, but access is limited to the lessee.
Uniqueness/Heritage Value	4	c	large occurrence of common wetland plant communities and a concentration of state-rare birds

Ratings: 1=no; 2=low; 3=medium; 4=high; 5=very high Confidence in Rating: a=low; b=medium; c=high

Jack Springs

Function/Value	Rating	Confidence	Comments
Ground Water Recharge	2	b	little water storage on site
Ground Water Discharge	5	c	extensive areas of strong ground water discharge
Floodflow Alteration	2	b	minimal water storage in seasonally saturated soils
Sediment Stabilization	3	c	some stabilization along small streams
Sediment/Toxicant Retention	1	b	no in flow
Nutrient Removal/Transformation	3	b	wetlands probably remove some nutrients from cattle operation
Production Export	2	b	minimal out flow
Wildlife Diversity/Abundance	2	c	watering spot for some birds and antelope
Aquatic Diversity/Abundance	2	c	little open water and virtually no aquatics
Recreation	1	c	very limited access
Uniqueness/Heritage Value	4	c	limited extent in Larimer County and along Front Range for this kind of wetland

Ratings: 1=no; 2=low; 3=medium; 4=high; 5=very high Confidence in Rating: a=low; b=medium; c=high

Jimmy Creek at Frenchwoman Creek

Function/Value	Rating	Confidence	Comments
Ground Water Recharge	2	b	essentially no flow constrictions
Ground Water Discharge	4	c	strong springs on the west side of the site, although its not clear how much of this water originates in the irrigation ditch further west.
Floodflow Alteration	3	b	moderate microtopography; wide area only seasonally flooded; opportunity limited
Sediment Stabilization	3	c	moderately robust vegetation
Sediment/Toxicant Retention	3	c	not much flooding; low water retention
Nutrient Removal/Transformation	4	c	good variety within the wetland
Production Export	2	c	low productivity
Wildlife Diversity/Abundance	4	c	coyote, antelope
Aquatic Diversity/Abundance	3	b	potential habitat, but no clear signs of high diversity/abundance
Recreation	2	c	public land has no clear access; much of site private
Uniqueness/Heritage Value	4	c	a globally rare and restricted plant occurrence in fair condition.

Ratings: 1=no; 2=low; 3=medium; 4=high; 5=very high Confidence in Rating: a=low; b=medium; c=high

Lake Pasture

Function/Value	Rating	Confidence	Comments
Ground Water Recharge	2	b	may perform some recharge late in summer
Ground Water Discharge	4	c	upper edges are all recharge
Floodflow Alteration	2	b	no connection with surface waters, though does store water that would otherwise fill channel
Sediment Stabilization	3	c	wetlands stabilized shoreline
Sediment/Toxicant Retention	1	c	no surface water input
Nutrient Removal/Transformation	3	c	nutrient cycling occurring, but this is not an especially complex wetland mosaic
Production Export	1	c	no outflow
Wildlife Diversity/Abundance	5	c	breeding waterfowl; elk watering and feeding
Aquatic Diversity/Abundance	4	b	invertebrates only
Recreation	3	c	private--inaccessible but actively used for recreation.
Uniqueness/Heritage Value	4	c	this wetland type is unusual at this elevation; the plant communities present are uncommon to rare in the state; on private land this is the only example in good shape in Larimer County.

Ratings: 1=no; 2=low; 3=medium; 4=high; 5=very high Confidence in Rating: a=low; b=medium; c=high

Laporte

Function/Value	Rating	Confidence	Comments
Ground Water Recharge	2	b	water stored in ponds may temporarily recharge adjacent groundwater
Ground Water Discharge	3	b	floodplains wetlands may contribute minimally to river in late summer and winter
Floodflow Alteration	4	c	riparian wetlands and old gravel ponds store water in spring
Sediment Stabilization	5	c	robust vegetation adjacent to river
Sediment/Toxicant Retention	4	b	riparian wetlands are very important for removing pollutants from urban areas.
Nutrient Removal/Transformation	4	c	productive riparian vegetation facilitates removal of nutrients
Production Export	4	c	productive riparian vegetation
Wildlife Diversity/Abundance	4	c	migratory stopover; nesting herons; beaver;
Aquatic Diversity/Abundance	3	c	aquatic environments are dominated by non-natives; but note the native minnows.
Recreation	5	c	much visitation; valuable open space
Uniqueness/Heritage Value	3	c	a concentration of state rare elements and potential Preble's mouse.

