Saguache County, Closed Basin Biological Inventory
Volume II:
A Natural Heritage Assessment of Wetlands and Riparian Areas in the Closed Basin, Colorado
Final Report

Prepared for:

Colorado Department of Natural Resources
and the U.S. Environmental Protection Agency

Prepared by:

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The Nature Conservancy

Natural Heritage Program COLORADO

Colorado State University

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USER'S GUIDE

The Saguache County Conservation Inventory conducted by the Colorado Natural Heritage Program consisted of three essentially distinct projects: a Natural Heritage inventory, a wetlands inventory and assessment, and a riparian vegetation survey and classification. These projects were highly integrated with respect to methodology, field work, and coordination with Saguache County government. All three projects utilized the same Natural Heritage methodology that is used throughout North America. All of the projects searched for and assessed the plants, animals, and plant communities on Colorado Natural Heritage Program's List of rare and imperiled elements of biodiversity.

Because of the distinct nature of the projects, the inventory results are presented in a two volume report and the riparian vegetation classification is presented in a third report. Each volume of the inventory report prioritizes potential conservation sites based on the relative significance of the biodiversity they support and the urgency for protection of the site. All information explaining Natural Heritage methodology and ranks is repeated in each volume, so that each volume can be used independently. The riparian vegetation classification report presents survey results from the Closed Basin and the Upper Rio Grande watershed.

Volume I of the inventory report presents *all* potential conservation sites identified in Saguache County that support rare and imperiled plants and animals, and significant plant communities, including wetland and riparian areas. Volume II focuses exclusively on wetland and riparian areas. Additionally, Volume II presents an assessment of the wetland functions performed by each site that was surveyed. These functional assessments are intended to provide the user with a more complete picture of the value wetlands and riparian areas provide to Saguache County/Closed Basin residents.

Glossary

biodiversity: The full range of life on earth, from species such as bacteria and fungi through very complex organisms such as vascular plants and vertebrate animals. Biodiversity can be described at many levels, from genetic diversity through landscape diversity.

Biological and Conservation Data System (BCD): The comprehensive database maintained by the Colorado Natural Heritage Program. This database contains information on all the elements tracked by CNHP (including the above information), and is used to identify biologically significant areas on the landscape.

ecological processes: A variety of dynamics which occur in all ecosystems by which the system evolves and regenerates. These dynamics can be physical (slope erosion, river meandering, flooding), biological (vegetation growth, animal grazing, predation, pollination), or both (fire dynamics, soil development).

ecosystem: A term first used by A. G. Tansley (1932) to describe basic functional unit of nature comprising both organisms and their nonliving environment, closely linked by a variety of biological, chemical, and physical processes. Fundamental concepts include energy flow through food-chains or food-webs, and the cycling of nutrients through the biological and geological portions of the system. The concept is independent of scale and can be applied to ephemeral lakes, extensive forests or grasslands, or the biosphere.

Element Occurrence Rank: A measure of the potential viability of an element occurrence used by the Natural Heritage Program, ranging from A to D. An A-ranked occurrence is considered highly viable and is generally nearly pristine. A D-ranked occurrence is not considered viable. Factors used to assign the element occurrence rank include size, presence of non-native species, presence of roads or buildings, the setting (entirely natural landscape or not), etc.

Element Occurrence: A location on the landscape where an element if found.

Element: A plant or animal species or natural community tracked by the Natural Heritage Program.

endemic: To be restricted or native to a particular locality (e.g. the Great Sand Dunes tiger beetle is found only at the Great Sand Dunes of the San Luis Valley, Colorado, so it is considered endemic to that area).

hydric: Characterized by or requiring wet conditions.

mesic: Characterized by or requiring a medium supply of moisture.

non-native: A term used to describe animal or plant species which are not native to the region or ecosystem of interest. Most noxious weeds fall into this category, having evolved in areas with a long history of human or natural disturbance. In most cases, invasion by non-native

species is more closely liked to human caused disturbance than deliberate introductions, with the exception of aquatic habitats, where non-native gamefish have been widely introduced.

playa: A shallow depression at the bottom of a drainage basin which receives runoff from snowmelt or rainfall in the surrounding landscape. In most cases, these depressions have no drainage and accumulate salts due poorly permeable soils and evaporation.

rarity/imperilment ranks: Used by the Natural Heritage Program, a numerical value from 1 to 5 that indicates the degree of rarity and/or imperilment for a particular element. A value of 1 is very rare or highly imperiled, and is typically known from five or fewer occurrences. A value of 5 indicates that the element is demonstrably secure. Rarity/imperilment ranks are given to all elements at both a global (G) or state (S) scale.

watershed: The area drained by one river system (e.g. the Rio Grande watershed encompasses much of New Mexico, west Texas, northern Mexico, and the lower portion of the San Luis Valley in Colorado)

xeric: Characterized by dry conditions; lacking moisture.

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EXECUTIVE SUMMARY

In 1997, CNHP received funding to conduct a comprehensive biological survey of wetlands and riparian areas within the Closed Basin watershed. The primary goal of this project was to identify areas in the Closed Basin with natural heritage significance, i.e., those areas where a rare or imperiled species or a significant plant community occur. A secondary goal was to assess the functions and values of the wetland sites visited. The purpose of this work is to provide local planners, resource managers, and citizens with information on the status and value of their riparian and wetland areas.

The Closed Basin of the San Luis valley contains a diverse array of wetlands which support a wide variety of plants, animals, and plant communities (collectively called natural heritage "elements"). At least 7 plants, 11 birds, 2 fish, 2 mammals, and 45 major wetland/riparian plant communities from the Colorado Natural Heritage Program's (CNHP's) list of elements are known to occur in or associated with Closed Basin wetlands. Several of these elements (e.g., the slender spiderflower) are globally significant: if they are not protected in the San Luis Valley they may be lost forever. Others have state-wide significance; they are found in few if any other places in Colorado.

Twenty-eight wetland and riparian potential conservation sites, each based on one or more elements, are profiled in this report. The sites are prioritized according to their biodiversity rank,

or “B-rank,” which ranges from B1 (outstanding global significance) to B5 (locally or regionally significant). The highest ranking sites are the highest priorities for conservation action. CNHP believes these sites represent those wetlands that most merit conservation efforts, while recognizing that protecting only these sites in no way adequately protects all the values associated with Closed Basin wetlands.

In addition to their biological significance, these wetlands perform many functions that provide value to the residents of the watershed. Closed Basin wetlands maintain water quality, provide wildlife habitat, support diverse recreational opportunities, and add to the aesthetic quality of Saguache and Alamosa Counties. To understand better these functions and values, an assessment was done for each site (with the exception of sites that were included in this report based on work done during another field project).

In addition to providing important information for Saguache and Alamosa Counties, this inventory will advance efforts to evaluate and manage wetlands on state and regional levels. Wetland plant community information gathered during this project is being assimilated into The Nature Conservancy’s National Vegetation Classification System, which Heritage Programs across the country have developed. Policy makers, land use planners, and resource managers can use information in the classification to make informed decisions governing the use and conservation of natural heritage resources.

Information from this effort will also be used to enhance the development of a program for hydrogeomorphic (HGM) wetland function assessment. This report can be used to help identify wetland subclasses in the area, and to better characterize the range of variation within a subclass. Several of the sites profiled in this report have the potential for use as reference sites, or to be part of the reference standard.

RECOMMENDATIONS

1 **Develop and implement a plan for protecting the conservation sites profiled in this report**. Strong consideration should be given to protecting sites with global and state-wide significance as indicated by Biodiversity (B) Rank (B1=highest priority, B5=lowest priority) These sites provide regional planners with the basic framework to implement a wetland conservation program.

2. **Treat all the sites included in this report as "red flags" when considering proposals for commercial and residential land use changes**. Wetlands with significant natural heritage elements generally require a buffer from development, agriculture, and extractive activities of at least 300 feet, extending up to 1,000 feet or more (in the case of the Rio Grande cutthroat trout and many wetland birds).

3. **Consider the effects on wetlands, especially the significant wetlands identified in this report, when evaluating proposals for water diversions, extensive development within a watershed, ground water development, and other activities potentially affecting wetlands**. Hydrology defines wetlands, and wetlands can often be affected by changes in hydrology far from their boundaries. Changes in water quality and quantity must be considered in planning for protection of significant wetlands in the Closed Basin.

4. **Develop and implement a basin-wide wetland conservation program**. Use the U.S. Fish and Wildlife Service definition of wetlands, 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.

5. **Prohibit the introduction, sale, and planting of plants that are known to negatively and profoundly affect wetlands and riparian areas**. These include, but are not limited to; wild chamomile, crack willow, purple loosestrife, and Russian olive. Encourage land managers and others to remove these plants from their properties.

6. **Encourage and support statewide wetland protection efforts**. County governments are encouraged to support research efforts on wetlands. Basin-wide education stressing the importance of wetlands could be implemented through the county extension services or other local agencies. Cultivate communication and cooperation with landowners regarding protection of wetlands in the Closed Basin.

PROJECT BACKGROUND AND PURPOSE

Wetlands are places where soils are inundated or saturated with water long enough and frequently enough to significantly affect the plants and animals that live and grow there. Until recently, most people viewed wetlands as a hindrance to productive land use. As a result, many wetlands across North America were 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/year). In Colorado an estimated 1 million acres of wetlands (50% of the total for the state) were lost prior to 1980 (Dahl 1990).

Although the extent of wetland loss in the Closed Basin is difficult to quantify, it is clear that many of the area's wetlands, especially valley bottom wetlands, have been lost or impacted. Irrigated agriculture, grazing, groundwater pumping, and water diversions have had tremendous impacts on wetlands throughout the watershed. Fertile soils and available water for irrigation attract agriculture to floodplains and other level areas in the Valley. Since the nineteenth century hydrological diversions developed for irrigation, recreation, and drinking water supplies, have removed water from some wetlands, and created other wetlands very different from those present prior to European settlement. For example, irrigated hay meadows have essentially replaced riparian forests along much of lower Saguache Creek. It is clear that with the current rate of land use conversion in the watershed, and the lack of comprehensive wetland protection programs, wetlands will continue to be lost or dramatically altered.

We hope that this report helps county planners, landowners, government agencies, and non-profit organizations understand the value of wetlands in the Closed Basin. We also hope that the information contained in this report will assist the county in making wise decisions regarding these natural resources so that their value will be maintained for generations to come.

Study Area

The San Luis Valley is Colorado's largest and driest mountain park, and the Closed Basin, which lies primarily in Saguache County, is the driest section of the valley. The Saguache County/Closed Basin portion is the northern most part of this valley and is approximately 2 million acres, of which private lands comprise about 600,000 acres (30%) (From: SLV Regional Development and Planning Commission. 1992 Overall Economic Development Program). Most private lands are along the major stream corridors and in the valley bottom. The majority of remaining lands is managed by the U.S. Forest Service and the Bureau of Land Management (Figure 1).

The Closed Basin is bounded on all sides by imposing mountain ranges. The Sangre de Cristo Mountains line the east and northeast sides of the basin, rising abruptly from the level valley floor to over 14,000 feet above sea level. Alluvial fans are common all along the west slopes of the Sangre de Cristos. The San Juan Mountains, which form the western perimeter, are a less striking feature as viewed from the valley floor. Unlike the narrow, jagged profile of the Sangre de Cristo, the San Juan rise gradually over 40 miles from the valley to the Continental Divide, which forms the western boundary of the study area. Because the upland watersheds are much more extensive in area, and because these basins receive greater annual precipitation, the streams and rivers draining the San Juan Mountains are much larger than those originating in the Sangre de Cristo Mountains (Essington 1996). The Cochetopa Hills, which form the northwest boundary of the basin, bridge the San Juan and Sangre de Cristo highlands. Significant watercourses in the Closed Basin include Saguache, San Luis, and La Garita creeks. In addition, the Closed Basin contains many ephemeral lakes (i.e., playas) and permanent wetland systems, such as those found at Russell Lakes, Mishak Lakes, Blanca Wetlands Area, and San Luis Lakes.

Geology

The geology of the eastern and western sides of the Closed Basin is quite different. Generally, the Sangre de Cristo range is composed of Precambrian granites and schists with some conglomerates, sandstones, and limestones. Pleistocene glaciation dramatically sculpted areas above 10,000 feet, particularly on the northeast side of the range (Peterson 1971). The San Juan Mountains are generally older lava and ash flow deposits of Tertiary origin, with basalts and tuffs of Pliocene/Miocene origin found throughout (Tweto 1979). Alluvial fans line both sides of the valley and contain sedimentary-type cobbles.

The valley floor proper is relatively flat, with a topographic depression on the eastern side. This depression, which contains the remnants of a large Pleistocene lake, is known locally as the "sump" area, and contains many of the wetland features mentioned above (Jodry *et al.*, 1989; Rogers *et al.*, 1992). The Great Sand Dunes lie just east of this concavity, and abut the west slope of the Sangre de Cristo Range. These aeolian deposits rise almost 800 feet above the valley floor and comprise almost 60 square miles (Landreth 1990).

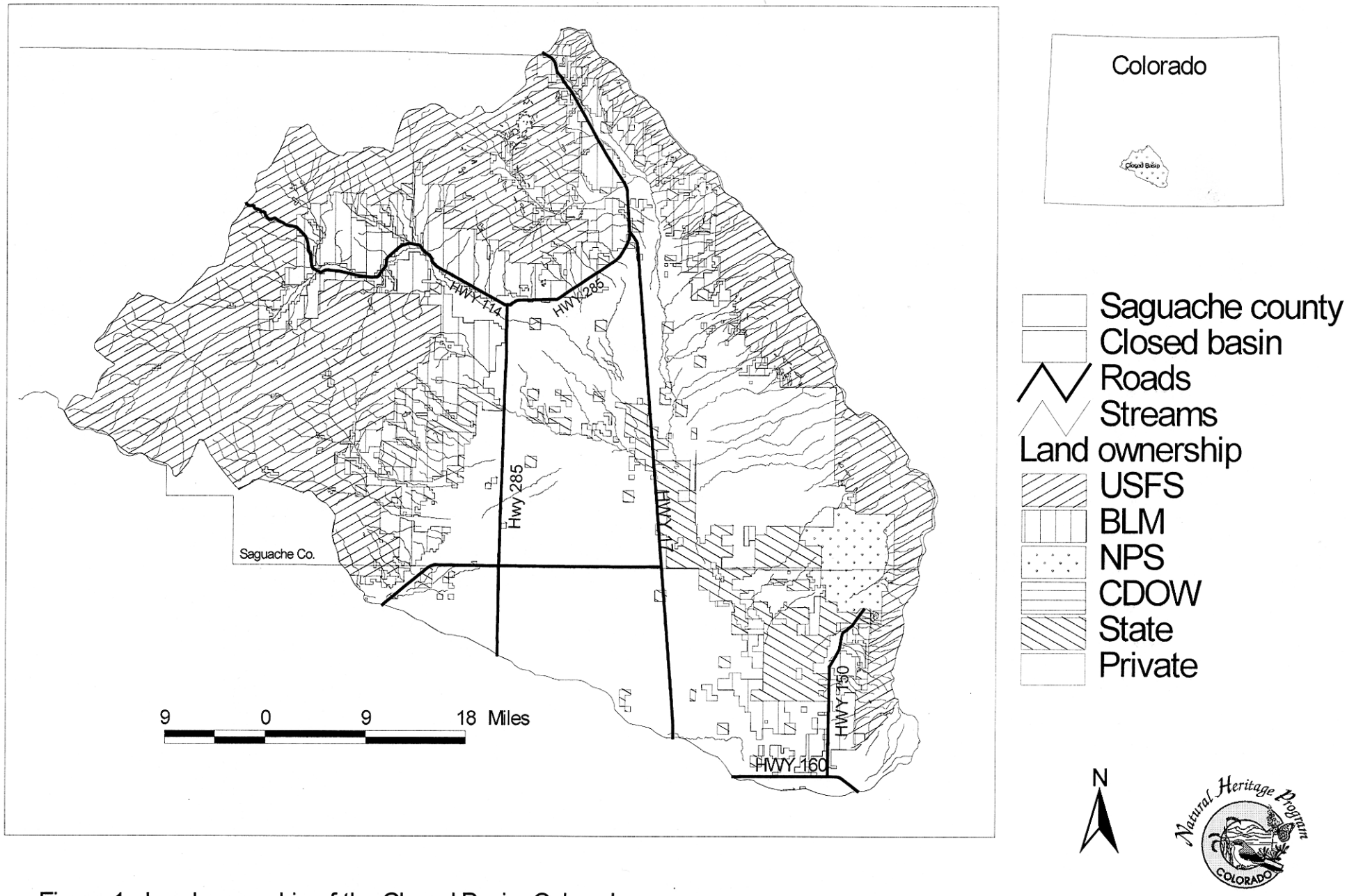


Figure 1. Land ownership of the Closed Basin, Colorado.

The valley floor is composed of sediments of up to 30,000 feet thick. Several layers of lava flows are embedded within these sediments. In addition, a layer of largely impermeable clay, 10 to 80 feet thick, underlies the superficial sediments (U.S. Department of Agriculture 1984a). The clay layer, at depths of 50 to 130 feet, inhibits the vertical movement of water, and creates two separate aquifers, both containing large quantities of water. The lower aquifer is **confined** while the uppermost aquifer is **unconfined** and lies above the clay lens. The locations and degree of contact between these two reservoirs are presently unknown. This hydro-geologic structure results in a relatively high water table (less than 13 feet) on the floor of the Closed Basin. Soils in both the confined and the unconfined aquifers are composed of unconsolidated clay, silt, sand, and gravel, with particle sizes decreasing towards the center of the valley (Leonard and Watts 1989). Recharge areas for both aquifers are believed to be along the alluvial fans at the base of the planning area's mountain ranges (U.S. Department of Agriculture 1984a). The San Luis Valley is estimated to contain over 2 billion acre-feet of ground water (Pearl 1974).

Soils

Soils in the basin vary widely, ranging from rocky shallow soils in the mountains, to cobbly, loamy well drained soils in the foothills and alluvial fans, to clayey, sandy, silty and highly alkaline soils in the valley bottom (U.S. Department of Agriculture 1973; U.S. Department of Agriculture 1980a; U.S. Department of Agriculture 1984a). Although many of the soil patterns in the high elevations are common in Colorado, the extremely alkaline nature of valley bottom soils is unusual and is a significant determinant of the vegetation pattern in low elevations (U.S. Department of Agriculture 1972b; U.S. Department of Agriculture 1984b; Galatowitsch 1988; Dick-Peddie 1993).

Climate

The study area is characterized by cold winters and cool summers. At Alamosa, the average January temperature is 18 F and the average July temperature is 65 F (U.S. Department of Agriculture 1973). Local microclimates are strongly influenced by topography. The higher elevations are decidedly cooler and moister, except during winter thermal inversions, which trap the coldest air at the valley floor. The valley bottom lies in a double rain shadow. The San Juan Mountains block westerly winter storms and the Sangre de Cristo Mountains block spring moisture, creating a very dry landscape. Alamosa is, in fact, the driest weather station in Colorado. In late summer, southerly "monsoon" flows commence, and provide the only respite from drought. In general, precipitation increases with altitude, from the southeastern basins near San Luis Lakes, where yearly precipitation averages just over six inches, to the crests of the surrounding mountain ranges, where estimated precipitation approaches 40 inches annually (Colorado Weather Center, 1998). Runoff and groundwater recharge from higher elevations of the watershed, which receive abundant snowfall and summer rain, are crucial Closed Basin water resources.

Vegetation

The Closed Basin contains an exceptional array of terrestrial and aquatic habitats. Elements of Great Basin, Short Grass Steppe, Rio Grande Valley, and southern Rocky Mountain floras, with steep gradients in elevation, moisture, and soil characteristics produce a landscape unique in Colorado. Valley bottom vegetation is typified by greasewood (*Sarcobatus vermiculatus*) and halophytic (salt-loving) grasses such as alkali sacaton (*Sporobolus airoides*) and saltgrass (*Distichlis spicata*) in the extensive alkali basins. Rubber rabbitbrush (*Chrysothamnus nauseosus*) and xeric grasses, such as indian rice grass (*Oryzopsis hymenoides*), occur on sandy soils where summer rains leach salts below the rooting zone. Valley bottom wetlands support a flora adapted to seasonal soil saturation and saline conditions. The marshes, lakes, and playas vary greatly in depth, salinity, and period of inundation. Regularly flooded basins support well developed aquatic and shoreline emergent vegetation, such as pondweeds (*Potamogeton* spp.), spikerush (*Eleocharis palustris*), hardstem bulrush (*Scirpus acutus*), and American three-square (*Scirpus pungens*). Basins with irregular or short duration flooding contain saltgrass and/or western wheatgrass (*Pascopyrum smithii*) meadows, or barren salt flats. Basins which dry by mid-summer often support seasonal stands of salt tolerant annuals which complete their life cycles after surface water evaporates and the late summer rains begin. Several locally common species include seablite (*Suaeda calceoliformis*), seaside heliotropium (*Heliotropium curassavicum*), and red glasswort (*Salicornia rubra*).

The alluvial fans which line the valley bottom have their own characteristic vegetation. Extensive stands of pinyon pine (*Pinus edulis*), Gambel oak (*Quercus gambelii*), needle and thread grass (*Stipa comata*) and short grass steppe vegetation indicate the greater precipitation and milder winter temperatures of this zone, compared to the valley bottom. Many of the streams in these alluvial fans, particularly at the base of the Sangre de Cristo Range, support excellent riparian forests of narrowleaf cottonwood (*Populus angustifolia*), with dense shrub understories of willows (*Salix* spp.) western birch, (*Betula occidentalis*), ocean spray (*Holodiscus discolor*), and wild rose (*Rosa woodsii*).

The Sangre de Cristo and San Juan Mountains contain typical southern Rocky Mountain vegetation including mixed forests of Douglas-fir (*Pseudotsuga menziesii*) and ponderosa pine (*Pinus ponderosa*) , and occasional stands of white fir (*Abies concolor*) at lower elevations, and Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) at higher elevations. Dry south-facing slopes at high elevations support open woodlands of bristle-cone pine (*Pinus aristata*). Aspen (*Populus tremuloides*) stands are abundant throughout the study area at elevations over 8,500 feet. Mountain wetlands are largely vegetated with willows, sedges (*Carex* spp.), and wetland grasses, such as Canadian reedgrass (*Calamagrostis canadensis*) and tufted hairgrass (*Deschampsia cespitosa*).

WETLAND DEFINITIONS AND REGULATIONS

Wetland Definitions

Wetlands are places where soils are inundated or saturated with water often and 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 the 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 circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." For Corps programs, wetland boundaries 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, e.g., low chroma matrices, gleyed matrices, histic epipedons, and iron and manganese concretions.).

The U.S. Fish and Wildlife Service defines wetlands from an ecological point of view. In *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin *et al.* 1979) the 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 undrained 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 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, which often fail to satisfy all the criteria to be considered jurisdictional wetlands, are biologically critical, and merit inclusion in a wetland conservation 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).

Wetland Regulation in Closed Basin and throughout Colorado

Wetlands in Closed Basin are currently regulated 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 in fact many wetlands are protected through implementation of these regulations. 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, after impacts have been minimized or mitigated. Many wetlands eventually are impacted by permitted activities.

The U.S. Fish and Wildlife Service has conducted inventories of the extent and types of our nation's wetlands. The classification system (Cowardin *et al.* 1979) provides the basic mapping units for the U.S. National Wetlands Inventory (NWI). The NWI drew maps for the Closed Basin area west of the 106th meridian based on 1:58,000 scale color infrared aerial photography taken in September 1983. The NWI maps east of the 106th meridian were completed in the 1960s using black and white photos. These maps are available to the public at the 1:24,000 scale.

The NWI maps provide important information regarding the location of wetlands. However, wetland maps for the Closed Basin should be used with caution, for two reasons. First, the older generation of maps (those east of the 106th meridian made from black and white photos) have a high degree of error, mainly because of the type of photos used to make the maps. Second, even for areas west of the 106th meridian, wetlands on the Valley bottom are often difficult to identify and map accurately. Some wetlands may appear dry for one or more years, then become inundated with flourishing wetland vegetation. Wherever there are questions about the accuracy of these maps, an on-site visit by a knowledgeable wetland scientist is essential.
NWI maps are very useful for gaining an understanding of the general types of wetlands in the county and their distribution. However, the NWI maps cannot be used as the only source of information for federal regulatory programs that govern wetlands for two reasons. First, the U.S. Fish and Wildlife Service uses a definition of wetland that differs slightly from U.S. Army Corps

of Engineers, the agency responsible for executing federal wetland regulations. Secondly, there is a limit to the resolution of the 1:24,000 scale maps. For example, at this scale, the width of a fine line on a map represents about 5 m (17 ft) on the ground (Mitsch and Gosselink 1993). For this reason, precise wetland boundaries must be determined on a project by project basis. 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 Boulder, Boulder County, and San Miguel County.

THE NATURAL HERITAGE NETWORK AND BIODIVERSITY

Colorado is well known for its rich diversity of geography, wildlife, plants, and plant 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 the absence 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 and known threats to the species. 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 facilitate in prioritizing conservation efforts so the most rare and imperiled species may be preserved first. As the scientific community began to realize that plant communities are equally important as individual species, this methodology has also been applied to ranking and preserving rare plant communities as well as the best examples of common communities.

The Natural Heritage Methodology is used 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, five provinces of Canada, and 13 countries in South and Central 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.

What is Biological Diversity?

With the accelerated increase in human population, resource use, and land conversion, natural ecosystems have become increasingly compromised by altered function, fragmentation, and habitat loss. The protection of biological diversity has become a global priority, particularly for natural resource professionals and land planners. Biological diversity at its most basic level includes the full range of species on Earth, from unicellular organisms such as bacteria, viruses, and protists, through higher lifeforms to complex biological communities, such as old growth forests. 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, diversity includes variations in the biological communities in which species live, the ecosystems in which communities exist, and the array of interactions among these levels. All organizational levels are necessary for the continued survival of species, co-evolved groups of species, and humans. Consequently, biological diversity preservation should concern everyone.

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.

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 within an area. These communities may be diagnostic or even endemic to an area. It is within communities that all life dwells.

4. **Landscape Diversity** -- the type, condition, pattern, connectedness, and spatial configuration of natural communities. A landscape consisting of a mosaic of natural communities may contain one multifaceted ecosystem, such as a wetland, or several distinct ecosystems, such as a riparian corridor meandering through farmland and shortgrass prairie. 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 their activities, are often critical agents affecting landscape diversity patterns.

The conservation of biological diversity must include all levels of diversity: genetic, species, community, and landscape. Each level is dependent on the other levels and inextricably linked. In addition, and all too often omitted, humans are also linked to all levels of this hierarchy. At the Colorado Natural Heritage Program, we believe that a healthy natural environment and

human environment go hand in hand, and that recognition of the most imperiled elements is an important step in comprehensive conservation planning.

Colorado's Natural Heritage Program

To place this document in context, it is useful to understand the history and functions of the Colorado Natural Heritage Program (CNHP). CNHP is the state's primary comprehensive biological diversity data center, gathering information and field observations to help develop statewide conservation priorities. After operating in Colorado for 14 years, the Program was relocated from the 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, threatened, and endangered species and significant plant communities of Colorado. Life history, status, and locational data are incorporated into a continually updated data system. Sources include published and unpublished literature, museum and herbaria 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 maps and enter it into the Biological and Conservation Data System. The Element Occurrence 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 unit.

CNHP is part of an international network of conservation data centers that use the Biological and Conservation Data System developed by The Nature Conservancy. CNHP has effective relationships with several state and federal agencies, including the Colorado Natural Areas Program, Colorado Department of Natural Resources and the Colorado Division of Wildlife, the U.S. Environmental Protection Agency, 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 the Natural Heritage Programs around the globe provides a means to protect species before the need for legal endangerment status arises.

Concentrating on site-specific data for each element of natural diversity allows us to evaluate the significance of each location to the conservation of Colorado's, and indeed the nation's, natural biological diversity. By using species rarity ranks and quality ratings for each location, priorities can be established for the protection of the most sensitive or imperiled sites. A continually updated locational database and priority-setting system such as that maintained by CNHP provides an effective, proactive land-planning tool.

The Natural Heritage Ranking System

Information is gathered by CNHP on Colorado's plants, animals, and plant communities. Each of these species and plant communities is considered an **element of natural diversity**, or simply an **element**. Each element is assigned a rank that indicates its relative degree of imperilment on a five-point scale (e.g., 1 = extremely rare/imperiled, 5 = abundant/secure). The primary criterion for ranking elements is the number of occurrences, i.e., the number of known distinct localities or populations. This factor is weighted more heavily because an element found in one place is more imperiled than something found in twenty-one places. Also of importance are the size of the geographic range, the number of individuals, trends in both population and distribution, identifiable threats, and the number of already protected occurrences.

Element rarity ranks are assigned both in terms of the element's degree of imperilment within Colorado (its State or S-rank) and the element's imperilment over its entire range (its Global or G-rank). Taken together, these two ranks give an instant picture of the degree of imperilment of an element. CNHP actively collects, maps, and electronically processes specific occurrence information for elements considered extremely imperiled to vulnerable (S1 - S3). Those with a ranking of S3S4 are "watchlisted," meaning that specific occurrence data are collected and periodically analyzed to determine whether more active tracking is warranted. A complete description of each of the Natural Heritage ranks is provided in Table 1.

This single rank system works readily for all species except those that are migratory. Those animals that migrate may spend only a portion of their life cycles within the state. In these cases, it is necessary to distinguish between breeding, non-breeding, and resident species As noted in Table 1, ranks followed by a "B", e.g., S1B, indicate that the rank applies only to the status of breeding occurrences. Similarly, ranks followed by an "N", e.g., S4N, refer to nonbreeding status, typically during migration and winter. Elements without this notation are believed to be year-round residents within the state.

Table 1. Definition of Colorado Natural Heritage Rarity Ranks.

Global rarity ranks are based on the range-wide status of a species. State rarity ranks are based on the status of a species in an individual state. State and Global ranks are denoted, respectively, with an "S" or a "G" followed by a character. **These ranks should not be interpreted as legal designations.**

G/S1 Critically imperiled globally/state because of rarity (5 or fewer occurrences in the world/state; or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extinction.

G/S2 Imperiled globally/state because of rarity (6 to 20 occurrences), or because of other factors demonstrably making it very vulnerable to extinction throughout its range.

G/S3 Vulnerable through its range or found locally in a restricted range (21 to 100 occurrences).

G/S4 Apparently secure globally/state, though it might be quite rare in parts of its range, especially at the periphery.

G/S5 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.

G/SU Unable to assign rank due to lack of available information.

GQ Indicates uncertainty about taxonomic status.

G/SH Historically known, but not verified for an extended period, usually.

G#T# Trinomial rank (T) is used for subspecies or varieties. These taxa are ranked on the same criteria as G1-G5.

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 reliable identified, mapped, and protected.

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.

Notes: Where two numbers appear in a state or global rank (e.g., S2S3), the actual rank of the element falls between the two numbers.

Protection Urgency Ranks

Protection urgency ranks (P-ranks) refer to the time frame in which conservation protection must occur. In most cases, this rank refers to the need for a major change of protective status (e.g., agency special area designations or ownership). 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., development that would destroy, degrade or seriously compromise the long-term viability of an element occurrence and 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
3) In extraordinary circumstances, a prospective change in ownership management that will make future protection actions more difficult.

Management Urgency Ranks

Management urgency ranks (M-ranks) indicate 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 urgency for management rating focuses on land use management or land stewardship action required to maintain element occurrences at the potential conservation area.

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. The following codes are used to indicate the action needed to be taken at the area:

M1 Management action required immediately or element occurrences could be lost or irretrievably degraded within one year.
M2 New management action will be needed within 5 years to prevent the loss of element occurrences.
M3 New management action will be needed 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.

Element Occurrence Ranking

Actual location of elements, whether they be single organisms, populations, or plant 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 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 E, 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. If there is insufficient information available to rank an element occurrence, an EO-Rank is not assigned. Possible EO-Ranks and their appropriate definitions are as follows:

A The occurrence is relatively large, pristine, defensible, and viable.
B The occurrence is small but in good condition, or large but removed from its natural condition and/or not viable and defensible.
C The occurrence is small, in poor condition, and possibly of questionable viability.
D The occurrence does not merit conservation efforts because it is too degraded or not viable.

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 proposed conservation planning boundary should be carefully considered and evaluated for their consequences to the element on which the conservation unit is based.

Proposed Conservation Planning Boundaries

Once the presence of a rare or imperiled species or significant natural community has been confirmed, the first step towards its protection is the delineation of a proposed conservation planning boundary. In general, the proposed 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.

Legal Designations

Natural Heritage rarity ranks should not be interpreted as legal designations. Although most species protected under state or federal endangered species laws are extremely rare, not all rare species receive legal protection. Legal status is designated by either the U.S. Fish and Wildlife Service under the Endangered Species Act or by the Colorado Division of Wildlife under Colorado Statutes 33-2-105 Article 2. In addition, the U.S. Forest Service recognizes some species as "Sensitive," as does the Bureau of Land Management. Table 2 defines the special status assigned by these agencies and provides a key to the abbreviations used by CNHP.

Please note that the U.S. Fish and Wildlife Service has issued a Notice of Review in the February 28, 1996 Federal Register for plants and animal species that are "candidates" for listing as endangered or threatened under the Endangered Species Act. The revised candidate list replaces an old system that listed many more species under three categories: Category 1 (C1), Category 2 (C2), and Category 3 (including 3A, 3B, 3C). Beginning with the February 28, 1996 notice, the Service will recognize as candidates for listing only species that would have been included in the former Category 1. This includes those species for which the Service has sufficient information on their biological status and threats to propose them as endangered or threatened under the Endangered Species Act. Candidate species listed in the February 28, 1996 Federal Register are indicated with a "C". While obsolete legal status codes (Category 2 and 3)

are no longer used, CNHP will continue to maintain them in its Biological and Conservation Data system for reference.

Table 2. Federal and State Agency Special Designations.

1. U.S. Fish and Wildlife Service (58 Federal Register 51147, 1993) and (61 Federal Register 7598, 1996)
   - **LE** Endangered; taxa formally listed as endangered.
   - **E(S/A)** Endangered due to similarity of appearance with listed species.
   - **LT** Threatened; taxa formally listed as threatened.
   - **P** Proposed E or T; taxa formally proposed for listing as endangered or threatened.
   - **C** Candidate: taxa for which the Service has on file sufficient information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened.

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

WETLAND FUNCTIONS AND VALUES

Many physical and biological functions and values associated with wetlands provide benefit to society. CNHP ranks natural communities, plants, animals according to their relative degree of imperilment within a global and state context and is most interested in the contribution of wetlands in maintenance of Colorado's natural diversity. The Southern Rocky Mountain population of the boreal toad (*Bufo boreas boreas*), for example, contains only three to four healthy subpopulations, with less than 20 high priority breeding sites (S. Corn and L. Livo personal communication as cited in Pague et al. 1997). The Colorado Division of Wildlife lists the boreal toad as an endangered species, while the U.S. Fish and Wildlife Service has designated it as 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 *et al.* (1991) list the following functions performed by wetlands (detailed definitions for each function are located on page 24):

- Ground water recharge--the replenishing of below-ground aquifers.
- Ground water discharge--the movement of ground water to the surface, e.g., springs.
- Floodflow alteration--the temporary storage of potential flood waters.
- Sediment stabilization--the protection of stream banks and lake shores from erosion.
- Sediment/toxicant retention--the removal of suspended soil particles from the water, along with toxic substances that may be attached to these particles.
- Nutrient removal/transformation--the removal of excess nutrients from the water, in particular nitrogen and phosphorous.
- Production export--supply organic material (dead leaves, etc.) to the base of the food chain.
- Aquatic diversity/abundance--wetlands support fisheries.
- Wildlife diversity/abundance--wetlands provide habitat for wildlife.

Adamus and Stockwell (1983) include two items they call "values" which also provide benefits to society:

- Recreation--wetlands provide areas for fishing, birdwatching, etc.
- Uniqueness/heritage value--wetlands support rare and unique plants, animals, and plant communities.

"Values" are subject to societal perceptions, whereas "functions" are all biological and physical processes and manifestations of processes which occur in wetlands, regardless of the value placed on them by society (National Research Council 1995). The actual value attached to any given function or value listed above depends on the needs and perceptions of society.

It is important to recognize that not all wetlands provide all functions. For instance, many subalpine willow carrs, especially small ones, do not have significant amounts of open water. They are supported by seeps and springs on the mountain sides and thus cannot provide habitat for fish (the aquatic diversity/abundance function). The lack of certain functions at a wetland does not necessarily decrease the importance of that wetland.

Descriptions of Wetland Functions and Values

The Wetland Evaluation Technique (WET) (Adamus *et al.* 1991) was developed by the U.S. Army Corps of Engineers for the Federal Highway Administration. WET is a broad-brush approach to wetland evaluation, and is based on information derived from predictors of wetland functions which can be gathered relatively quickly. WET can be used to compare ratings of a wetland for future uses in management and planning. This technique was developed to assist planners, regulators, and others to assess the probability that a particular wetland performs specific functions, and to provide insight as to the local, regional, and national significance of those functions. CNHP did not use WET for the Closed Basin wetland assessment, but a modified WET first used by Cooper (1988).

Ground Water Recharge and Discharge

Ground water recharge occurs when the water level in a wetland is higher than the water table of its surroundings resulting in the movement (usually downward) of surface water (e.g., flood water retention). Ground water discharge results when the groundwater level of a wetland is lower than the water table of its surroundings, resulting in the movement (usually laterally or upward) of surface water (e.g., springs, seeps). Neither of these functions is exclusionary for a wetland can perform both functions simultaneously. Ground water movement can greatly influence some wetlands, whereas in others it may have minimal effect (Carter and Novitzki 1988). There are three processes that directly affect ground water movement:

1) ground water flow rates and storage capacity;
2) direction and location (within the wetland) of ground water movement; and
3) evapotranspiration

Both groundwater discharge and recharge are difficult to estimate without intensive data collection. Wetland characteristics that may indicate groundwater recharge are: porous underlying strata, irregularly shaped wetland, dense vegetation, and presence of a constricted outlet. Indicators of groundwater discharge are: a dam upstream and wet slopes with no obvious source.

Flood Storage

Wetlands are excellent in their ability to store or delay flood waters that occur from peak flow, gradually recharging the adjacent groundwater table. Indicators of flood storage include: debris along streambank and in vegetation, low gradient, formation of sand and gravel bars, high density of small and large depressions, and dense vegetation.

Shoreline Anchoring

Shoreline anchoring is the stabilization of soil at the water's edge by roots and other plant parts. The vegetation dissipates the energy caused by fluctuations of water and prevents streambank erosion. The presence of woody vegetation and sedges in the understory are the best indicator of good shoreline anchoring.

Sediment Trapping

Sediment and toxicant trapping is the process by which suspended solids and chemical contaminants are retained and deposited within the wetland. Deposition of sediments can ultimately lead to removal of toxicants through burial, chemical break down, or temporary assimilation into plant tissues (Boto and Patrick 1979). Most vegetated wetlands are excellent sediment traps, at least in the short term. Riverine wetlands tend to have relatively short retention times, because of the typical seasonal flooding that occurs. Wetland characteristics indicating this function include: dense vegetation, deposits of mud or organic matter, gentle sloping gradient, and location next to beaver dams or human-made detention ponds/lakes.

Long and Short Term Nutrient Removal

Nutrient retention is the storing of nutrients within the sediment or vegetation. Inorganic nutrients are transformed into the organic form, resulting in the transformation and subsequent removal of one nutrient (e.g., nitrogen) as a gas. Nutrient removal/transformation involves trapping of 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 (Kadlec and Kadlec 1979). Nutrient storage in wetlands may be for long-term (greater than 5 years) for example peatlands, or short-term (30 days to 5 years), as in riverine wetlands. A densely vegetated cattail or bulrush community would be an example of a wetland that performs this function for the short-term. A wetland that would not perform this function would be sparsely vegetated and located on a steep slope.

Processes involving nitrogen removal and conversion to gas are pertinent to wetlands. Denitrification is frequently a critical process because it results in nutrient removal rather than retention. Denitrification is the microbial conversion of nitrate to gaseous nitrogen, resulting in a permanent loss of nitrogen from a wetland. This process must occur under anaerobic or near anaerobic conditions. There are two sources of nitrate for denitrification: diffusion from water and nitrification. Nitrification, the microbial conversion of ammonia to nitrate, occurs only under aerobic conditions.

Nitrogen fixation is the opposite process of nitrification in that gaseous nitrogen is converted or fixed, usually into organic forms of nitrogen, by bacteria and blue-green algae. Also, several wetland vascular plant genera (e.g., *Lemna* spp. and *Juncus* spp.) host nitrogen-fixing bacteria. In most wetlands, denitrification exceeds nitrogen fixation (Seitzinger 1988), which results in a net loss of nitrogen. However, reviews of mass balance studies show that wetlands do generally act as sinks for nitrogen and phosphorus both under nutrient-enriched and natural conditions (Nichols 1983; Nixon and Lee 1986). Some indicators of nutrient retention include: high sediment trapping, organic matter accumulation, presence of free-floating, emergent, and submerged vegetation, and permanently or semi-permanently flooded areas.

Production Export (Downstream and Within Food Chain Support)

Production export refers to the flushing of relatively large amounts of organic material (carbon) from the wetland downstream. Production export emphasizes the production of organic foods within the wetland and the utilization of the exported production by fish and aquatic invertebrates. Food chain support is the direct or indirect use of nutrients, in any form, of animals inhabiting aquatic environments. Indicators of wetlands that perform downstream food chain support are: an outlet, seasonally flooded, overhanging vegetation, and dense and diverse vegetation. Wetlands that perform within food chain support do not have stagnant water and contain productive vegetation.

Habitat

Habitat includes those physical and chemical factors which affect the metabolism, attachment, and predator avoidance of the adult or larval forms of fish, and the food and cover needs of wildlife in the place where they reside. Wetland characteristics indicating good fish habitat include: deep, open, non-acidic water, no barriers to migration, well-mixed (high oxygen content) water, and high vegetation cover. Wetland characteristics indicating good wildlife habitat are: the presence of islands, high plant diversity, and a sinuous, irregular basin with good edge to area ratio.

Recreation (Active and Passive)

Active recreation refers to recreational activities which are water-dependent. This includes the following activities: swimming, boating, canoeing, and kayaking. Passive recreation refers to the use of wetlands for aesthetic enjoyment, nature study, picnicking, open space, or research.

Uniqueness/Heritage Value

Heritage value refers to the biological significance of the wetland. This function is based on the ranking of imperiled plant, animal, and natural communities according to CNHP.

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 their regulation for public good provokes controversy. In an effort to provide a more consistent and logical basis for regulatory decisions about wetlands, a new approach to assessing wetland functions--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) called "hydrogeomorphic" classification (Brinson 1993). There are four hydrogeomorphic classes present in the Closed Basin: riverine, slope, depression, and lacustrine (Table 3). 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. CNHP tentatively proposes seven subclasses for the Closed Basin, based on field experience. Their descriptions and characterizations may have to change as the definition of each subclass is extended to the entire area.

Using the HGM method, wetlands 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 river, but it has little flood control value. Conversely, the wetlands along the Saguache Creek floodplain perform important flood control functions.