Ratings: 1=no; 2=low; 3=medium; 4=high; 5=very high Confidence in Rating: a=low; b=medium; c=high

Nunn Creek

Function/Value	Rating	Confidence	Comments
Ground Water Recharge	5	b	many constrictions throughout the wetland system; plant communities indicate continuous high water table.
Ground Water Discharge	3	b	a few springs seen along the edge, probably much more discharge along the edge than is visible
Floodflow Alteration	5	c	2nd order stream; very complex wetland mosaic
Sediment Stabilization	5	c	robust woody vegetation; much microtopographic complexity
Sediment/Toxicant Retention	4	c	high sediment retention, but little opportunity to retain toxins
Nutrient Removal/Transformation	5	c	wetlands range from seasonally to semi-permanently to permanently saturated.
Production Export	4	c	very productive system with good but not complete flowthrough.
Wildlife Diversity/Abundance	5	c	excellent: moose, deer, beaver, waterfowl, amphibians, etc.
Aquatic Diversity/Abundance	5	c	many fish seen
Recreation	2	c	limited access, but horse packing to some adjacent USFS land
Uniqueness/Heritage Value	4	c	best occurrences of these willow communities in Larimer County; state rare kettle pond communities; one small rare alkaline seep plant community.

Ratings: 1=no; 2=low; 3=medium; 4=high; 5=very high Confidence in Rating: a=low; b=medium; c=high

Sand Creek

Function/Value	Rating	Confidence	Comments
Ground Water Recharge	4	b	generally highly restricted soils
Ground Water Discharge	2	b	probably some discharge along edges of the wetland
Floodflow Alteration	4	c	very high microtopography; wetland is relatively high in the watershed
Sediment Stabilization	5	c	very robust, secure vegetation
Sediment/Toxicant Retention	4	c	much sediment deposition, but low opportunity for toxicant retention
Nutrient Removal/Transformation	5	c	high diversity in wetland from shrubland to wet meadow to mesic meadow; water levels fluctuate considerable across year
Production Export	4	c	very high productivity; somewhat constricted flow through
Wildlife Diversity/Abundance	5	c	moose, beaver, sandhill crane, etc.
Aquatic Diversity/Abundance	3	b	high macroinvertebrate numbers; no fish seen and poor breeding habitat, but otherwise good potential fish habitat
Recreation	3	c	important open space for local landowners
Uniqueness/Heritage Value	4	c	both common and uncommon plant communities in fair to good condition, plus a nesting greater sandhill crane.

Ratings: 1=no; 2=low; 3=medium; 4=high; 5=very high Confidence in Rating: a=low; b=medium; c=high

Terrace Ponds

Function/Value	Rating	Confidence	Comments
Ground Water Recharge	2	b	appears mostly discharge
Ground Water Discharge	4	c	water discharge site occurring across the site
Floodflow Alteration	2	b	retains limited amounts of water in the basins (ponds)

Sediment Stabilization	4	c	robust vegetation on at least one pond offers good shoreline protection
Sediment/Toxicant Retention	2	c	little surface input
Nutrient Removal/Transformation	3	b	limited surface input; perennially saturated
Production Export	2	c	very little outflow
Wildlife Diversity/Abundance	4	c	waterfowl; probably shorebirds
Aquatic Diversity/Abundance	3	b	probably abundant macroinvertebrates
Recreation	1	c	no access
Uniqueness/Heritage Value	4	c	two state rare wetland plant communities; best occurrence of these communities in Larimer County

Ratings: 1=no; 2=low; 3=medium; 4=high; 5=very high Confidence in Rating: a=low; b=medium; c=high

APPENDIX 2. SAN MIGUEL COUNTY LAND USE ORDINANCES GOVERNING WETLANDS

EXCERPTED FROM SAN MIGUEL COUNTY LAND USE CODE
(As Amended Through April 12, 1994)

SECTION 5-22: WETLAND AREAS

5-2201 General

This section of the Code establishes standards for the protection and restoration of wetland areas.