One of the fundamental goals of the HGM approach is to create a system whereby every wetland in a given geographic region is evaluated according to the same standard. In the past, wetland functional assessments were typically conducted on a site by site basis, which severely compromised the 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 the highest, sustainable functional capacity is achieved in wetland ecosystems and landscapes that have not been subject to long-term anthropogenic disturbance. Under such conditions, the structural components and physical, chemical, and biological processes in the wetland and surrounding landscape are at a dynamic equilibrium which allows maximum ecological function (Smith *et al*. 1995). If a wetland is to be designated a reference standard for a given subclass of wetlands, it must meet these criteria. The need to find reference standard wetlands 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 may be selected as reference wetlands for the Closed Basin watershed.

Table 3. Hydrogeomorphic wetland classes in the Closed Basin.

Class	Geomorphic setting	Water Source	Water Movement	Subclass	Examples
Riverine	In riparian areas along streams	Overbank flow from channel	One-directional and horizontal (downstream)	1. High-order, meandering river, floodplain, intermittently flooded forested wetlands 2. Low-order stream, seasonally to permanently saturated shrubland, frequently including beaver complexes	1. Cottonwood forest wetlands along lower Rito Alto Creek. 2. Willow shrublands along upper Saguache Creek.
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. Fresh groundwater-fed herbaceous wetlands on organic soil. 4. Fresh groundwater-fed herbaceous wetlands on mineral soil. 5. Fresh groundwater-fed shrublands with mineral soils. 6. Fresh groundwater-fed shrublands with organic soils.	3. Villa Grove fen 4. Altai Cottongrass wetlands in Wild Cherry Lake Basin 5. Gooseberry-willow talus seep wetlands at headwaters of Whale Creek 6. Groundhog Park Fen
Depressional	In depressions cause by glacial action (in the mountains) and wind erosion or buffalo wallowing (on the plains); depressions caused by human activity (e.g., gravel pits in floodplains).	Shallow ground water, or variable surface inlet and outlet	Generally two-directional, flowing into and out of the wetland in the bottom and sides of the depression, or in combination with surface inlet and outlet	1. Inter-dunal ponds 2. Montane and subalpine kettle ponds 3. Alkaline, ephemeral playa wetlands	1. Great Sand Dunes dune ponds 2. Antora kettle ponds 3. Red glasswort wetlands at Blanca Wetland Area
Lacustrine	Along the edges of lakes	Flow between deep water and shallow water areas	Two-directional, horizontal: flowing into/out of shallow water wetlands as lakes and reservoirs rise/fall	4. Seasonally to permanently flooded marshes around the larger lakes 5. Permanently flooded floating/submerged aquatic bed wetlands	4. Three square meadows on edges of San Luis Lake 5. Sago pondweed / horned pondweed communities in shallow water of Russell Lakes

METHODS

Survey Site Selection

Site selection was based on the goal of visiting every wetland type at various locations and elevations within the Closed Basin. Across the full spectrum of wetland types, the highest quality occurrence of each type was targeted during the field season. The variety of wetland types was defined by plant associations, because CNHP classifies wetland and riparian plant associations or communities, not wetlands types, *per se*. Plant communities reflect the broader nature of the wetlands in the study area (i.e., willow carr, sedge meadow, etc.), while also mirroring the local nature of the wetlands in the watershed. Most other classifications applied to wetlands in Colorado and across the nation including the U.S.F.W.S. classification used for mapping purposes in the Closed Basin discriminate wetlands based mainly on the physiognomy (physical structure) of the vegetation. Broad structural classes, however, do not recognize the relative rarity of the plant species or communities contained in Closed Basin wetlands.

Target inventory areas (TIAs) with potential biodiversity significance were identified using color infrared aerial photographs and 7.5 minute topographic quadrangles, in conjunction with a review of CNHP's Biological and Conservation Data System (BCD) for known occurrences of target species or communities. The TIAs were prioritized for field survey based on visual qualities (e.g., size, evidence of dense wetland vegetation, standing water, lack of alteration) and concentrations of biological elements. A significant percentage of these TIAs fell on private lands, so field personnel requested landowner permission to access the sites. Each land owner was contacted either by telephone or in person at their residence. It is a credit to the private landowners of the Closed Basin that permission for survey was granted at all sites where a field visit was deemed necessary.

Site Assessment

Site assessments included examination of the natural heritage elements at the site and a wetland function evaluation. Site visits and assessments were conducted on the following three levels:

1) **Roadside or adjacent land assessments.** Many of the sites could be viewed at a distance from a public road or from adjacent public land. While on the ground the field scientist can see, even from a distance, many features not apparent on maps and aerial photos. Many of the sites selected during the TIA analysis were rejected during this phase from consideration as potential conservation sites. The roadside assessments evaluated the extent of human and livestock impacts on the TIA, such as ditching, excessive weed cover (especially noxious weeds), abundance of native plant species known to increase with intensive livestock use, stream bank destabilization, major hydrologic alterations, or new construction. Sites with one or more of these characteristics were generally excluded as potential high significance conservation sites and no further data were gathered.

2) **On-site assessments**. On-site assessment was the preferred method, as it is the only evaluation technique that can yield high-confidence statements concerning the known or potential presence of rare and imperiled elements or excellent examples of common communities. On-site assessments are also the most resource intensive because of the required landowner contact and comprehensive field efforts.

3) **Off-site assessments**. Off-site assessment was the least preferred method because of the low confidence in the results. All the sites presented in this report were visited by a CNHP wetland or riparian ecologist.

For the sites that were visited, the following information was noted:

General Field Information

- 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.

Natural Heritage Information

- list of elements present or expected at the site
- element occurrence (EO) ranks, or information that will lead to EO Rank
- proposed site boundaries

General Wetland Information

- HGM subclass
- water source
- hydroperiod
- flooding and inundation frequency
- general soils description, i.e., texture, color, cobble size, percent mottling

Qualitative Function and Value Assessment

- hydrological functions, i.e., groundwater recharge/discharge, flood storage, shoreline anchoring
- biogeochemical functions, i.e., sediment trapping, long and short term nutrient retention
- biological functions, i.e., downstream foodchain support, within food chain support, fish and wildlife habitat, passive recreation

Plant Communities

Plant communities are very useful integrators of site conditions, therefore, our TIA analysis attempted to identify potential sites for the full range of plant communities present in the study area. The following information about plant communities was gathered when visiting a site. For every site where an element occurrence was located, the following information was entered into BCD:

- List of all plant associations in the wetland complex, including the amount of wetland area covered by that community. In almost all cases, plant associations were immediately placed in existing classifications. However, on rare occasion a plant association was encountered which could not be easily classified based on stands sampled previously.
- Vegetation data for each major plant association in the wetland were collected using rough ocular estimates of species cover in a representative portion of the plant association.
- Hydrologic information, including water source and hydroperiod (i.e., perennially flooded, seasonally saturated, etc.).
- Soil descriptions based on a shallow pit or an augered 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.

Function and Value Assessment

Function and value assessment was based on Cooper (1988), which employs a modified methodology developed by Adamus and Stockwell (1983). Cooper's methodology was modified slightly to place it more in line with Adamus' modified methodology, known as the Wetland Evaluation Technique (W.E.T.) (Adamus *et al*. 1991).

The technique developed by Adamus *et al.* (1991) 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 based on the "Best Professional Judgment" of CNHP's wetland ecologists.

The ratings for each function are not based on quantitative data, and only a limited amount of data on these functions are available. Some of the functions (e.g., groundwater recharge and nutrient retention) 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. CNHP was aware of these limitations, but CNHP is confident that the function and value assessments, as presented, provide a useful preliminary basis for development of a wetlands protection program.

Absolute assessments of the functions of Closed Basin wetlands can be known only after extensive (generally multi-year) data have been collected at a site. County government is encouraged to support such research efforts. Such research will generate potential reference sites for the hydrogeomorphic (HGM) approach to wetland function assessment.

RESULTS

OBSERVATIONS ON MAJOR THREATS TO BIODIVERSITY IN THE CLOSED BASIN

Hydrological Modification

Groundwater pumping is one of the greatest threats to the Closed Basin's biodiversity. Surface water impoundments and diversions present an equally widespread, and allied threat. The playa lake ecosystems of the San Luis Valley floor depend upon a complex interaction of surface and groundwater sources that undergo characteristic seasonal and inter-annual fluctuations. Where sources of fresh surface water, such as creeks or springs build on the shallow water table to create seasonal groundwater mounds, extensive wetlands have developed. Preliminary work has shown that not only are hydrologic dynamics in the valley complex, but that the differing water sources vary widely in water quality (Cooper and Severn 1992). Wetland vegetation is strongly affected by water salinity, and valley wetlands have developed unique floristic patterns based on the quantity and quality of water they receive. Water uses that perturb the timing or magnitude of surface flows, or affect the water table, have the potential to detrimentally affect valley bottom wetlands. Even minor changes in the water depth or duration of inundation in the wetland basins can have profound effects on soil salinity, and consequently, wetland vegetation. Cooper and Severn (1992) observed that the entire range of soil moisture and salinity, and associated plant communities, from permanently saturated wetland to saline flat to rain rinsed upland, occurred over an elevation gradient of only 5 to 8 feet. Wetland dependent fauna, such as nesting waterbirds, amphibians, or vertebrates may be affected by even brief fluctuations in wetland hydrology.

For the last six years, the Bureau of Reclamation's Closed Basin Project has pumped shallow groundwater to supplement Rio Grande flows, in order to meet Colorado's commitments to New Mexico, Texas, and Mexico under the Rio Grande Compact. Impacts from this project are purported by land owners and researchers (Cooper and Severn 1992), but not yet quantitatively described. The recent increases in groundwater development are superimposed on an a extensive background of surface water diversion. Nearly all the streams in the watershed are diverted for irrigated agriculture or hay meadows, or affected by unintentional impoundments, such as roads or ditches. The effects of such extensive hydrologic alterations are varied, from waterlogging in some areas to drying of wetlands in others. A solid understanding of the interactions between groundwater and surface water developments is presently lacking. Plans to pump confined aquifer water for trans-basin use are a serious concern given such scientific uncertainty.

Despite considerable debate, the hydrologic connections between surface, as well as shallow and deep groundwater resources and valley bottom wetlands remain poorly understood. The confusing array of past, present, and anticipated hydrologic disturbances, make it exceedingly

difficult to accurately estimate management needs and viability potential for the elements of concern at many valley bottom sites. Although information needs are immense, independent research has been minimal to date (Cooper and Severn 1992). Effective management will require a much better understanding of the hydrologic connections between surface and shallow and deep groundwater resources of the Closed Basin, and how they vary temporally and spatially. Management of the valley bottom sites presented in this report will require, therefore, not only local protection of on-site wetland elements, but secure water resources, and greater understanding of how current and anticipated water uses within the watershed will affect the wetlands. For an accurate assessment of the risks to Closed Basin biodiversity posed by water development, further quantitative research linking hydrology, vegetation, and wetland obligate fauna is imperative.

Development

Residential development is a localized but increasing threat in the Valley. Although growth rates in the Closed Basin watershed have lagged well behind most other Colorado regions, it is likely that the Valley may begin to receive "overflow" development pressure, especially close to the mountains in northern and eastern Saguache County. Development creates a number of stresses, including habitat loss and fragmentation, introduction of exotic species, fire suppression, and domestic animals (dogs and cats) (Oxley *et al.*, 1974; Coleman and Temple, 1994; Knight *et al.*, 1995). Habitat loss to development is considered irreversible and a very serious problem. Pinyon-juniper and ponderosa pine woodlands and various grassland types are the most threatened by these stresses due to their developable characteristics (i.e., they are flat, scenic, or have good soils) and their vulnerability to sustained fire suppression. Development also tends to occur adjacent to water courses in this arid region, with consequent effects on aquatic and riparian habitats.

Mining

Mining has been a traditional industry in the valley for over a century. Poorly planned or managed mining operations have the potential to impact biodiversity for decades after the activity has ceased. Summitville, just south of the study area, has been the country's most highly publicized mining mishap in recent years. Bonanza Mine has also contributed lead and other heavy metal contamination to Kerber Creek, above Villa Grove (K. Navo, pers. comm. as quoted in Essington 1996). In fact, a major fish kill in Kerber Creek and confluent San Luis Creek was noted during field assessment for this report, presumably due to leaching of toxins from tailings at Raleigh Mine upstream (D. Sarr personal observation). Stresses from mining activities include habitat loss and fragmentation, water pollution by acid mine drainage, which can contain heavy metals, cyanide, and excessive sediment. Aquatic systems are the most threatened by these stresses, but riparian communities can be impacted as well.

Livestock Grazing

The other traditional industry of the valley, domestic livestock grazing, has left a much more varied imprint. Depending upon grazing practices and local environmental conditions, impacts can be minimal, moderate and largely reversible (slight shifts in species composition, willow browsing), or severe and irreversible (extensive gullying, introduction of exotic forage species, extirpation of local willow populations). Also, "pest" control of unwanted rodents and predators can impact native fauna (D. Armstrong, pers. comm.). Stresses due to sediment deposition and water quality changes from improper grazing practices are more difficult to judge, but they may be detrimental to aquatic biota (Gifford *et al.*, 1975). Riparian and grassland communities, and rare plants found on rangelands, such as Ripley's milkvetch, are particularly vulnerable to livestock use.

Observations during the field assessment for this report indicated that livestock impacts are most severe in the foothills of the San Juan Mountains, where mild topography and open range allow the livestock to access and congregate in nearly all riparian areas. Non-native species and degraded willow and alder stands are abundant in riparian habitats of this area.

Recreation

Recreation, once very local and perhaps even unnoticeable, is on the increase and may become a threat to the Valley's ecology. Like grazing, recreation practices and their stresses differ, mostly between motorized and non-motorized activities. All terrain vehicles (ATVs) are becoming increasingly popular and the Rio Grande National Forest is a favorite area for ATV use (especially for big-game retrieval). BLM lands are also used. ATVs can disrupt migration and breeding patterns, and fragment habitat for native resident species. This activity can also threaten rare plants found in non-forested areas.

Non-motorized recreation, mostly hikers but also some mountain biking, presents a different set of problems (Cole and Knight, 1990; Knight and Cole, 1991; Holmes *et al.*, 1993). Wildlife behavior can be significantly altered by repeat visits of hikers/bicyclists. Trampling of sensitive plant species, particularly in high alpine areas (among the most popular destinations for hikers), is of concern along the most popular areas such as 14,000 ft. peak routes (Spackman, pers. comm.).

Roads

Owing to past timber harvest and mining operations, much of the Closed Basin watershed is roaded. Expansion of the existing road network will detrimentally affect the heritage values of the region. Roads are correlated with a wide variety of impacts to natural communities, including invasion of exotic plant species, increased depredation and parasitism of bird nests, increased impacts of pets, fragmentation of habitats, erosion, pollution, and road mortality. Additionally, roads can affect hydrology by intecepting surface flows.

Exotic Species

Although exotic species are mentioned repeatedly as stresses in the above discussions, because they can come from so many activities they are included here as a general threat as well. Exotic plants or animals and can have wide ranging impacts. Exotic plants can increase dramatically under the right conditions and essentially dominate a previously natural area. This can generate secondary effects on animals (particularly invertebrates) that depend on native plant species for forage, cover, or propagation. Whitetop (*Cardaria* spp.), is an introduced, highly aggressive weed found in irrigated areas and low wetlands that is very difficult to control. Cheatgrass (*Bromus tectorum*), smooth brome (*Bromus inermis*), and crested wheatgrass (*Agropyron spicatum*) are hardy, xeric grasses from Eurasia that are also very difficult to control (H. Dixon, pers. comm.).

SIGNIFICANT ELEMENTS ASSOCIATED WITH CLOSED BASIN WETLANDS

The following table presents CNHP elements of biological significance known to occur in or associated with Closed Basin Wetlands. Occurrences for all elements are archived in CNHP's Biological and Conservation Data System.

Table 4. List Of Known Elements of Concern for the Closed Basin by Taxonomic Group.

Elements with the highest global significance (G1-G3) are in bold type.

Element	Common Name	Global Rank	State Rank	Federal and State Status
Plants				
Astragalus bodinii	Bodin's milkvetch	G4	S2	
Cleome multicaulis	slender spiderflower	G2G3	S2S3	(C2)
Epipactis gigantea	helleborine	G4	S2	FS
Platanthera sparsiflora var. *ensifolia*	canyon bog-orchid	G4G5T3	S2	
Sisyrinchium demissum	blue-eyed grass	G5	S2	
Sisyrinchium pallidum	**pale blue-eyed grass**	**G3**	**S2**	**(C2)**
Plant Communities				
Abies concolor-Picea pungens-Populus angustifolia/Acer glabrum	**montane riparian forest**	**G1**	**S1**	
Abies lasiocarpa-Picea engelmannii/Salix drummondiana	montane riparian forest	G4	S4	
Alnus incana-mixed willow	thinleaf alder-mixed willow riparian shrubland	G3G4	S3S4	
***Alnus incana/*mesic forb**	**thinleaf alder/mesic forb riparian shrubland**	**G3**	**S3**	
***Alnus incana/*mesic graminoid**	**montane riparian shrubland**	**G2G3**	**S3**	
***Betula occidentalis/*mesic forb**	**foothills riparian shrubland**	**G2G3**	**S2**	

Element	Common Name	Global Rank	State Rank	Federal and State Status
Calamagrostis stricta	slimstem reedgrass	GU	S1?Q	
Cardamine cordifolia-Caltha leptosepala	alpine wetland	G4	S4	
Carex aquatilis	montane wet meadow	G5	S3S4	
Carex lanuginosa	montane wet meadow	G4	S3	
Carex lasiocarpa	montane wetland	G4	S1	
Carex simulata	**wet meadow**	**G3**	**S3**	
Carex utriculata	beaked sedge montane wet meadow	G5	S3	
Catabrosa aquatica-Mimulus glabratus	spring wetland	GU	S3	
Eleocharis palustris	spikerush wetland	G5	S3S4	
Populus angustifolia-Juniperus scopulorum	**montane riparian forest**	**G2**	**S2**	
Populus angustifolia/Alnus incana	**montane riparian forest**	**G3**	**S3**	
Populus angustifolia/Betula occidentalis	**montane riparian forest**	**G3**	**S1**	
Populus angustifolia/Salix drummondiana-Acer glabrum	**montane riparian forest**	**G1**	**S1**	
Populus angustifolia/Salix lucida var. caudata	**montane riparian forest**	**G1**	**S1**	
***Populus angustifolia/*sand dunes**	**sand dune riparian forest**	**G1**	**S1**	
Populus tremuloides/Acer glabrum	**montane riparian forest**	**G2**	**S1S2**	
Populus tremuloides/Alnus incana	montane riparian forest	GU	S3	
Populus tremuloides/Betula occidentalis	**montane riparian forest**	**G1**	**S1**	
Populus tremuloides/Cornus sericea	**montane riparian woodland**	**G3**	**S2S3**	
*Populus tremuloides/*tall forb	montane aspen forest	G5	S5	
Pseudotsuga menziesii/Acer glabrum	mixed deciduous-evergreen forest	G?	S?	
Pseudotsuga menziesii/Betula occidentalis	montane riparian forest	G4	S3	
Salicornia rubra	**western slope salt meadow**	**G2**	**S1?**	
Salix bebbiana	**montane willow carr**	**G3**	**SU**	
Salix brachycarpa/Carex aquatilis-Carex utriculata	subalpine willow carr	GU	S3S4	
Salix brachycarpa/Carex aquatilis-Carex utriculata	subalpine willow carr	GU	S3S4	
Salix drummondiana/mesic forb	montane riparian shrubland	G4	S4	
Salix exigua/barren soil	coyote willow/bare soil	G5	S5	
*Salix geyeriana-Salix monticola/*mesic graminoid	montane riparian willow carr	GU	S3	
*Salix geyeriana/*mesic forb	montane willow carr	G3	SU	
Salix monticola/Calamagrostis canadensis	**montane willow carr**	**G3**	**S3**	
Salix monticola/mesic graminoid	montane riparian willow carr	GU	S3	
Salix planifolia/Calamagrostis canadensis	subalpine willow carr	G4	S4	
Salix planifolia/Caltha leptosepala	subalpine willow carr	G4	S4	
Salix planifolia/Deschampsia cespitosa	**montane willow carr**	**G2G3**	**S3**	

Element	Common Name	Global Rank	State Rank	Federal and State Status
Sarcobatus vermiculatus/Distichlis spicata	**saline bottomland shrubland**	**G3**	**S1**	
Scirpus maritimus wetland	Emergent wetland	G4	S?	
Scirpus pungens	Emergent wetland	G?	S?	
Sporobolus airoides	great plains salt meadow	G2?	SU	
Birds				
Charadrius montanus	**mountain plover**	**G2**	**S2B,SZN**	**C, SC, FS**
Circus cyaneus	northern harrier	G5	S3B, SZ	
Cistothorus palustris	marsh wren	G5	S3B,SZN	
Egretta thula	snowy egret	G5	S2B,SZN	
Numenius americanus	long-billed curlew	G5	S2B,SZN	(3C), SC, FS
Nycticorax nycticorax	black-crowned night-heron	G5	S3B,SZN	
Plegadis chihi	white-faced ibis	G5	S2B,SZN	(C2), FS
Podiceps nigricollis	eared grebe	G5	S3B,SZN	
Sterna forsteri	Forster's tern	G5	S2B,S4N	
Fish				
Gila pandora	**Rio Grande chub**	**G3**	**S1?**	**SC**
Oncorhynchus clarki virginalis	Rio Grande cutthroat	G4T3	S3	(3C), SC, FS
Invertebrates				
Aeshna constricta	lance-tailed darner	G5	S1?	
Libellula nodisticta	hoary skimmer	G5	S1	
Paratrytone snowi	Snow's skipper	G4	S3	
Physa cupreonitens	**hot springs physa**	**G2?**	**S2**	
Polites sabuleti ministigma	San Luis sandhill skipper	G5T3	S5	
***Prochoerodes* n.sp.**	**geometrid moth**	**G2?**	**S1?**	
Promenetus umbilicatellus	umbilicate sprite	G?	S3	

CLOSED BASIN WETLAND SITES OF BIODIVERSITY SIGNIFICANCE

The 28 most important wetland sites in Closed Basin are profiled in this section, ranked by biodiversity significance (see Table 5). These sites include the wetlands with the highest biodiversity significance as well as the best examples of all wetland types present in the Closed Basin. Figure 2 displays all 28 sites in the Closed Basin watershed (site numbers for these and subsequent maps are included in "site name" field of Table 5). All of these sites merit protection, but any available resources should be directed first toward the B2 sites (Figure 3), then the B3, the B4, and finally the B5 sites. These sites alone do not represent a complete wetland conservation program; they only represent the rare and imperiled elements.

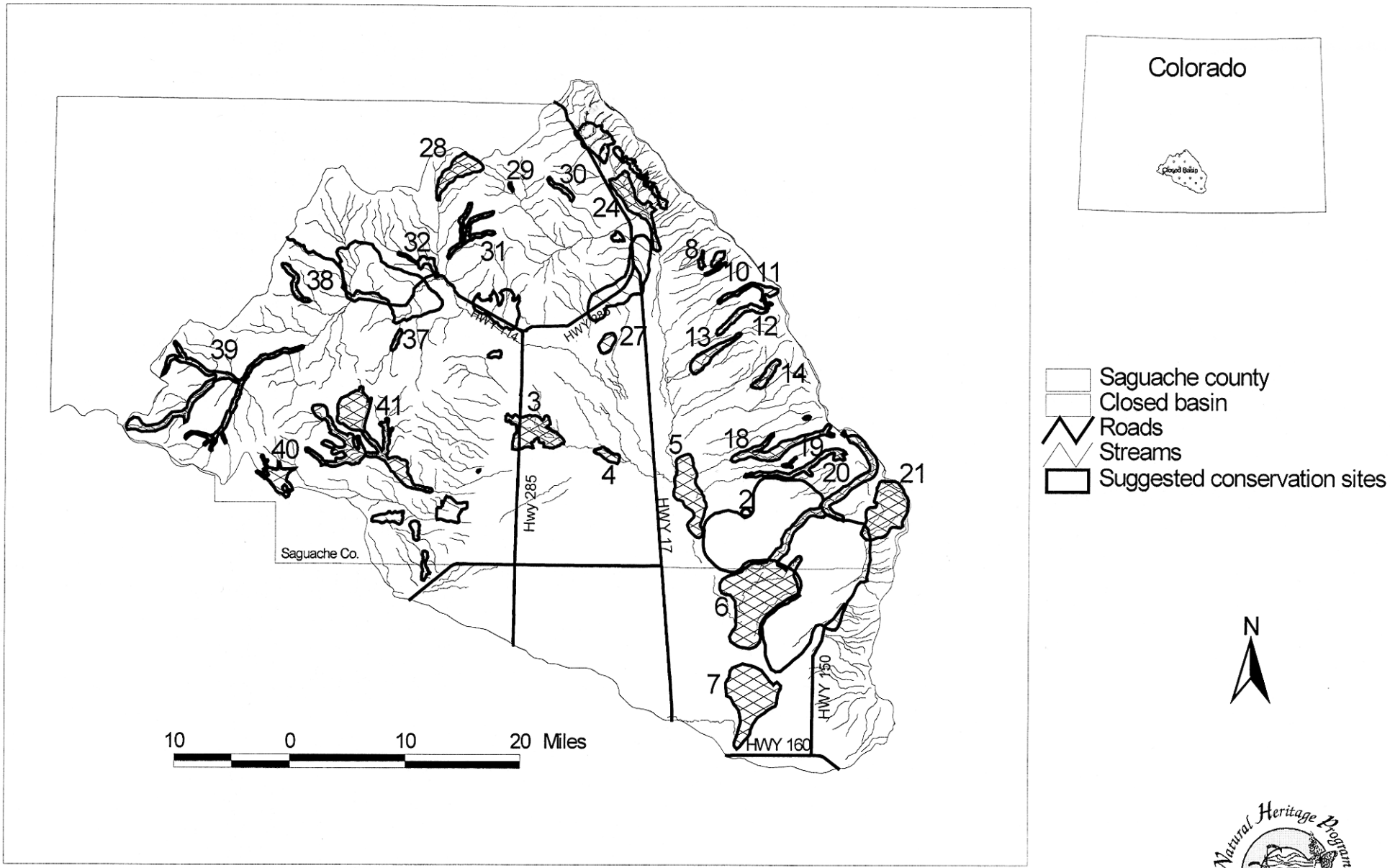


Figure 2. Proposed conservation wetland sites of the Closed Basin (numbered); unnumbered sites are uplands. See following table for site names.

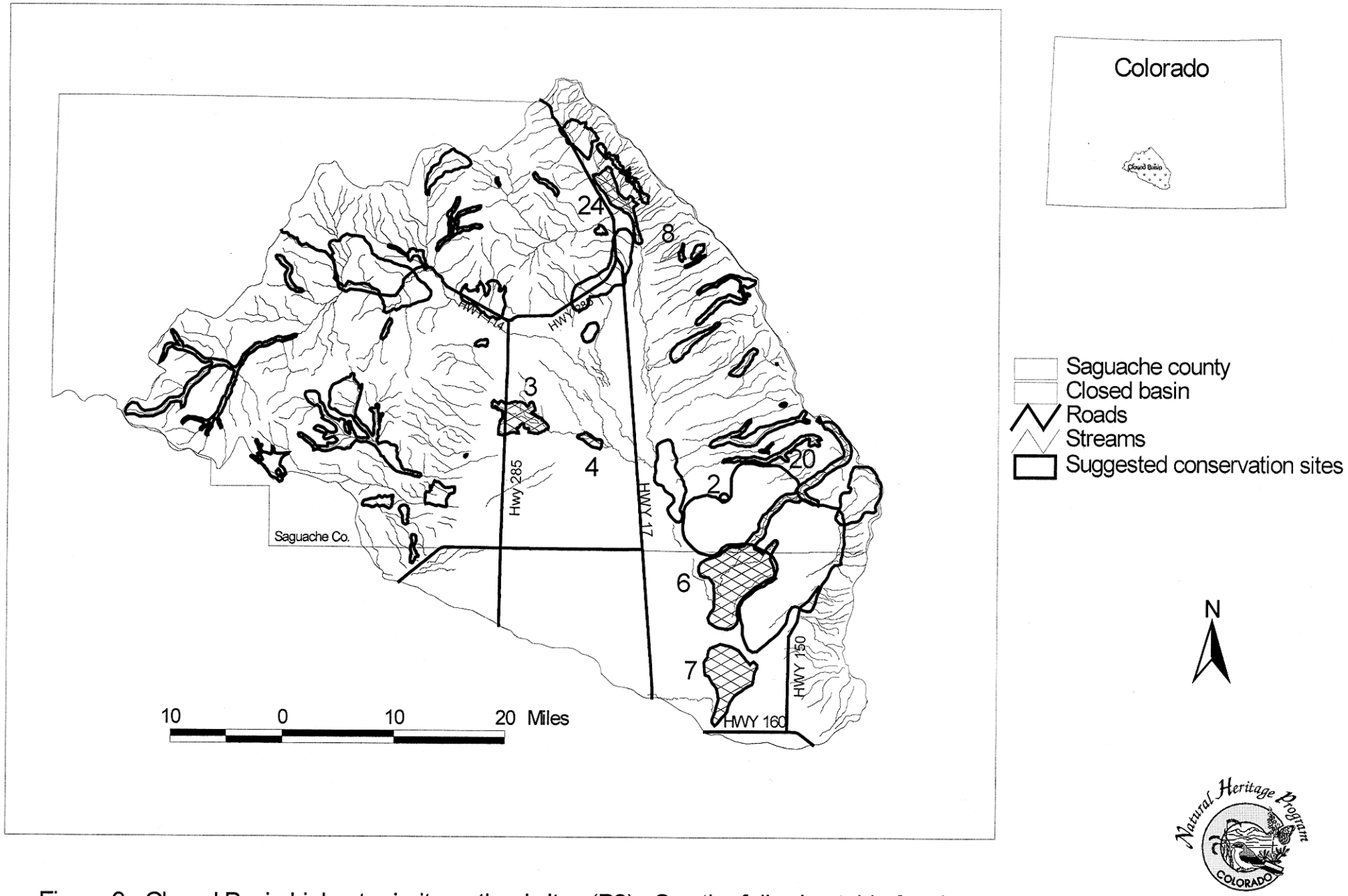


Figure 3. Closed Basin highest priority wetland sites (B2). See the following table for site names

Table 5. List of Closed Basin Proposed Conservation Sites by Biodiversity Significance, as of 1997 (CNHP).

SITENAME/Map Number	Biodiversity Rank	Protection Urgency Rank	Management Urgency Rank	Functional Assessment	Region within this report
Antelope Springs (2)	2	3	4		Sand Dune
Blanca Wetlands (7)	2	3	4	x	Playa Lakes
Deadman Creek (20)	2	3	3	x	Middle Sangre de Cristo Mountains
Mishak Lakes (4)	2	2	3	x	Playas
Russell Lakes (3)	2	2	3	x	Playa Lakes
San Luis Lakes/Sand Creek (6)	2	4	4	x	Playa Lakes
Valley View Hot Spring (8)	2	3	3		Middle Sangre de Cristo Mountains
Villa Grove (24)	2	3	3	x	N. Sangre de Cristo Mountains and N. Valley Floor
Carnero Creek (41)	3	4	2	x	San Juan Mountains
Cotton Creek (11)	3	4	3		Middle Sangre de Cristo Mountains
Cottonwood Creek (18)	3	3	3		Middle Sangre de Cristo Mountains
Dimick Gulch (14)	3	4	5		Middle Sangre de Cristo Mountains
Ford Creek (31)	3	3	3		Cochetopa Hills
Jacks Creek Cemetery (3)	3	3	4		Cochetopa Hills
Kelley Creek (30)	3	4	4		Cochetopa Hills
Rito Alto Bosque (13)	3	3	3	x	Middle Sangre de Cristo Mountains
Upper Saguache Creek (39)	3	4	3	x	San Juan Mountains
Upper Medano Creek (21)	3	4	4		Middle Sangre de Cristo Mountains
Weisman Lakes (5)	3	2	4	x	Playa Lakes
Cedar Canyon (19)	4	3	3		Middle Sangre de Cristo Mountains
Garner Creek (10)	4	3	3	x	Middle Sangre de Cristo Mountains
Houselog Creek (37)	4	4	4	x	Cochetopa Hills
Luder Creek (38)	4	4	3	x	Cochetopa Hills
Moffat playas (27)	4	2	2		N. Sangre de Cristo Mountains and N. Valley Floor
Slaughterhouse Creek (29)	4	4	5		Cochetopa Hills
Wild Cherry Creek (12)	4	4	4	x	Middle Sangre de Cristo Mountains
East Middle Creek (28)	5	4	4		Cochetopa Hills
Groundhog Park (40)	5	4	3	x	San Juan Mountains

Each site is described in a standard site report that reflects data fields in CNHP's Biological and Conservation Data System (BCD), used to track rare and imperiled elements. The sections of the following site profiles, and their contents, are outlined and explained below.

BIODIVERSITY RANK: The overall significance of the conservation site in terms of imperilment of the natural heritage resources and the quality (health, abundance, etc.) of their occurrences. As discussed in Section 2, these ranks range from B1 (Outstanding Significance) to B5 (General Biodiversity Significance).

PROTECTION URGENCY RANK: The time frame in which conservation protection must occur. In most cases, this rank refers to the need for a major change of protective status (e.g., agency special area designations or ownership). The ranks range from P1 (immediate urgency; within a one year time frame) to P5 (no known urgency).

MANAGEMENT URGENCY 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).

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, general location, vegetation, and current use of the site. Common names are used along with the scientific names.

BIODIVERSITY RANK JUSTIFICATION: A synopsis of the rare species and significant natural communities that occur on the site. The Natural Heritage elements are listed alphabetically according to genera. The species or community that is the primary element is bolded within the table. See Table 1 for explanations of ranks.

BOUNDARY JUSTIFICATION: The proposed 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.

WETLAND FUNCTIONAL EVALUATION. A summary of the functions and values and the confidence with which each was ranked that are occurring on each conservation site . Each function is ranked (i.e., no, low, medium, high, or very high rank) according to how well the wetland is performing that function. A confidence level rank of low, medium, or high accompanies each rank.

Playa Lakes Sub-Region

Snowy egret at Russell Lakes

The Playa Lakes Sub-region lies in the south and central part of Saguache County as well as northern Alamosa County. This sub-region contains five proposed conservation sites, of which the first four are wholly or partially within Saguache County: 1) Russell Lakes, 2) Mishak Lakes, 3) Weisman Lakes, and 4) San Luis Lakes/Sand Creek (Figure 5). The San Luis Lakes/Sand Creek proposed conservation site is in both Saguache and Alamosa Counties. Blanca Wetlands is wholly within Alamosa County and is not discussed in Volume I of this report, which covered only Saguache County. Three of these sites have a very high biodiversity significance (B2) and should be considered as top priorities in any protection plans for Saguache County. All of these sites, except for Weisman Lakes have some form of protection for part of the site, e.g., part of Mishak Lakes is a Nature Conservancy preserve. In spite of this protection, we still believe the protection urgency for the entire site is high, largely due to much of the site falling outside of formal protection. The table below, summarizes the biodiversity, protection, and management ranks for the Playa Lakes Sub-region proposed conservation sites. See the following site descriptions for more detail.

Table 6. Playa Lakes Sub-region Proposed Conservation Sites by Biodiversity Rank

SITENAME	Biodiversity Rank	Protection Urgency Rank	Management Urgency Rank
Russell Lakes	2	2	3
San Luis Lakes/Sand Creek	2	2	4
Blanca Wetlands	2	3	4
Mishak Lakes	2	2	3
Weisman Lakes	3	2	4

Hydrology of the playa lake landscape

The playa lakes of Saguache County are a unique landscape in the Southern Rocky Mountain ecoregion. In order to give some background on this area, which may be useful towards management and conservation efforts, the following text elaborates on the distinct geomorphology and vegetation of this system.

The Closed Basin of the northern San Luis Valley, of which most is within Saguache County, contains many shallow depressions which support a variety of wetland types. The basins fill from snowmelt runoff in late spring and most are dry by late summer. Heavy monsoon precipitation can cause some basins to refill in late summer, but summer rains are generally of secondary importance. The soils in the lake basins are alkali clays with low rates of water infiltration allowing rapid evaporation at the water surface and accumulation of salts. They support a flora adapted to seasonal soil saturation and saline conditions. The lakes vary greatly in depth, salinity, and period of inundation.

Regularly flooded basins support well developed aquatic and shoreline emergent vegetation, such as pondweeds (*Potamogeton* spp.), spikerush (*Eleocharis palustris*), hardstem bulrush (*Scirpus acutus*), and American three-square (*Scirpus pungens*). Basins with irregular or short duration flooding contain saltgrass (*Distichlis stricta*) and/or western wheatgrass (*Pascopyrum smithii*) meadows, or barren salt flats. Basins which dry by mid-summer often support seasonal stands of salt tolerant annuals which complete their life cycles after surface water evaporates and the late summer rains begin. Several locally common species include seablite (*Suaeda calceoliformis*), seaside heliotropium (*Heliotropium curassavicum*), and red glasswort (*Salicornia rubra*). Adjacent alkali flats and dunes are dominated by greasewood (*Sarcobatus vermiculatus*) and rabbitbrush (*Chrysothamnus* spp.) vegetation, respectively.

The playa lake ecosystems of the San Luis Valley floor depend upon a complex interaction of surface and groundwater sources which undergo characteristic seasonal and inter-annual fluctuations. Water uses which perturb the timing or magnitude of surface flows, or affect the valley bottom water table, are likely to affect these wetlands detrimentally. Changes in the water depth or duration of inundation in the basins can have profound effects on soil salinities and wetland vegetation (Cooper and Severn 1992). Wetland dependent fauna, such as waterbirds, amphibians, or vertebrates may be affected by even brief changes in wetland hydrology.

Despite considerable debate, the hydrological connections between surface as well as shallow and deep groundwater resources and valley bottom wetlands are poorly understood. Management of valley bottom wetlands must, therefore, seek not only local protection of on-site wetland elements, but secure water resources providing natural hydrologic variability.

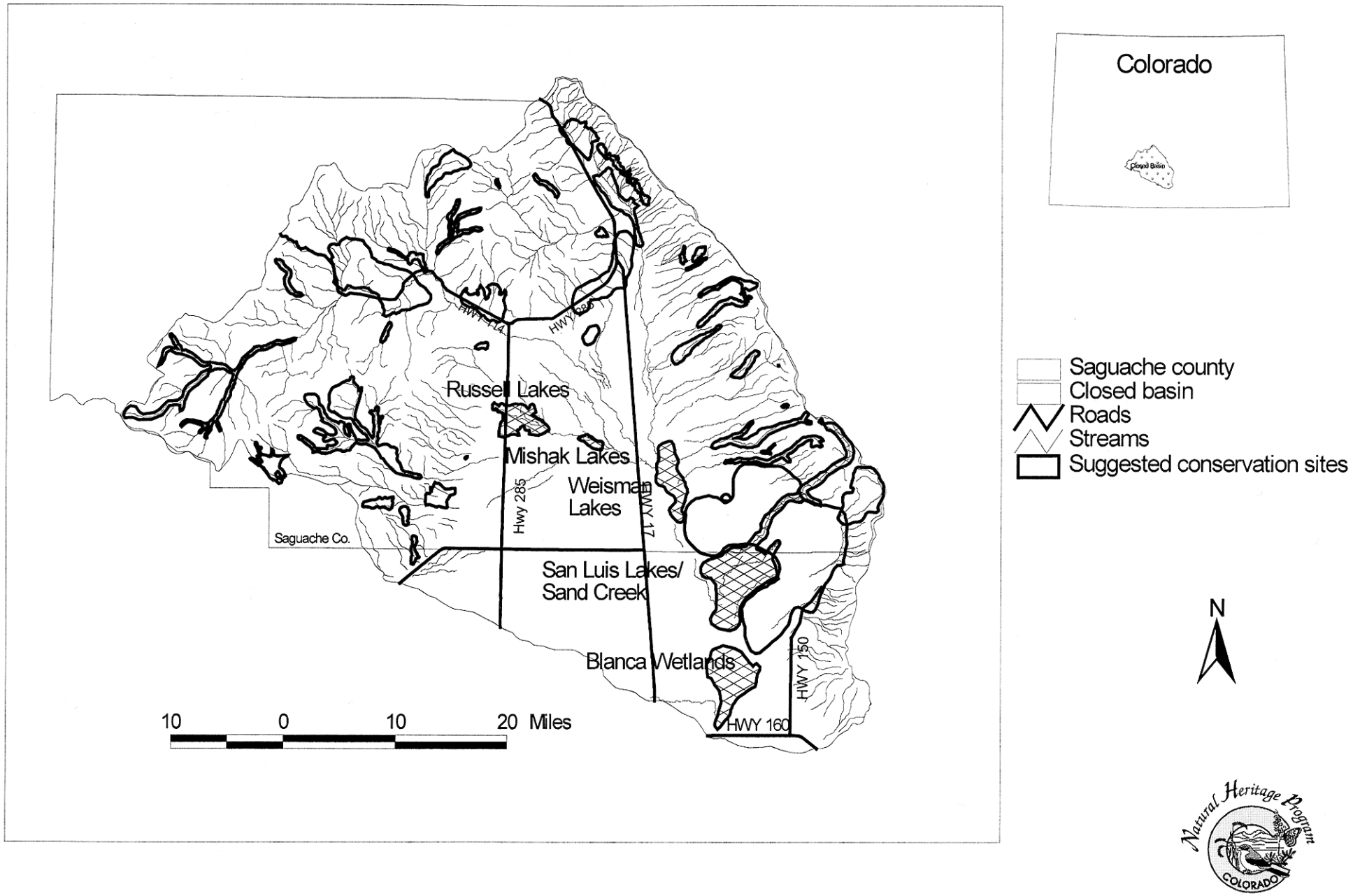


Figure 4. Playa Lakes sub-region wetland proposed conservation sites.

Russell Lakes

Biodiversity Rank: B2 (Very high significance)
This site contains one of the largest populations known of the rare slender spiderflower, an alkaline wetland specialist with less than 20 occurrences worldwide. In addition, this is the only substantial nesting area in Saguache County for many state rare waterbirds.

Protection Urgency Rank: P2
This site is primarily state land managed by the Colorado Division of Wildlife. The most prevalent threat pertains to surface and ground water. Stable hydrologic conditions are critical to the maintenance of wetland conditions, and stable open water levels, which are critical for many of the nesting birds at this site.

Management Urgency Rank: M3
White-faced ibis are extremely sensitive to changing conditions in the environment, including fluctuating water levels during the breeding cycle; nest abandonment is a common response to disturbance or changing conditions (Ryder et al. 1979, Ryder and Manry 1994). A change from flood irrigation techniques to center-pivot irrigation in recent years has reduced the amount of foraging habitat for white-faced ibis and, in turn, reduced the number of ibis using the area (Ron Ryder pers. comm.). Since center-pivot irrigation uses water more efficiently, there is less wet ground that provides foraging areas for these birds. Management tactics to benefit the white-faced ibis, as well as the other waterbirds nesting at Russell Lakes, will have to address the water quality and quantity available to the site. Cooper and Severn (1992) report that a regional water table decline could detrimentally impact the wetlands. If water management efforts at this site are not ongoing, waterbirds that once depended on the historic wetlands (and subsequent flooded croplands) present in the San Luis Valley, will disappear from the area.