5-2201 A. Purpose

This Section 5-22 is established to regulate development in wetland areas of San Miguel County to protect wetland areas and to protect the health, safety and welfare of the inhabitants of the County. These regulations seek maximum protection of wetland areas and all waters of San Miguel County by avoiding development activity whenever possible, minimizing unavoidable adverse development activity and mitigating the impacts of development on wetland areas.

5-2201 B. Applicability

This Section 5-22 applies to all wetland areas and wetland area buffer zones, and to all waters of San Miguel County. This Section does not repeal, abrogate, or impair any existing federal, state, and/or local laws, easements, covenants, or deed restrictions. However, where this Section imposes more restrictive regulations than those otherwise imposed, the provisions of this Section shall prevail. The provisions of this Section do not apply to normal and customary agricultural and ranching activities, including sale, transfer or conveyance of irrigation water.

5-2201 C. Definitions

I. "Buffer Zone" shall mean all areas where development could impact wetland areas, extending at least 100 feet around wetland areas.

II. "Mitigation plan" means a plan approved by San Miguel County describing the restoration of wetland areas destroyed or otherwise negatively impacted by an activity.

III. "Restoration" means a human activity that returns wetland areas from a disturbed or altered condition with lesser wetland area acreage and/or functional values to a previous condition with greater wetland area acreage and/or functional values.

IV. "Waters of San Miguel County" means all waters, including without limitation, lakes, rivers, streams (including intermittent streams), natural sloughs, wet meadows, natural ponds, impoundments and tributaries. Waste treatment systems presently in use, including treatment ponds and lagoons designed to meet the requirements of the Clean Water Act (33 U.S.C. § 1341), treated water distribution and storage facilities or treated water that otherwise meets the criteria of this definition, and water used for irrigation purposes are not waters of San Miguel County.

V. "Wetland" means an area inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation. Wetland areas include all waters of San Miguel County, all riparian areas in the County, and are presumed to include all areas identified in "An Ecological Characterization and Functional Evaluation of Wetlands in the Telluride Region of Colorado" (a 1990 report completed for the U.S. Environmental Protection Agency by David J. Cooper), including any amendments thereto, and any wetland areas in the County identified on wetland area maps filed in the County Planning Department.

5-2202 Wetland Area Mapping

5-2202 A. Adoption of Wetland Maps

Wetland maps are hereby adopted and may continue to be adopted and modified by Board of Commissioners resolution as part of this section, and shall remain on file in the San Miguel County Planning Department. The maps shall serve as guides only; all wetland areas must be verified on the ground. Wetland areas not shown on the maps but verified on the ground shall be protected as fully as mapped wetland areas.

5-2202 B. Modification of Wetland Area Boundaries

A potential developer shall have the burden of showing that any area delineated on County wetland maps and/or on accompanying reference material should not be classified as a wetland. Wetland boundaries may be modified at the potential developer's expense through the performance of a wetland boundary determination by

an expert wetland consultant and established on a plat executed by a Colorado licensed surveyor using the wetland definition in Section 5-2201 C.

5-2202 C. Boundary Modification Application Review

A potential developer desiring to modify a wetland and/or buffer zone boundary must submit an application for such modification to the County for review under the Two-step Process described in Section 3-6 of this Code. If such application is not approved by the Board of Commissioners, the applicant and the Board of Commissioners may attempt to set mutually agreeable wetland area and/or buffer zone boundaries, relying on the services of an expert wetland consultant and, if necessary, a Colorado licensed surveyor, approved by the Board of Commissioners and paid for by the applicant.

5-2203 Development in Wetland Areas

5-2203 A. Two-Step Special Use Permit Review

A potential developer desiring to develop within a wetland or within 100 feet of a wetland must submit an application for approval of such activity to the County for review under the Two-step Special Use Permit Process described in Section 3-6 of this Code. However, when such proposed development comprises construction of access, utilities and/or a home or homes on parcels final platted or otherwise legally created prior to June 4, 1992, such application shall be reviewed in accordance with the Administrative Review Process described in Section 3-4 of this Code. No development activity shall be allowed within any wetland or buffer zone without a Wetland Special Use Permit issued in compliance with the terms of this section. All activities that are not permitted by Special Use Permit shall be prohibited.