Location: Approximately 10 miles south of Saguache.
U.S.G.S. 7.5 minute quadrangles: Swede Corners, Harrence Lake
Legal Description: T43N, R7E S 13, 14, 23, 24, 25
T43N, R8E S 17-21, 28-33

General Description: The site is located in the western portion of the Closed Basin along Highway 285 approximately 10 miles south of Saguache ,and covers an area of approximately 8,000 acres (see following map). The Russell Lakes site is nearly flat in relief, and ranges from 7,525 – 7,650 feet (2,295 – 2,330 meters) in elevation. Highest elevations are at the western margin and Russell Creek drains eastward through the site. A shallow underground water table and mildly undulating topography allow for expansive freshwater wetlands to flourish at the site interspersed with meadows, alkali shrublands, and ephemerally wet basins.

Vegetation within the wetlands varies considerably along salinity and moisture gradients. The larger lakes, which are predominantly freshwater, support well developed aquatic and shoreline emergent vegetation, such as pondweeds (*Potamogeton* spp.), spikerush (*Eleocharis palustris*),

hardstem bulrush (*Scirpus acutus*), broadleaf cat-tail (*Typha latifolia*), and American three-square (*Scirpus pungens*). Near Russell Springs, along Russell Creek, and around the outer margins of the large freshwater lakes are meadows of slimstem reedgrass (*Calamagrostis stricta*) and woolly sedge (*Carex lanuginosa*). Smallbeak sedge (*Carex simulata*) becomes locally abundant around springs towards the western edge of the site, and Baltic rush (*Juncus balticus*) is common where soils are slightly saline. Basins with irregular or short duration flooding, accumulate salts due to evaporation, contain saltgrass (*Distichlis spicata*), alkali cordgrass (*Spartina gracilis*), and/or western wheatgrass (*Pascopyrum smithii*) meadows. Spikerush may also dominate these ephemeral wetlands if moisture is sufficient. Adjacent alkali flats and dunes are dominated by greasewood (*Sarcobatus vermiculatus*) and rabbitbrush (*Chrysothamnus* spp.) vegetation, respectively. The slender spiderflower (*Cleome multicaulis*) forms extensive stands at this site. This annual plant flourishes on alkali soils which remain moist throughout the growing season. Stands can be seen throughout the Russell Lakes site, usually growing in rings around the wetland basins at about the same microelevation as Baltic rush.

Russell Springs, the water source for the Russell Lakes site, occur at the western edge of the site, and form the headwaters of one branch of the Closed Basin playa lake system. In addition, the hydrology is augmented by a series of artesian wells. Hardstem bulrush stands along the margins of the lakes provide excellent habitat for nesting white-faced ibis (*Plegadis chihi*), black-crowned night heron (*Nycticorax nycticorax*), snowy egret (*Egretta thula),* cattle egret (*Bubulcus ibis*), marsh wren (*Cistothorus palustris*), and perhaps the occasional migrating great egret (*Casmerodius albus*). The perennial lakes also provide habitat for chorus frog (*Pseudacris triseriata*), Great Plains toad (*Bufo cognatus*), introduced carp (*Cyprinus carpio*) and Rio Grande chub (*Gila pandora*), which serve, among other things, to feed the abundance of nesting birds.

Biodiversity Rank Justification: This site supports one of the largest populations known of the globally rare slender spiderflower (*Cleome multicaulis*). The slender spiderflower has a fairly large global range from southern Wyoming to central Mexico. In spite of its large geographic range, the plant is spatially limited by its specific habitat requirements. It requires moist, alkaline soils for germination and growth. In addition to stringent moisture and alkaline needs, the slender spiderflower appears to do well with some form of soil disturbance. These discriminating restrictions limit the slender spiderflower to the edges of alkaline playa lakes and wetlands. The Closed Basin of Colorado contains the most numerous, largest, and healthiest populations of the slender spider-flower known in the world.

Russell Lakes is unique to Saguache County in that it represents the best known breeding habitat for four state-rare wetland-dependent species of birds (white-faced ibis, black-crowned night-heron, snowy egret, and marsh wren).

Table 7. Natural Heritage elements at the Russell Lakes site.
Multiple listings of the same element represent suboccurrences. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Plant communities					
Calamagrostis stricta	slimstem reedgrass	GU	S1?Q		B 9/4/97
Carex lanuginosa montane wetland	montane wet meadow	G4	S3		A 8/24/97
Carex simulata	wet meadow	G3	S3		B 9/4/97
Plants					
Astragalus bodinii	Bodin's milkvetch	G4	S2		unranked 8/14/91
Cleome multicaulis	**slender spiderflower**	**G2G3**	**S2S3**	**(C2)**	**A 8/24/97**
Cleome multicaulis	**slender spiderflower**	**G2G3**	**S2S3**	**(C2)**	**A 8/24/97**
Cleome multicaulis	slender spiderflower	G2G3	S2S3	(C2)	A- 7/30/86
Cleome multicaulis	slender spiderflower	G2G3	S2S3	(C2)	B 8/24/97
Sisyrinchium demissum	blue-eyed grass	G5	S2		unranked 7/14/86
Fish					
Gila pandora	Rio Grande chub	G3	S1?	SC	I 1996
Birds					
Cistothorus palustris	marsh wren	G5	S3B,SZN		A 7/15/97
Egretta thula	snowy egret	G5	S2B,SZN		A 7/15/97
Nycticorax nycticorax	black-crowned night-heron	G5	S3B,SZN		A 7/15/97
Nycticorax nycticorax	black-crowned night-heron	G5	S3B,SZN		A 7/15/97
Nycticorax nycticorax	black-crowned night-heron	G5	S3B,SZN		unranked 5/14/93
Nycticorax nycticorax	black-crowned night-heron	G5	S3B,SZN		unranked 5/14/93
Nycticorax nycticorax	black-crowned night-heron	G5	S3B,SZN		unranked 6/7/94
Plegadis chihi	white-faced ibis	G5	S2B,SZN	(C2), FS	B 7/15/97
Plegadis chihi	white-faced ibis	G5	S2B,SZN	(C2), FS	unranked 6/1493
Plegadis chihi	white-faced ibis	G5	S2B,SZN	(C2), FS	unranked 5/14/93

*EO=Element Occurrence; date indicates date of last observation

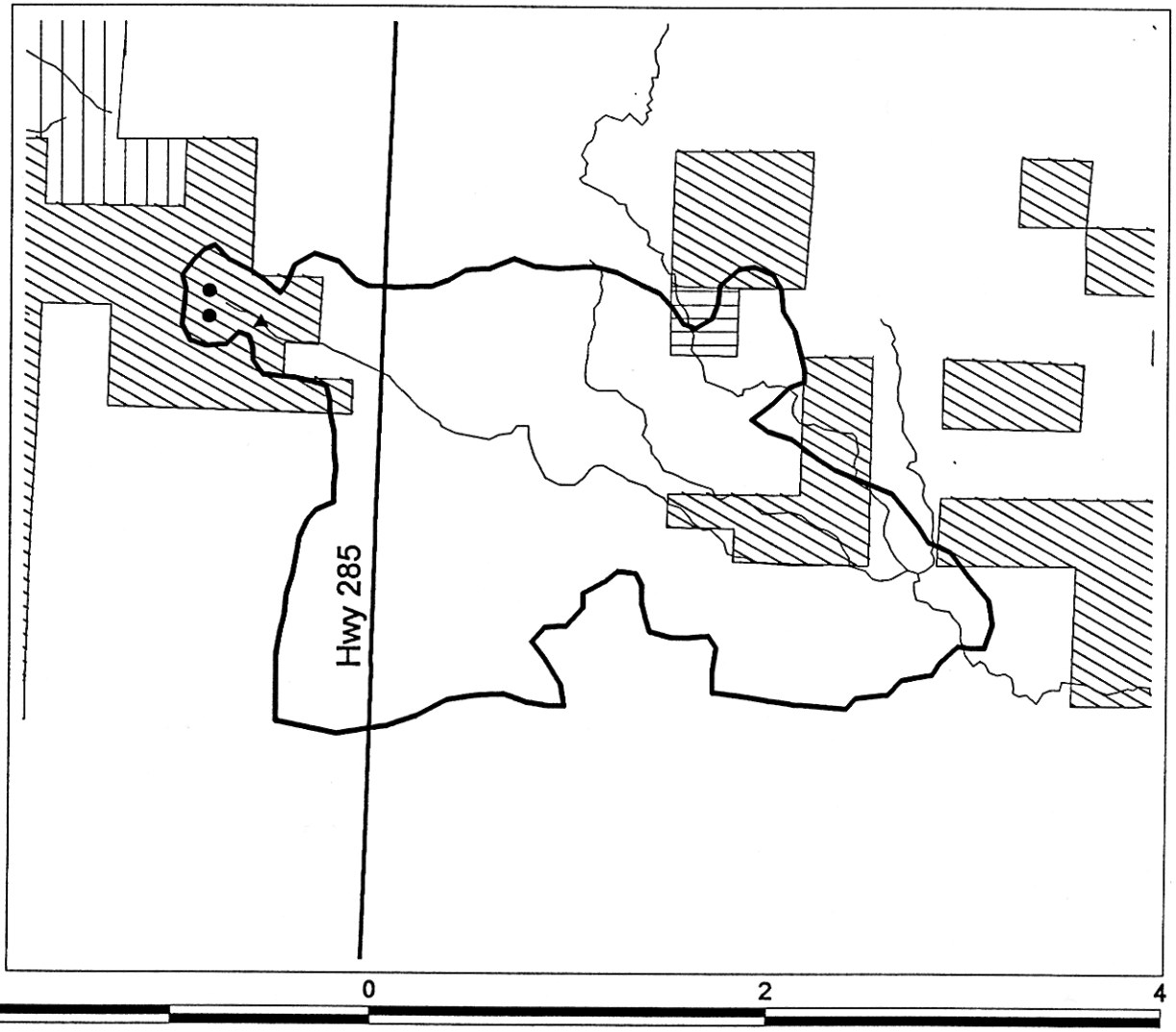
Boundary Justification: The boundaries for this site were drawn using a satellite image at a scale of 1:100,000 and encompass the spring origin, the lakes, the surrounding wetlands, and adjacent irrigated hay meadows. We considered these components to be the most critical for the long-term persistence of the elements present at the site.

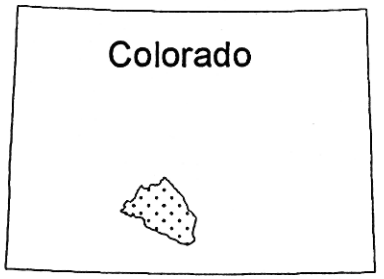
Wetland Functional Evaluation for the Russell Lakes site:
Wetland Class: riverine/lacustrine
Table 8. Wetland functional evaluation for the Russell Lakes site.

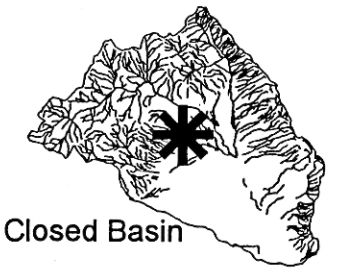
Function	Ratings	Confidence in Rating	Comments
Hydrologic Functions			
Groundwater Recharge	high	high	early season water table mound along Russell Creek
Groundwater Discharge	high	high	several free-flowing wells at this site
Floodflow Alteration	medium	medium	there is high potential for flood flow capture, but this is not an area with high surface flows
Sediment Stabilization	medium	medium	dense, but patchy vegetation
Biogeochemical Functions			
Sediment/Toxicant Retention	medium	medium	dens vegetation and numerous settling basins
Nutrient Removal/ Transformation	medium	medium	vigorous vegetation growth and organic matter accumulation
Biological Functions			
Production Export	high	high	this site is extremely productive of vegetation and exports organic material downstream
Habitat	very high	high	has one of the highest bird densities in Colorado
Aquatic Diversity/ Abundance	medium	medium	aquatic biota not sampled, but habitat is good, non-native species present
Recreation	high	high	Colorado division of wildlife preserve
Uniqueness/ Heritage Value	very high	high	outstanding concentration of wetland habitats and imperiled biological elements

Russell Lakes

(ownership status)







Public land element occurrences
- ■ vertebrate
- ★ invertebrate
- ▲ plant
- ● community

Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

N

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 12 January, 1998. Map created by Anne Ochs.

San Luis Lakes

Biodiversity Rank: B2 (Very high significance)
The site contains occurrences of eight plant communities, of which four are globally rare, four rare plant species, two rare mammal subspecies, seven rare birds, and one globally rare invertebrate species.

Protection Urgency Rank: P4
Approximately 60 % of this site is public land. The remaining 40% is owned by two large landowners, the Baca and Zapata Ranches. The majority of this site is unprotected. Considering the proximity of this site to the Great Sand Dunes ecosystem, and the concentration of biological elements contained both areas, this would be an excellent site to include in a Habitat Conservation Plan, or other regional conservation plan.

Threats to the San Luis Lakes site include disturbances to site hydrology as a result of current and potential hydrological disturbances in the watershed. The Closed Basin Project, located immediately northwest of the site, began pumping groundwater from the unconfined aquifer and transporting it to the Rio Grande in the late 1980s. Cumulative effects from this and other proposed water development projects are presently unknown, but potentially detrimental to the aquatic elements at this site.

Management Urgency Rank: M4
Current management appears to be adequate to maintain the elements at this site. Current management goals include: recreation and wetland conservation at San Luis Lakes State Park, livestock production on private and state leased lands, and wilderness preservation in the upper Sand Creek watershed. Surface impacts appear moderate at this time.

Hydrologic connections with the natural surface water sources have been disturbed by the Franklin-Eddy canal, which passes through the site. Management within the San Luis Lakes State Park appears to be supporting and, in some cases, enhancing the element occurrences there. Historically, runoff reached the valley bottom wetlands near San Luis Lakes from the northeast, via Big Springs Creek. Maintenance of the seasonal ground water mound underlying this natural flow pattern is crucial to the viability of the wetland habitats along and downstream of Big Springs Creek. This groundwater is also important to the stability of the sand dunes which form the eastern edge of this site. Water from Franklin-Eddy canal, while invaluable for wetlands at San Luis Lakes, is not an equivalent substitute for natural groundwater discharge entering the site from the east.

Location: This site extends northeast from San Luis Lakes State Park and is located 17 air miles northeast of Alamosa.

U.S.G.S. 7.5 minute quadrangles:		Hooper East, Medano Ranch, Sand Camp, Liberty, Crestone Peak, Beck Mountain
Legal Description:	T39N, R11E	S 1, 2, 3
	T39N, R12E	S 6

T40N, R11E S 1-3, 9-11, 13-16, 22-26,34-36
T40N, R12E S 2-10,14-21, 29-31
T41N, R12E S 16, 20, 21, 28-35
(some portions unsurveyed)
T25S, R73W S 1, 6, 7, 11-16,20-22, 28-31
T24S, R73W S 22-23, 25-27, 35, 36

General Description: This large site encompasses nearly 35,000 acres in the southern part of the Closed Basin playa-wetland system and is adjacent to two other significant sites: The Great Sand Dunes and Blanca Wetlands (see the following map). This site encompasses the San Luis Lakes Basin and Sand Creek, one of its primary water sources. Elevations range from approximately 7,497 feet (2287 meters)at the bottom of San Luis Lake to 12,042 feet (3673 meters) at the headwaters of Sand Creek.

There are two natural lakes at the San Luis Lakes site which have no outlet in most years. The surrounding upland habitats are saline basins or aeolian sand deposits with a decidedly saline character, supporting greasewood (*Sarcobatus vermiculatus*) and saltgrass (*Distichlis spicata*) vegetation. One of the major sources of water to the lakes is Big Springs Creek, which originates at Indian Springs approximately seven miles northeast of the lakes. The area between Indian Springs and San Luis Lakes supports the highest concentration of freshwater wetlands in the southern Closed Basin. Common wetland species include beaked sedge (*Carex utriculata*), water sedge (*Carex aquatilis*), mare's tail (*Hippuris vulgaris*), and water smartweed (*Polygonum amphibium*). Big Springs Creek receives groundwater from the extensive aquifer under Great Sand Dunes National Monument immediately to the east. Other major habitats of the site include subsaline wetlands in the San Luis Lakes basins, alkali cordgrass (*Spartina gracilis*) meadows around the lake periphery, and rabbitbrush (*Chrysothamnus* spp.) shrubland on stabilized dunes. Freshwater dune ponds occur at the eastern edge of the site and support unique wetlands of American three-square (*Scirpus pungens*) and coyote willow (*Salix exigua*).

Sand Creek drains the western slopes of the Sangre de Cristo Mountains. It originates as a steep mountain stream, eventually becoming a braided, sand bottomed stream as it flows out on the San Luis Valley floor and skirts the northern edge of Great Sand Dunes National Monument. In the mountains, Sand Creek is in a wide, steep valley floor with no roads or heavily used trails. On the valley floor, the creek and riparian zone exhibit a unique habitat produced by active fluvial processes (meandering, braiding) juxtaposed with moving sand dunes. Along its course, Sand Creek supports several globally-rare riparian plant associations.

With the exception of San Luis Lakes State Park, which is focused on recreation, and the headwaters of Sand Creek, the majority of this site is used as open range at the present time. The Zapata Ranch maintains large herds of cattle and bison, which graze the private ranch lands and leased state lands contained in the site. Grazing intensity appears moderate at this time. Elk (*Cervus elaphus*) are also numerous at the site and browse the wetland habitats extensively. A number of two track roads traverse the site, but are lightly used.

Although the site hydrology is largely natural over most of the site, there are several ditches which spread water on the Zapata Ranch, and water levels at San Luis Lakes State Park have been stabilized by water input from the Closed Basin Project.

Biodiversity Rank Justification: This site supports 21 elements of concern: eight plant communities, three plant species, two mammal subspecies, seven birds, and one invertebrate species. Five significant wetland communities are found at this site: small flowered sedge (*Carex simulata*) wet meadow, aquatic catabrosa/common monkeyflower (*Catabrosa aquatica/Mimulus glabrata*) spring wetland, spikerush (*Eleocharis palustris*) wetland, mare's tail (*Hippuris vulgaris*) wetland, and aquatic smartweed (*Polygonum amphibium*) wetland. Three riparian communities found at this site are globally-rare: white fir-blue spruce-narrowleaf cottonwood/Rocky Mountain maple (*Abies concolor-Picea pungens-Populus angustifolia/Acer glabrum*) montane riparian forest, narrowleaf cottonwood/Drummond's willow-Rocky Mountain maple (*Populus angustifolia/Salix drummondiana-Acer glabrum*) montane riparian forest, and narrowleaf cottonwood/bare sand (*Populus angustifolia/*bare sand) montane riparian forest. One state rare plant species, Bodin's milkvetch (*Astragalus bodinii*), one globally-rare subspecies, the canyon bog-orchid (*Platanthera sparsiflora* var. *ensifolia*), and the globally-rare Slender spiderflower (*Cleome multicaulis*), have been recorded at this site recently. During the 1875 Hayden expedition, botanist , T. S. Brandegee collected the only specimen known for the Colorado watercress (*Rorippa coloradensis*) (Sturkey 1972, pgs. 303-305). It is presumed that the specimen came from "Lakes of San Luis valley", meaning the San Luis Lakes region. This plant has not been seen since. Given the imprecise nature of this information, this species occurrence is not listed for this site. Should this species be found here in the future, it would dramatically increase the biodiversity significance of this site.

This site supports one of the largest populations known of the globally rare slender spiderflower. The slender spiderflower has a fairly large global range from southern Wyoming to central Mexico. In spite of this large range, populations of this plant have decreased sharply in the last 100 years, particularly in the southwestern states. The plant is also limited to very specific microhabitats, requiring moist alkaline soils. The slender spiderflower also appears to do well with some form of soil disturbance, which presumably limits plant competition. These discriminating habitat requirements limit the slender spiderflower to the edges of alkaline playa lakes and wetlands. The Closed Basin of Colorado contains the most numerous, largest, and healthiest populations in the world.

Several imperiled animal species are represented at the site, as well. Two mammal subspecies, the plains pocket mouse (*Perognathus flavescens relictus*) and silky pocket mouse (*Perognathus flavus sanluisi*), have been recorded from the dunes and alkali shrublands on the lower elevations of the site. Two invertebrate species, the camel cricket (*Daihinbaenetes giganteus*) and San Luis sandhill skipper (*Polites sabuleti ministigma*), have been recorded from the dune habitats which comprise the eastern edge of the site. Six state or globally rare bird species which use the site include: short-eared owl (*Asio flammeus*), western snowy plover (*Charadrius alexandrinus nivosus*), long-billed curlew (*Numenius americanus*), black-crowned night-heron (*Nycticorax nycticorax*), white-faced ibis (*Plegadis chihi*), and Forster's tern (*Sterna forsteri*).

Table 9. Natural Heritage element occurrences at the San Luis Lakes site.
Multiple listings of the same element represent suboccurrences. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Plant communities					
Abies concolor-Picea pungens-Populus angustifolia/Acer glabrum	**montane riparian forest**	**G1**	**S1**		**A 7/25/97**
Abies concolor-Picea pungens-Populus angustifolia/Acer glabrum	montane riparian forest	G1	S1		B 7/25/97
Carex simulata	wet meadow	G3	S3		A 6/10/97
Catabrosa aquatica-Mimulus glabratus	spring wetland	GU	S3		B 6/10/97
Eleocharis palustris	spikerush wetland	G5	S3S4		B 6/11/97
Hippuris vulgaris	mare's tail wetland	GU	S3		A 8/22/97
Polygonum amphibium montane wetland	montane wet meadow	G2	SU		B 8/22/97
Populus angustifolia/Salix drummondiana-Acer glabrum	**montane riparian forest**	**G1**	**S1**		**A 7/25/97**
Populus angustifolia/sand dunes	**sand dune riparian forest**	**G1**	**S1**		**A 7/10/97**
Insects					
Polites sabuleti ministigma	San Luis sandhill skipper	G5T3	S5		B 6/13/97
Plants					
Astragalus bodinii	Bodin's milkvetch	G4	S2		unranked 7/30/91
Cleome multicaulis	**slender spiderflower**	**G2G3**	**S2S3**	**(C2)**	**A 7/8/86**
Cleome multicaulis	**slender spiderflower**	**G2G3**	**S2S3**	**(C2)**	**A 6/10/97**
Cleome multicaulis	slender spiderflower	G2G3	S2S3	(C2)	A- 7/8/86
Cleome multicaulis	slender spiderflower	G2G3	S2S3	(C2)	A- 7/8/86
Cleome multicaulis	slender spiderflower	G2G3	S2S3	(C2)	A- 7/8/86
Cleome multicaulis	slender spiderflower	G2G3	S2S3	(C2)	B 7/8/86
Cleome multicaulis	slender spiderflower	G2G3	S2S3	(C2)	B 8/22/97
Cleome multicaulis	slender spiderflower	G2G3	S2S3	(C2)	B 6/11/97
Cleome multicaulis	slender spiderflower	G2G3	S2S3	(C2)	C- 7/8/86
Platanthera sparsiflora var. *ensifolia*	canyon bog orchid	G4G5T3	S2		C 6/28/97
Birds					
Asio flammeus	short-eared owl	G5	S2B,SZN		unranked 6.23/93
Charadrius alexandrinus nivosus	western snowy plover	G4T3	S1B,SZN	LT, SC, FS	unranked 5/19/92
Charadrius alexandrinus nivosus	western snowy plover	G4T3	S1B,SZN	LT, SC, FS	unranked 6/3/92
Numenius americanus	long-billed curlew	G5	S2B,SZN	(3C), SC, FS	unranked 1975-06
Numenius americanus	long-billed curlew	G5	S2B,SZN	(3C), SC, FS	unranked 6/15/75

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Nycticorax nycticorax	black-crowned night-heron	G5	S3B,SZN		unranked 5/21/93
Nycticorax nycticorax	black-crowned night-heron	G5	S3B,SZN		unranked 5/26/93
Plegadis chihi	white-faced ibis	G5	S2B,SZN	(C2), FS	A 6/12/97
Plegadis chihi	white-faced ibis	G5	S2B,SZN	(C2), FS	unranked 5/21/93
Podiceps nigricollis	eared grebe	G5	S3B,SZN		A 6/12/97
Sterna forsteri	Forster's tern	G5	S2B,S4N		unranked 5/26/94
Sterna forsteri	Forster's tern	G5	S2B,S4N		unranked 8/1/94
Mammals					
Perognathus flavescens relictus	plains pocket mouse subsp.	G5T2	S2		unranked 7/2/09
Perognathus flavus sanluisi	silky pocket mouse subsp.	G5T3	S3		unranked no date
Perognathus flavus sanluisi	silky pocket mouse subsp.	G5T3	S3		historic 6/21/09
Perognathus flavus sanluisi	silky pocket mouse subsp.	G5T3	S3		historic 6/30/09

*EO=Element Occurrence; dates indicate date of last observation

Boundary Justification: The San Luis site boundary includes all of the known occurrences listed for the site. It also includes immediate potential habitat that has not been thoroughly inventoried, but is likely to include many of the elements of concern. The adjacent Blanca Wetlands site contains similar habitat and the sites may be regarded as functionally connected. The site boundary was based on initial aerial photo analysis, a field visit by several CNHP scientists, and subsequent validation with satellite imagery.

Wetland Functional Evaluations for the San Luis Lakes site:

Table 10. Wetland functional evaluation for lower Sand Creek (San Luis Lakes site).
Wetland Type: riverine

Function	Ratings	Confidence in Rating	Comments
Hydrologic Functions			
Groundwater Recharge	very high	high	this creek loses its entire flow to the streambed and is very important in maintaining the locally high water table
Groundwater Discharge	low	medium	no springs were observed at the site
Floodflow Alteration	low	medium	flooding is a minor risk at this site
Sediment Stabilization	low	medium	due to the sandy substrate, vegetation can only marginally stabilize the site
Biogeochemical Functions			
Sediment/Toxicant Retention	low	medium	the sediment at this site is in constant flux
Nutrient Removal/ Transformation	low	medium	no known source of excess nutrients in the upper watershed
Biological Functions			
Production Export	low	medium	overall productivity is low, surface flows do not escape the site
Habitat	high	high	this is excellent riparian habitat which serves as a water source for elk and other animals
Aquatic Diversity/ Abundance	low	medium	although aquatic biota were not sampled, shifting sand substrata and large fluctuations in water temperatures probably limit diversity and abundance
Recreation	medium	medium	access is difficult, but this site is very scenic
Uniqueness/ Heritage Value	very high	high	this stream, and Medano Creek which drains the southern dunes, are the only streams passing through moving sand dunes in Colorado

Table 11. Wetland functional evaluation for the San Luis Lakes (San Luis Lakes site).
Wetland Type: lacustrine

Function	Ratings	Confidence in Rating	Comments
Hydrologic Functions			
Groundwater Recharge	high	high	these lake basins are a holding basin for surface flow from off-site
Groundwater Discharge	low	medium	some discharge into lake basins during low water, but water table is generally below the surface
Floodflow Alteration	low	medium	floods are fairly uncommon in the area
Sediment Stabilization	low	medium	the area is covered with sparse vegetation
Biogeochemical Functions			
Sediment/Toxicant Retention	medium	medium	this site is a settling basin for transported sediment
Nutrient Removal/ Transformation	low	medium	no known source of excess nutrients in the upper watershed
Biological Functions			
Production Export	low	medium	although production in this wetland is high, it is only rarely transported downstream
Habitat	very high	high	this wetland complex provides outstanding habitat for many common and rare species
Aquatic Diversity/ Abundance	medium	medium	aquatic biota were not sampled, but invertebrate life is copious
Recreation	very high	high	much of this wetland is a state park and is heavily used for recreation
Uniqueness/ Heritage Value	very high	high	this is a natural lake basin with associated wetlands in an alkali desert. the habitat is unique and harbors many biological elements of concern

Table 12. Wetland functional evaluation for the Little Springs Creek (San Luis Lakes site).
Wetland Type: Depressional/slope

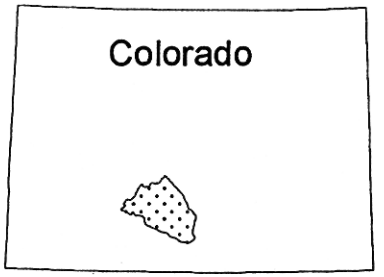
Function	Ratings	Confidence in Rating	Comments
Hydrologic Functions			
Groundwater Recharge	low	medium	on and adjacent to this wetland groundwater is lost, not gained
Groundwater Discharge	high	medium	this is a site where the water table intercepts the soil surface as a dune pond, springs are located at the edge of the dunefield just adjacent
Floodflow Alteration	low	high	no flooding at this site
Sediment Stabilization	low	medium	this pond is in the midst of an active dune field which is inherently unstable
Biogeochemical Functions			
Sediment/Toxicant Retention	low	medium	no transported sediment or toxins reach this wetland
Nutrient Removal/ Transformation	low	medium	no excess nutrients reach this wetland
Biological Functions			
Production Export	low	high	although productivity is high, little or no organic material escapes this wetland
Habitat	high	high	this is a very unique wetland habitat and watering hole in the midst of a dune field
Aquatic Diversity/ Abundance	medium	medium	this wetland is isolated and probably dries occasionally, limiting aquatic biodiversity
Recreation	low	medium	although this site is unique and offers excellent opportunity for wildlife observation, it is privately owned and access is difficult
Uniqueness/ Heritage Value	very high	high	this wetland type is globally rare

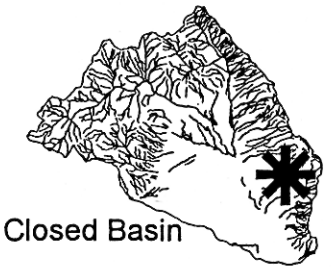
Table 13. Wetland functional evaluation for Big Springs Creek wetland (San Luis Lakes site).
Wetland Type: slope

Function	Ratings	Confidence in Rating	Comments
Hydrologic Functions			
Groundwater Recharge	very high	high	this springfed wetland transports water from springs near the edge of the sand dunes to build up groundwater levels near the San Luis Lakes downstream
Groundwater Discharge	very high	high	the springs at the upstream edge of this site discharge abundant groundwater
Floodflow Alteration	low	medium	this stream is springfed and overbank flooding is unlikely
Sediment Stabilization	medium	medium	dense vegetation
Biogeochemical Functions			
Sediment/Toxicant Retention	low	medium	site does not receive transported sediment
Nutrient Removal/ Transformation	low	medium	no excess nutrients in watershed
Biological Functions			
Production Export	high	high	this wetland complex is very productive and exports organic material to the San Luis Lakes complex downstream
Habitat	high	high	this site provides water and forage for native ungulates and other wildlife in an otherwise arid saline region
Aquatic Diversity/ Abundance	high	high	good diversity of aquatic plants, and stable baseflows; high potential for aquatic invertebrate fauna
Recreation	low	high	although this site provides excellent potential for natural history observation, it is entirely privately owned
Uniqueness/ Heritage Value	very high	high	this is an exceptionally stable springfed peatland in the midst of arid sand dune and alkali shrubland habitat. this wetland type is unique in Colorado

San Luis Lakes/ Sand Creek

(ownership status)





Public land element occurrences
- vertebrate
- invertebrate
- plant
- community

Saguache county
Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

N

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 12 January, 1998. Map created by Anne Ochs.

Mishak Lakes

Biodiversity Rank: B2 (high significance)
This site contains excellent stands of two plant communities, a spikerush wetland and a saline bottomland shrubland; a globally rare plant species, the slender spiderflower; and one rare invertebrate, the San Luis Valley sand hills skipper.

Protection Urgency Rank: P2
There is a definable threat of hydrologic alteration which may occur in the near future. This site is entirely in private ownership. Approximately 75% of this site is owned and managed by The Nature Conservancy. The remaining 25%, which lies around the perimeter of the TNC preserve, is private or federal rangeland with no formal protection. A conservation easement or other form of protection might be considered to prevent development or other negative impacts to the unprotected wetland habitat. The status of the water supporting the site is volatile and may change dramatically within the next few years.

Management Urgency Rank: M3
Management may be needed within the next five years to maintain the current quality of the element occurrences. The majority of this site is managed for conservation. Livestock grazing at the site is present, and impacts are moderate. The site hydrology is affected by numerous on-site and off-site disturbances. Perturbations from the upper watershed, such as water diversion on the tributary creeks and center pivot irrigation, have complicated hydrologic effects on downstream sites such as this one. In addition to agricultural development, which has affected the local hydrology for many years, the more recent Closed Basin project, located immediately east of the site, began pumping groundwater from the unconfined aquifer and transporting it to the Rio Grande in the late 1980s.

Due to the confusing array of hydrologic disturbances, it is extremely difficult to accurately estimate management needs and viability potential for the elements of concern at this site. Information needs are vast. Effective management will require a much better understanding of the hydrologic connections between surface, and shallow and deep groundwater resources. Management of this site requires, therefore, not only local protection of on-site wetland elements, but secure water resources, and greater understanding of how current and anticipated water uses within the watershed will affect the wetlands.

Location: The site is located 6 air miles southwest of Moffat.
U.S.G.S. 7.5 minute quadrangles: Moffat South, Harrence Lake
Legal Description: T42N, R9E S 2, 3, 4, 5, 9, 10, 11, 14, 15
T43N, R9E S 32, 33, 34, 35

General Description: This site contains over 1300 acres of shallow wetlands, meadows and shrublands between 7,500 and 7,550 feet (2,288-2,303 meters) in elevation in the west-central part of the Closed Basin. The Mishak Lakes basin receives seasonal runoff from Russell Creek and Werner Arroyo, two ephemeral streams. The sites contains Mishak Lakes Preserve, which is

owned by The Nature Conservancy, with peripheral private and Bureau of Land Management land. The lakes fill from snowmelt runoff in late spring and are usually dry by late summer. The lakes may fill again in late summer if convective precipitation is adequate. The soils in the lake basins are alkali clays with low rates of water infiltration. This allows rapid evaporation at the water surface and an accumulation of salts.

The basins support a flora adapted to seasonal soil saturation and saline conditions (TNC 1993). The lakes vary in depth, salinity, and period of inundation, all of which influence local vegetation patterns. Regularly flooded basins support aquatic and shoreline emergent vegetation, with pondweeds (*Potamogeton* spp.) in standing water, and spikerush (*Eleocharis palustris*) or American three-square (*Scirpus pungens*) forming marshlands at the lake margins. This site contains some of the most extensive spikerush wetlands in the Closed Basin. At the highest elevations of these basin wetlands, stands of Baltic rush (*Juncus balticus*) or alkali cordgrass (*Spartina gracilis*) usually mark the wetland boundary, interspersed with populations of the globally imperiled slender spiderflower (*Cleome multicaulis*). Stands of this plant are concentrated near the western margin of the site, presumably where hydrologic inputs from Russell Creek are more reliable. Basins with irregular or short duration flooding contain saltgrass (*Distichlis spicata*) and/or western wheatgrass (*Pascopyrum smithii*) meadows, or barren salt flats. Basins which dry by mid-summer often support seasonal stands of salt tolerant annuals, such as goosefoot (*Chenopodium album*), which complete their life cycles after surface water evaporates and the late summer rains begin. Adjacent alkali flats and dunes are dominated by greasewood (*Sarcobatus vermiculatus*) and rabbitbrush (*Chrysothamnus* spp.) vegetation, respectively, with understories of saltgrass or alkali sacaton (*Sporobolus airoides*).

The Mishak Lakes site is unique in its abundance of shallow, seasonal wetlands, and plays a supportive role to the other large wetland complexes in the Closed Basin. Although no rare breeding birds nest at the site, shorebirds, such as Wilson's phalarope (*Phalaropes tricolor*) seem to prefer the shallow water habitats of the site (TNC 1993), and many other shorebirds, waterbirds, and waterfowl use the site for foraging. The saltgrass basins of the site provide habitat for the state rare San Luis Valley sand hills skipper (*Polites sabuleti* ssp. *ministigma*).

Although the majority of the site is now managed for conservation, livestock continue to graze the site. The lands around the edges of the site are managed as rangeland. Site visitation is very limited, with no site for open public access at this time.

Biodiversity Rank Justification: Mishak Lakes is one of the last remaining playa systems in the San Luis Valley with a largely natural pattern of hydrologic variation. The lake system is unique in its shallow and ephemeral nature, and likely represents a wetland type which was formerly much more extensive in the San Luis Valley and the Great Plains (TNC 1993). Most of the wetlands complexes in the San Luis Valley have been modified, intensively managed for waterfowl production, or destroyed (TNC 1993). Protection of this naturally functioning shallow wetland system is an essential complement to the other wetland communities of the San Luis Valley and a valuable contribution to biodiversity protection in Colorado.

This site supports a medium sized population of the globally rare slender spiderflower. The slender spiderflower has a fairly large global range from southern Wyoming to central Mexico.

In spite of this large range, populations of this plant have decreased sharply in the last 100 years, particularly in the southwestern states. The plant is also limited to very specific microhabitats, requiring alkaline soils which remain moist throughout the growing season. The slender spiderflower also appears to do well with some form of soil disturbance, which presumably limits plant competition. These discriminating habitat requirements limit the slender spiderflower to the edges of alkaline playa lakes and wetlands. The Closed Basin of Colorado contains the most numerous, largest, and healthiest populations known in the world.

The San Luis Valley sandhills skipper (*Polites sabuleti* ssp. *ministigma*) is an endemic subspecies found in the alkaline grasslands of the San Luis Valley. Although its biology is poorly known at present, saltgrass is used by the insect as a host plant. The San Luis Valley sandhills skipper can be found in shallow wetland basins of the valley floor after ponded waters have receded.

Table 14. Natural Heritage element occurrences at the Mishak Lakes site.
Multiple listings of the same element represent suboccurrences. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Plant communities					
Eleocharis palustris	**spikerush wetland**	**G5**	**S3S4**		
Sarcobatus vermiculatus/Distichlis spicata	**saline bottomland shrubland**	**G3**	**S1**		**A 7/10/97**
Plants					
Cleome multicaulis	slender spiderflower	G2G3	S2S3	(C2)	B 7/10/97
Insects					
Polites sabuleti ssp. *ministigma*	San Luis Valley sand hills skipper	G5	S3		
Mammals					
Cynomys gunnisoni gunnisoni	Gunnison prairie dog	G5T3	S3		C 8/97
Birds					
Athene cunicularia	burrowing owl	G4	S3S4B	(C2)	C 5/97

*EO=Element Occurrence; date indicates date of last observation

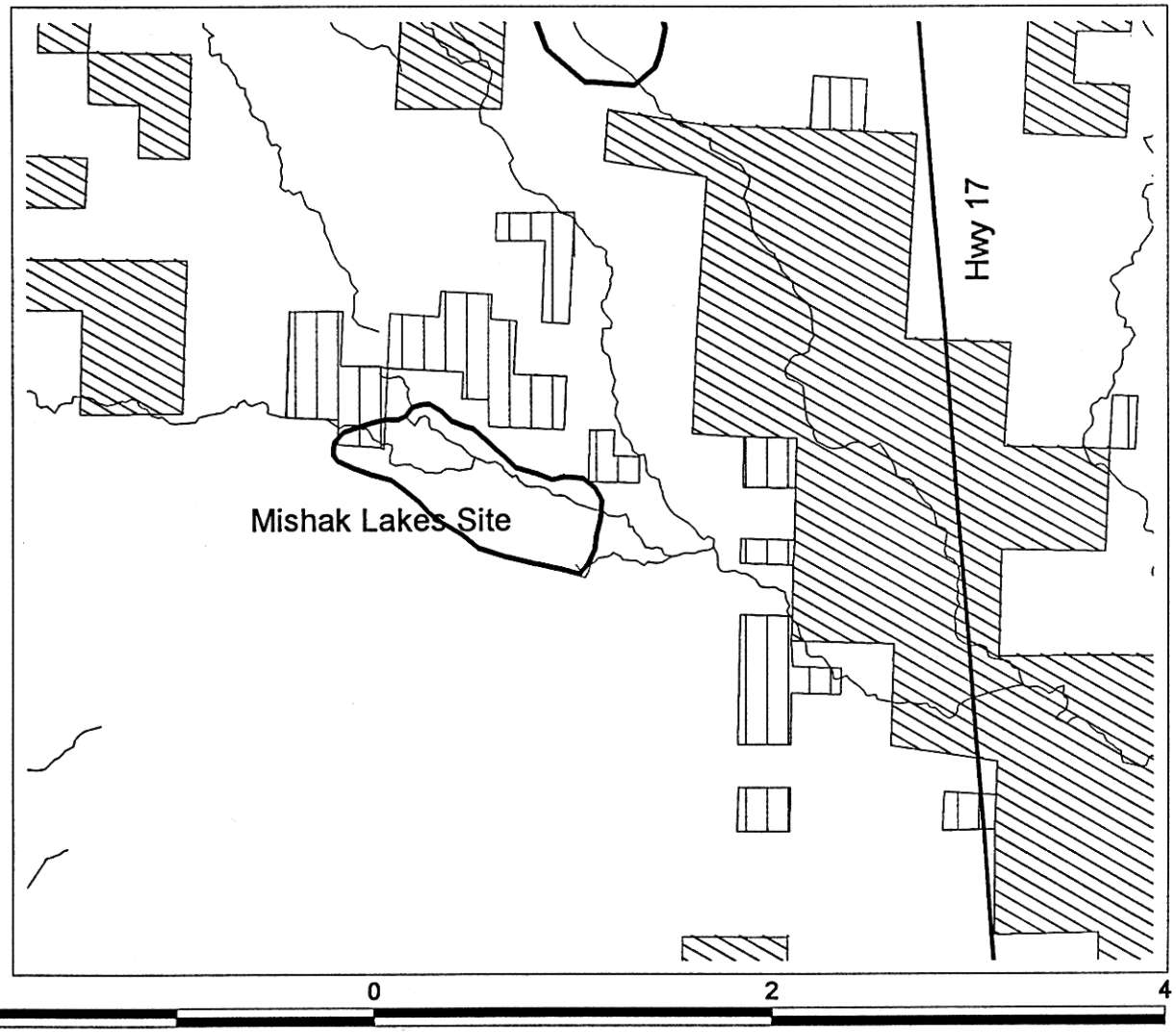
Boundary Justification: This boundary is drawn to 1) protect the occurrences from direct impacts such as trampling or other surface disturbances; 2) provide suitable habitat where additional individuals of slender spiderflower can become established over time; and 3) include representation from each of the local plant communities which may support a pollinator for the rare plant species.

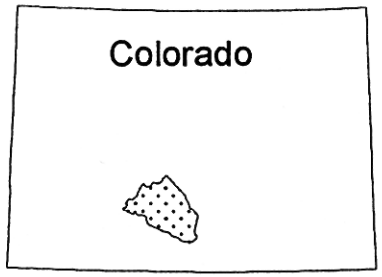
Wetland Functional Evaluation for the site:
Wetland Class: riverine/depressional
Table 15. Wetland functional evaluation for the Mishak Lakes site.

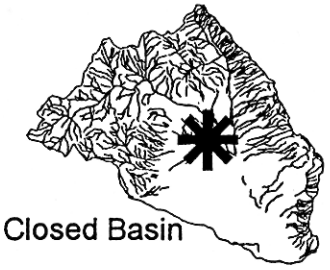
Function	Ratings	Confidence	Comments

		in Rating	
Hydrologic Functions			
Groundwater Recharge	low	medium	playa soils are poorly permeable; most water lost to evaporation
Groundwater Discharge	low	medium	no natural springs at the site
Floodflow Alteration	high	high	playa basins intercept surface flows from several streams and arroyos
Sediment Stabilization	medium	medium	patchy but dense rhizomatous vegetation
Biogeochemical Functions			
Sediment/Toxicant Retention	medium	medium	playa basins cause settling of tranported sediment
Nutrient Removal/ Transformation	high	high	transforms runoff and groundwater from surrounding agricultural lands
Biological Functions			
Production Export	medium	medium	little exit flow from site
Habitat	very high	high	shorebirds, waterfowl, native mammals
Aquatic Diversity/ Abundance	medium	high	excellent production of aquatic insects
Recreation	medium	high	access is difficult, but birdwatching is excellent
Uniqueness/ Heritage Value	high	high	This is one of the best largely natural functioning playa wetland ecosystems in the San Luis Valley, and contains habitat for several state rare species.

Mishak Lakes
(ownership status)







Public land element occurrences
- vertebrate
- invertebrate
- plant
- community

Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

N

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 12 January, 1998. Map created by Anne Ochs.

Blanca Wetlands

Biodiversity Rank: B2 (Very high significance)
The Blanca Wetlands site contains one globally imperiled plant species, the slender spiderflower. The snowy plover, white-faced ibis, and black-crowned night heron, all state rare birds, nest at the site. Excellent stands of saltmarsh bulrush and red glasswort wetlands also occur at the site.

Protection Urgency Rank: P3
This site is of mixed ownership; the center 60% of the site is publicly owned and managed for wildlife habitat by the Bureau of Land Management; the remainder of the site is comprised of state and private lands. The private lands have no formal protection, but the BLM lands are restricted in use during the breeding season to protect nesting birds.

Management Urgency Rank: M4
Current management appears to be adequate, but adjustments may be needed in the future to enhance the site. The site, as it is described here, relies upon a system of intensive water management for maintenance of the existing biological elements. Hydrologic connections with the natural surface water sources have been severed by the Franklin-Eddy canal, which skirts the eastern edge of the site. Therefore, continued access to water and appropriate management are essential to maintain the elements. Management within the BLM Blanca Wetlands Area appears to be supporting and, in some cases, enhancing the element occurrences there. Restoration of the playa depressions north of the BLM Blanca Wetlands Area to naturally functioning wetlands will require sufficient water allocations from canal or artesian sources, and active management. Water should be applied to these sites in a natural seasonal regime, including both seasonal and inter-annual variation, to restore natural wetland functions and values.

Location: The Blanca Wetlands site is located in east-central Alamosa County, approximately 8 air miles northeast of the city of Alamosa.

U.S.G.S. 7.5 minute quadrangle: Dry Lakes
Legal Description: T39N, R12E S 29, 30, 31, 32
T39N, R11E S 23, 24, 25, 26, 35, 36
T38N, R12E S 4, 5, 6, 7, 8, 9, 16, 17, 18, 19
T38N, R11E S 1, 2, 11, 12, 13, 14, 23, 24, 25, 26, 35, 36

General Description: The Blanca Wetlands site encompasses over 15,400 acres at the lowest elevation of the Closed Basin, 7,500 to 7,550 feet (2,288-2,303 meters). The site is characterized by a mosaic of low dunes and depressions, with little topographic relief. The Bureau of Land Management presently employs intensive management for waterfowl, waterbird, and shorebird habitat. The natural and augmented topographic depressions are seasonally flooded by canal or artesian water to produce a diverse mosaic of wetland habitats. The artesian wells are generally located at the slightly higher elevations, and water is allowed to flow by gravity through the reserve, supporting a series of wetland types. Ponds, marshes, subsaline wetlands, and hypersaline playas are produced sequentially from a given water source as flow is lost to evaporation and salts accumulate. With the exception of rinsed pond or marsh soils near the

artesian wells, wetland soils are highly alkaline (pH 8.5-10.5) and poor in organic matter (BLM 1995).

The Blanca Wetlands site supports a variety of wetland vegetation types. The basins historically filled from snowmelt runoff in late spring and were dry by late summer. Although management has changed conditions considerably, the site retains a flora adapted to seasonal soil saturation and, in many areas, saline conditions. Regularly flooded basins or ponds support well-developed aquatic and shoreline emergent vegetation, such as pondweeds (*Potamogeton* spp.), broadleaf cat-tail (*Typha latifolia*), spikerush (*Eleocharis palustris*), hardstem bulrush (*Scirpus acutus*), and saltmarsh bulrush (*Scirpus maritimus*) . Basins with irregular or short duration flooding contain saltgrass (*Distichlis spicata*) and/or western wheatgrass (*Pascopyrum smithii*) meadows, or barren salt flats. Basins which dry by mid-summer support seasonal stands of salt tolerant annuals, such as goosefoot (*Chenopodium* spp.), seablite (*Suaeda calceoliformis*), and red glasswort (*Salicornia rubra*), which complete their life cycles after surface water evaporates and the late summer rains begin. The largest stands of red glasswort in the Closed Basin, and possibly all of Colorado, occur in hypersaline playas at this site. Alkali flats and dunes adjacent to the wetlands are dominated by greasewood (*Sarcobatus vermiculatus*) and rabbitbrush (*Chrysothamnus* spp.) vegetation, respectively.

The slender spiderflower (*Cleome multicaulis*) forms extensive stands at this site. This annual plant flourishes on alkali soils which remain moist throughout the growing season. Stands can be seen throughout the Blanca Wetlands site, usually growing in rings around the wetland basins at about the same microelevation as Baltic rush (*Juncus balticus*).

Stands of cat-tail, spikerush, and bulrush along the margins of the ponds provide excellent habitat for nesting white-faced ibis (*Plegadis chihi*), western snowy plover (*Charadrius alexandrinus nivosus*), and black-crowned night heron (*Nycticorax nycticorax*); and many other migratory birds use the site. Perennial ponds at the artesian wells provide habitat for chorus frog (*Pseudacris triseriata*) and Great Plains toad (*Bufo cognatus*). Bass, bluegill, and trout introduced for angling, and carp used for weed control, serve, among other things, to feed the abundance of nesting birds.

Biodiversity Rank Justification: The Blanca Wetlands site contains large populations of the globally imperiled slender spiderflower (*Cleome multicaulis*). The slender spiderflower has a fairly large global range from southern Wyoming to central Mexico. In spite of this large range, the plant is geographically limited due to its specific growing requirements. The Closed Basin of Colorado contains the most numerous and largest populations known in the world.

The site contains some of the largest stands of red glasswort (*Salicornia rubra*) and saltmarsh bulrush (*Scirpus maritimus*) in the state of Colorado. This red glasswort wetland type occurs over a broad geographic range, but also has very specific habitat needs (Ungar 1974). It has been documented from San Luis Valley, Colorado northeast to Nebraska and north to Saskatchewan (Ungar 1974, Cooper 1990). In many areas, hypersaline wetland basins which support this community type have been impacted by water diversion, livestock grazing, and land conversion in many places, and red glasswort wetlands are considered to be highly imperiled in

Nebraska (Gersib and Steinauer 1991). There are only two confirmed localities for this wetland type in Colorado. Saltmarsh bulrush wetlands also have a broad distribution in North America, but sizable stands are rare in Colorado. Only two other saltmarsh bulrush wetlands have been documented in Colorado (CNHP 1997).

The Blanca Wetlands area is a critical source of support for migratory birds in interior North America. American bittern, avocet, common yellow throat, eared grebe, Forster's tern, northern harrier, savanna sparrow, snowy egret, snowy plover, sora rail, western grebe, white-faced ibis, and yellow-headed blackbird are all deemed "species of management priority" by Colorado Division of Wildlife, and documented to nest at this site (BLM 1995). Annual production is estimated at 6,000 birds per year.

Table 16. Natural Heritage element occurrences at Blanca Wetlands site.
Multiple listings of elements represent suboccurrences. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Plant communities					
Salicornia rubra	**western slope salt meadow**	**G2**	**S1?**		**A 8/25/97**
Scirpus maritimus wetland	emergent wetland (marsh)	G4	S?		A 8/25/97
Plants					
Cleome multicaulis	**slender spiderflower**	**G2G3**	**S2S3**	**(C2)**	**A 8/25/97**
Cleome multicaulis	slender spiderflower	G2G3	S2S3	(C2)	A- 7/7/86
Cleome multicaulis	slender spiderflower	G2G3	S2S3	(C2)	B+ 9/8/86
Cleome multicaulis	slender spiderflower	G2G3	S2S3	(C2)	D+ 7/786
Birds					
Charadrius alexandrinus nivosus	western snowy plover	G4T3	S1B,SZN	LT, SC, FS	A 5/25/97
Charadrius alexandrinus nivosus	western snowy plover	G4T3	S1B,SZN	LT, SC, FS	unranked 6/24/92
Charadrius alexandrinus nivosus	western snowy plover	G4T3	S1B,SZN	LT, SC, FS	unranked 7/22/93
Charadrius alexandrinus nivosus	western snowy plover	G4T3	S1B,SZN	LT, SC, FS	unranked 7/16/92
Nycticorax nycticorax	black-crowned night-heron	G5	S3B,SZN		unranked 6/21/93
Nycticorax nycticorax	black-crowned night-heron	G5	S3B,SZN		unranked 6/7/94

*EO=Element Occurrence; date indicates date of last observation

Boundary Justification: The Blanca Wetlands site boundary includes all of the known occurrences listed in this site. It also includes proximate potential habitat that has not been thoroughly inventoried, but is likely to include many of the elements of concern. The adjacent San Luis Lakes site contains similar habitat, and the sites may be regarded as functionally connected. The site boundary was based on initial aerial photo analysis, a field visit by a CNHP wetland ecologist, and subsequent validation with satellite imagery.

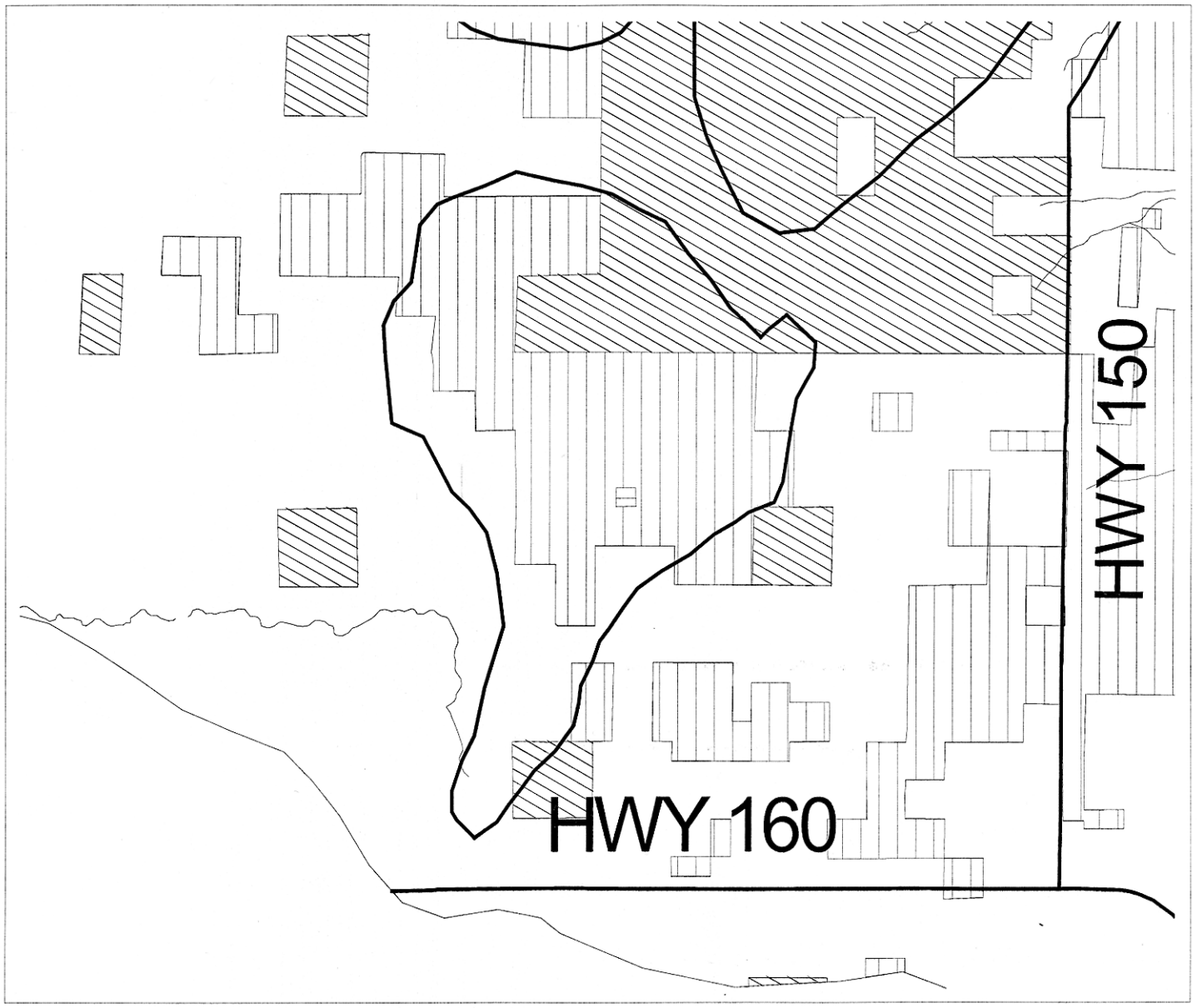
Wetland Functional Evaluation for the Blanca Wetlands site:

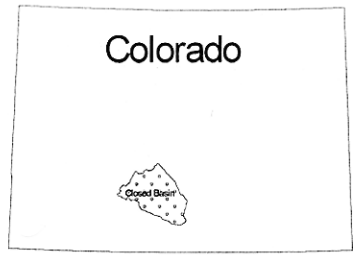
Wetland Class: depressional

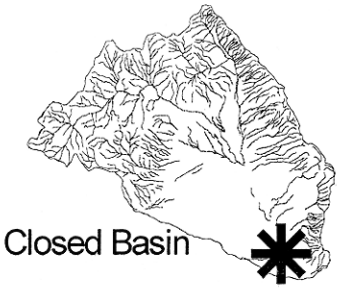
Table 17. Wetland functional evaluation for the Blanca Wetlands site.

Function	Ratings	Confidence in Rating	Comments
Hydrologic Functions			
Groundwater Recharge	very high	high	surface inputs of closed basin canal and artesian water
Groundwater Discharge	low	high	no natural springs at site
Floodflow Alteration	low	high	no natural flood flows reach site
Sediment Stabilization	low	medium	relatively sparse vegetation cover
Biogeochemical Functions			
Sediment/Toxicant Retention	low	medium	no known surface inputs
Nutrient Removal/ Transformation	low	medium	no known surface inputs
Biological Functions			
Production Export	low	medium	substantial production in marshes, but no outflow
Habitat	very high	high	excellent habitat for shorebirds, waterfowl, wading birds, passerines, and raptors
Aquatic Diversity/ Abundance	very high	high	very high densities of aquatic insects
Recreation	high	high	popular fishing, hunting and birdwatching site
Uniqueness/ Heritage Value	very high	high	best example of hypersaline playas in the San Luis Valley

Blanca Wetlands
(ownership status)







Saguache county
Closed basin
Roads
Streams
Suggested conservation sites
Land ownership
USFS
BLM
NPS
CDOW
State
Private

N

Weisman Lakes

Biodiversity Rank: B3 (High significance)
This wetland site includes eight occurrences of globally and state imperiled fish, mammals, birds, and plant communities.

Protection Urgency Rank: P2
This site is comprised of private, state land board properties, and a U. S. Fish and Wildlife refuge on White Ranch. The state parcels are leased by an adjacent landowner, primarily for cattle grazing. There are no current easements on the property, and the status of the water that affects the site is volatile and may change dramatically within the next few years.

Management Urgency Rank: M4
In general, the landscape appears to be more or less intact, with only a few two-track roads and ditches crossing the site. However, the site hydrology is affected by numerous on-site and off-site disturbances. The White Ranch U.S. Fish and Wildlife refuge at the extreme southern end of this site has several active wells which are maintained to enhance waterbird habitat. The Baca Ranch, at the northern part of this site, diverts much of the incoming water from Cottonwood and Deadman creeks into irrigated hay meadows, severely limiting the direct flow into Weisman Lakes. Perturbations from the upper Closed Basin (e.g., water diversion on San Luis and Saguache creeks and center pivot irrigation) have complicated effects on downstream sites such as this one. In addition to agricultural development, which has affected the local hydrology for many years, the more recent Closed Basin project, located adjacent to the site, began pumping groundwater from the unconfined aquifer and transporting it to the Rio Grande in the late 1980s.

Due to the confusing array of hydrologic disturbances, it is extremely difficult to accurately estimate management needs and viability potential for the elements of concern at this site. Information needs are vast. Effective management will require a much better understanding of the hydrologic connections between surface and shallow and deep groundwater resources. Management of this site requires, therefore, not only local protection of on-site wetland elements, but secure water resources, and greater understanding of how current and anticipated water uses within the watershed will affect the wetlands.

Location: Western edge of the Luis Maria Baca Ranch and the adjacent state lands.

U.S.G.S. 7.5 minute quadrangles: Sheds Camp, Deadman Camp.

Legal Description:	T41N, R10E	S 1, 2, 11-14, 23-25, 36
	T41N, R11E	17-20, 30, 31 and unsurveyed
	T42N, R10E	S 1, 2, 11-15, 23-26, 35, 36
	T42N, R11E	unsurveyed

General Description: The Weisman Lakes site occurs in the middle of the playa lake system of the central Closed Basin (see following map). The playa lakes system in the Closed Basin

includes ephemeral wetlands that generally support salt meadow grass (*Distichlis spicata*), western wheatgrass (*Pascopyrum smithii*), and spikerush (*Eleocharis palustris)* in the lake basins, and are often surrounded by greasewood (*Sarcobatus vermiculatus*) uplands.

The Weisman Lakes area occurs at the confluence of most of the prominent drainages of the closed basin including San Luis, Saguache, Deadman, Cottonwood, and Russell Creeks. This location allows wetlands to hold open water longer than in other areas of the playa lake system. These permanent wetlands support, spikerush (*Eleocharis palustris*), the native Rio Grande chub (*Gila pandora*), the introduced fathead minnow (*Pimephales promelas*), the eared grebe (*Podiceps nigricollis*), and many amphibians, including striped chorus frog (*Pseudacris triseriata*), plains spadefoot (*Spea bombifrons*), and Great Plains toad (*Bufo cognatus*). This diverse vertebrate biomass base no doubt provides forage for many of the state rare waterbirds that nest in the Closed Basin.

Basin wetlands at the southern end of the site become increasingly ephemeral and support salt meadow grass and western wheatgrass communities which are common throughout the playa lake system. These ephemeral basins abut the greater sand dunes ecosystem to the southeast, which may help to support the richness of endemic small mammals that occur on this site.

The site is approximately 7,800 acres in size and ranges in elevation from 7,500 to 7,515 feet (2,285-2,290 meters).

Biodiversity Rank Justification: In times of drought, the perennial wetlands in the northern portion of the site provide refuge for the globally rare Rio Grande chub (*Gila pandora*). Additionally, they provide nesting habitat for the state rare eared grebe (*Podiceps nigricollis*). The southern portion of the site is more arid and supports an excellent example of the globally rare saline bottomland shrubland (*Sarcobatus vermiculatus/Distichlis spicata*). This community in turn supports good populations of two globally rare and San Luis Valley endemic subspecies of small mammal, the silky pocket mouse (*Perognathus flavus sanluisi*), and the thirteen-lined groundsquirrel (*Spermophilus tridecemlineatus blanca*).

Table 18. Natural Heritage elements at the Weisman Lakes site.
Multiple listings of the same element represent suboccurrences. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Plant communities					
Eleocharis palustris	spikerush wetland	G5	S3S4		B 6/29/97
Sarcobatus vermiculatus/Distichlis spicata	**Saline bottomland shrubland**	**G3**	**S1**		**A 6/29/97**
Insects					
Polites sabuleti ministigma	San Luis sandhill skipper	G5T3	S5		B 6/24/97
Fish					
Gila pandora	**Rio Grande chub**	**G3**	**S1?**	**SC**	**B 7/29/97**
Mammals					
Perognathus flavus sanluisi	silky pocket mouse subsp.	G5T3	S3		B 8/9/97
Perognathus flavus sanluisi	silky pocket mouse subsp.	G5T3	S3		B 6/24/97
Podiceps nigricollis	eared grebe	G5	S3B,SZN		A 7/28/97
Spermophilus tridecemlineatus blanca	thirteen-lined ground squirrel subsp.	G5T3	S3		A 8/9/97

*EO=Element Occurrence; date indicates date of last observation

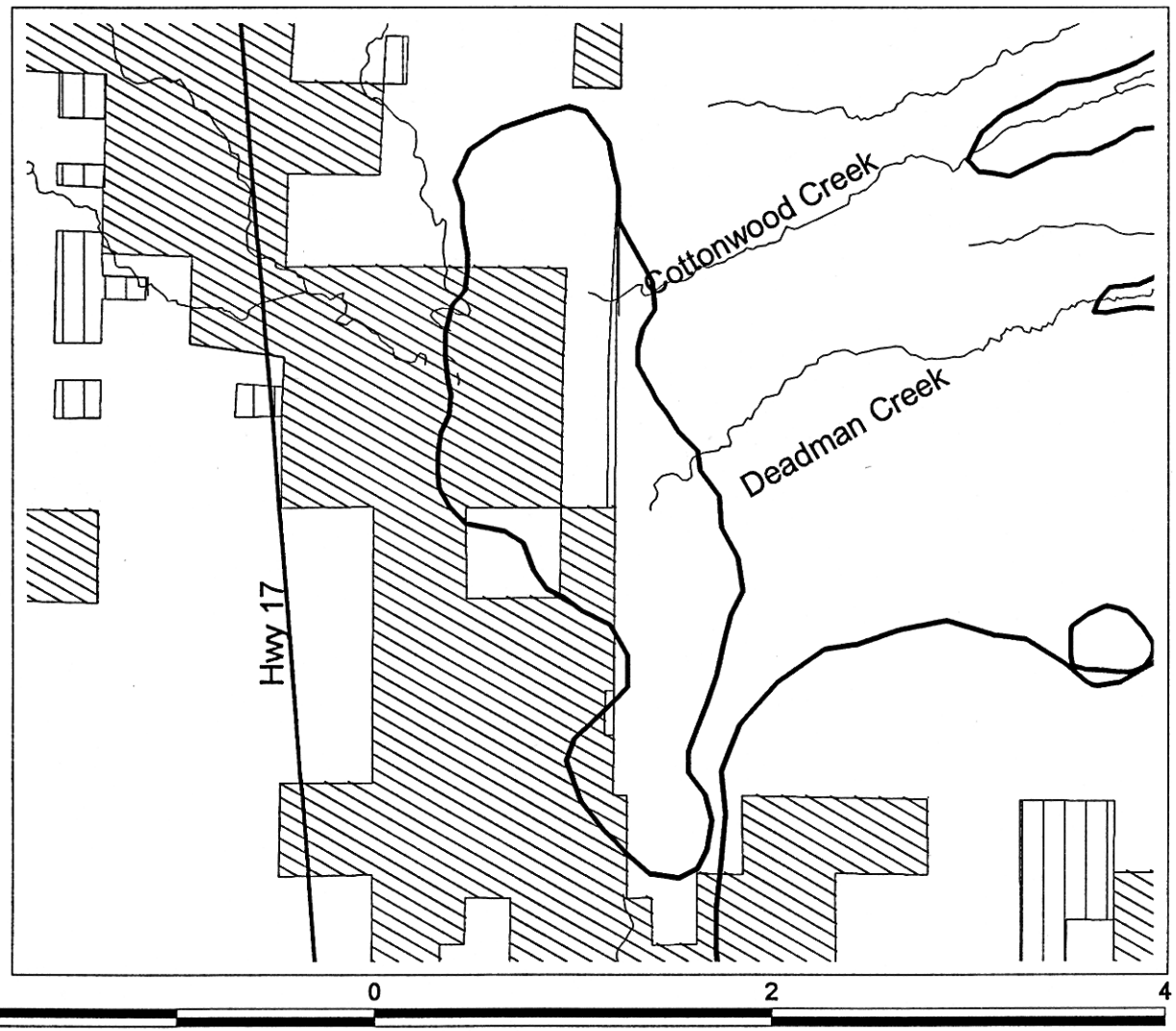
Boundary Justification: The boundaries for this site were drawn using satellite imagery at a scale of approximately 1:100,000. They include the wetland complex that supports the elements of biodiversity found at the site. The design is intended to encompass enough of the wetland areas in the north to provide refugia for the chub in times of drought or other stresses on the quality of the hydrology of the area. The southern boundary was drawn to include the areas where elements occur. However, it is important to stress that any project that affects surface or groundwater hydrology in the Closed Basin has the potential to affect the hydrology maintaining this site.

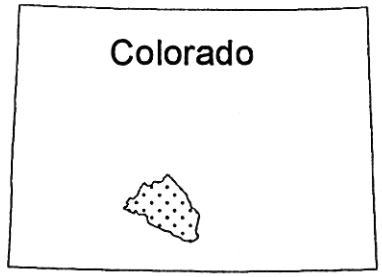
Wetland Functional Evaluation for the Weisman Lakes site:
Wetland Type: riverine/depressional
Table 19. Wetland functional evaluation for the Weisman Lakes site.

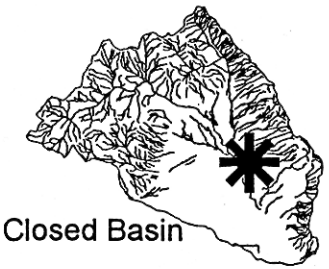
Function	Ratings	Confidence in Rating	Comments
Hydrologic Functions			
Groundwater Recharge	high	medium	porous strata, ponded surface flows
Groundwater Discharge	high	high	free-flowing well located at the site
Floodflow Alteration	high	high	basins at this site intercept and retain surface flows
Sediment Stabilization	low	medium	low vegetation density overall, but located next to the water edge
Biogeochemical Functions			
Sediment/Toxicant Retention	low	medium	low sediment trapping and organic matter accumulation
Nutrient Removal/ Transformation	low	medium	low sediment trapping and organic matter accumulation
Biological Functions			
Production Export	low	medium	although production is moderate, flows rarely escape the Weisman Lake basin to export organic material
Habitat	high	high	Habitat for shorebirds, elk, amphibians, and several rare plants
Aquatic Diversity/ Abundance	medium	high	Shallow, turbid, ephemeral water
Recreation	low	high	High potential, but no public access
Uniqueness/ Heritage Value	high	high	playa lake system with some invasive species and hydrologic alterations, but inherently unique in Colorado

Weisman Lakes

(ownership status)







Public land element occurrences
- vertebrate
- invertebrate
- plant
- community

Closed basin
Roads
Streams
Suggested conservation sites

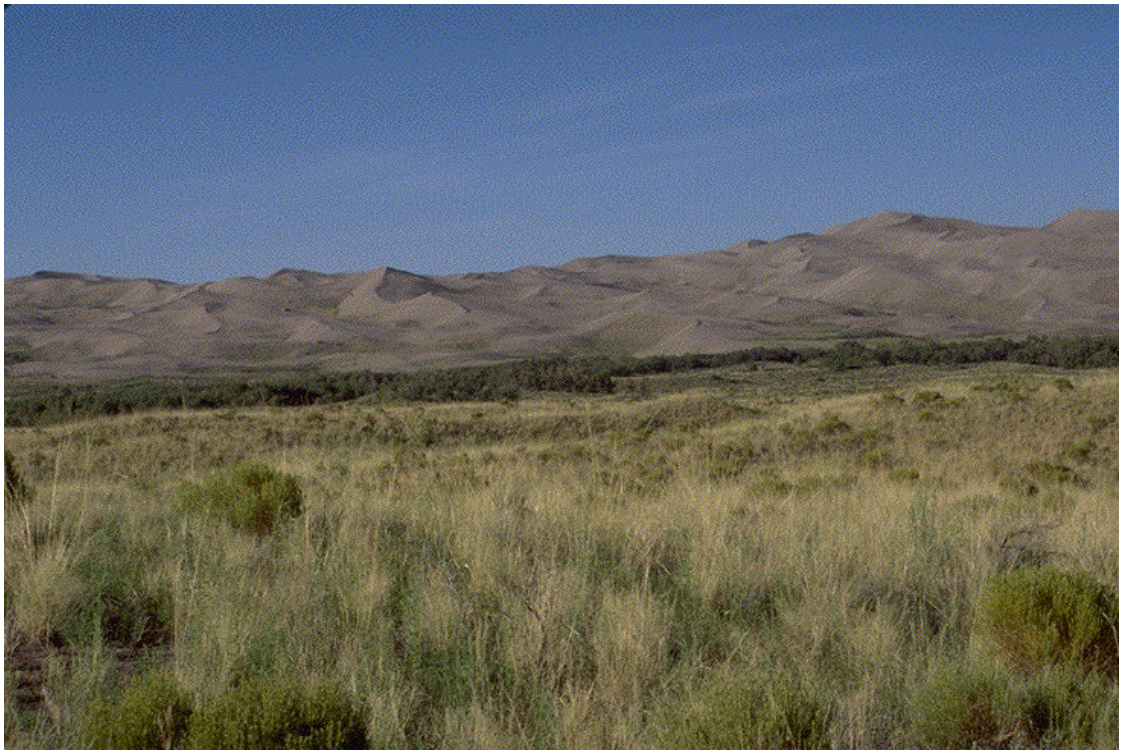
Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

N

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 12 January, 1998. Map created by Anne Ochs.

Sand Dune Sub-Region



The Sand Dune Sub-region lies in the southeast corner of Saguache County and includes part of Alamosa County. It contains two proposed conservation sites, Great Sand Dunes and Antelope Springs (Figure 4) Within the sand dunes subregion, there is only one wetland site of biodiversity significance, Antelope Springs.

Table 20. Site of Biodiversity Significance in the Sand Dunes subregion.

SITENAME	Biodiversity Rank	Protection Urgency Rank	Management Urgency Rank
Antelope Springs	2	3	4

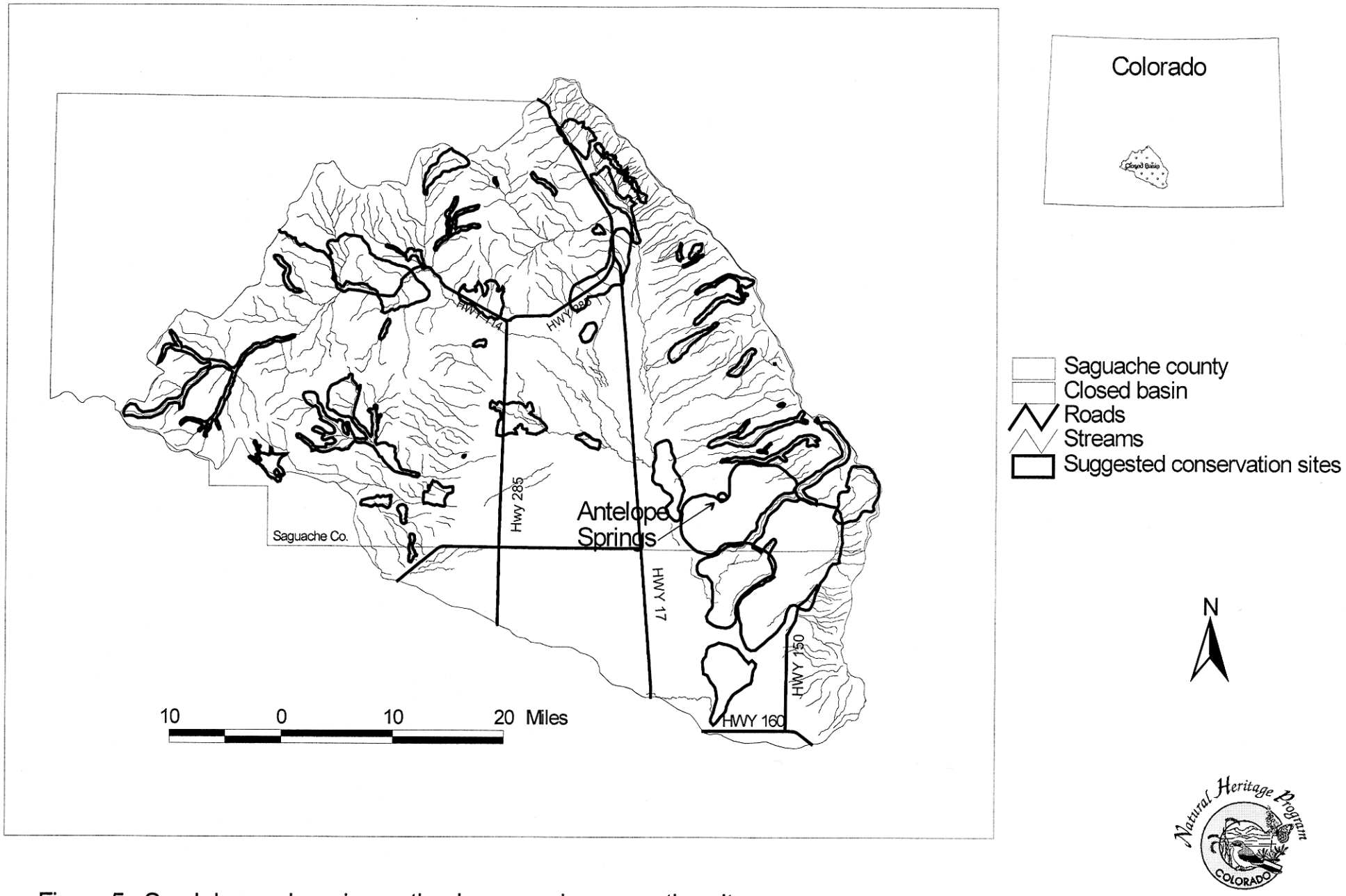


Figure 5. Sand dune sub-region wetland proposed conservation site.

Antelope Springs

Biodiversity Rank: B2 (Very high significance)
The Antelope Springs site contains a good example of the globally rare slender spiderflower and a Great Plains salt meadow wetland.

Protection Urgency Rank: P2
The site is in the center of a large, working, privately owned cattle ranch. The current and primary stress is water diversion from the springs into ditches. The primary use of the water is for irrigated hay meadows in the lower part of the Deadman Creek drainage. A conservation easement or other forms of protection might be considered to prevent development or other negative impacts to this wetland.

Management Urgency Rank: M3
The hydrology of this site is important to the ecological processes which support the wetland communities. Consideration of the biological effects of current water diversions on the elements of concern would help to develop a well-rounded management plan.

Location: Part of the Luis Maria Baca Ranch approximately 12 miles south-southwest of Alpine Camp

U.S.G.S. 7.5 minute quadrangle: Sand Camp
Legal Description**:** T41N R11E; not surveyed to sections

General Description: The Antelope Springs site is located near the middle of the Luis Maria Baca No. 4 Ranch, approximately 12 miles south-southwest of Crestone (see following map). This desert spring creates a seasonal wetland in an alkaline area at the edge of stabilized dunes. A large part of the wetland is dominated by alkali sacaton grass (*Sporobolus airoides*) and saltgrass (*Distichlis spicata)*, while the edges, and smaller disjunct meadows, are dominated by Baltic rush (*Juncus balticus)*. Within the saltgrass meadow we found the San Luis sandhills skipper (*Polites sublet ministigma),* a rare butterfly subspecies endemic to the San Luis Valley. This skipper requires the saltgrass for its larval stage of development (Scott 1986).

The uplands in the site are shrublands dominated by either rabbitbrush (*Chrysothamnus nauseosus)* with Baltic rush (*Juncus balticus)* or greasewood (S*arcobatus vermiculatus*) with salt meadow grass (*Distichlis spicata)*. The rare slender spiderflower (*Cleome multicaulis*) is found with the Baltic rush at the edge of the wetlands and in the adjacent shrublands. We found this plant to be most prolific where the northern pocket gopher *(Thomomys talpoides macrotis)* has burrowed and created bare ground patches. In approximately 2 acres, thousands of individual plants were found in association with the gopher disturbances.

These pocket gopher holes also create necessary habitat for the burrowing owls (*Athene cumcularia)* found at this site. Another significant owl, the short-eared owl (*Asio flammeus)* was seen hunting at this site in late June. It is very likely that the owl nests in the nearby Weisman Lakes area.

Livestock grazing is the primary use of this site. A two track road bisects the Antelope Springs wetland area, and ditches divert water for livestock and downstream hay meadows. This site is adjacent to the Great Sand Dunes, a site that harbors a diverse and significant insect fauna. The Antelope Springs site may provide an important water source for these insects, although we currently do not understand the needs of the Great Sand Dunes insect fauna.

The site is a total of 320 acres and is at approximately 7,600 feet (2,315 meters) in elevation.

Biodiversity Rank Justification: This site contains the globally rare slender spiderflower, the rare Great Plains salt meadow wetland community, the San Luis sandhills skipper, along with nesting burrowing and short-eared owls.

The slender spiderflower has a fairly large global range from southern Wyoming to central Mexico. But, in spite of this large range, the plant is geographically limited due to its specific growing requirements. It needs moist alkaline soils with available water through most of the growing season. In addition to stringent moisture and alkaline needs, the slender spiderflower appears to do very well with some form of soil disturbance, (e.g., pocket gopher (*Thomomys talpoides)* diggings). These rather stringent growing requirements limit the slender spiderflower primarily to the edges of alkaline playa lakes and wetlands. **The Closed Basin of Colorado probably contains the most numerous, largest, and healthiest populations in the world (Jennings 1998).** The Antelope Springs site contains a relatively small but healthy population. At this site the northern pocket gophers are creating ideal habitat for both the slender spiderflower and the burrowing owl.

Table 21. Natural Heritage element occurrences at the Antelope Springs site.
Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Plant Communities					
Sporobolus airoides	Great plains salt meadow	G2?	SU		B 6/18/97
Plants					
Cleome multicaulis	**slender spiderflower**	**G2**	**S2**	**(C2)**	**B 6/25/97**
Birds					
Asio flammeus	short-eared owl	G5	S2B,SZN		B 6/27/97
Athene cunicularia	burrowing owl	G4	S3S4B	(C2)	B 6/27/97
Insects					
Polites sabuleti ministigma	San Luis sandhill skipper	G5T3	S5		B 6/25/97

*EO=Element Occurrence; date indicates the date of last observation

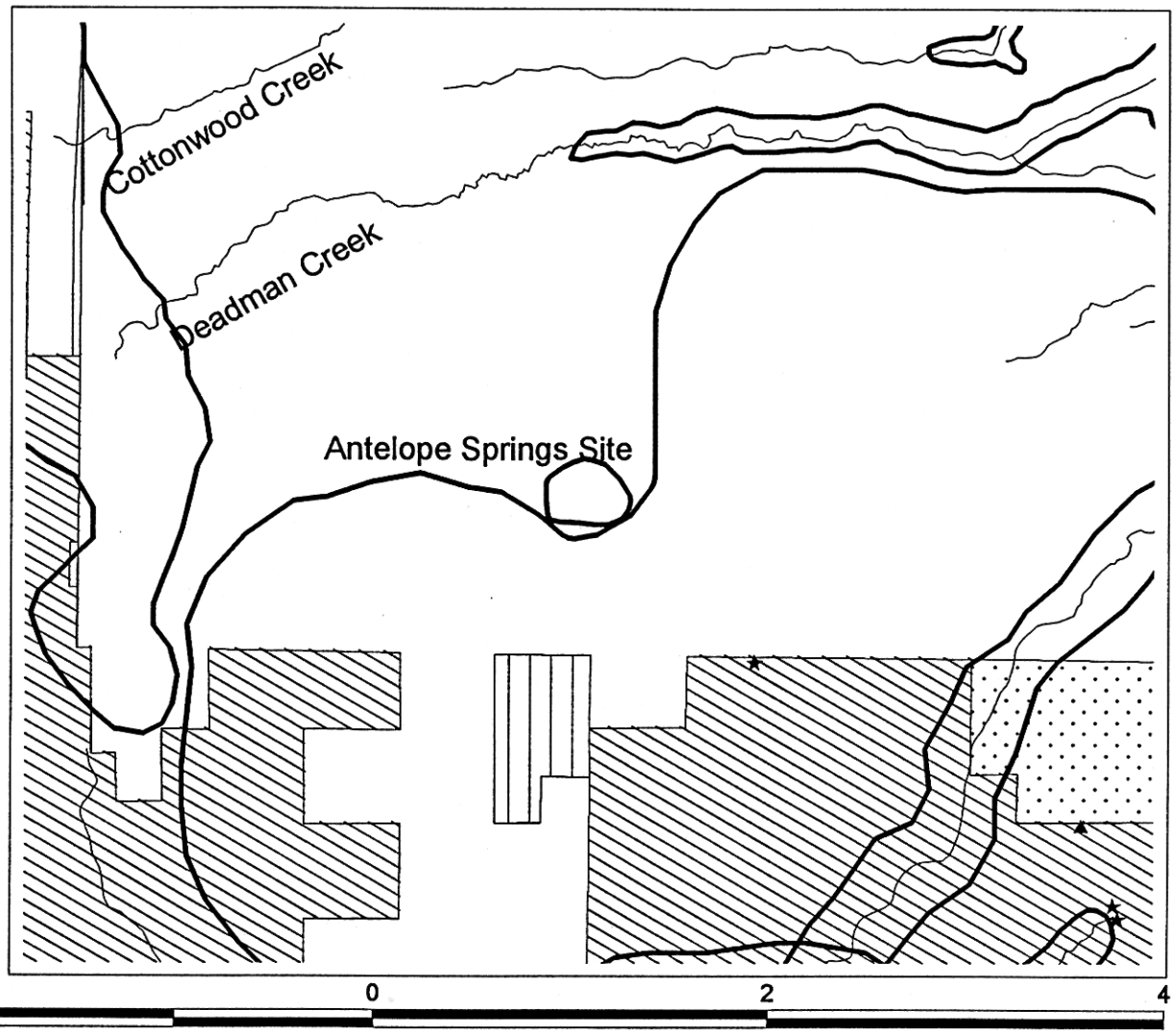
Boundary Justification: This boundary is drawn to include the wetland complex that supports the elements of biodiversity found at the site. It is designed to 1) protect the wetland occurrences from direct impacts such as trampling or other surface disturbances; and 2) to include the immediate slopes which contribute surface and groundwater flow to the wetlands. The boundary was delineated using 1988 NAPP 1:40,000 aerial photograph and satellite imagery at a scale of approximately 1:100,000.

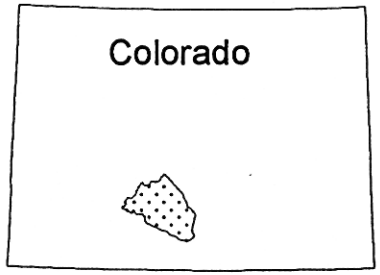
Wetland Functional Evaluation for the Antelope Springs site:

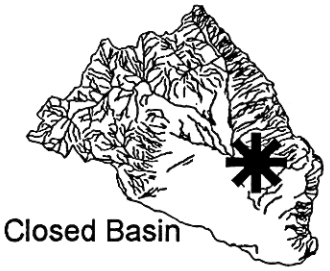
No wetland evaluation was conducted at this site.