5-2203 B. Issuance of Wetland Special Use Permits

A Wetland Special Use Permit may be issued only if the applicant has shown at least one of the following:

I. The proposed activity is water-dependent;

II. The proposed activity is necessary to achieve access to property, and no other access route avoiding wetland and buffer zone areas is technically feasible;

III. Denial of the permit sought would result in denying the land owner all practical, reasonable and/or economically viable use of the subject property;

IV. The proposed activity meets the definition of Essential Services in Article 6 of this Code and could not reasonably be located elsewhere; and

V. In the case of development proposed solely in a buffer zone, the proposed land use would not adversely affect the adjacent wetland area.

5-2203 C. Criteria for Review of Wetland Special Use Permits

In reviewing applications for Wetland Special Use Permits, the Board of Commissioners shall apply the following criteria:

I. Avoidance -- Development activity within a designated wetland area should be avoided whenever possible; and

II. Minimization of Impacts -- The impacts of unavoidable development activity should be minimized by including appropriate project design modifications, control techniques or other conditions deemed appropriate by the County.

5-2203 D. Impact Mitigation for Wetland Uses and Activities

As a condition of Wetland Special Use Permit approval, or in the event of a violation of any terms in this Section 5-22, the Board of County Commissioners may require a mitigation plan. The plan shall require the applicant or developer to engage in the restoration of wetland areas in order to offset, in whole or in part, the wetland losses resulting from an applicant's proposed or violator's historic actions. Approval of such plan by the Board of Commissioners shall not constitute an alternative to compliance with the standards set forth in this Section 5-22.

5-2203 E. Submission Requirements

An applicant for a wetland special use permit must submit an application in accordance with Section 4-2 of the Code. In addition, an applicant must submit evidence of compliance with the standards described in Sections 5-2203 B. and C., and the Board of County Commissioners may require additional information as

appropriate.

5-2204 Enforcement

5-2204 A. Inspection of Wetland Area

For the purpose of carrying out the provisions of this Section 5-22, the Board of County Commissioners or its designee may enter upon private land in a reasonable and lawful manner during daylight hours for the purpose of inspection of any wetland area or buffer zone area proposed for development by an applicant for a Wetland Special Use Permit. If denied access for these purposes, the Board of County Commissioners may inspect the subject property after following an appropriate legal process.

5-2204 B. Wetland Restoration

In addition to other remedies prescribed by this Code, the Board of County Commissioners may order wetland restoration measures for the damaged or destroyed wetland by the party responsible for the violation in accordance with section 5-2204 D. If the responsible party does not complete such measures within a period specified by the Board of County Commissioners, the Board of Commissioners may restore the affected wetland at the cost of the responsible party.

[WETLAND\LUC5-22]

APPENDIX 3. CONTACTS FOR MORE INFORMATION ABOUT WETLANDS

For additional information on the natural heritage values of Larimer County's wetlands, contact:

Colorado Natural Heritage Program
Colorado State University
254 General Services Building
Fort Collins, CO 80525
tel. 970-491-1309
fax 970-491-3349
e-mail: heritage@lamar.colostate.edu

For information on U.S. Army Corps of Engineers wetland regulations, contact:

U.S. Army Corps of Engineers--Omaha District
Tri-Lakes Project Office
9307 Colorado State Hwy. #121
Littleton, CO 80123-6901
tel. 303-979-4120
fax. 303-979-0602

For information on the U.S. Fish and Wildlife Service's National Wetlands Inventory, contact:

National Wetlands Inventory Office
U.S. Fish and Wildlife Service
134 Union Blvd.
Lakewood, CO 80228
tel. 303-236-4625

For more information on the Hydrogeomorphic approach to wetland function assessment in Colorado, contact:

The Colorado Geological Survey
Attn: Ms. Alison Barry, HGM Project Manager
Department of Natural Resources
1313 Sherman Street, Room 715
Denver, CO 80203