Antelope Springs

(ownership status)







Public land element occurrences
- vertebrate
- invertebrate
- plant
- community

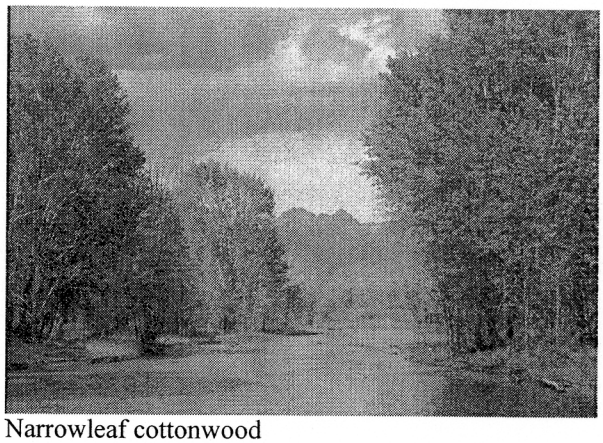
Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

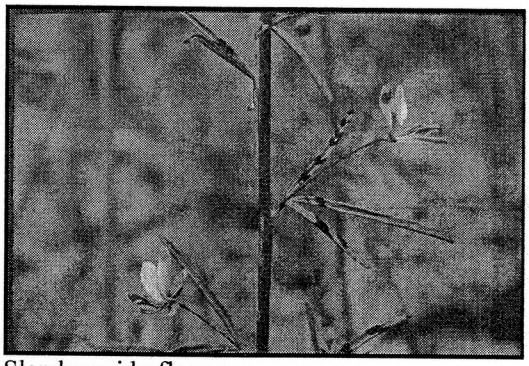
N

Element occurrences on private lands not shown.

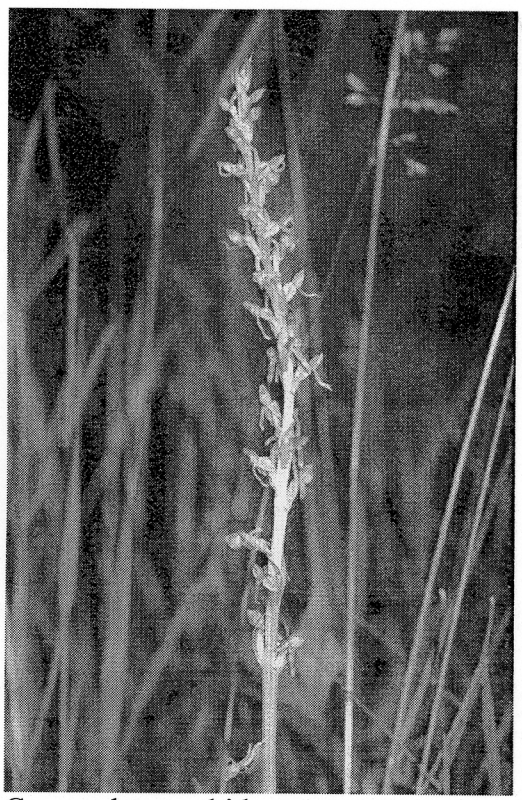
Occurrence data and site boundaries are current as of 12 January, 1998. Map created by Anne Ochs.



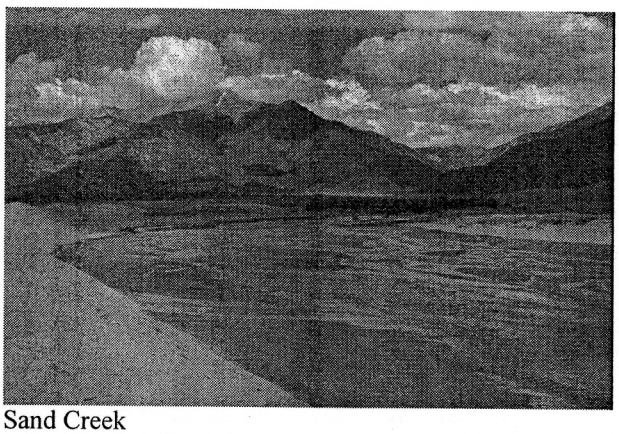
Narrowleaf cottonwood



Slender spiderflower



Canyon bog orchid



Sand Creek

Silky pocket mouse

Middle Sangre de Cristo Mountains Sub-Region

The Middle Sangre de Cristo Mountains Sub-region lies in the eastern part of Saguache County and includes sites of which all or part are in the Sangre de Cristo Mountains (Figure 6). This sub-region contains 10 proposed conservation sites (Table 22). **Two of these sites have a very high biodiversity significance (B2) and should be considered as top priorities in any protection plans for Saguache County: Deadman Creek and Valley View Hot Springs. Rito Alto Creek (B3) is also of outstanding value for riparian biodiversity.** Table 22, summarizes the biodiversity, protection, and management ranks for the proposed conservation sites of the Middle Sangre de Cristo Mountains sub-region. See the following site descriptions for more detail.

Table 22. Middle Sangre de Cristo Mountains Proposed Conservation Sites by Biodiversity Rank

SITENAME	Biodiversity Rank	Protection Urgency Rank	Management Urgency Rank
Deadman Creek	2	3	3
Valley View Hot Spring	2	3	3
Rito Alto Bosque	3	3	3
Cotton Creek	3	4	3
Cottonwood Creek	3	3	3
Dimick Gulch	3	4	5
Upper Medano Creek	3	4	4
Garner Canyon	4	3	3
Wild Cherry Creek	4	4	4
Cedar Canyon	4	3	3

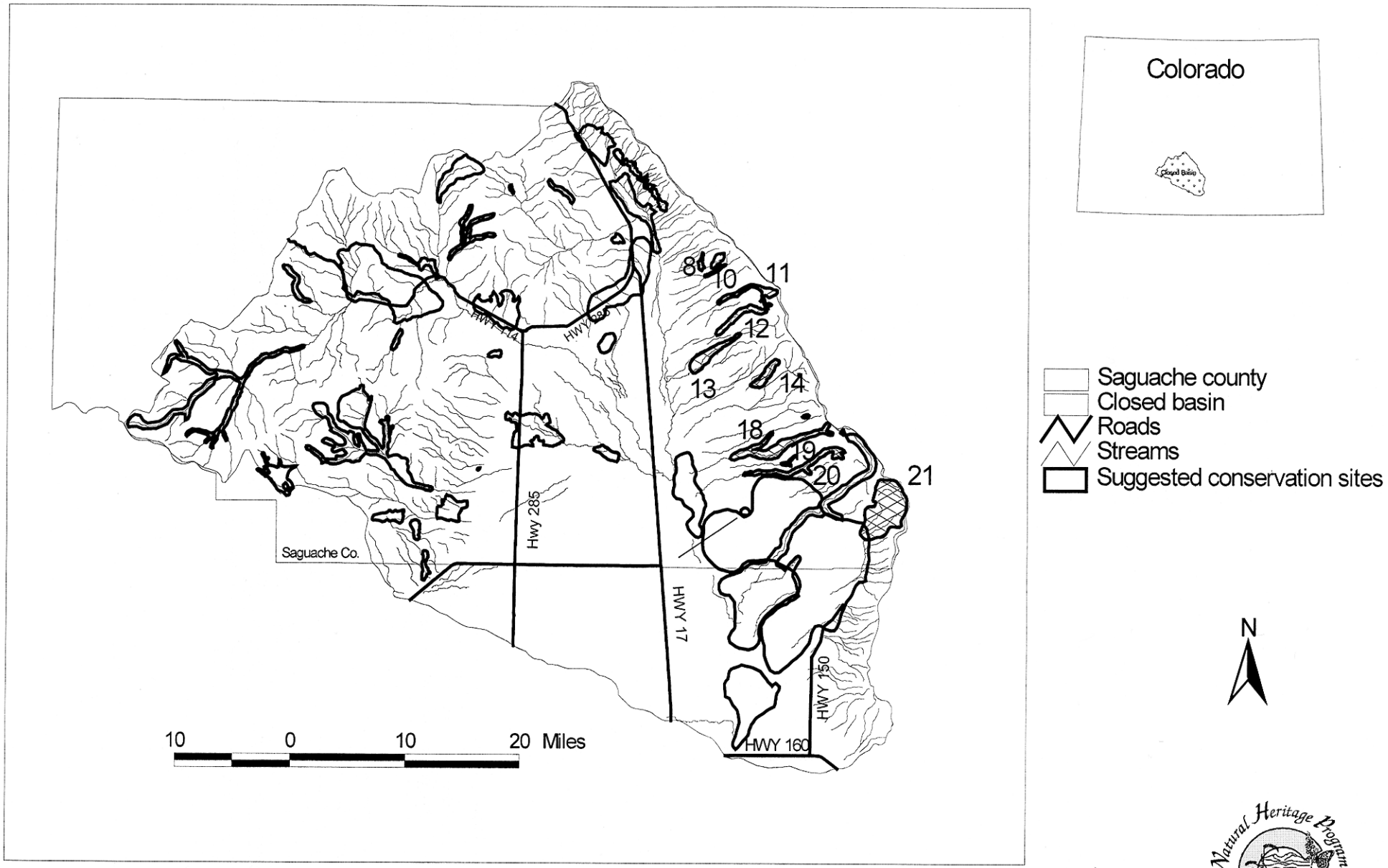


Figure 6. Middle Sangre de Cristo Mountains sub-region wetland proposed conservation sites (numbered). See following table for site names.

Deadman Creek

Biodiversity Rank: B2 (Very high significance)
The Deadman Creek site supports a good example of the globally rare Smith whitlow-grass. In Additionally, it supports the state's exemplary and largest occurrence known of the rare narrowleaf cottonwood-Rocky Mountain juniper montane riparian forest, and excellent examples of other riparian and upland plant communities. A population of the Rio Grande cutthroat trout, a breeding colony of the pale lump-nosed bat, and a globally rare orchid subspecies add to the importance of this site.

Protection Urgency Rank: P3
The upper part of this site is well-protected as a research natural area within a U.S. Forest Service wilderness area. The lower part of this site is privately owned and operated as a cattle ranch which affords no formal conservation protection. This site is an excellent candidate for a partnership conservation agreement with the landowner, e.g. a conservation easement, or habitat conservation plan. This site is adjacent to the Sand Dunes site (see following map).

Management Urgency Rank: M3
Management actions may be needed on the private section. The riparian vegetation shows little to no cottonwood regeneration. This is most likely caused by cattle grazing on seedlings, since a natural hydrologic regime is intact. Preventative and restoration actions could include fencing off the riparian areas or limiting grazing to early spring and summer, or solely in the winter, which would minimize grazing on seedlings.

If the abandoned mines on this site are scheduled for closure, installing bat-friendly gates, rather than simply plugging the entries, would allow the colony of pale lump-nosed bats to persist.

Location: Approximately 12 miles south of Crestone, on Rio Grande National Forest and Luis Maria Baca Ranch.

U.S.G.S. 7.5 min. quadrangles: Crestone Peak, Crestone
Legal Description: Not available, this area has not been surveyed

General Description: The Deadman Creek site encompasses much of the Deadman Creek watershed. This creek drains steeply out of the western flank of the Sangre de Cristo Mountains, tumbles out over a large alluvial fan, slowing considerably when it meets the valley floor. Once on the valley floor, the creek bed meanders and becomes braided in places. Historically, it appears to have been a "flashy" stream with consistent high flows in the spring from melting snow. In very wet years, the stream flowed through multiple channels, deposited abundant sediment, and changed courses, building the alluvial fan along the mountain front. Lower on the valley floor, the creek becomes entrenched in places and rarely leaves its banks. This active alluvial plain supports three excellent examples of globally rare deciduous forests. The upper, montane and foothill reaches support the aspen/Rocky Mountain maple *(Populus tremuloides/Acer glabrum*) plant association. The foothill, or transition, reaches support the largest known occurrence of the globally rare narrowleaf cottonwood-Rocky Mountain juniper

(*Populus angustifolia-Juniperus scopulorum*). On the valley floor, where the stream becomes intermittent, a stand of a newly described community, the narrowleaf cottonwood/whiplash willow (*Populus angustifolia/Salix lucida* var. *caudata*) plant association occurs.

In addition to these unique riparian communities, Deadman Creek also supports a population of Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis*) and the Canyon bog orchid (*Platanthera sparsiflora* var. *ensifolia).* In a near-by abandoned mine in the foothills is a maternity nursery for the pale lump-nosed bat (*Corynorhinus townsendii pallescens)*. The uplands of the steep mountain sides contain an excellent occurrence of Smith whitlow-grass (*Draba smithii*) and mixed mountain shrubland (*Cercocarpus montanus/Muhlenbergia montana*). The entire valley and riparian area is nearly roadless and in excellent to moderate condition.

The purity rating of the Rio Grande cutthroat trout population is potentially low and at best confusing due to the numerous stockings of Pike's Peak cutthroat trout in the 70's and Snake River cutthroat trout in the 80's and 90's (Harig and Fausch 1996). We also found rainbow trout in the lower section, which are known to hybridize with cutthroats.

The land use of this site varies considerably. The Forest Service Research Natural Area in the mountains is rarely used by humans due to difficult access, while the valley floor and foothills portions of the site are primarily used for cattle grazing. An old and unmaintained trail exists in the montane zone and a two-track road crosses Deadman Creek several times on the valley floor. Downstream of the lower boundary for the proposed conservation site, Deadman Creek is diverted into a hay meadow pasture.

The site is approximately 3,500 acres in size and ranges in elevation from 7,600 to 12,300 feet (2,315-3,745 meters).

Biodiversity Rank Justification: The Deadman Creek site supports a good example of the globally-rare Smith whitlow-grass (known, globally, from eight sites). In addition, it supports the largest occurrence known of the rare narrowleaf cottonwood-Rocky Mountain juniper montane riparian forest, and an excellent example of a rare aspen forest. Also, a newly described cottonwood community occurs within this site. A population of the Rio Grande cutthroat trout and a breeding colony of the pale lump-nosed bat (of which only four are documented in Colorado) add to the importance of this site. This site also includes one of the highest elevation occurrences of the mixed mountain shrubland and a globally rare orchid subspecies.

Table 23. Natural Heritage element occurrences at the Deadman Creek site.
Multiple listings of the same element represent suboccurrence. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Communities					
Cercocarpus montanus/Muhlenbergia montana	mixed mountain shrubland	GU	S2		B 6/28/97
Populus angustifolia/Salix lucida var. *caudata*	montane riparian forest	G1	S1		C 6/30/97
Populus angustifolia-Juniperus scopulorum	**montane riparian forest**	**G2**	**S2**		**B 6/30/97**
Populus tremuloides/Acer glabrum	**montane riparian forest**	**G2**	**S1S2**		**A 6/28/97**
Plants					
Draba smithii	**Smith whitlow-grass**	**G2**	**S2**	**(C2), FS**	**B 6/28/97**
Platanthera sparsiflora var. *ensifolia*	canyon bog orchid	G4G5T3	S2		C 6/28/97
Vertebrates					
Corynorhinus townsendii pallescens	pale lump-nosed bat	G4T4	S2		A 7/28/97
Oncorhynchus clarki virginalis	Rio Grande cutthroat	G4T3	S3	(3C), SC, FS	C 6/26/97

*EO=Element Occurrence; date indicates the date of last observation

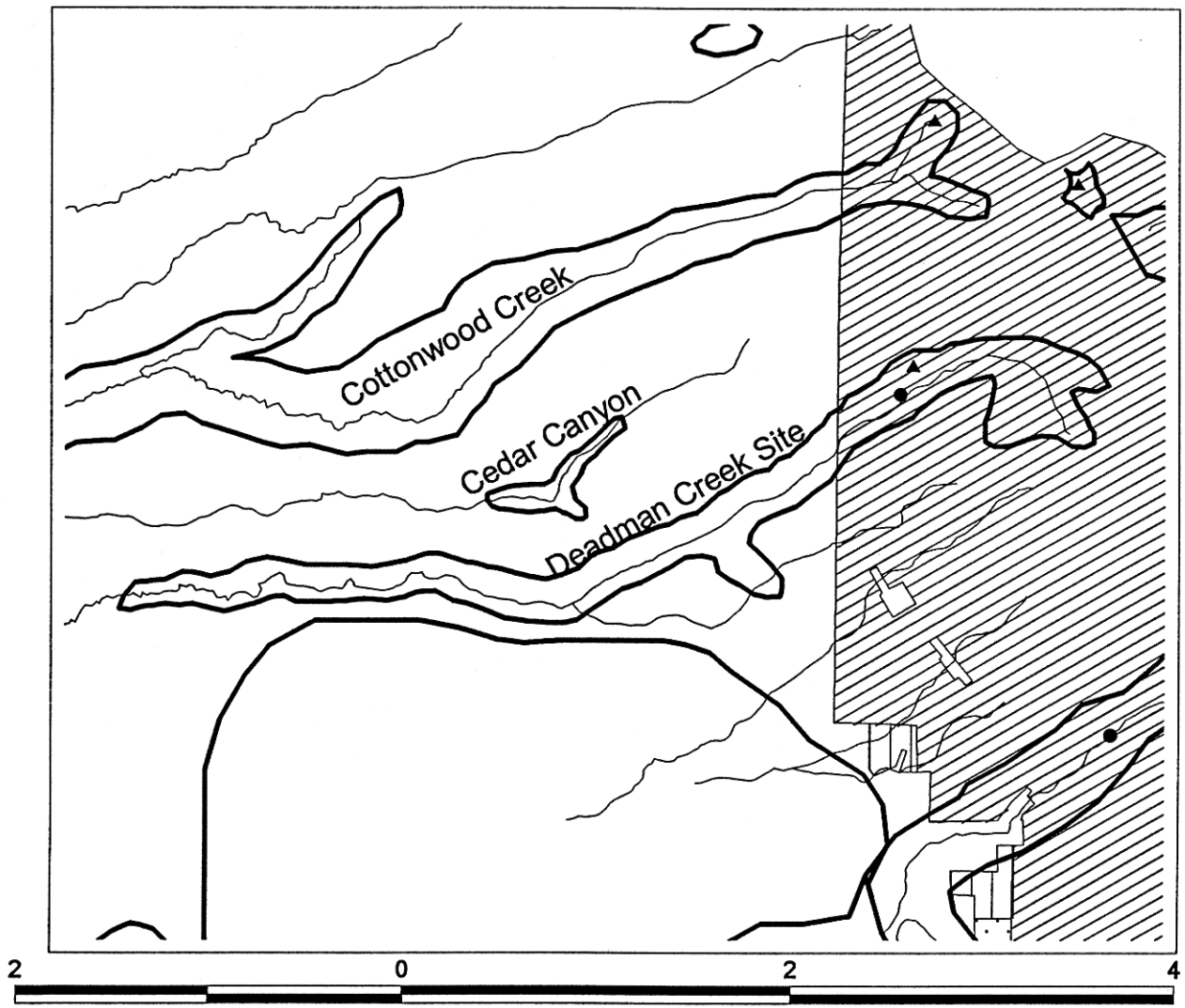
Boundary Justification: The boundaries drawn encompasses most of the Deadman Creek watershed and the bat maternity roost. Because of the imminent threat of ground water pumping, a much larger area should be considered in any management or protection strategy.

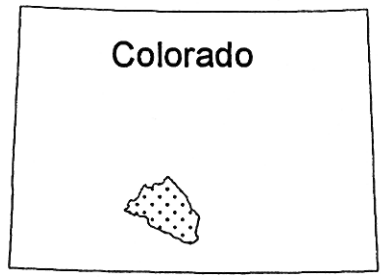
Wetland Functional Evaluation for the Deadman Creek site:
Wetland Class: riverine

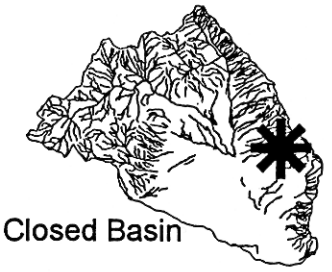
Table 24. Wetland functional evaluation for the Deadman Creek site.

Function	Ratings	Confidence in Rating	Comments
Hydrologic Functions			
Groundwater Recharge	very high	high	porous substrate, creek is absorbed in channel
Groundwater Discharge	medium	high	groundwater discharge is abundant in upper reaches of the site
Floodflow Alteration	low	high	this site is unstable and flood flows are unconstrained
Sediment Stabilization	medium	medium	although the riparian forest at this site provides some stability, the site is inherently unstable
Biogeochemical Functions			
Sediment/Toxicant Retention	low	medium	vegetation can only moderately stabilize this sandy stream
Nutrient Removal/ Transformation	low	medium	no known sources of excess nutrients in watershed
Biological Functions			
Production Export	medium	medium	moderate productivity, but little export from site
Habitat	high	high	unique riparian forest habitat and water in an arid area
Aquatic Diversity/ Abundance	medium	medium	stream bottom substrates appear quite unstable and flows are variable, more reliable at higher elevations
Recreation	low	high	not accessible
Uniqueness/ Heritage Value	very high	high	this is a unique sand bottomed stream in a desert habitat, a type which is rare in Colorado

Deadman Creek
(ownership status)







Public land element occurrences
- ■ vertebrate
- ★ invertebrate
- ▲ plant
- ● community

Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

N

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 12 January, 1998. Map created by Anne Ochs.

Valley View Hot Springs

Biodiversity Rank: B2 (Very high significance)
The Valley View Hot Springs site supports a large population of the hot springs physa, a rare snail limited to hot springs in Colorado. In addition to this hot springs specialist, several rare orchids, the Brazilian free-tailed bat, and a pinyon pine woodland community are found within the site.

Protection Urgency Rank: P3
This site has multiple ownership including private, state, and Bureau of Land Management lands (see the following map). Part of this site is owned by the Valley View Hot Springs resort. The impact of hot springs development to the hot springs elements, for example the hot springs physa snail, is unknown. Any protection strategy for this site will need to work closely with the Valley View Hot Springs resort. Several tools exist, e.g., conservation easements, habitat conservation plans, nomination of the state land board lands for Stewardship Trust designation, direct acquisition, and cooperative management plans.

Management Urgency Rank: M3
In order to maintain a native flora, management actions should focus on weed control at the hot springs area. Hand weeding of non-native plants, particularly in the area of known orchid populations, should be conducted prior to seed maturity of the weeds. Care should be taken to avoid physically disturbing native species. The application of herbicides is not recommended due to the presence of the snail and rare plants. Periodic monitoring of the hot springs physa population would help to show trends.

Location: Valley View Hot Springs and Orient mine.
U.S.G.S. 7.5 minute quadrangle: Valley View Hot Springs
Legal Description: T46N R10E S 25, 36
T45N R10E S1

General Description:. The Valley View Hot Springs site is located at the base of the Sangre de Cristo Mountains in the northeastern part of Saguache County. The hot springs are a series of springs at the base of the mountains. These springs form a small creek that cuts through an alluvial fan. In 1984, this creek flowed approximately 1 mile or more into the San Luis Valley bottom, but due to changes in water management, the creek no longer reaches its original destination. This change has caused the extirpation of a population of Rio Grande chub (*Gila pandora)*.

The majority of this site is a hot springs resort. The hot springs area is privately developed with a swimming pool, sauna, several hot spring pools, a campground, and riding stables. Most of the pools and creeks entering or exiting these pools are excellent habitat for the hot springs physa (a snail). Only the upper springs support much native vegetation with seep monkey flower (*Mimulus guttatus)*, *Potamogeton*, and *Catabrosa aquatica* dominating. The lower springs and creek are comprised of more non-natives than native plants, including thistle (*Cirsium* spp.),

clover (*Trifolium repens*), black medic (*Medicago lupulina*), Kentucky bluegrass (*Poa pratensis*) and more. Within this weedy vegetation a few individuals of the rare helleborine (*Epipactis gigantea)* and canyon bog orchid (*Platanthera sparsiflora* var. *ensifolia*) were located.

Orient Mine, a large non-active mine just north of the Valley View Hot Springs Resort, is a very important roost site for the Brazilian free-tailed bat, which use the hot springs pools for drinking and feeding.

The site is approximately 360 acres ranging in elevation from 8,600 to 9,300 feet (2,625-2,830 meters).

Biodiversity Rank Justification: The Valley View Hot Springs site supports an excellent example of a rare snail (*Physa cupreonitens*). This snail appears to be limited to hot springs in Colorado and has been found in Grand, Saguache, Fremont, and Mesa counties. The Colorado Natural Heritage Program (1997) documents six occurrences. In addition to this hot springs specialist, several other significant plants, animals and plant communities are here, including a very large and healthy occurrence of pinyon pine/needle and thread grass (*Pinus edulis/Stipa comata)* on the upland slopes, a globally restricted community.

Table 25. Natural Heritage element occurrences at the Valley View Hot Springs site. Elements responsible for the biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Plant Communities					
Pinus edulis/Stipa comata	**xeric western slope pinyon-juniper woodland**	**G2**	**S2**		**A 7/13/97**
Invertebrates					
Physa cupreonitens	**hot springs physa**	**G2?**	**S2**		**A 7/12/97**
Physa cupreonitens	hot springs physa	G2?	S2		unranked 8/14/77
Plants					
Epipactis gigantea	helleborine	G4	S2	FS	C 7/13/97
Epipactis gigantea	helleborine	G4	S2	FS	unranked 1989
Platanthera sparsiflora var. *ensifolia*	canyon bog-orchid	G4G5T3	S2		B 7/14/97
Mammals					
Tadarida brasiliensis	Brazilian free-tailed bat	G5	S1		unranked 6/29/65
Tadarida brasiliensis	Brazilian free-tailed bat	G5	S1		unranked 7/17/93

*EO=Element Occurrence; date indicates the date of last observation

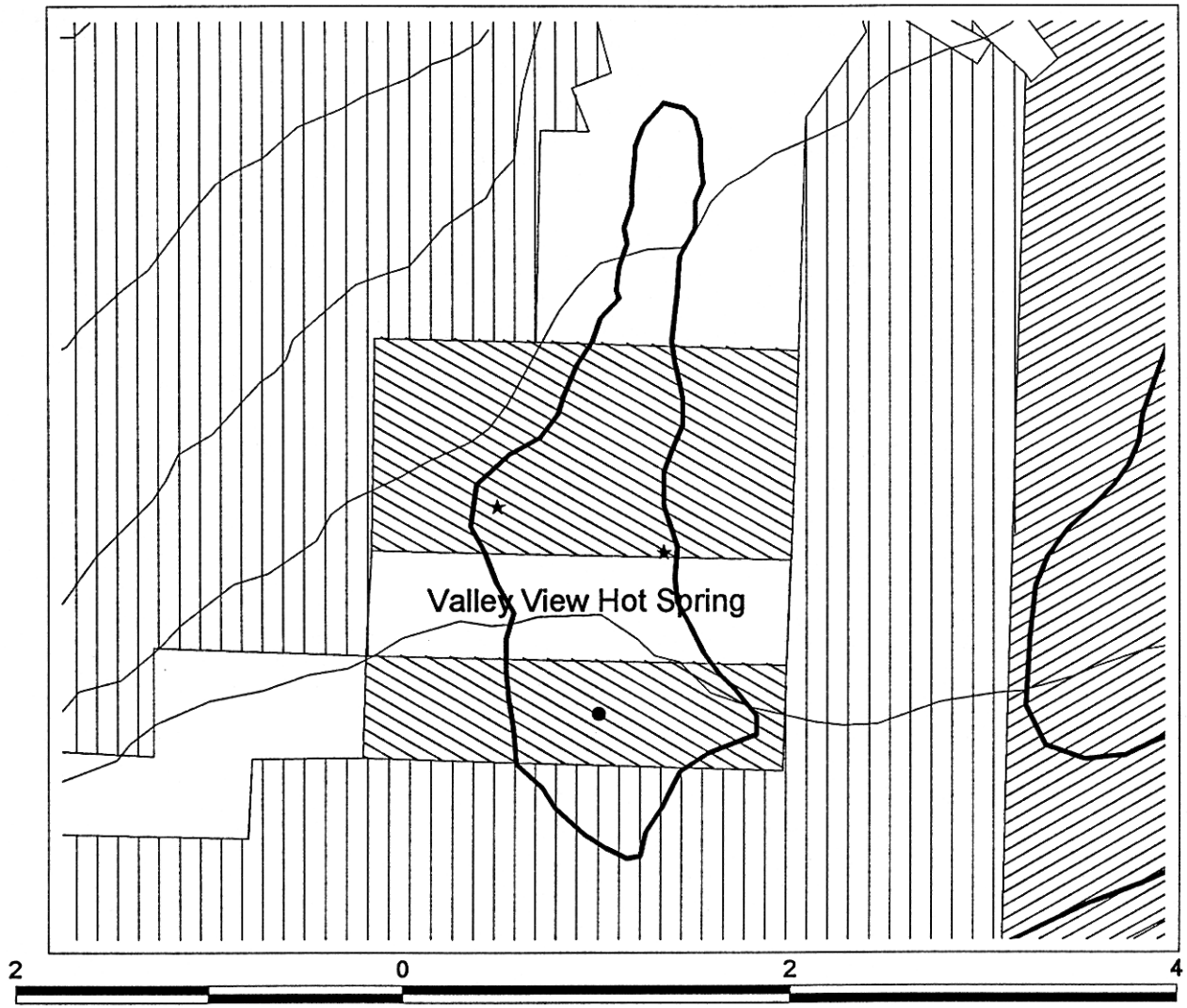
Boundary Justification: This boundary is drawn to 1) protect the occurrences from direct impacts such as trampling or other surface disturbances; and 2) provide suitable habitat where additional individuals can become established over time. The boundary was delineated using 1988 and 1990 NAPP 1:40,000 infrared aerial photographs and satellite imagery.

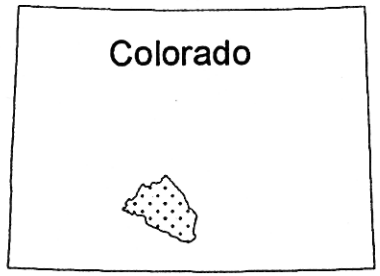
Wetland Functional Evaluation for the Valley View Hot Springs site:

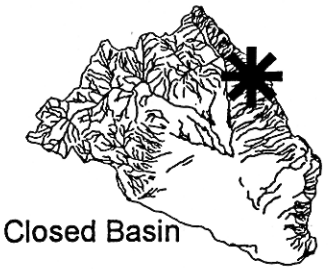
No wetland evaluation was conducted at this site.

Valley View Hot Spring

(ownership status)







Public land element occurrences
- vertebrate
- invertebrate
- plant
- community

Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

N

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.

Cotton Creek

Biodiversity Rank: B3 (High significance)
This site supports an excellent occurrence of a montane and foothill riparian forest and shrubland, two rare plants, and a mixed population of cutthroat trout (see below for explanation).

Protection Urgency Rank: P4
This site falls within the Rio Grande National Forest (see following map), much of it within the Sangre de Cristo Wilderness area. Protection appears adequate at this time.

Management Urgency Rank: M3
For the botanical resources the current management is adequate, however the trout population is in need of action. The trout population is a mix of native, introduced, and reintroduced cutthroat; and in the lowest reaches, additional introduced non-native brook trout species are present. Colorado Division of Wildlife is aware of the unpurity rating for the fish, although no plans are currently in place to change the status.

Fires may play an important role in maintaining the south-facing mountain-mahogany dominated shrublands, therefore a let-it-burn policy is encouraged.

Location: Cotton Creek is approximately 4 miles southeast of Valley View Hot Springs. A forest service trail parallels the creek.

U.S.G.S. 7.5 minute quadrangles: Electric Peak, Valley View Hot Springs
Legal Description: T45N, R11E S 11-16, 20, 21
T45N R12E S 7, 17-19

General Description: The Cotton Creek site includes Cotton Creek from the alpine lakes of Cotton and Teacup to the mouth of the canyon. The alpine lakes are surrounded by willows (*Salix* spp.) and sedges (*Carex* spp.) with mixed conifer forest on the uplands. Cotton Creek retains a low gradient stream in the glaciated terrain at the head of the watershed, for a short distance before becoming a fast moving stream. After it makes a nearly 90 degree bend, the creek becomes very steep and the streamside vegetation is dominated by Engelmann spruce (*Picea engelmannii*) and Drummond's willow (*Salix drummondiana*), changing to aspen (*Populus tremuloides*) along the lower reaches. South-facing slopes of the valley are precipitous, and are dominated by oceanspray (*Holodiscus dumosus*) and mountain mahogany (*Cercocarpus montanus*) shrublands or pinyon pine (*Pinus edulis*) woodlands. The wetter, north-facing slopes are forested with Engelmann spruce at the upper elevations and Douglas fir (*Pseudotsuga menziesii*) at lower elevations. The streamside community along the lower sections of Cotton Creek is very diverse and includes aspen, water birch (*Betula occidentalis*), Rocky Mountain maple (*Acer glabrum*), Drummond's willow, and Woods rose (*Rosa woodsii*). The site is virtually free from weeds, although small patches of the non-native species such as Kentucky bluegrass (*Poa pratensis*), dandelions (*Taraxacum officinale*), and smooth brome (*Bromus inermis*) were found near the creek at the trailhead.

Cotton Creek is a clear water creek flowing over a cobble substrate, approximately 15 to 20 feet wide in the lower stretches and narrows to three to five feet in places, which creates stronger currents and oxidizes the water. This provides excellent habitat for trout, including the native cutthroat and non-native brook trout. Past stocking records and conversations with the Colorado Division of Wildlife indicate the cutthroat population is unpure and mixed with other subspecies of cutthroat trout.

The primary use within the Cotton Creek site is recreation, with access from a U. S. Forest Service trail that parallels the stream. The area affords good wildlife habitat for common large mammals including mule deer (*Odocoileus hemionus)*, American elk (*Cervus canadensis)*, black bear (*Ursus americanus)*, and mountain lion (*Felis concolor)*. The scenic views are an added attraction.

This site is approximately 2,100 acres with an elevation range from 8,950 to 12,750 feet (2,040-2,730 meters).

Biodiversity Rank Justification: The Cotton Creek site contains an excellent occurrence of a montane riparian forest and a good occurrence of a foothills riparian shrubland. It is unusual to find healthy and large stands of water birch (*Betula occidentalis*). When water birch is dominant it may denote a perennial spring or subsurface water adjacent to the creek. We found several of the Sangre de Cristo Mountain streams to have water birch present at the lower elevations. In addition to the riparian plant communities the area supports populations of the globally rare canyon bog-orchid, state rare Altai chickweed, and a mix of native, introduced, and reintroduced cutthroat trout.

Table 26. Natural Heritage elements at the Cotton Creek site.
Elements responsible for the biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Plant communities					
Populus tremuloides/Betula occidentalis	**montane riparian forest**	**G1**	**S1**		**B 9/12/97**
Abies lasiocarpa-Picea engelmannii/Salix drummondiana	montane riparian forest	G4	S4		A 7/12/97
***Betula occidentalis/*mesic forb**	**foothills riparian shrubland**	**G2G3**	**S2**		**B 7/15/97**
Cercocarpus montanus/Muhlenbergia montana	mixed mountain shrubland	GU	S2		A 7/12/97
Plants					
Platanthera sparsiflora var. *ensifolia*	canyon bog-orchid	G4G5T3	S2		C 7/12/97
Stellaria irrigua	Altai chickweed	G4?	S2	(3C)	unranked 7/20/43
Fish					
Oncorhynchus clarki	cutthroat trout	G4	S3	(3C), SC, FS	B 7/12/97

*EO=Element Occurrence; date indicates the date of last observation

Boundary Justification: This boundary is drawn to 1) protect the occurrences from direct impacts such as trampling or other surface disturbances; 2) provide suitable habitat where additional individuals and plant communities can become established over time; and 3) include the alpine lakes which may be important for the cutthroat trout as a refugia. The boundary was delineated using 1988 and 1990 NAPP 1:40,000 infrared aerial photographs.

Wetland Functional Evaluation for the Cotton Creek site:

No wetland evaluation was conducted at this site

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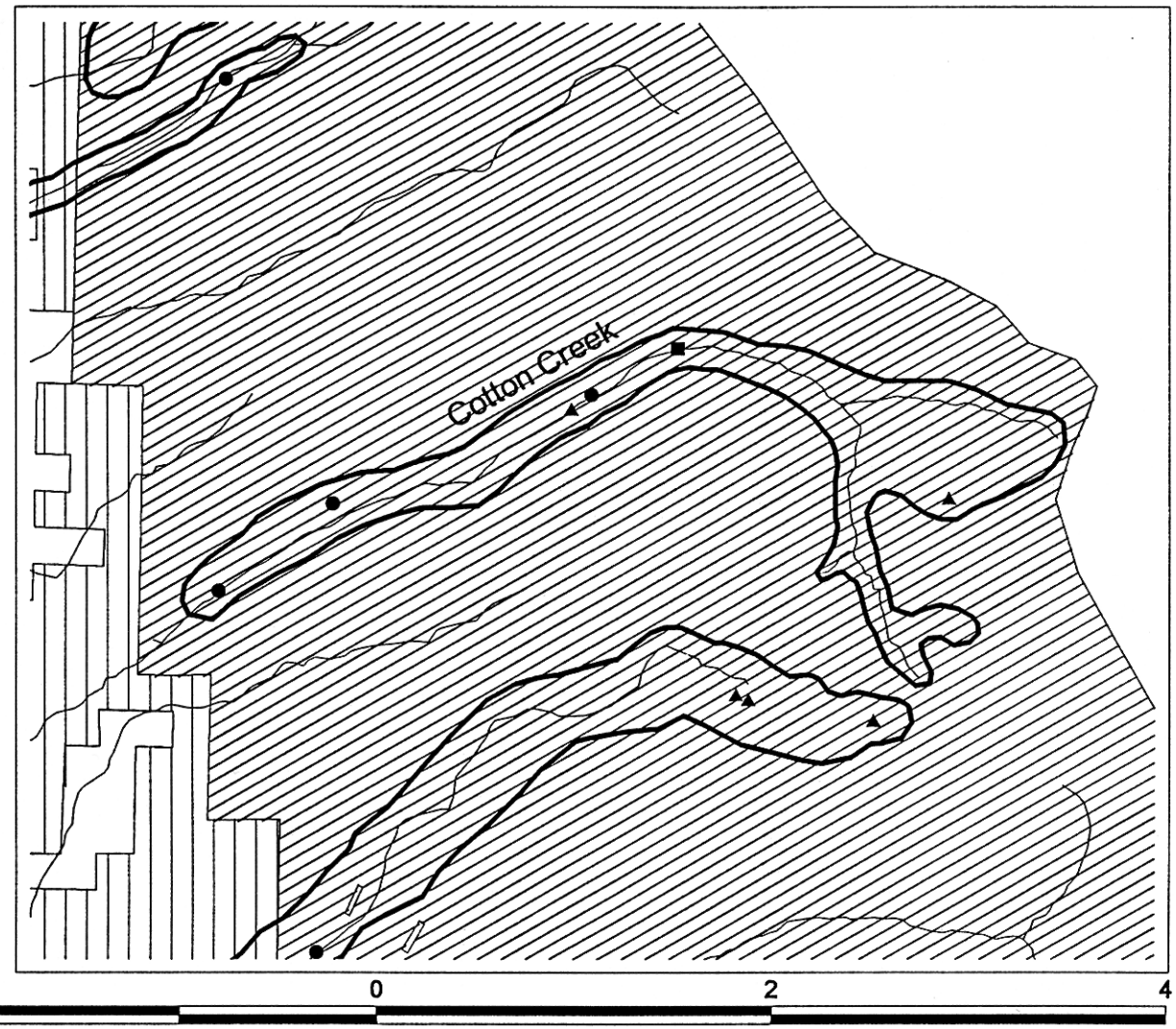
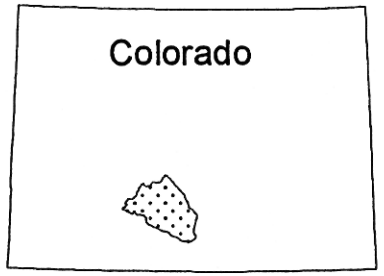
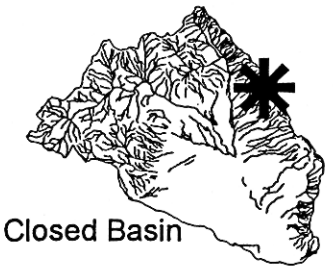
Cotton Creek
(ownership status)







Public land element occurrences
- ■ vertebrate
- ★ invertebrate
- ▲ plant
- ● community

Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

N

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.

Cottonwood Creek

Biodiversity Rank: B3 (High significance)
This site includes three plant communities of concern and two rare plants, of which the slender spiderflower and the narrowleaf cottonwood/rocky mountain juniper riparian community are the most significant elements.

Protection Urgency Rank: P3
The upper elevations of this site is owned and managed by Rio Grande National Forest, while the lower elevations are privately owned (see following map). This private section of this site is an excellent candidate for a partnership conservation agreement with the landowner, e.g., a conservation easement.

Management Urgency Rank: M3
Management of water resources and livestock grazing may be needed, especially with regards to the privately owned part of this site. The riparian vegetation shows little to no cottonwood regeneration. This is most likely caused by cattle grazing on seedlings, since a natural hydrologic regime is intact. Preventative and restoration actions could include fencing off the riparian areas or limiting grazing to early spring and summer, or only in the winter, which would minimize grazing on seedlings. Periodic monitoring of the riparian area and especially the slender spiderflower occurrence would help assess any future changes in quality and condition of these elements.

Location: Approximately 5 miles south of the town of Crestone.
U.S.G.S. 7.5 minute quadrangles: Crestone, Crestone Peak
Legal Description: not surveyed to sections

General Description: Cottonwood Creek begins in the alpine zone at the 14,000 foot peaks of Kit Carson Mountain and Crestone Peak in the Sangre de Cristo Mountains and ends at the Weisman Lake area on the San Luis Valley floor. The alpine lakes support a small occurrence of the arctic draba (*Draba fladnizensis*). The lower montane riparian areas support the unusual combination of Douglas fir (*Pseudotsuga menziesii*) and river birch (*Betula occidentalis*). As Cottonwood Creek reaches the San Luis Valley floor it becomes a lower gradient and more meandering stream. The vegetation reflects this change in geomorphology with narrowleaf cottonwood (*Populus angustifolia*) and rocky mountain juniper (*Juniperus scopulorum*) dominating the creek side. At the lowest elevations of this site a small occurrence of the slender spiderflower (*Cleome multicaulis*) was found scattered across an area where the water table apparently approaches the soil surface. It was found in a dry, sandy soil dominated by an open community of saltgrass (*Distichlis spicata)*. Adjacent to the saltgrass, nearer the creek, is a wet meadow dominated by Baltic sedge (*Juncus balticus*) and Kentucky blue grass (*Poa pratensis*).

The upland vegetation at the upper elevations is dominated by mixed conifer forests, including pinyon pine (*Pinus edulis*), Douglas fir, and Engelmann spruce (*Picea engelmannii*). The upland vegetation at the lower elevations is a shrubland comprised of rabbitbrush (*Chrysothamnus*

nauseosus) and greasewood (*Sarcobatus vermiculatus*). The slender spiderflower occurs in the transition area between the shrubland and the wet meadow.

The site include approximately 5,724 acres ranging in elevation from 14,000 to 7600 feet.

Biodiversity Rank Justification: The Cottonwood Creek site is biologically significant for its plant communities and plant occurrences. A good example of the globally rare slender spiderflower, is the species of primary concern. This small annual plant has its center of distribution in the Closed Basin of Colorado. Also of global importance is the riparian community of narrowleaf cottonwood/rocky mountain juniper. The nearby Deadman Creek supports the exemplary occurrence of this riparian community. The excellent example of the Douglas fir/river birch community in the foothills portion of this site adds further importance to this site.

Table 27. Natural Heritage elements at the Cottonwood Creek site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Pinus edulis-(Juniperus monosperma)/Stipa scribneri	foothills pinyon-juniper woodland	G2G3	S1?		historic 1977-02
Populus angustifolia-Juniperus scopulorum	montane riparian forest	G2	S2		B 6/27/97
Pseudotsuga menziesii/Betula occidentalis	montane riparian forest	G4	S3		A 6/29/97
Cleome multicaulis	slender spiderflower	G2G3	S2S3	(C2)	B 6/27/97
Draba fladnizensis	arctic draba	G4	S2S3		C 7/22/97

*EO=Element Occurrence; date indicates the date of last observation

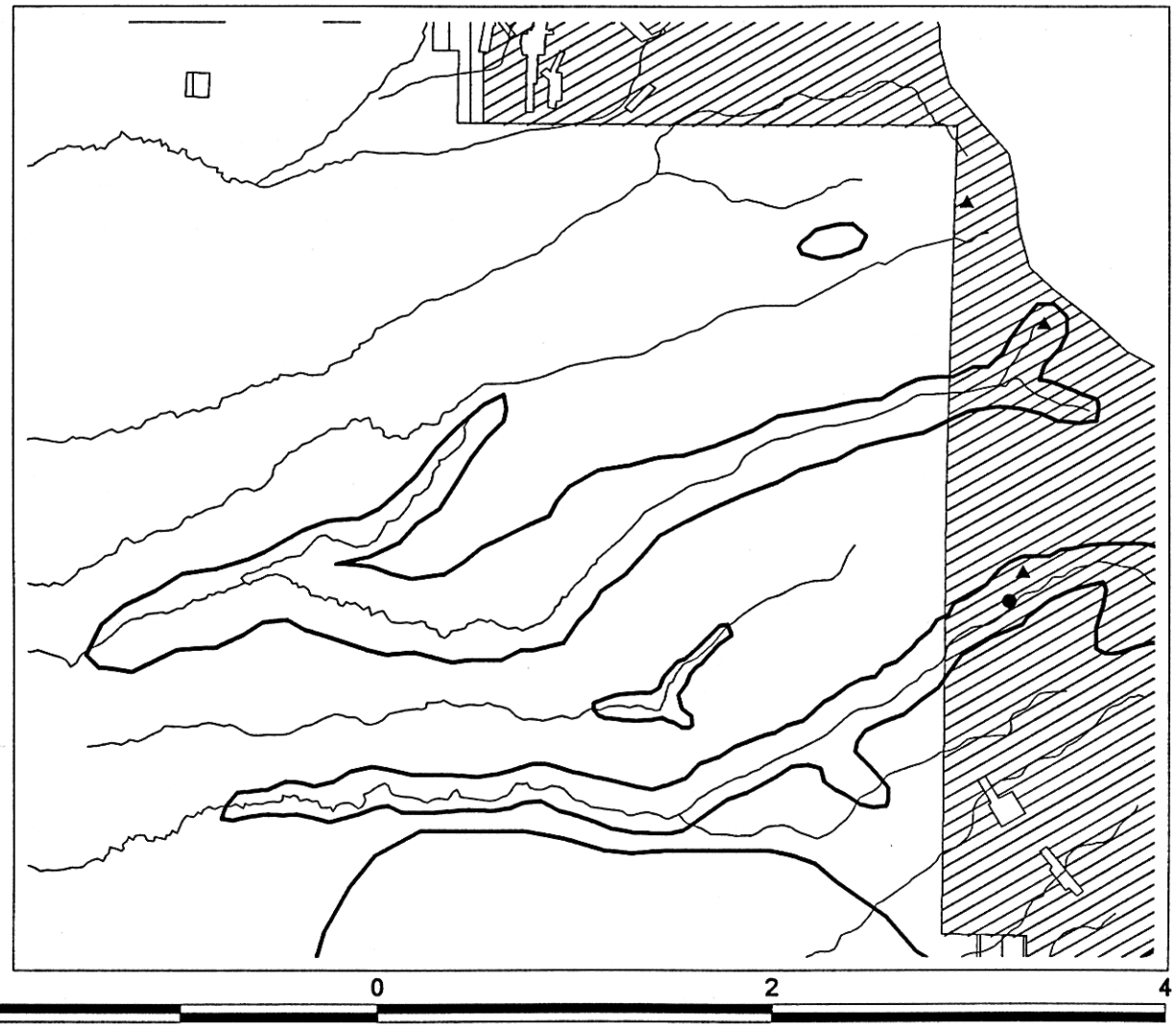
Boundary Justification: This boundary is drawn to 1) protect the occurrences from direct impacts such as trampling or other surface disturbances; 2) provide suitable habitat where additional individuals can become established over time. The boundary was delineated using a 1988 NAPP 1:40,000 aerial photograph and satellite imagery.

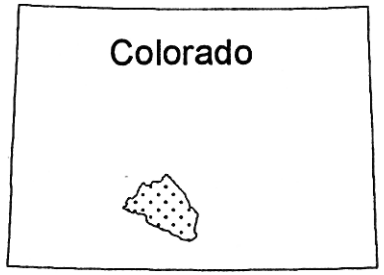
Wetland Functional Evaluation for the Cottonwood Creek site:

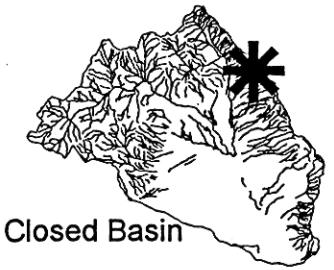
No wetland evaluation was conducted at this site.

Cottonwood Creek

(ownership status)







Public land element occurrences
- vertebrate
- invertebrate
- plant
- community

Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

N

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 29 December, 1997. Map created by Anne Ochs.

Dimick Gulch

Biodiversity Rank: B3 (High significance)
The Dimick Gulch site contains an excellent occurrence of a narrowleaf cottonwood-Rocky Mountain juniper riparian plant association.

Protection Urgency Rank: P4
Over 90% of the Dimick Gulch site is owned and managed by Rio Grande National Forest and Bureau of Land Management. Two small inholdings occur in the lower and middle sections. Development of this site is not likely in the near future, but adequate protection requires continued hydrologic integrity in the watershed. The site has no special protection status on either the private or federal lands. If special protection of this site is desired, actions should focus on preserving the key watershed processes of flooding and natural fluvial disturbance as well as the on-site elements.

Management Urgency Rank: M5
Management of this site is currently adequate.

Location: This site lies two air miles northwest of the town of Crestone.
U.S.G.S. 7.5 minute quadrangle name : Rito Alto Peak
Legal Description: T44N, R11E S 35, 36
T44N, R12E S 20,29,30,31

General Description: The Dimick Gulch site is located on the western slope of the Sangre de Cristo Mountains, at the edge of the San Luis Valley. It is a steep and rugged canyon with dense riparian growth. A four-wheel drive road follows the canyon up to an old cabin, where it terminates. The site contains a diverse array of shrub species on slopes adjacent to the riparian zone. Surrounding hillsides have ponderosa pine (*Pinus ponderosa*) and pinyon pine-juniper (*Pinus edulis-Juniperus monosperma*) woodlands. This site covers approximately 1,750 acres and extends from 7900 to 11600 feet (2420-2890 meter) in elevation.

Biodiversity Rank Justification: The Dimick Gulch site contains an excellent occurrence of a narrowleaf cottonwood-Rocky Mountain juniper (*Populus angustifolia-Juniperus scopulorum*) riparian plant association. Narrowleaf cottonwood (*Populus angustifolia*) and Rocky Mountain juniper (*Juniperus scopulorum*) dominated riparian areas are very uncommon. This plant association is usually restricted to stream banks of narrow washes and creeks on steep-sided canyons such as occur at the Dimick Gulch site. Rocky Mountain juniper grows at the high water line and above, while the narrowleaf cottonwood grades into the active floodplain area. The narrowleaf cottonwood-Rocky Mountain juniper plant association and related types have been reported from Wyoming, and south to New Mexico; excellent occurrences of this type are rare (Hansen *et al.* 1995, Youngblood *et al.* 1985, Gerard *et al*. 1995, Padgett *et al.* 1989, Durkin *et al*. 1995, Johnston 1987, Cooper and Cottrell 1990, Colorado Natural Heritage Program 1997).

Table 28. Natural Heritage elements at the Dimick Gulch site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Populus angustifolia-Juniperus scopulorum	montane riparian forest	G2	S2		A 6/17/97

*EO=Element Occurrence; date indicates date of last observation

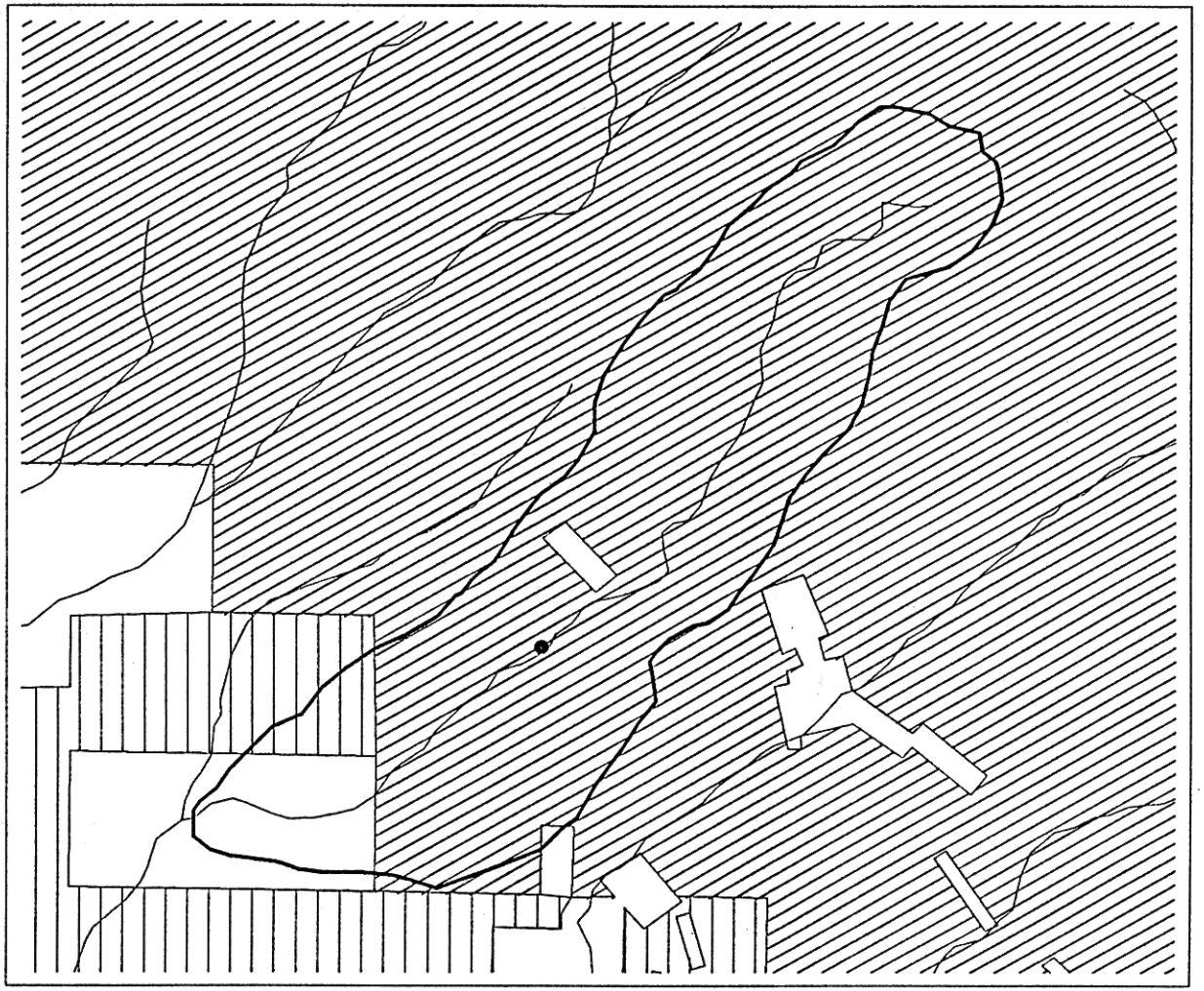
Boundary Justification: The boundary drawn encompasses the riparian community described above and the adjacent uplands. The boundary also includes the immediate upstream watershed to protect against alterations to the stream flow which could impair the regeneration of the cottonwood element of this association.

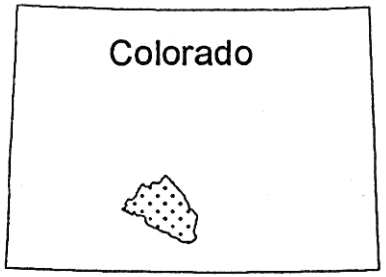
Wetland Functional Evaluation for the Dimick Gulch site:

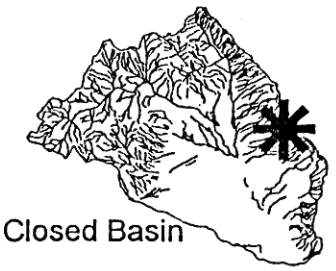
No wetland evaluation was conducted at this site.

Dimick Gulch

(ownership status)







Public land element occurrences
- vertebrate
- invertebrate
- plant
- community

Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

N

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 29 December, 1997. Map created by Anne Ochs.

Rito Alto Bosque

Biodiversity Rank: B (Very High significance)
The Rito Alto site supports some of the best examples of aspen/water birch and narrow-leaf cottonwood/water birch riparian forest in the Closed Basin and Colorado. Both communities are globally restricted to a few sites in the southern Rocky Mountains and Great Basin.

Protection Urgency Rank: P3
This site is almost 90% privately owned with small amounts of Rio Grande National Forest and Bureau of Land Management lands. No known development threats are foreseen in the immediate future; however, with the exception of a small portion of Sangre de Cristo Wilderness at the eastern edge, the site has no formal protection at this time.

Management Urgency Rank: M3
The downstream portion of the site is beginning to show impacts from livestock use, such as invasion of exotic plant species and poor tree regeneration. Cottonwood seedlings and saplings as well as birch shrubs show heavy browsing by cattle. Excessive grazing and browsing will reduce native plant vigor and allow invasion of non-native plant species. Moist soils also make this community susceptible to soil compaction. Cottonwood-dominated riparian areas in Colorado are best grazed moderately for short periods during the growing season or solely during the winter season. This type grazing regime maintains high forage quality and quantity.

The hydrologic regime of Rito Alto is moderately altered by small diversions at the top of the watershed. However, several springs that feed the creek in the upper portions of this site are intact. The regeneration and establishment of new stands of cottonwood is dependent upon flooding events, and any further alteration to the natural flow regime of the creek could affect the cottonwood component of this ecosystem. Without periodic disturbance by flooding, riparian areas may become dominated by late successional species, such as conifers, or lose riparian trees entirely.

Location: This site is located eight air miles northeast of he town of Moffat at the base of the Sangre de Cristo Mountains.

U.S.G.S. 7.5 minute quadrangle: Mirage
Legal Description: T44N, R11E S 3, 8, 9, 10, 16, 17, 18, 19
T44N, R10E S 15, 24, 25

General Description: The Rito Alto Bosque site delineates nearly 3000 acres of riparian forests/woodlands which extend down the alluvial fan from the mouth of Rito Alto Canyon on the western edge of the Sangre de Cristo Mountains. The site slopes westward from the mountain front and ranges from an elevation of just under 7600 feet at the western edge to nearly 9450 feet at the eastern margin. The large areal extent, complex canopy structure, and community diversity make this streamside forest/woodland unique in the northern San Luis Valley. The near streamside zone is vegetated with quaking aspen (*Populus tremuloides*) and narrowleaf cottonwood (*Populus angustifolia*), with an understory of water birch (*Betula occidentalis*), Bebb's willow (*Salix bebbiana*), wild rose (*Rosa woodsii*), and mesic forbs,

sedges, and grasses. Further from the channel, mixed woodlands of Rocky Mountain juniper (*Juniperus scopulorum*) and Gambel oak (*Quercus gambelii*) predominate, extending the forest/woodland as much as 100 meters on either side of Rito Alto Creek. At the upland edges of the site, needle and thread (*Stipa comata*) forms extensive grasslands. This is the most extensive riparian corridor extending from the Sangre de Cristo Mountains toward the valley bottom wetlands of the San Luis Valley. Dense canopy shading, with perennial water and abundant cottonwood snags, suggest the site provides excellent habitat for riparian dependent fauna.

Livestock graze the site. Impacts are light in the upper reaches of the site, where an abundance of downed aspen logs apparently inhibit access to the creek. At the lower reaches of the site, the forest becomes more open, and livestock impacts are evidenced by browsed and trampled cottonwood seedlings, and large patches of non-native grasses (*Bromus* spp*., Poa pratensis*) in the understory. Several two-track roads skirt the edge of the riparian forest, but they appear to show little use. The extreme eastern edge of the site is contained within the Sangre de Cristo Wilderness and a hiking trail passes through the northeast edge of the site.

Biodiversity Rank Justification: This site supports some of the most extensive stands of aspen/water birch (*Populus tremuloides/Betula occidentalis*) and narrow-leaf cottonwood/water birch (*Populus angustifolia/Betula occidentalis*) riparian forests in Colorado.

The narrow-leaf cottonwood/water birch plant association occurs in Utah and Colorado (Padgett *et al.* 1989, Kittel *et al.* 1994). Similar types may occur in Nevada, Idaho, Montana, Wyoming (Manning and Padgett 1995, Hansen *et al.* 1995, Youngblood *et al.* 1985, and Gerard *et al.*1995). In Colorado, this association occurs in the White and Gunnison National Forests on the western slope and along the Front Range (Kittel *et al.* 1996, Kittel *et al.* 1995, Kittel *et al.* 1994, Rondeau 1995, Cooper and Cottrel 1990). Thus far, less than twenty occurrences of the type have been reported in the state.

The aspen/water birch plant association is documented from eastern Nevada (Manning and Padgett 1995) and Colorado (Colorado Natural Heritage Program 1997). In Colorado, this plant association is known only from steep foothill streams of the west side of the Sangre de Cristo Mountains and along the Colorado Front Range. This association is highly threatened by development, recreational use, and stream impoundments.

In addition to the rare plant communities, the site contains excellent grassland, woodlands, and aquatic habitats, providing exceptional habitat for common species of plants and animals.

Table 29. Natural Heritage elements at the Rito Alto Bosque site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Populus angustifolia/Betula occidentalis	montane riparian forest	G3	S1		B 7/13/97
Populus tremuloides/Betula occidentalis	montane riparian forest	G1	S1		A 7/13/97

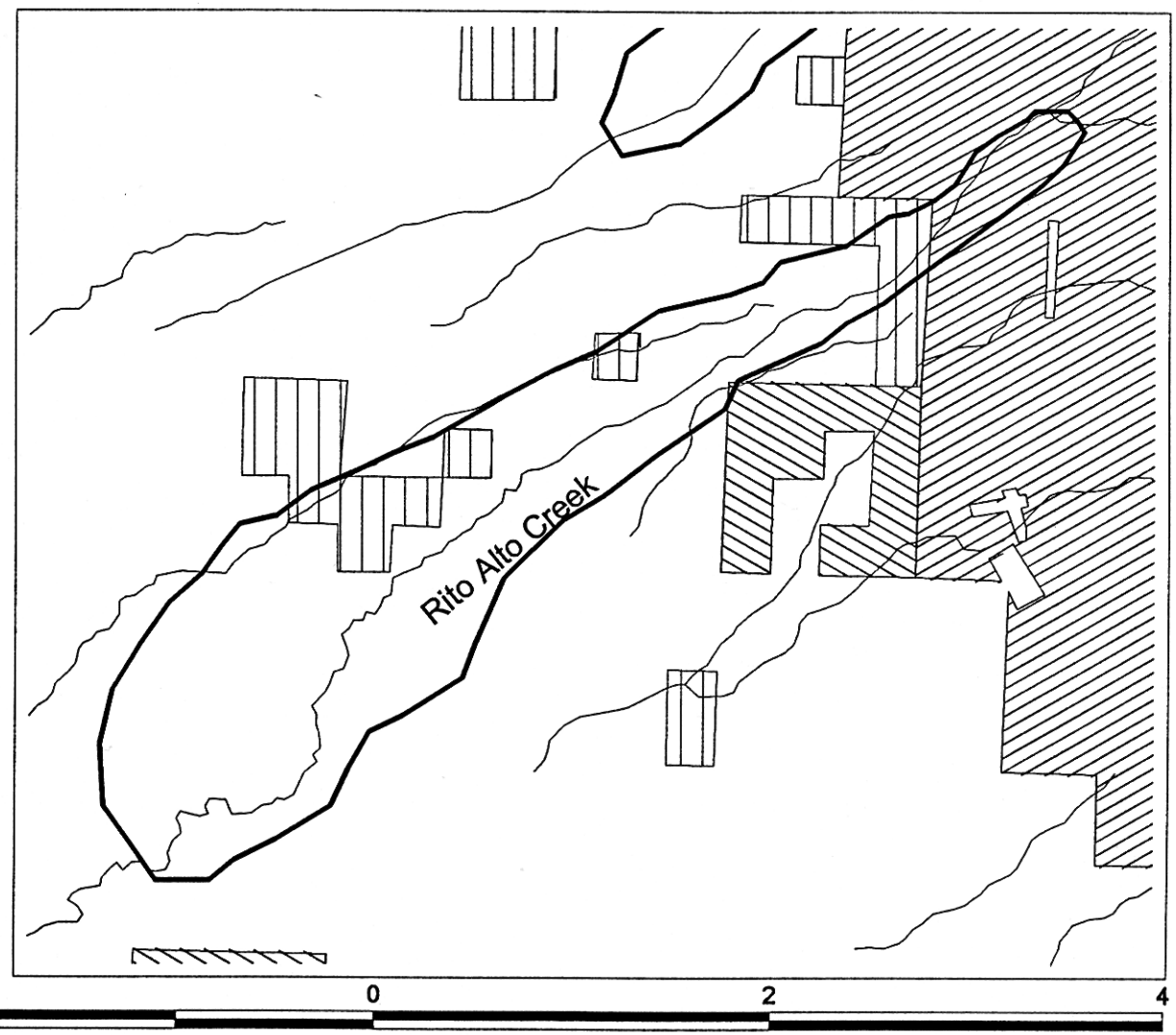
*EO=Element Occurrence; date indicates date of last observation

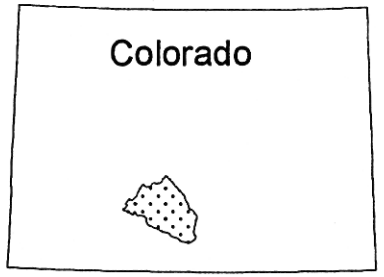
Boundary Justification: The site boundary is drawn to encompass the floodplain of Rito Alto Creek and the juniper and oak woodlands which flank the riparian wetlands. This boundary is drawn to 1) protect the occurrences from direct impacts such as trampling or other surface disturbances; 2) to delineate an area of valuable aquatic habitat which may be impacted by hydrological disturbances upstream. The site boundary was based on initial aerial photo analysis, a field visit by CNHP wetland and riparian ecologists, and subsequent corroboration with satellite imagery.

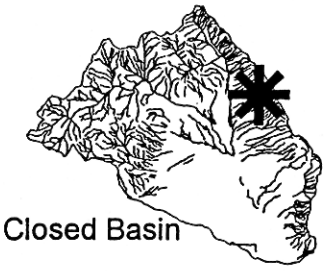
Wetland Functional Evaluation for the Rito Alto Bosque site:
Wetland Class: riverine/slope
Table 30. Wetland functional evaluation for the Rito Alto Bosque site.

Function	Ratings	Confidence in Rating	Comments
Hydrologic Functions			
Groundwater Recharge	very high	high	the stream loses water to its bed as it extends out into the valley
Groundwater Discharge	high	high	numerous springs at the upper elevations of the site
Floodflow Alteration	very high	high	the stream floodplain is structurally diverse and allows natural dissipation of flows
Sediment Stabilization	very high	high	dense floodplain vegetation is resistant to bank erosion
Biogeochemical Functions			
Sediment/Toxicant Retention	high	high	the floodplain is densely vegetated and filters transported sediment during overbank events
Nutrient Removal/ Transformation	low	medium	no known excessive nutrient inputs in watershed
Biological Functions			
Production Export	medium	medium	the ecosystem is very productive, but organic exports other than invertebrates are minimal
Habitat	very high	high	outstanding habitat for riparian dependent fauna
Aquatic Diversity/ Abundance	medium	high	the upper reaches of Rito Alto creek have perennial flow and excellent aquatic habitat; lower reaches are ephemeral
Recreation	low	medium	the site is largely privately owned and recreational access is limited; excellent recreation potential
Uniqueness/ Heritage Value	very high	high	most diverse and extensive riparian forest in Closed Basin of San Luis Valley and harbors excellent occurrences of two globally rare riparian forest communities

Rito Alto Bosque
(ownership status)







Public land element occurrences
- ■ vertebrate
- ★ invertebrate
- ▲ plant
- ● community

Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

N

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.

Upper Medano Creek

Biodiversity Rank: B3 (High significance)
The Upper Medano Creek site harbors a good occurrence of a globally rare riparian shrubland, an excellent example of an alpine wetland, an introduced population of the globally rare Rio Grande sucker, and several unranked occurrences of the globally rare Rio Grande cutthroat.

Protection Urgency Rank: P4
This site falls entirely on public lands owned and managed by Rio Grande National Forest and Great Sand Dunes National Monument. The Forest Service lands are designated as wilderness area, which affords some protection against human-induced alterations, and the Park Service lands afford similar protection measures.

Management urgency Rank: M4
Management actions are not needed now. Currently, the streams are free from exotic fishes, but periodic monitoring will help to verify this through time.

Location: On upper Medano Creek, just northeast of Great Sand Dunes on Rio Grande National Forest land.

U.S.G.S. 7.5 minute quadrangles: Beck Mountain, Liberty, Medano Pass.
Legal Description: T25S, R72W S 4,5,6,7,8,9
T25S, R73W S 1,2,11,12
T26S, R72W S 16,17,18,19,20,21,28,29,30,31,32,33
T26S, R73W S 24,25,36

General Description: The Upper Medano Creek Site covers about 11,500 acres and spans an elevational range from 8,700 - 12,600 feet (2,600 – 3,800 meters). This site has some sand dunes at the lowest elevations, and grades through montane forests to subalpine areas at the crest of the Sangre De Cristo Mountains. Upper portions of the Medano Creek site lie in a glaciated cirque basin. Medano Lake, at the upper elevations, is surrounded by subalpine wetlands in excellent condition. These wetlands include shrublands, sedge meadows, and forblands. The dominant plants within these wetlands include short fruit willow (*Salix brachycarpa*), water sedge (*Carex aquatilis),* beaked sedge (*Carex utriculata*), bittercress (*Cardamine cordifolia*), mountain bluebells (*Mertensia ciliata*), and narrowleaf groundsel (*Senecio triangularis*).

Medano Creek steepens as it leaves the cirque basin and plunges through subalpine fir-Engelmann spruce forests (*Abies lasiocarpa-Picea engelmannii*), followed by aspen forests (*Populus tremuloides*) and finally Douglas-fir (*Pseudotsuga menziesii)* forests in the foothills before reaching the north-eastern edge of the sand dunes. When the stream lessens its gradient at the lower elevations, patches of alders (*Alnus incana)*, and Drummond willow (*Salix drummondii*) shrublands dominate the streamside. These shrublands are small in size but provide important nutrient and cover to the aquatic habitat.

Biodiversity Rank Justification: The Upper Medano Creek site supports six different elements of biodiversity, and a total of ten occurrences distributed among these elements. Three of these elements, thinleaf alder/mesic forb riparian shrubland (*Alnus incana/*mesic forb*),* Rio Grande sucker *(Catostomus plebeius),* and Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis);* are considered globally rare. The populations of Rio Grande cutthroat were introduced following an exotic fish removal project in the 1970's. The Rio Grande sucker was introduced to the site in 1996, and was still doing well in 1997 (Sue Swift pers. comm.).

The Rio Grande cutthroat trout's range once included the entire Rio Grande and Pecos River watersheds, and possibly the upper Canadian River as well (Trotter 1987). In Colorado, the species occupies less than 1% of its former range (Alves 1996), and wild, genetically pure stock populations are especially imperiled. Artificial habitat including wells, farm ponds, and extensive canal systems as well as human activities including dewatering, fishing and stocking, transbasin diversions, release of domestic sewage, stream channelization, and agricultural chemical applications have greatly modified the original aquatic ecosystem of the San Luis Valley (Zuckerman 1984). These modifications may have contributed directly to the decline in range of the native fishes of the Rio Grande drainage. Free-flowing streams with good quality water, healthy banks, and streamside vegetation within the upper Rio Grande watershed are vital habitat for this subspecies of trout.

Table 31. Natural Heritage element occurrences at the Upper Medano Creek site. Multiple listings of the same element represent suboccurrences. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Plant communities					
***Alnus incana/*mesic forb**	**thinleaf alder/mesic forb riparian shrubland**	**G3**	**S3**		**B 7/23/97**
Cardamine cordifolia-Caltha leptosepala alpine wetland	alpine wetland	G4	S4		A 7/24/97
Salix brachycarpa/Carex aquatilis-Carex utriculata	**subalpine willow carr**	**G3G4**	**S3S4**		**A 7/24/97**
*Salix drummondiana/*mesic forb	montane riparian shrubland	G4	S4		C 7/22/97
Fish					
Catostomus plebeius	**Rio Grande sucker**	**G3G4**	**S1**	**SE**	**I 1996**
Oncorhynchus clarki virginalis	Rio Grande cutthroat	G4T3	S3	(3C), SC, FS	unranked no date
Oncorhynchus clarki virginalis	Rio Grande cutthroat	G4T3	S3	(3C), SC, FS	unranked 10/12/87
Oncorhynchus clarki virginalis	Rio Grande cutthroat	G4T3	S3	(3C), SC, FS	unranked no date
Oncorhynchus clarki virginalis	Rio Grande cutthroat	G4T3	S3	(3C), SC, FS	unranked 8/10/93

*EO=Element Occurrence

Boundary Justification: This boundary is drawn to include the riparian complex that supports the elements of biodiversity found at the site. It is designed to 1) protect the occurrences from

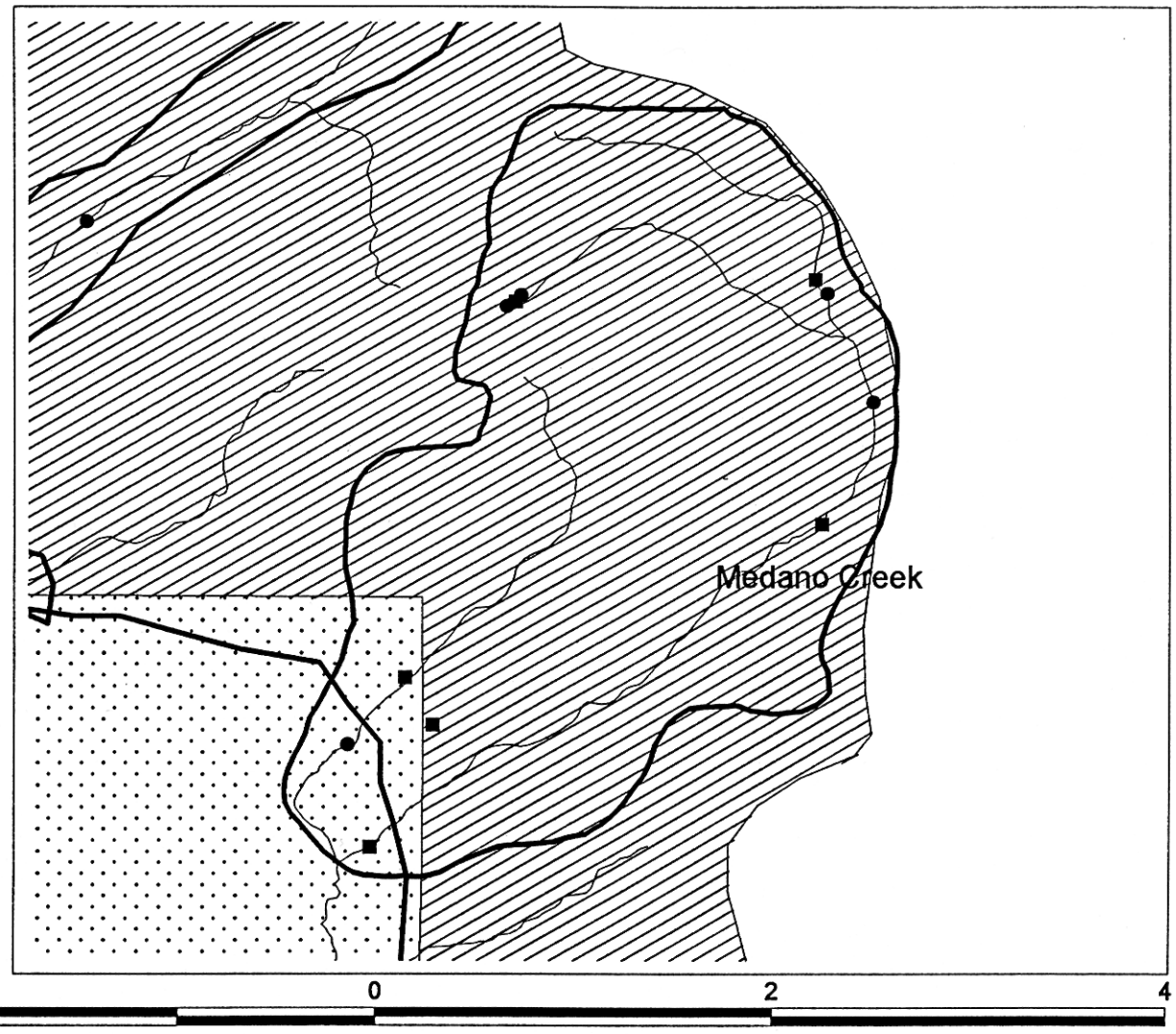
direct impacts such as trampling or other surface disturbances; and 2) to include the immediate slopes which contribute surface and groundwater flow to the creek and riparian ecosystem. Any activity within the boundary of this watershed has the potential to negatively affect the fishes and riparian communities by impacting water quality and quantity. The boundary was delineated using 1988 NAPP 1:40,000 aerial photograph and satellite imagery at a scale of approximately 1:125,000.

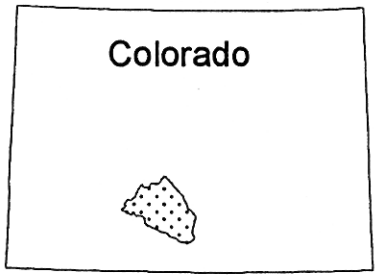
Wetland Functional Evaluation for the Upper Medano Creek site:

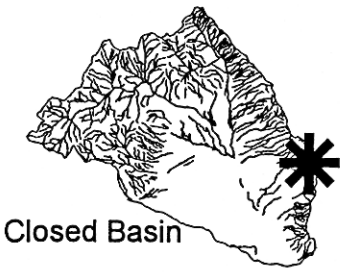
No wetland evaluation was conducted at this site.

Upper Medano Creek

(ownership status)







Public land element occurrences
- vertebrate
- invertebrate
- plant
- community

Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

N

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 29 December, 1997. Map created by Anne Ochs.

Cedar Canyon

Biodiversity Rank: B4 (Moderate significance)
The Cedar Canyon site includes a good condition, but small example of a foothills riparian forest.

Protection Urgency Rank: P3
This site is privately owned, although no future development plans are known.

Management Urgency Rank: M3
The riparian vegetation shows little or no cottonwood regeneration. This is most likely because of cattle grazing on seedlings and sapling, since other natural processes and a natural hydrologic regime appear intact. Improved livestock management could include fencing off the riparian areas, or limiting grazing to short duration summer or winter only use, which would minimize grazing on seedlings. Regeneration of cottonwoods is essential to prevent loss to the occurrence.

Location: This site is on an unnamed tributary of Cedar Canyon, located near the center of the Luis Maria Baca Ranch.

U.S.G.S. 7.5 minute quadrangle: Crestone
Legal Description: unsurveyed

General Description: Cedar Canyon contains an unnamed tributary that is a cobble -bottomed, clear water creek, arising in the Sangre de Cristo mountains(see following map). The surrounding uplands are sand ridges covered with pinyon-juniper (*Pinus edulis-Juniperus* sp.), rabbitbrush (*Chrysothamnus nauseosus*), and ponderosa pine (*Pinus ponderosa*) communities on the north-facing sides. The south-facing sides are similar in vegetation, but lack the ponderosa pine. The creek runs over an alluvial at the mouth of the canyon before reaching the San Luis Valley floor. The creek has a narrow band of riparian vegetation, containing cottonwood (*Populus angustifolia)* and Rocky Mountain juniper (*Juniperus scopulorum*). Numerous mayflies were observed on the overhanging vegetation.

Biodiversity Rank Justification: This site includes a small but good quality example of a narrowleaf cottonwood-Rocky mountain juniper riparian forest. This riparian community is limited to foothill streams in Colorado. A much larger occurrence of this is found along Deadman Creek, just south of Cedar Canyon.

Table 32. Natural Heritage element occurrence at Cedar Canyon site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Populus angustifolia-Juniperus scopulorum	montane riparian forest	G2	S2		B 6/28/97

*EO=Element Occurrence; date indicates date of last observation

Boundary Justification: This boundary is drawn to include the riparian area that supports the above community. It is designed to protect the occurrence from direct impacts such as trampling

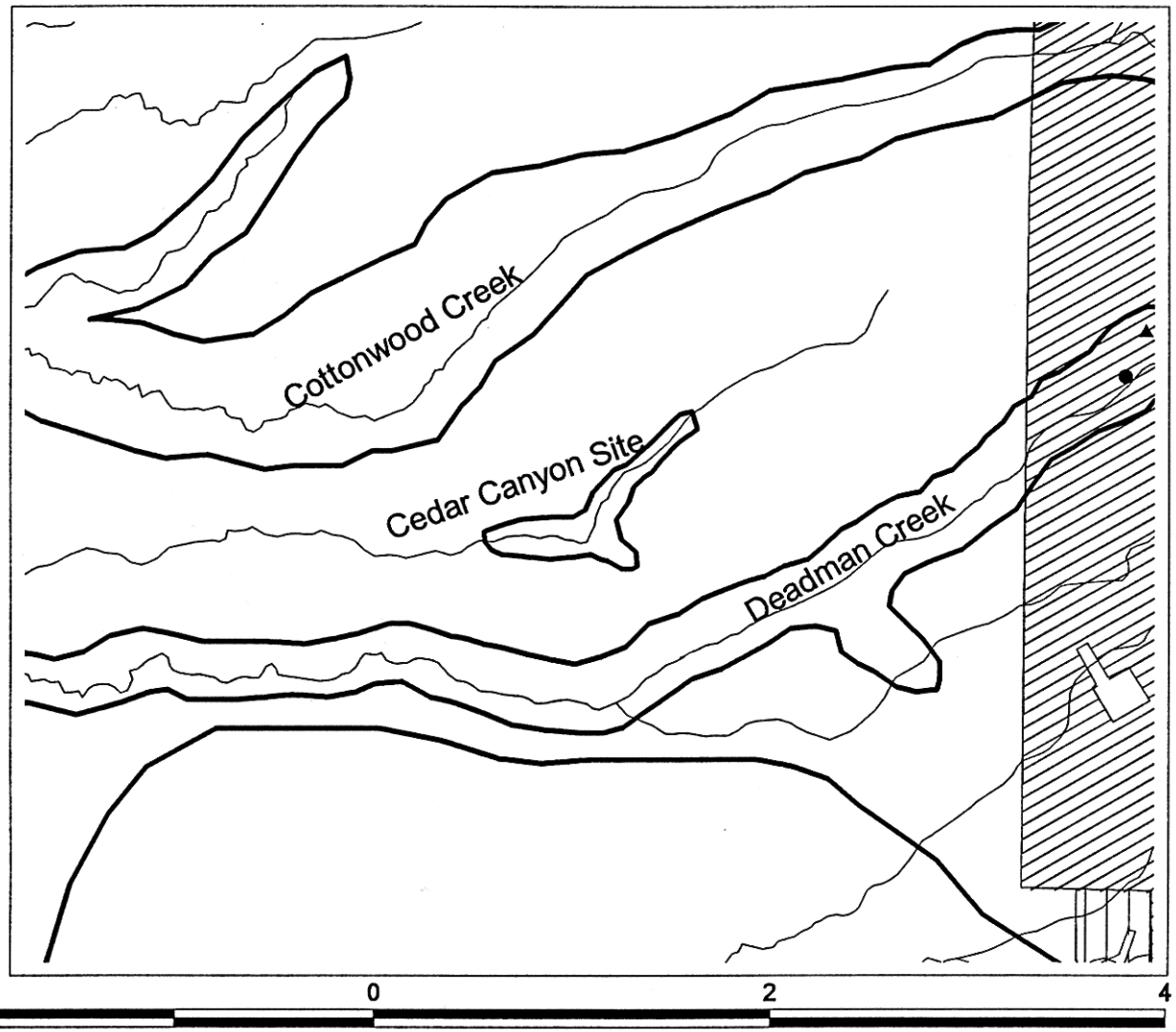
or other surface disturbances; and to include the immediate slopes which contribute surface and groundwater flow to the riparian area. The boundary was delineated using 1988 NAPP 1:40,000 aerial photograph and satellite imagery at a scale of approximately 1:100,000.

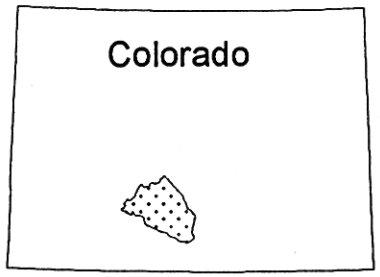
Wetland Functional Evaluation for the Cedar Canyon site:

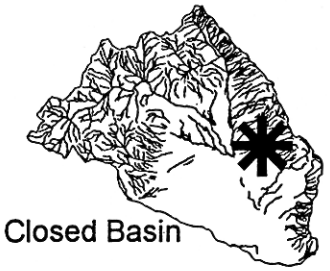
No wetland evaluation was conducted at this site.

Cedar Canyon

(ownership status)







Public land element occurrences
- vertebrate
- invertebrate
- plant
- community

Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

N

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 12 January, 1998. Map created by Anne Ochs.

Garner Canyon

Biodiversity Rank: B4 (Moderate significance)
This site contains occurrences of uncommon montane forests, including Douglas-fir/Rocky Mountain maple montane coniferous forest and aspen/western birch montane deciduous forest. In addition, a stand of the globally rare subspecies canyon bog-orchid has been recorded at the site.

Protection Urgency Rank: P3
This site is predominantly publicly owned and managed by Rio Grande National Forest with some private parcels at the base of the watershed. A new residence has recently been erected at the base of the canyon near the lower springs where a population of canyon bog-orchid has been reported. CNHP recommends that the private landowner be informed of this plant and encouraged to conserve its habitat.

Management Urgency Rank: M3
The majority of this site is under public ownership. Activities of concern take place primarily on the private land at the base of the site. Horse grazing and haying operations occur which may detrimentally impact the wetland elements. Both activities should be avoided in the immediate vicinity of the springs and riparian wetlands at the site. If water is diverted from the creek or spring wetlands, sufficient in-channel flow should be preserved to maintain the riparian elements.

Location: This site is located in northeastern Saguache county approximately seven miles east of Mineral Hot Springs resort and two miles south of Valley View Hot Springs
U.S.G.S. 7.5 minute quadrangle: Valley View Hot Springs
Legal Description: T45N, R10E S 1, 12
T45N, R11E S 5, 6
T46N, R11E S 32, 33

General Description: The Garner Canyon site is drawn to delineate a complex of valley bottom and toeslope vegetation communities in the lower reaches of the canyon. The canyon is wider than most of the other gorges draining the western flank of the Sangre de Cristo Mountains, and the valley bottom is less steep. The toeslope on the south side of Garner Creek supports a dense stand of Douglas-Fir (*Pseudotsuga menziesii*) with an understory of Rocky Mountain maple (*Acer glabrum*), snowberry (*Symphoricarpos rotundifolius*), wild rose (*Rosa woodsii*), buffaloberry (*Sheperdia canadensis*), and a lush understory of forbs, sedges, and grasses. At the base of the canyon, where a complex of springs augment the riparian wetlands along Garner Creek, there is a small but lush stand of aspen (*Populus tremuloides*) with western birch (*Betula occidentalis*) in the understory. The site covers over 300 acres and extends from 8700 to 9950 feet (2654-3035 meters) in elevation.

Biodiversity Rank Justification: The site contains occurrences of Douglas-fir/Rocky Mountain maple (*Pseudotsuga menziesii/Acer glabrum*) lower montane forest and aspen/western birch (*Populus tremuloides/Betula occidentalis*) montane riparian forest.

Stands of Douglas-fir/Rocky Mountain maple communities have been reported from less than ten sites in western Colorado. Although both species are common, pure stands with high proportions of Rocky Mountain maple are restricted to mesic montane slopes. The aspen/western birch montane forest is documented from eastern Nevada (Manning and Padgett 1995) and Colorado (Colorado Natural Heritage Program 1997), but less than 20 stands have been reported in this state.

The globally rare canyon bog-orchid (*Platanthera sparsiflora* var. *ensifolia*) which occurs at this site has been recorded at scattered sites throughout southern and western Colorado. It is an obligate wetland plant which favors spring habitats. This occurrence is threatened by livestock trampling and invasive plant species, which can have especially severe impacts on spring ecosystems.

Table 33. Natural Heritage element occurrences at the Garner Creek site.
Multiple listings of elements represent suboccurrences. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Populus tremuloides/Betula occidentalis	montane riparian forest	G1	S1		C 9/20/97
Pseudotsuga menziesii/Acer glabrum	lower montane forest	G4	S1		B 9/20/97
Platanthera sparsiflora var. *ensifolia*	canyon bog-orchid	G4G5T3	S2		unranked 6/30/90

*EO=Element Occurrence; date indicates date of last observation

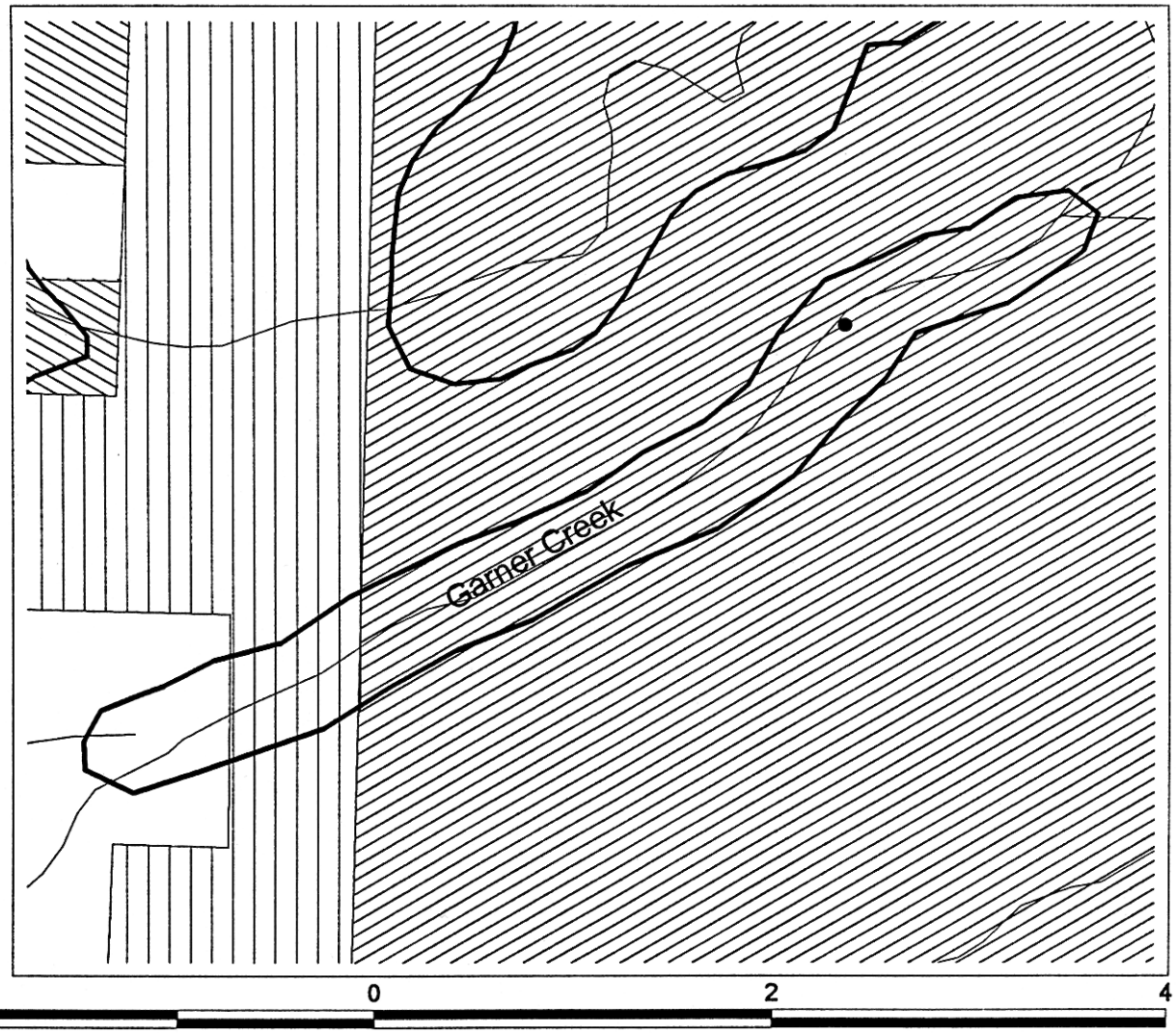
Boundary Justification: The site boundaries are drawn to include all the occurrences presented above, and valley toeslopes within 1/8 mile of the stream which contribute surface runoff to the stream channel. In addition, the boundary is drawn to 1) protect the occurrences from direct impacts such as trampling or other surface disturbances; and 2) provide suitable habitat where additional individuals can become established over time. The boundary was developed following a field visit by a CNHP wetland ecologist and corroborated with remotely sensed data.

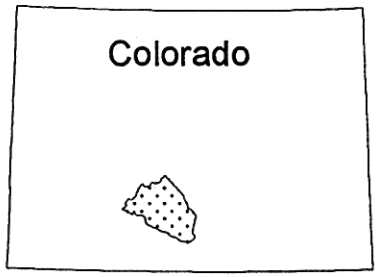
Wetland Functional Evaluation for the Garner Canyon site:
Wetland class: Riparian/slope

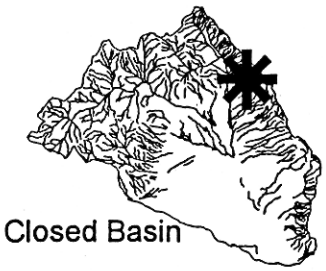
Table 34. Wetland functional evaluation for the Garner Canyon site.

Function	Ratings	Confidence in Rating	Comments
Hydrologic Functions			
Groundwater Recharge	medium	medium	stream and spring flow is reabsorbed below the canyon mouth
Groundwater Discharge	very high	high	this site contains several perennial springs
Floodflow Alteration	medium	medium	well vegetated, but few off-channel basins
Sediment Stabilization	high	high	densely vegetated
Biogeochemical Functions			
Sediment/Toxicant Retention	medium	medium	densely vegetated
Nutrient Removal/ Transformation	medium	medium	dense, vigorous vegetation, but water moves rapidly through the system
Biological Functions			
Production Export	very high	high	dense canopy of deciduous trees add organic matter to the stream
Habitat	high	high	excellent habitat for riparian dependent fauna.
Aquatic Diversity/ Abundance	medium	medium	good to excellent stream habitat
Recreation	medium	medium	much of the site is privately owned and access is restricted, potential is high
Uniqueness/ Heritage Value	medium	medium	three occurrences of moderate Natural Heritage significance

Garner Creek
(ownership status)







Public land element occurrences
- ■ vertebrate
- ★ invertebrate
- ▲ plant
- ● community

Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

N

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.

Wild Cherry Canyon

Biodiversity Rank: B4 (moderate significance)
The Wild Cherry Canyon site contains the region's only known occurrence of Altai cottongrass at the upper elevations, along with a good example of quaking aspen/red-osier dogwood in the lower canyon.

Protection Urgency Rank: P3
The majority of this site is within the Sangre de Cristo Wilderness Area, which is owned and managed by the Rio Grande National Forest. The lower section is privately owned and development of a small Christian retreat is planned there. This would be an excellent opportunity to develop a conservation easement on the floodplain of Wild Cherry Creek. The private owner, Santa Fe Community School, would like the retreat to have minimal impacts on the natural values of the property and has provisionally agreed not to build on, or unnecessarily disturb, the Wild Cherry Creek floodplain. Colorado Natural Heritage Program prepared a brief list of protection guidelines for the landowners on 8/17/97, but a formal conservation agreement is strongly recommended.

Management Urgency Rank: M4
Although the elements at the site are not currently threatened, management adjustments may be needed in the future to maintain the quality of the element occurrences. Livestock grazing, particularly of packstock, occurs along the riparian corridor of Wild Cherry Creek. Current impacts are minor, but invasive plant species are becoming established along the trail corridor and in the small meadow just below the lake basin. The abundance of invasive plant species warrants monitoring, and packstock use may need to be adjusted to minimize disturbance to soils and native vegetation. There is some grazing by goats on the private land at the base of the site. The land owners should be informed of the destructive effects of confined livestock and encouraged to avoid allowing livestock in the floodplain.

Location: This site is located eight miles east of highway 17, via Saguache County road "AA".
U.S.G.S. 7.5 minute quadrangles: Mirage, Electric Peak
Legal Description: T44N, R11E S 4, 5
T45N, R11E S 23, 24, 25, 26, 27, 28, 33

General Description: The Wild Cherry canyon site designates a 2,060 acre watershed draining the western slope of the northern Sangre de Cristo Mountains. Site elevations range from 12,524 feet (3,819 meters) at the upper edge of the lake basin to 8,072 feet (2,462 meters) at the western boundary below the mouth of the canyon. Wild Cherry Lake basin, at the head of the watershed, contains alpine wetlands which harbor several species of sedges (*Carex* spp.) and willows (*Salix* spp.), as well as elephantella (*Pedicularis groenlandica*), rose crown (*Sedum rhodanthum*), star gentian (*Swertia perennis*), and the state imperiled Altai cottongrass (*Eriophorum altaicum* var. *neogaeum*). Below the lake basin, the canyon narrows and supports a large aspen (*Populus tremuloides*) forest. The understory is dominated by red-osier dogwood (*Cornus sericea*) near the stream and wild rose (*Rosa woodsii*) and forbs farther upslope. On the alluvial fan below the

canyon mouth, the riparian forest is flanked by woodlands of Rocky Mountain juniper (*Juniperus scopulorum*) and Gambel oak (*Quercus gambelii*), creating a structurally diverse riparian ecosystem which extends approximately one mile west from the Sangre de Cristo mountain front.

The setting and hydrology of this site appear largely pristine. A pack trail follows the north side of Wild Cherry Creek from the canyon mouth to the lake basin. Invasive species, such as soft brome (*Bromus inermis*) and Kentucky bluegrass (*Poa pratensis*) are present along the trail corridor but did not appear widespread in the canyon. A single house is located next to the creek at the extreme west end of the site.

Biodiversity Rank Justification: The Wild Cherry Canyon site contains the Sangre de Cristo region's only known occurrence of Altai cottongrass. Altai cottongrass is an alpine wetland plant with a geographically broad, but sporadic, distribution through the higher ranges of the Rocky Mountain states. It occurs from Alaska and British Columbia south to the Uinta Mountains of Utah and several ranges of western Colorado. This stand is disjunct by nearly 100 miles from Hinsdale and Park County populations to the west and north, respectively.

A good example of a quaking aspen/red-osier dogwood (*Populus tremuloides/Cornus sericea*) community fills the lower canyon. This plant association occurs in Montana (Hansen et al. 1988), Utah (Padgett et al. 1989), and Colorado (Colorado Natural Heritage Program 1997). In Colorado, this plant association is known from only three stands, but is estimated to be somewhat more common. The association typically occurs in deep, narrow valleys along banks of low order streams.

Gray's peak whitlow grass (*Draba grayana*) has been historically reported from higher elevations of the site in 1942. Gray's peak whitlow grass is a Colorado endemic scattered along the eastern crest of the southern Rocky Mountains. It inhabits talus slopes in crevices between rocks or other protected sites (Spackman et al. 1997). This plant was not censused in 1997, and viability or persistence of this population is presently unknown.

Table 35. Natural Heritage elements at the Wild Cherry Canyon site.
Multiple listings of elements represent suboccurrences. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Plant communities					
Populus tremuloides/Cornus sericea	montane riparian woodland	G3	S2S3		B 7/12/97
Plants					
Draba grayana	Gray's peak whitlow-grass	G2	S2		unranked 8/19/42
Eriophorum altaicum var neogaeum	**Altai cottongrass**	**G4T?**	**S2**		**B 8/23/97**
Eriophorum altaicum var *neogaeum*	Altai cottongrass	G4T?	S2		unranked 8/19/42

*EO=Element Occurrence; date indicates date of last observation

Boundary Justification: The site boundaries are drawn to protect the floodplain of Wild Cherry Creek, and valley toeslopes within 1/8 mile of the stream which contribute surface runoff to the stream channel. In the glaciated headwater basin, all valley bottom wetlands were included. Although not contained in the present site boundary, contributory sub-watersheds should be managed to avoid downstream impacts to elements in the Wild Cherry Creek site. The site boundary was based on initial aerial photo analysis, a field visit by a CNHP wetland ecologist, and subsequent corroboration with satellite imagery.

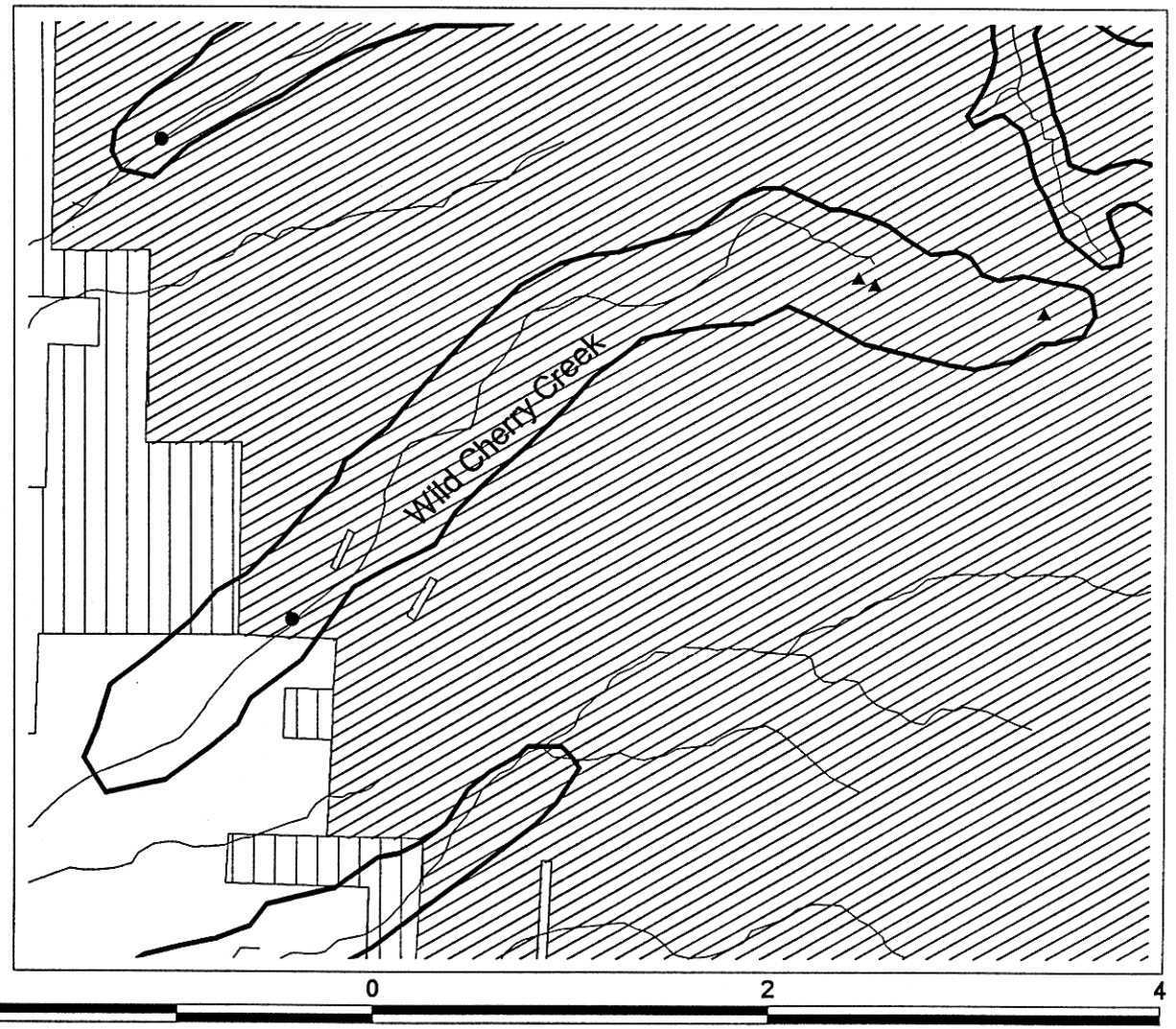
Wetland Functional Evaluation for the Wild Cherry Canyon site:
Wetland Class: slope/riverine

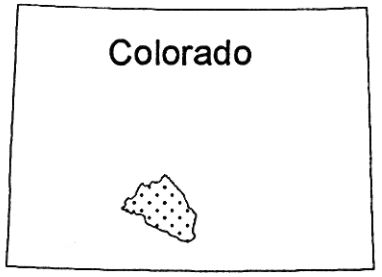
Table 36. Wetland functional evaluation for the Wild Cherry Canyon site.

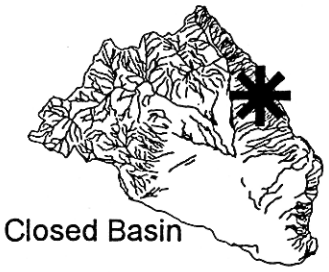
Function	Ratings	Confidence in Rating	Comments
Hydrologic Functions			
Groundwater Recharge	high	high	areas below the canyon mouth lose water into the underlying alluvial fan
Groundwater Discharge	very high	high	the upper reaches of the canyon discharge groundwater continuously
Floodflow Alteration	medium	medium	dense vegetation disperses overbank flows; no off-channel reservoirs to store excess flow
Sediment Stabilization	high	high	dense vegetation resists bank erosion
Biogeochemical Functions			
Sediment/Toxicant Retention	medium	high	the riparian forest can filter transported sediment; no toxicant inputs likely
Nutrient Removal/ Transformation	medium	medium	no known sources of excess nutrients, but vegetatio production and uptake is high
Biological Functions			
Production Export	high	medium	very productive vegetation, but minimal export of organic material from watershed
Habitat	very high	high	outstanding habitat for riparian dependent fauna
Aquatic Diversity/ Abundance	medium	medium	not sampled, excellent habitat.
Recreation	very high	high	this is an outstanding recreational area with opportunities for hiking, horseback riding, fishing, hunting, and wildlife viewing.
Uniqueness/ Heritage Value	medium	medium	this is a watershed/ riparian ecosystem of excellent quality; natural processes are intact and habitat is diverse; several natural heritage elements present

Wild Cherry Creek

(ownership status)







Public land element occurrences
- ■ vertebrate
- ★ invertebrate
- ▲ plant
- ● community

Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

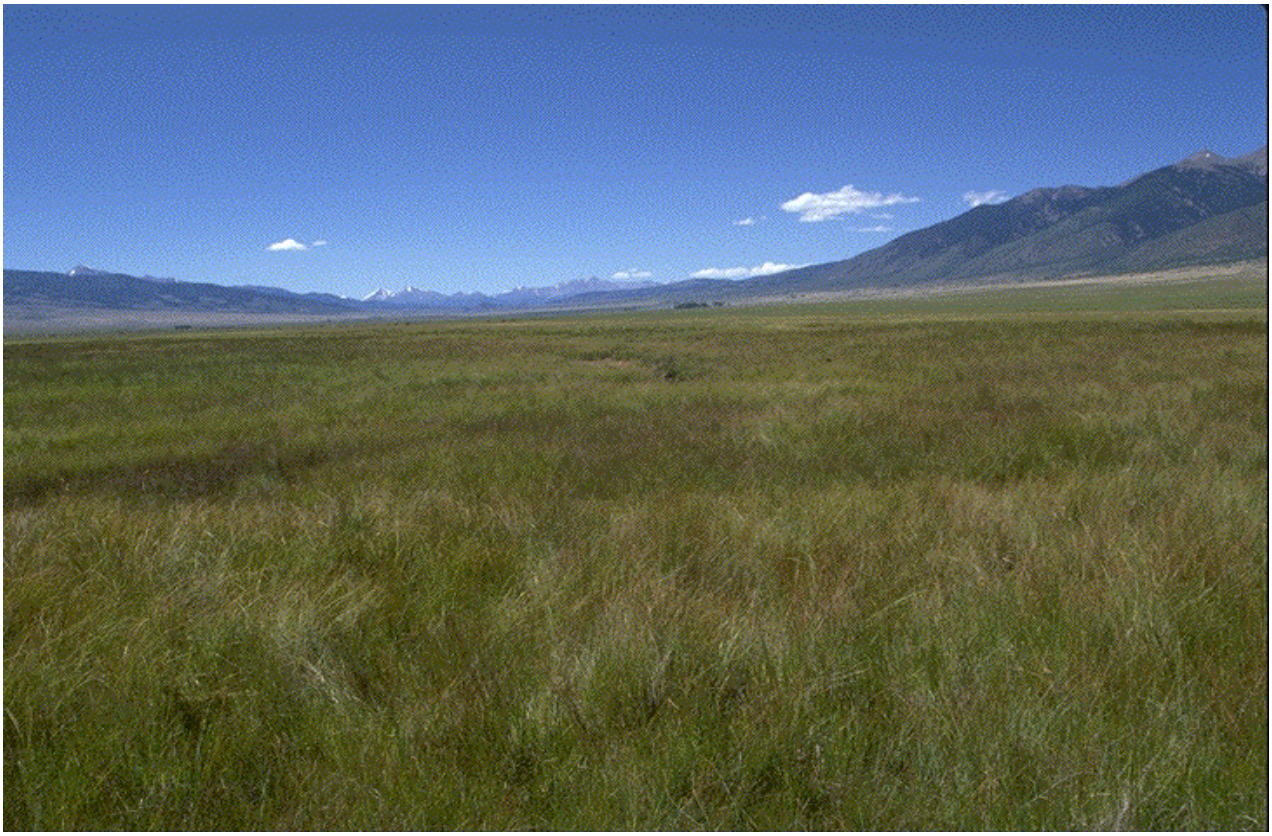
N

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.

Aspen and birch

North Sangre de Cristo Mountains-North Valley Floor Sub-Region



The North Sangre de Cristo Mountains-North Valley Floor-Sub-region lies in the northeastern part of Saguache County and includes sites along the foothills of the Sangre de Cristo Mountains and on the northern part of the San Luis Valley floor (Figure 7). This sub-region contains two proposed wetland conservation sites (see following table). **Villa Grove (B2) is the most outstanding wetland site in this subregion.** The Villa Grove site contains significant amounts of private land, while Decker Creek is owned and managed primarily by the Bureau of Land Management (See Appendix A for ownership maps). The following table summarizes the biodiversity, protection, and management ranks for the proposed conservation sites of the sub-region.

Table 37. North Sangre de Cristo Mountains-North Valley Floor Sub-region Proposed Conservation Sites by Biodiversity Rank.

SITENAME	Biodiversity Rank	Protection Urgency Rank	Management Urgency Rank	Page number
Villa Grove	B 2	P 3	M 3	
Moffat playas	B 4	P 2	M 2	

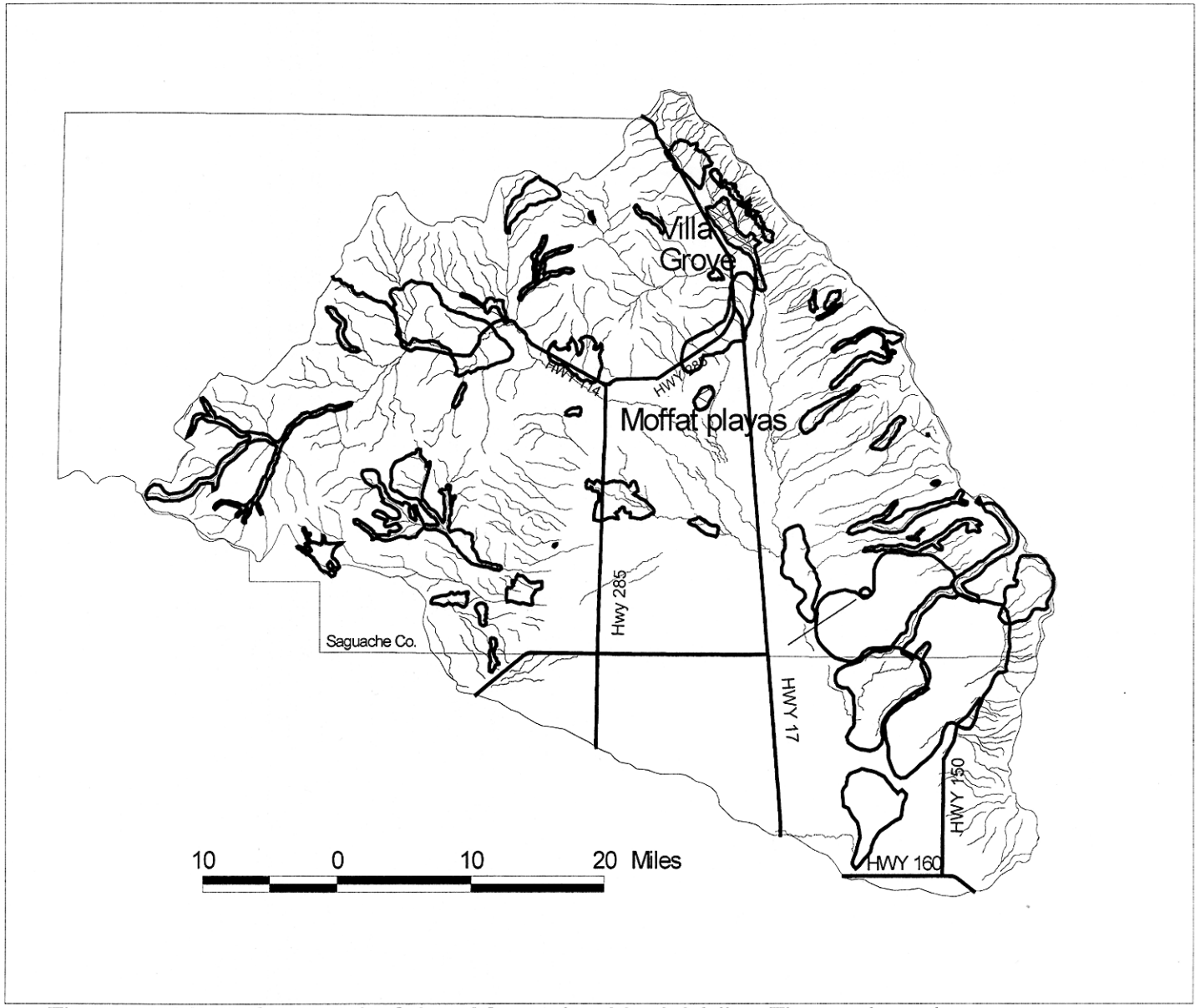


Figure 7. North Sangre de Cristo Mountains-North Valley Floor sub-region proposed conservaiton sites (labeled).

Villa Grove

Biodiversity Rank: B2 (very high significance)
This extensive montane wetland supports an excellent example of the geographically restricted Rio Grande chub. In addition, a small population of the globally rare pale blue-eyed grass, and a large stand of the state-rare slender sedge is found here. The fen wetland found at this site is the most extensive and unfragmented wetland of its kind observed during the 1997 survey of the Closed Basin.

Protection Urgency Rank: P3
This site is primarily privately owned by three separate landowners. Development is not anticipated in the near future, but none of the site is currently protected. Off-site land uses have the potential to impact elements at this site. The wetland elements at this site are adapted to a highly stable hydrologic environment. Therefore, protection of the hydrologic regime, including ground and surface water resources, is imperative. Possible impacts from upstream mining or toxic spills on Kerber Creek can directly affect the aquatic biota at this site.

Management Urgency Rank: M3
The entire site is used as pasture for domestic livestock. Although the site is generally in good condition, trampling impacts are evidenced by puncturing of wet peat soils, bank erosion along San Luis Creek, and altered species composition. Directing livestock away from the perennially wet stream and fen areas towards more resistant uplands, or limiting grazing to fall/winter when wetlands are drier, would lessen grazing impacts.

Location: This site lies two miles east of the town of Villa Grove.
U.S.G.S. 7. minute quadrangles: Bushnell Peak, Villa Grove
Legal Description: T46N, R9E S 1, 2, 12
T46N, R10E S 6, 7, 18, 19, 20, 29, 30,
T47N, R9E S 21, 22, 26, 27, 28, 34, 35, 36

General Description: The Villa Grove site contains 5,868 acres of valley bottom wetlands between the northern Sangre de Cristo Mountains and the northeastern Cochetopa Hills. The site encompasses a complex of perennial springs which support extensive fen and meadow wetlands in an otherwise semi-arid sagebrush steppe. The site extends down San Luis Creek from approximately two miles north of the town of Villa Grove to four miles southeast and ranges from 7,780 to 8,100 feet (2,373-2,471 meters) in elevation. Rock and San Luis creeks flow southward and converge with east flowing Kerber Creek in the middle of the site.

This is the largest fen wetland complex in the Closed Basin, and the cold, peat soils and stable hydrology are unique on the San Luis Valley floor. Large sedge wetlands, dominated by beaked sedge (*Carex utriculata*), small flowered sedge (*Carex simulata*), water sedge (*Carex aquatilis*), and Nebraska sedge (*Carex nebrascensis*) occur at the northern end of the site, where the

hydrology is most stable. In the fen areas, peat soils are well developed and often exceed three feet in thickness. In places, exceptionally strong upwelling lifts the peat layer from the mineral substrate, producing "quaking fens". Montane wet meadows occur downstream of the fens, where soils are moist to wet, but irrigated primarily by surface flow. Common species of the meadow portion include the state-rare slender sedge (*Carex lasiocarpa*), tufted hairgrass (*Deschampsia cespitosa*), and Canadian reedgrass (*Calamagrostis canadensis*). At drier margins of the wetlands, Baltic rush (*Juncus balticus*) meadows, with scattered small populations of the globally-rare pale blue-eyed grass (*Sisyrinchium pallidum*) and fringed gentian (*Gentianopsis thermalis*) occur.

Stream and pond habitats of the site support excellent populations of Rio Grande chub (*Gila pandora)*, and several species of trout. Pronghorn (*Antilocapra americana*) are abundant, and apparently use the site for forage and water.

The site is presently used for livestock pasture and receives seasonal grazing. Trampling and erosion of the moist wetland soils are common. On the adjacent, drier Baltic rush meadows, Missouri iris (*Iris missouriensis*), a species known to increase with grazing, is very abundant. Other uses of the site are limited by private ownership.

Biodiversity Rank Justification: Of primary significance to this site is the excellent population of the Rio Grande chub (*Gila pandora)* found in San Luis Creek. This minnow-like fish is restricted to the Rio Grande watershed, including the Closed Basin. Although we do not clearly understand the status and trends for this species, we do know its distribution is limited to less than 20 occurrences in Colorado, its main center of distribution.

The northern part of this site is an important shelter from the effects of Bonanza Mine, which is located twenty miles upstream on Kerber Creek. The two northern creeks and their springfed tributaries provide off-channel refugia for aquatic elements such as the Rio Grande chub, which can flourish in low to moderately oxygenated waters which exclude predatory trout. In July of 1997, heavy rains caused upstream tailing ponds to overtop, resulting in toxic spills and fish mortality in Kerber Creek, and San Luis Creek downstream of their confluence. The off-channel aquatic habitats present at this site may be especially important biotic reservoirs for the recolonization of the San Luis Creek and Kerber Creek channels following such lethal spills.

In addition to the globally imperiled fish, this site supports excellent examples of short-beaked sedge (*Carex simulata*) and beaked sedge (*Carex utriculata*) fen wetlands, state rare slender sedge (*Carex lasiocarpa)* montane meadows, and the globally rare pale-blue eyed grass. The discovery of the slender sedge is a significant range extension, previously only known in Colorado from North Park and the Laramie River Valley (Weber pers. com.); it is more common in the northern Rocky Mountain states. Fen wetlands, which are formed by stable discharge of groundwater, are one of Colorado's rarer wetland types, particularly at elevations below 9,000 feet. They require wet, anaerobic soils, carbon accumulation from vigorous plant growth, low soil temperatures, and thousands of years to form their characteristic peat soils. Once formed, these peat soils are essentially irreplaceable in any management time frame. The fen wetlands at the Villa Grove site are perhaps the largest relatively low elevation fens in Colorado.

Table 38. Natural Heritage element occurrences at the Villa Grove site.
Multiple listings of the same element represent suboccurrences. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	'ederal an(tate Statu	/O* Rank nd date
Plant communities					
Carex simulata	**wet meadow**	**G3**	**S3**		**A 7/14/97**
Carex utriculata	beaked sedge montane wet meadow	G5	S3		B 7/14/97
Plants					
Carex lasiocarpa	slim sedge	G5	S1		A 7/24/97
Sisyrinchium pallidum	pale blue-eyed grass	G3	S2		B 7/14/97
Sisyrinchium pallidum	pale blue-eyed grass	G3	S2		B 7/24/97
Birds					
Circus cyaneus	northern harrier	G5	S3B, SZ		unranked 1990
Fish					
Gila pandora	**Rio Grande chub**	**G3**	**S1?**		**A 8/6/97**
Gila pandora	**Rio Grande chub**	**G3**	**S1?**		**A 8/6/97**
Gila pandora	Rio Grande chub	G3	S1?		B 7/14/97
Gila pandora	Rio Grande chub	G3	S1?		historic 1983-08-25
Gila pandora	Rio Grande chub	G3	S1?		historic 1983-08-25

*EO=Element Occurrence; dates indicates date of last observation

Boundary Justification: This boundary is drawn to 1) protect the wetland elements from direct impacts such as trampling or other surface disturbances; 2) provide suitable habitat where additional individuals can become established over time; and 3) encompass the full range of valley bottom habitats surrounding the springfed wetlands. The site boundary was based on initial aerial photo analysis, a field visit by a CNHP scientists, and subsequent corroboration with satellite imagery.

Wetland Functional Evaluation for the Villa Grove site:
Wetland Class: depressional/slope

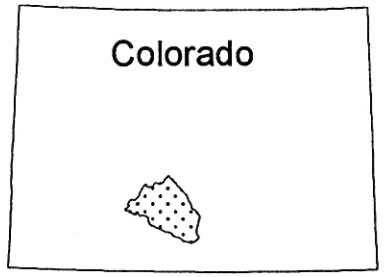
Table 39. Wetland functional evaluation for the Villa Grove (Villa Grove site).

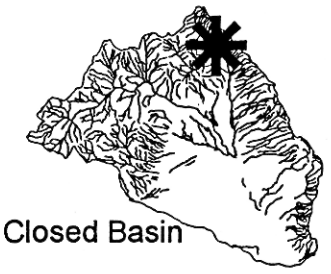
Function	Ratings	Confidence in Rating	Comments
Hydrologic Functions			
Groundwater Recharge	medium	medium	some surface flow from San Luis and Kerber creeks, generally a point of groundwater discharge
Groundwater Discharge	very high	high	numerous perennial springs
Floodflow Alteration	very high	high	broad, low gradient meadows
Sediment Stabilization	very high	high	very dense herbaceous vegetation
Biogeochemical Functions			
Sediment/Toxicant Retention	high	medium	dense herbaceous vegetation, off-site inputs of toxicants from Bonanza Mine probable
Nutrient Removal/ Transformation	high	medium	may remove excess nutrients and heavy mestals from upstream mining
Biological Functions			
Production Export	very high	high	densely vegetated, occasional flushing flows
Habitat	high	high	Rio Grande chub, trout
Aquatic Diversity/ Abundance	medium	medium	both flowing water and still water habitats
Recreation	medium	high	popular trout fishing site
Uniqueness/ Heritage Value	very high	high	largest fen on San Luis Valley floor, occurrence of five imperiled elements within site

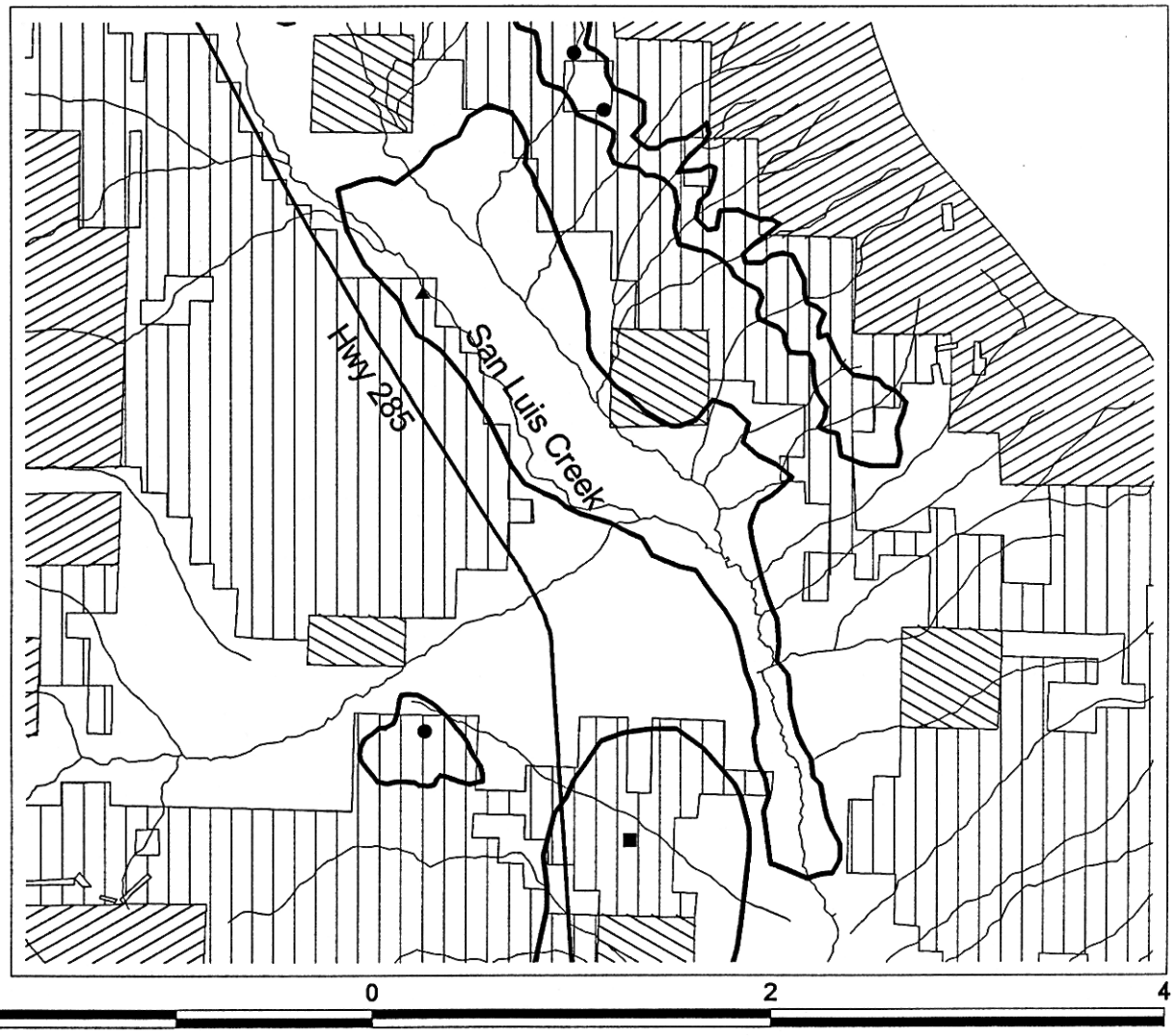
Table 40. Wetland functional evaluation for the lower meadows site (Villa Grove site).
Wetland Class: riverine/slope

Function	Ratings	Confidence in Rating	Comments
Hydrologic Functions			
Groundwater Recharge	medium	medium	a floodplain which recharges during high flows
Groundwater Discharge	medium	medium	some groundwater upwelling evident
Floodflow Alteration	high	high	this is a broad, densely vegetated floodplain
Sediment Stabilization	high	high	dense vegetation, peaty soils
Biogeochemical Functions			
Sediment/Toxicant Retention	high	high	dense vegetation filters sediment during overbank flows
Nutrient Removal/ Transformation	medium	medium	dense vegetation
Biological Functions			
Production Export	high	high	dense, productive vegetation
Habitat	high	high	multi-layered vegetation, available surface water
Aquatic Diversity/ Abundance	low	medium	water levels and temperatures are variable, habitat marginal
Recreation	low	high	no public access
Uniqueness/ Heritage Value	high	medium	nice stands of a regionally rare species

Villa Grove
(ownership status)







2 0 2 4 Miles

Public land element occurrences
- vertebrate
- invertebrate
- plant
- community

Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

N

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.

Moffat Playas

Biodiversity Rank: B4 (Moderate significance)
The Moffat Playas site contains two globally significant wetland communities. A great plains salt meadow was found to be in good condition and a *Carex simulata* wet meadow was found to be in fair condition.

Protection Urgency Rank: P2
This site has a mixed ownership with approximately 75% private and 25% state (see following map). Numerous residences and roads are within and adjacent to this site. A conservation easement or county open space designation is recommended to protect this wetland for the future.

Management Urgency Rank: M2
The Moffat Playas site and the surrounding area has been subdivided. New roads, residences, and further subdivision threatens the integrity of the site. The hydrology of this site is extremely important. Any further water development or alterations in groundwater and above ground flow will affect this site.

Location: Approximately 6 miles northwest of Moffat.
U.S.G.S. 7.5 min. quadrangle: Moffat North
Legal Description: T44N R9E S 8, 9, 15, 16, 17

General Description: The Moffat Playas site is a small part of a large saline playa lake complex northwest of Moffat. It is characterized by alternating dry shrublands and wetlands. The more saline shrublands are dominated by greasewood (*Sarcobatus vermiculatus*) and the less saline by rabbitbrush (*Chrysothamnus nauseosus*). The understories of both of these shrubland types are similar and vary with any of the following dominants: Alkali sacaton grass (*Sporobolus airoides*), western wheat grass (*Pascopyrum smithii*), salt meadow grass (*Distichlis spicata*), Baltic rush (*Juncus balticus*), or barren ground. The low lands or small basins are dominated with ubiquitous stands of spike rush (*Eleocharis palustris),* Baltic rush, western wheat grass, salt meadow grass, and alkali sacaton grass.

We did not find the slender spiderflower at this site, but this annual species is known to vary in abundance with yearly moisture condition. We believe the numerous wetlands that are visible on the color infrared aerial photos indicate potential habitat for this globally rare plant.

Current land practices include cattle grazing, road building, and subdividing. The site is approximately 1,400 acres and ranges in elevation from 7,600-7,635 feet (2,315-2,330 meters).

Biodiversity Rank Justification: The Moffat Playas support small occurrences of two globally rare wetland plant communities: Great plains salt meadow (*Sporobolus airoides)* and *Carex simulata* wet meadow. Larger and less fragmented occurrences of both of these communities are known from other sites in the Closed Basin.

Table 41. Natural Heritage elements at the Moffat Playas site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Carex simulata	wet meadow	G3	S3		C 7/26/97
Sporobolus airoides	great plains salt meadow	G2?	SU		B 7/25/97

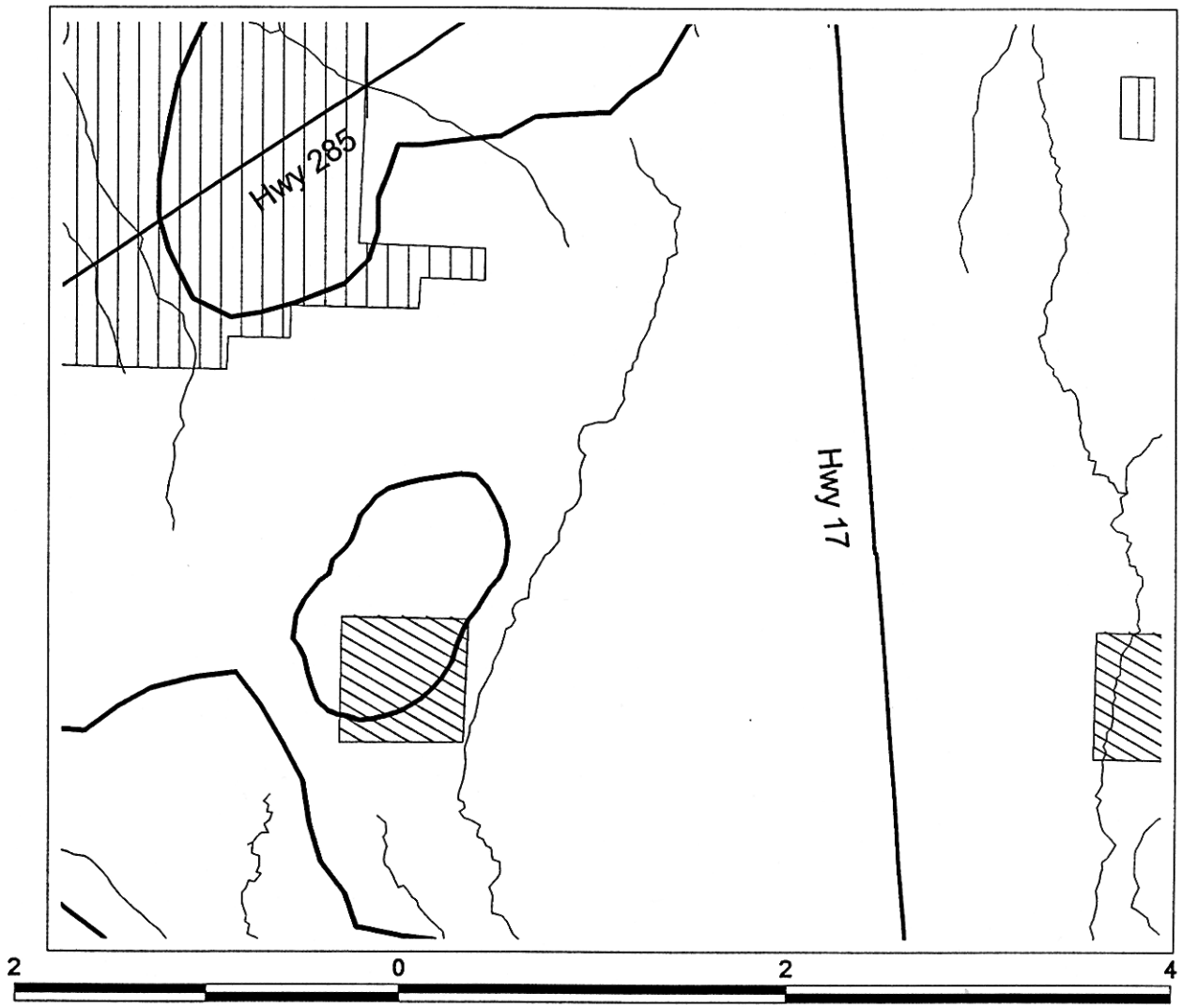
*EO=Element Occurrence; date indicates the date of last observation

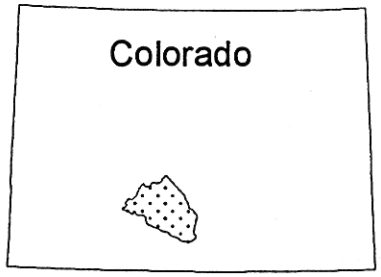
Boundary Justification: The boundaries drawn encompass the elements and a small part of the surrounding playa complex. Further inventories may find these boundaries to be too small and that a better ecological boundary incorporates the entire playa/shrubland complex. We drew the boundaries using 1988 NAPP 1:40,000 color infrared aerial photos.

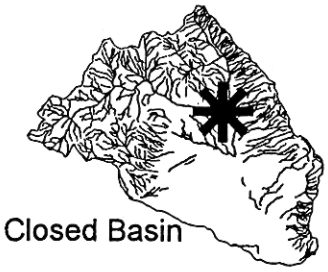
Wetland Functional Evaluation for the Moffat Playas site:

No wetland evaluation was conducted at this site.

Moffat Playas
(ownership status)







Public land element occurrences
- vertebrate
- invertebrate
- plant
- community

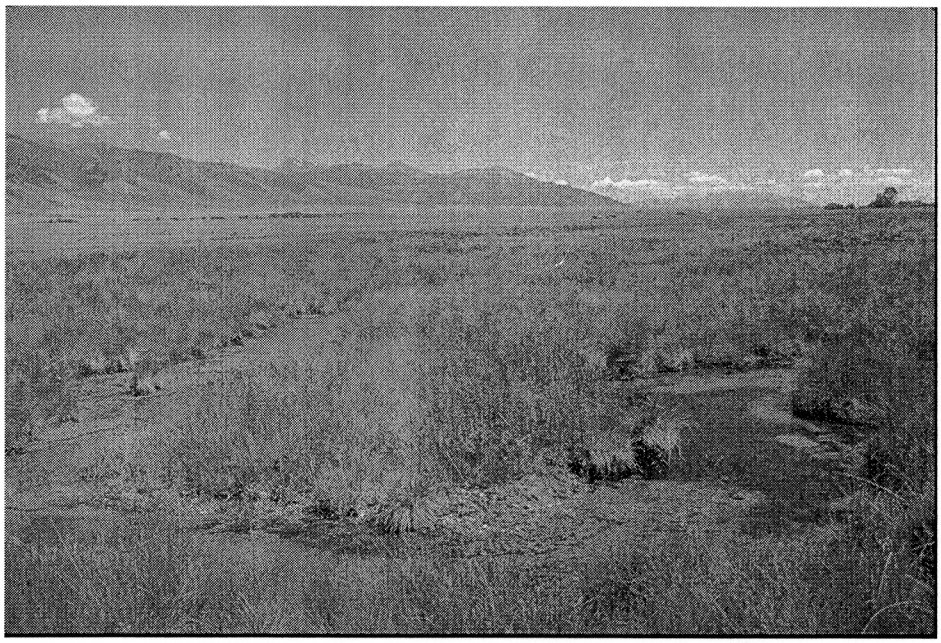
Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

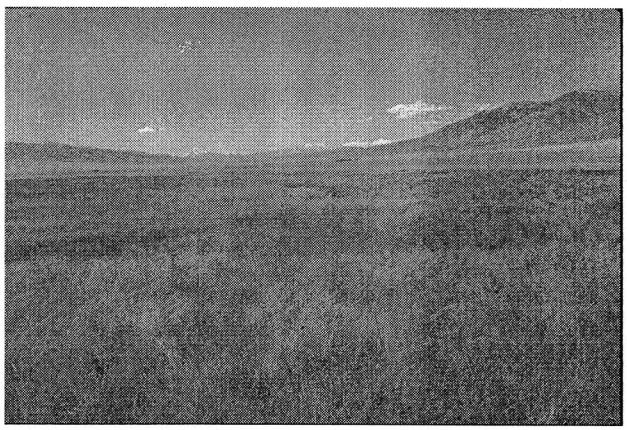
N

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.



Villa Grove wetland



Villa Grove wetland

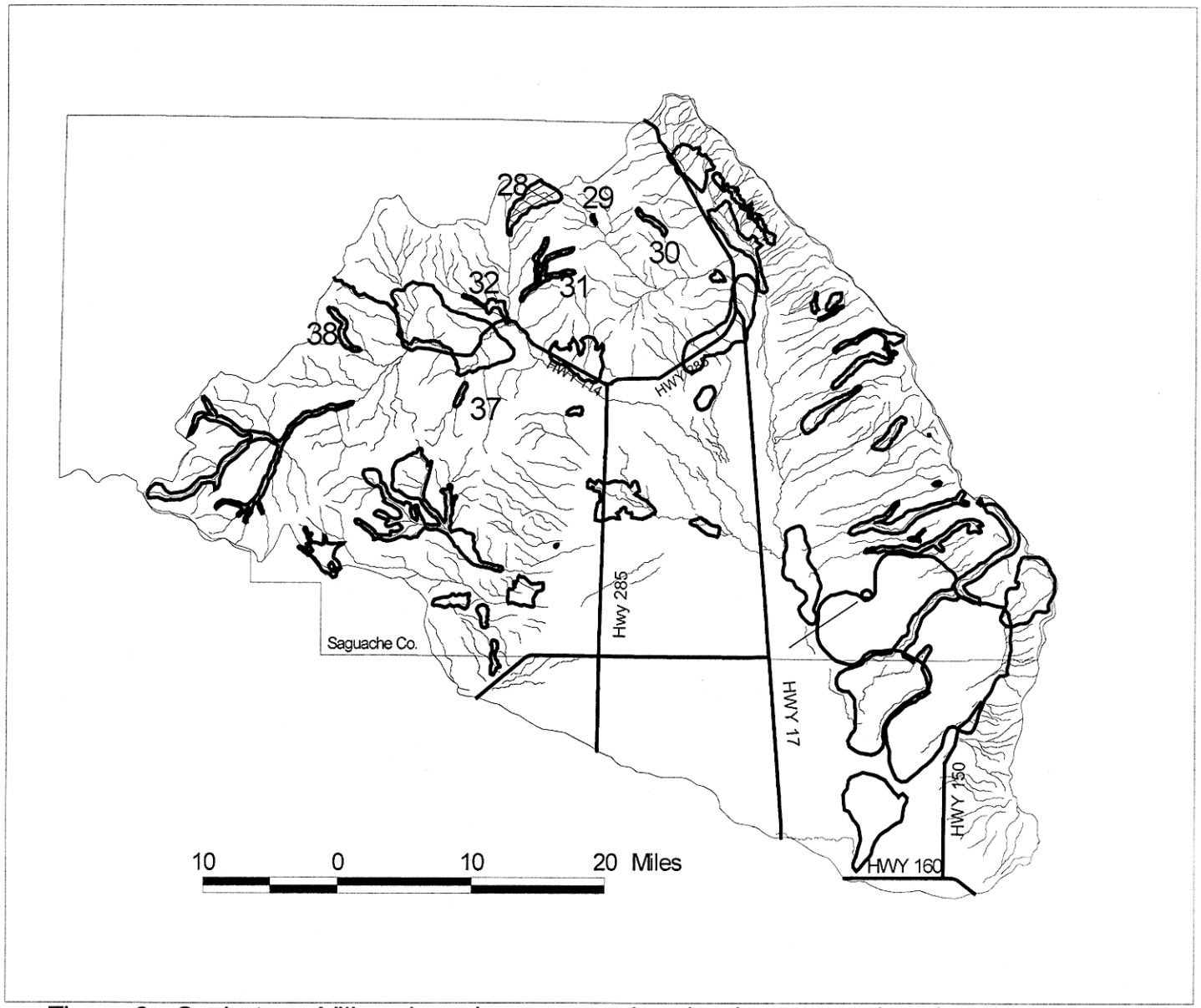
Rio Grande club

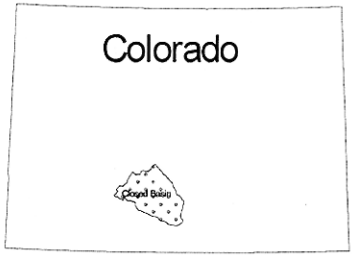
Cochetopa Hills Sub-Region

The Cochetopa Hills Sub-region lies in the northwest part of Saguache County and includes sites from the foothills to the subalpine zone of the Cochetopa Hills (Fig. 7). This sub-region contains 7 proposed wetland conservation sites. The following table summarizes the biodiversity, protection, and management ranks for the proposed conservation sites of the Cochetopa Hills sub-region. See the following site descriptions for more detail.

Table 42. Cochetopa Hills Sub-region Proposed Conservation Sites by Biodiversity Rank

SITENAME	Biodiversity Rank	Protection Urgency Rank	Management Urgency Rank	Identification number in Figure 8
Ford Creek	B 3	P 3	M 3	31
Jacks Creek Cemetery	B 3	P 3	M 4	32
Kelley Creek	B 3	P 4	M 4	30
Houselog Creek	B 4	P 4	M 4	37
Luder Creek	B 4	P 4	M 3	38
Slaughterhouse Creek	B 4	P 4	M 5	29
East Middle Creek	B 5	P 4	M 4	28





Saguache county
Closed basin
Roads
Streams
Suggested conservation sites

N

Figure 8. Cochetopa Hills sub-region proposed wetland conservation sites (numbered). See following table for site names.

Ford Creek

Biodiversity Rank: B3 (High significance)
This creek supports a healthy population of the Rio Grande cutthroat trout and a good example of a thinleaf alder/mesic forb riparian shrubland.

Protection Urgency Rank: P3
This site is approximately 95% federal land, with ownership split between Rio Grande National Forest and the Bureau of Land Management (see following map). There are two private inholdings near the center of the site. There are no known development threats foreseen for this site, but changes in the hydrological regime due to water diversion could impact the elements of concern.

Management Urgency Rank: M3
Although the lower portion of this site is a BLM riparian study area, livestock grazing impacts are evidenced by channel incision, heavy shrub browsing, and non-native grass species. Monitoring is warranted to ensure that stocking levels do not compromise riparian or aquatic habitat quality. Thinleaf alder is not particularly palatable to livestock, but can be trampled as animals search for more palatable forb species (Hansen *et al*. 1995). Invasive species are getting a hold at this site, and care should be taken to avoid introduction of non-native seed, or disturbance.

The Rio Grande cutthroat trout is dependent upon cold, well oxygenated water and ample cover. Livestock can impact riparian communities and cause geomorphologic alterations, leading to a decrease in cover, which increases the water temperature and sediment load (Schulz and Leininger 1990; Skovlin 1984). Platts (1983) recognizes all of these adverse changes as detrimental to trout populations. Interactions of livestock grazing with habitat for Rio Grande cutthroat remain poorly described (Rinne 1995), and further research in this field is recommended.

Location: The Ford Creek site is located one air mile southwest of the Ford and Baxter Creek confluence along Ford Creek.

U.S.G.S. 7.5 minute quadrangles: Chester, Klondike Mine, Lake Mountain NE, Bonanza

Legal Description: T46N, R6E S 12, 13, 24, 25, 35
T46N, R7E S 7, 8, 9, 18, 19, 20, 21

General Description: Ford Creek site includes several confluent streams, and their riparian areas, which pass through semi-arid rangeland north of Saguache Creek . Within the site, the riparian shrub canopy is continuous and stands of thin-leaf alder/mesic forb (*Alnus incana*/mesic forb) occur along the creek at lower elevations; willows (*Salix* spp.) are also common on the creek floodplain. Part of this site is included in the Bureau of Land Management riparian study area established in 1988, and appears to be recovering from past heavy livestock grazing. The historical grazing regime has caused channel entrenchment and stands of non-native grasses, such as Kentucky bluegrass and bromes (*Poa pratensis, Bromus* spp.). Beaver (*Castor canadensis*) are

present and are an important component of this ecosystem. Their ponds expand the wet floodplain habitat and capture fine textured sediment which facilitates meadow formation. Dry shortgrass meadow dominated by blue grama (*Bouteloua gracilis*) occur on surrounding toeslopes and thick stands of Douglas-fir (*Pseudotsuga menziesii*), pinyon pine (*Pinus edulis*) and juniper (*Juniperus monosperma*) occur on the higher slopes of the valley. The stream channel is comprised largely of fine textured substrates in the lower reaches, and banks are armored with dense herbaceous vegetation. The upper reaches increase in gradient and cobbly substrates are present.

The site is approximately 3,000 acres in size and ranges in elevation from 8,450 to 11,225 feet (2,575-3,425 m).

Biodiversity Rank Justification: This site supports a healthy population of the Rio Grande cutthroat trout and a good example of a thinleaf alder/mesic forb riparian shrubland. This plant association occurs throughout the Rocky Mountains of Colorado (Cooper and Cottrell 1990, Johnston 1987, Kittel and Lederer 1993, Kittel *et al.* 1994, Kittel *et al.* 1995, Kittel *et al.* 1996, Kettler and McMullen 1996, Richard *et al.* 1996, Colorado Natural Heritage Program 1997). This association was once common and widespread, but is now declining. This type is rarely found in good condition without non-native species in the undergrowth. There are only 10 documented occurrences of this plant association in Colorado. A total of 60 occurrences are estimated for the entire state.

The Rio Grande cutthroat trout's range once included the entire Rio Grande and Pecos River watersheds, and possibly the upper Canadian River as well (Trotter 1987). In Colorado, the species occupies less than 1% of its former range (Alves 1996), and wild, genetically pure stock populations are especially imperiled. Artificial habitat including wells, farm ponds, and extensive canal systems as well as human activities including dewatering, fishing and stocking, transbasin diversions, release of domestic sewage, stream channelization, and agricultural chemical applications have greatly modified the original aquatic ecosystem of the San Luis Valley (Zuckerman 1984). These modifications may have contributed directly to the decline in range of the native fishes of the Rio Grande drainage. Free-flowing streams with good quality water, healthy banks, and streamside vegetation within the upper Rio Grande watershed are vital habitat for this subspecies of trout.

Table 43. Natural Heritage elements at the Ford Creek site.
Multiple listings of the same element represent suboccurrences. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
***Alnus incana*/mesic forb**	**thinleaf alder/mesic forb riparian shrubland**	**G3**	**S3**		**B 7/13/97**
Oncorhynchus clarki virginalis	Rio Grande cutthroat	G4T3	S3	(3C), SC, FS	unranked 9/25/87
Oncorhynchus clarki virginalis	Rio Grande cutthroat	G4T3	S3	(3C), SC, FS	unranked 1980

*EO=Element Occurrence; date indicates the date of last observation

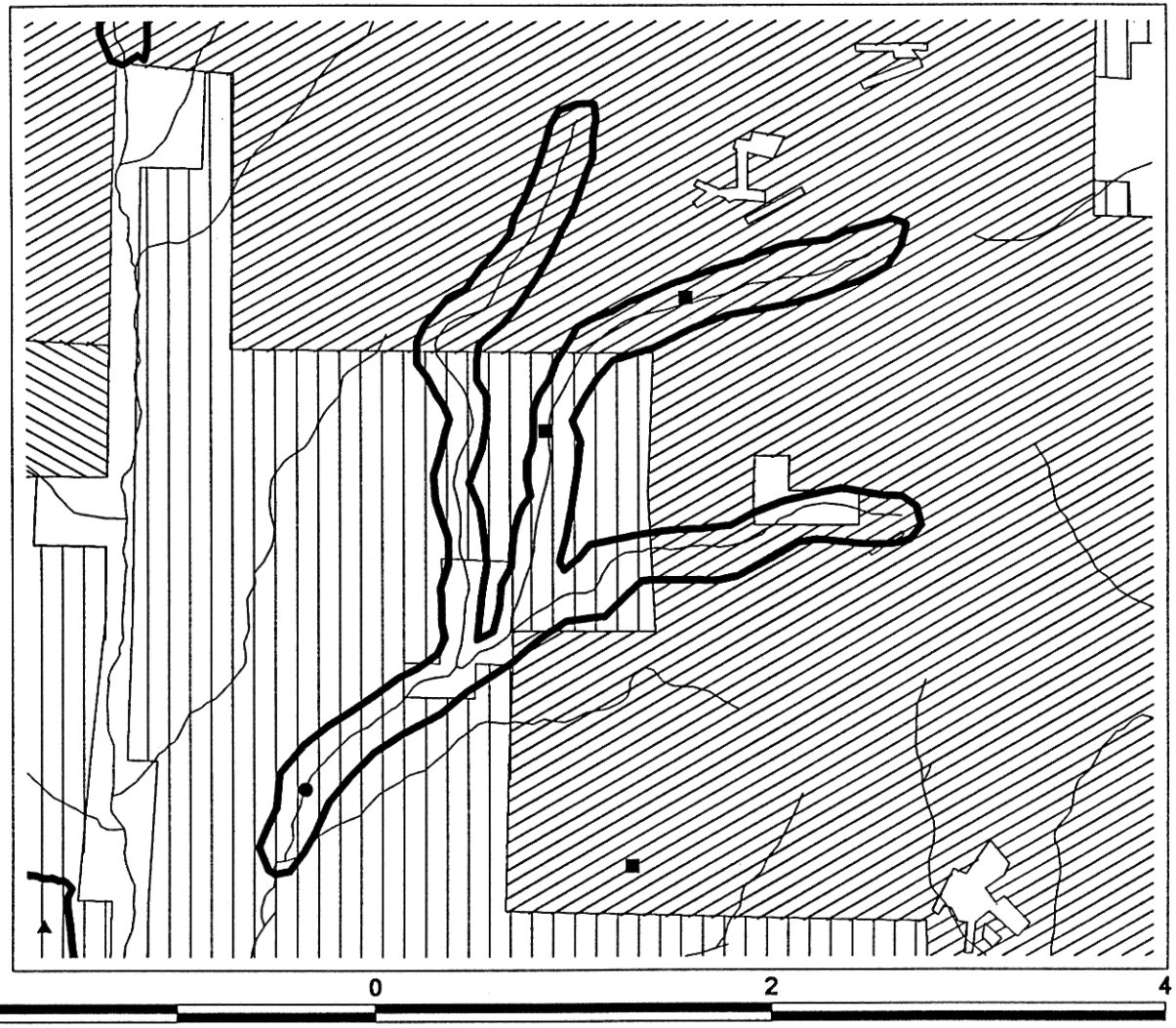
Boundary Justification: This boundary is drawn to include the riparian complex that supports the elements of biodiversity found at the site. It is designed to 1) protect the occurrences from direct impacts such as trampling or other surface disturbances; and 2) to include the immediate slopes which contribute surface and groundwater flow to the creek and riparian ecosystem. The boundary was delineated after 1997 field visits, using 1988 NAPP 1:40,000 aerial photograph and satellite imagery at a scale of approximately 1:100,000.

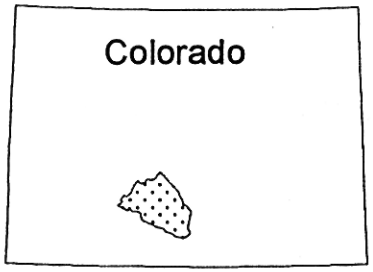
Wetland Functional Evaluation for the Ford Creek site:

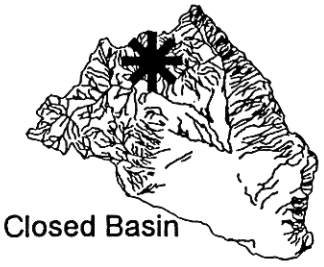
No wetland evaluation was conducted at this site.

Ford Creek

(ownership status)







Public land element occurrences
- vertebrate
- invertebrate
- plant
- community

Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

N

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 29 December, 1997. Map created by Anne Ochs.

Jacks Creek Cemetery

Biodiversity Rank: B3 (High significance)
The Jacks Creek Cemetery site contains a narrowleaf cottonwood forest and a montane wet meadow in good to excellent condition. It is one of the best examples of a riverine wetland complex observed on private lands in Saguache County.

Protection Urgency Rank: P3
This site is primarily privately owned with some Rio Grande National Forest Service land in the upper end of the site (see following map). Future management or development plans for these private lands are unknown. A conservation easement or open space designation is recommended to protect the site.

Management Urgency Rank: M4
The site is in good condition under the current landowners management practices.

Location: This site is located 14 air mile northwest of the town of Saguache, accessed via Rio Grande National Forest road 855**.**

U.S.G.S. 7.5 minute quadrangle: Lake Mountain NE
Legal Description: T46N, R5E S 36
T46N, R6E S 31
T45N, R6E S 5,6

General Description: The Jack's Cemetery site is centered around the old Cordova Homestead on Jacks Creek. The riparian community is a narrow strip right along the creek and consists of a very dense occurrence of narrowleaf cottonwood (*Populus angustifolia*) with a dense shrub cover comprised of alder (*Alnus incana*), currant (*Ribes montigenum*) and willows (*Salix monticola* and *S. geyeriana*). Although the woody community covers most of the corridor, open meadows of Baltic rush (*Juncus balticus*) and beaked sedge (*Carex utriculata*) occur on both sides of the creek. The surrounding hillslopes are covered in a dry shortgrass prairie and pinyon pine-juniper (*Pinus edulis-Juniperus monosperma*) woodlands.
The site is approximately 280 acres in size and ranges in elevation from 8400 to 8600 feet (2560-2620 meters).

The land is grazed with an appropriate regime for this riparian community, as little soil compaction, stream bank erosion, or species compositional shifts were observed. Details of this management regime should obtained for future application to similar riparian areas.

Biodiversity Rank Justification: The Jacks Creek Cemetery site contains a narrowleaf cottonwood forest and a montane wet meadow in good to excellent condition. The narrowleaf cottonwood with alder plant association is known from the West Slope of Colorado in the Yampa and Gunnison River Basins, and the San Juan National Forest (Kittel *et al.* 1993, Kittel *et al.* 1994, Richard *et al*. 1996). It also occurs along the Front Range in the Arkansas and South

Platte river basins (Kittel *et al.*1996, Kittel *et al.*1997). Although this community is considered a typical riparian forest type for the lower montane zone of the Rocky Mountain region, excellent examples of this association which are structurally diverse, self perpetuating, and contain a native understory, are uncommon. This site is one of the best examples of a montane riverine wetland observed on private lands in Saguache County.

Table 44. Natural Heritage elements at the Jacks Creek Cemetery site.
Element responsible for the high biodiversity rank is in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Carex utriculata	beaked sedge montane wet meadow	G5	S3		A 7/11/97
Populus angustifolia/Alnus incana	**montane riparian forest**	**G3**	**S3**		**B 7/11/97**

*EO=Element Occurrence; date indicates date of last observation

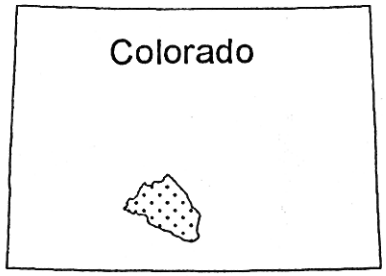
Boundary Justification: This boundary is drawn to include the riparian complex that supports the elements of biodiversity found at the site. It is designed to protect the riparian occurrences from direct impacts such as trampling or other surface disturbances; and to include the immediate slopes which contribute surface and groundwater flow to the wetlands. The boundary was delineated, using 1988 NAPP 1:40,000 aerial photographs and satellite imagery at a scale of approximately 1:100,000.

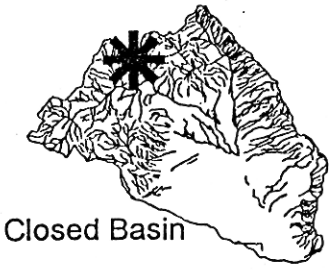
Wetland Functional Evaluation for the Jacks Creek Cemetery site:

No wetland evaluation was conducted at this site.

Jacks Creek Cemetery

(ownership status)





Public land element occurrences
- vertebrate
- invertebrate
- plant
- community

Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

N

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 29 December, 1997. Map created by Anne Ochs.

Kelley Creek

Biodiversity Rank: B3 (High significance)
The Kelley Creek site supports an excellent example of the globally rare thinleaf alder/mesic graminoid montane riparian shrubland.

Protection Urgency Rank: P4
This site is managed and owned by Rio Grande National Forest, but the site receives no special protection status.

Management Urgency Rank: M4
This site exhibits few stresses on the elements of concern and affords a natural hydrologic regime. Current management practices should be continued in order to preserve the excellent condition of this site. In particular, preservation of the natural hydrologic regime is essential to support the riparian community at this site.

Location: The Kelley Creek site is located 6 mile northwest of the town of Villa Grove.
U.S.G.S. 7.5 minute quadrangle: Whale Hill
Legal Description: T47N, R8E S 21, 26, 27, 28, 35

General Description: The Kelley Creek site is a moderately wide valley with a long, highly sinuous creek and a nearly continuous canopy of thinleaf alder (*Alnus incana*). The undergrowth is dominated by a thick stand of native grasses such as Canadian reedgrass (*Calamagrostis canadensis*), and aside from a few dandelions (*Taraxacum officinale)* is free from non-native plants. A faint pack trail traverses the valley, but it appears to get little use. The slopes are dominated by dense aspen (*Populus tremuloides*) stands. The site is in excellent condition, with few to no anthropogenic changes to the riparian and valley floor habitats. Beaver (*Castor canadensis*) are present in the valley and are important in maintaining the health of this ecosystem. Their ponds expand the wet floodplain habitat and capture fine textured sediment, facilitating meadow formation.

The Kelley Creek site delimits a drainage in the Cochetopa Hills east of Antora Peak. The site covers nearly 900 acres and ranges from 9,600 to 11,600 feet (2,925-3,535 meters) in elevation.

Biodiversity Rank Justification: The Kelley Creek site supports an excellent example of a globally imperiled montane riparian shrubland. This is a fairly common plant community with over 100 occurrences throughout the Rocky Mountains. Stands of this type occur in Routt and San Juan National Forests, the Rio Grande Basin, and the upper Arkansas River Basin (Kettler and McMullen 1996, Kittel *et al*. 1996, Richard *et al*. 1996, Colorado Natural Heritage Program 1997). It is rare, however, to find stands dominated by native species in the undergrowth. This association usually occurs at relatively low elevations in Colorado, where floodplain habitats are often impacted by water diversion, improper livestock grazing, invasive plant species, or agricultural conversion.

Table 45. Natural Heritage element at the Kelley Creek site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Alnus incana/mesic graminoid	montane riparian shrubland	G3	S3		A 7/26/97

*EO=Element Occurrence; date indicates the date of last observation

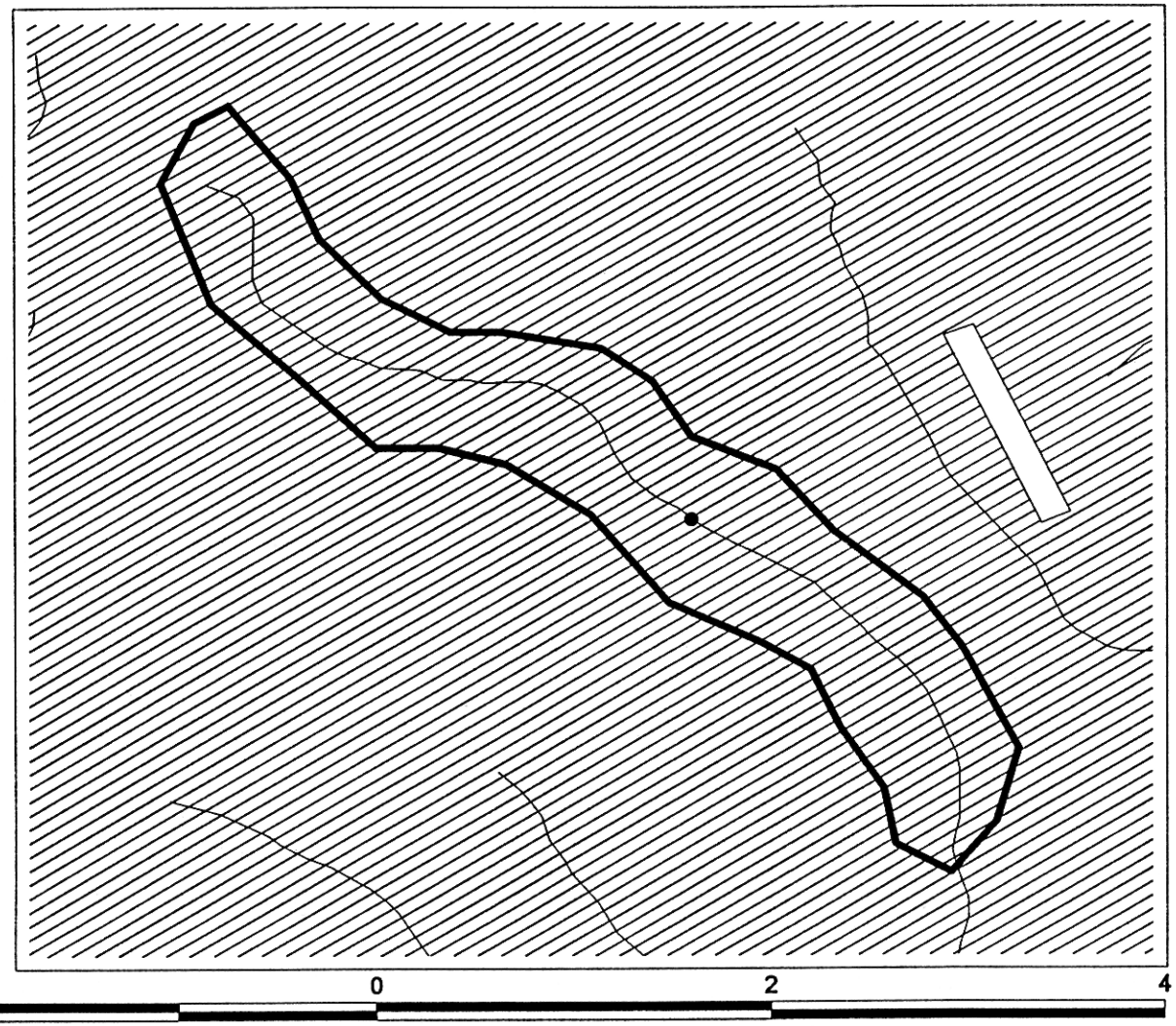
Boundary Justification: This boundary is drawn to include the wetland complex that supports the elements of biodiversity found at the site. It is designed to 1) protect the riparian occurrences from direct impacts such as trampling or other surface disturbances; and 2) to include the immediate slopes which contribute surface and groundwater flow to the riparian wetlands. Stream flow alterations, other than those made by beaver, would be detrimental to this community. The boundary was delineated after 1997 field visits, using 1988 NAPP 1:40,000 aerial photographs and satellite imagery at a scale of approximately 1:100,000.

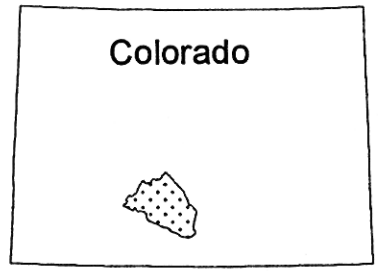
Wetland Functional Evaluation for the Kelley Creek site:

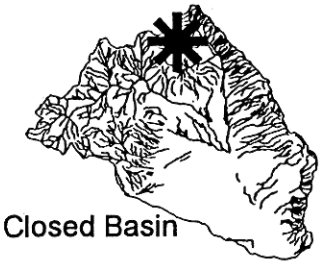
No wetland evaluation was conducted at this site.

Kelley Creek

(ownership status)







Public land element occurrences
- vertebrate
- invertebrate
- plant
- community

Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

N

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 29 December, 1997. Map created by Anne Ochs.

Houselog Creek

Biodiversity Rank: B3 (Moderate significance)
This site contains two montane riparian shrubland communities, both globally imperiled.

Protection Urgency Rank: P4
This site is owned and managed by Rio Grande National Forest. Management, rather than further protection, is the primary concern at this site.

Management Urgency Rank: M4
Although this site presently shows few livestock impacts, monitoring is warranted, and management adjustments may be needed in the future to maintain the quality of the elements. Thinleaf alder is not particularly palatable to livestock, but can be trampled as animals search for more palatable herbaceous species (Hansen *et al*. 1995). Season-long grazing can reduce the native forb cover in the understory and allow non-native grasses to increase. With proper rotation and rest, the thinleaf alder/mesic forb plant association (Padgett *et al.* 1989, Hansen *et al.* 1995) is moderately tolerant of livestock grazing. Bebb willow is highly palatable to livestock and wildlife and is more sensitive to grazing. With continued browsing, regeneration of this willow species will be impaired and may eventually be eliminated from the site. In particular, late-summer browsing reduces willow density and vigor since cattle prefer the more nutritious willows over sedges and grasses at that time of year (Kovalchik and Elmore 1992). Short duration or winter grazing are recommended to maintain this element.

Location: The site occurs 2.5 miles south of highway 114 adjacent to Rio Grande National Forest road 41G, or approximately 20 air miles west of the town of Saguache.

U.S.G.S. 7.5 minute quadrangles: Lake Mountain, Laughlin Gulch
Legal Description: T44N, R5E S 1, 11, 12, 13, 14

General Description: The Houselog Creek site includes 578 acres of riparian and valley bottom wetlands in a narrow canyon in the middle reaches of Houselog Creek. Site elevations range from 8770 to 9411 feet (2673 to 2870 meters). The canyon harbors excellent quality Bebb's willow (*Salix bebbiana)* and thin-leaf alder (*Alnus incana)* riparian shrublands which form a nearly continuous canopy approaching 20 feet in height. A subcanopy of several species of willows (*Salix* spp.), shrubby cinquefoil (*Pentaphylloides floribunda*), common juniper (*Juniperus communis*), wild rose (*Rosa woodsii*), and gooseberry (*Ribes inerme*) is also present. The understory is composed of a very species rich assemblage of native forbs, sedges, and grasses. Particularly abundant species include beaked sedge (*Carex utriculata*), water sedge (*Carex aquatilis*), tufted hairgrass (*Deschampsia cespitosa*), meadow rue (*Thalictrum fendleri*), shooting star (*Dodecatheon pulchellum*), and bluebells (*Mertensia ciliata*). Moist canyon toeslopes support a mesic forest of aspen (*Populus tremuloides*) and blue spruce (*Picea pungens*), which further increases the habitat diversity of the floodplain area.

Grazing impacts appear minor, possibly because the steep walls of the canyon or dense alder thickets inhibit livestock access. Upstream and downstream areas of the watershed, however, are severely impacted. Forest road 41G abuts the site on the western margin.

Biodiversity Rank Justification: This site supports excellent examples of a Bebb's willow (*Salix bebbiana*) montane willow carr and a thin-leaf alder/mesic forb (*Alnus incana/*mesic forb) riparian shrubland. These communities are contiguous and often form a diverse mosaic of habitats along Houselog Creek. The herbaceous understory accompanying these associations is among the most species-rich in the Closed Basin watershed.

The thinleaf alder/mesic forb plant association is widely distributed in the cordillera of the Western U.S. Similar types occur in Alaska (Viereck *et al*. 1992), Oregon (Kovalchik 1987), Nevada (Manning and Padgett 1995), Utah (Padgett *et al.* 1989), Montana (Hansen *et al*. 1995), Idaho, Wyoming (Youngblood *et al.* 1985, Jones 1992), and Colorado (Cooper and Cottrel 1990, Johnston 1987, Colorado Natural Heritage Program 1997). It is rare, however, to find stands dominated by native species in the undergrowth. The *Salix bebbiana* plant association is less common and occurs as a minor type in the canyonlands of southwestern Utah (Padgett *et al.* 1989) and at mid- to low-elevations in southwestern Montana (Hansen *et al.* 1988) and Colorado (Colorado Natural Heritage Program). Similar types occur in eastern Wyoming (Girard *et al.* 1995). In Colorado, this association occurs in canyon country at lower elevations in the San Juan National Forest (Richard *et al.* 1996), the Rio Grande River Basin (Kittel *et al.*, in preparation), and in foothill canyons of the South Platte River Basin (Kittel *et al.* 1997).

Both of these associations occur at relatively low elevations in Colorado, where floodplain habitats are often impacted by water diversion, improper livestock grazing, invasive plant species, or agricultural conversion. This site harbors stands which are in excellent condition with regards to species composition, regeneration, and canopy structure. The rather small size of this site, and poor condition of the riparian areas upstream and downstream, require a good rather than excellent ranking for both of these communities.

Table 46. Natural Heritage elements at the Houselog Creek site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
*Alnus incana/*mesic forb	thinleaf alder/mesic forb riparian shrubland	G3	S3		B 7/11/97
Salix bebbiana	montane willow carr	G3	SU		B 7/11/97

*EO=Element Occurrence; date indicates the date of last observation

Boundary Justification: This boundary is drawn to 1) protect the riparian occurrences from direct impacts such as trampling, overuse, or other surface disturbances; and 2) to include the immediate slopes which contribute surface and groundwater flow to the wetlands. Upstream portions of Houselog creek were excluded because no CNHP elements had been recorded there as of the conclusion of the 1997 field survey. Although not contained in the present site boundary, the contributory upper watershed has the potential to affect this site as well as the Saguache Creek site located just downstream. The site boundary was based on initial aerial

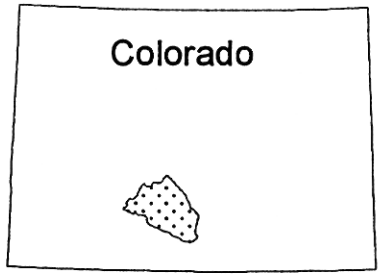
photo analysis, a field visit by a CNHP wetland ecologist, and subsequent validation with satellite imagery.

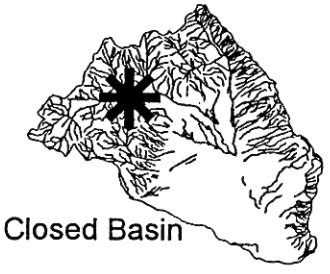
Wetland Functional Evaluation for the Houselog Creek site:
Wetland Class: riverine

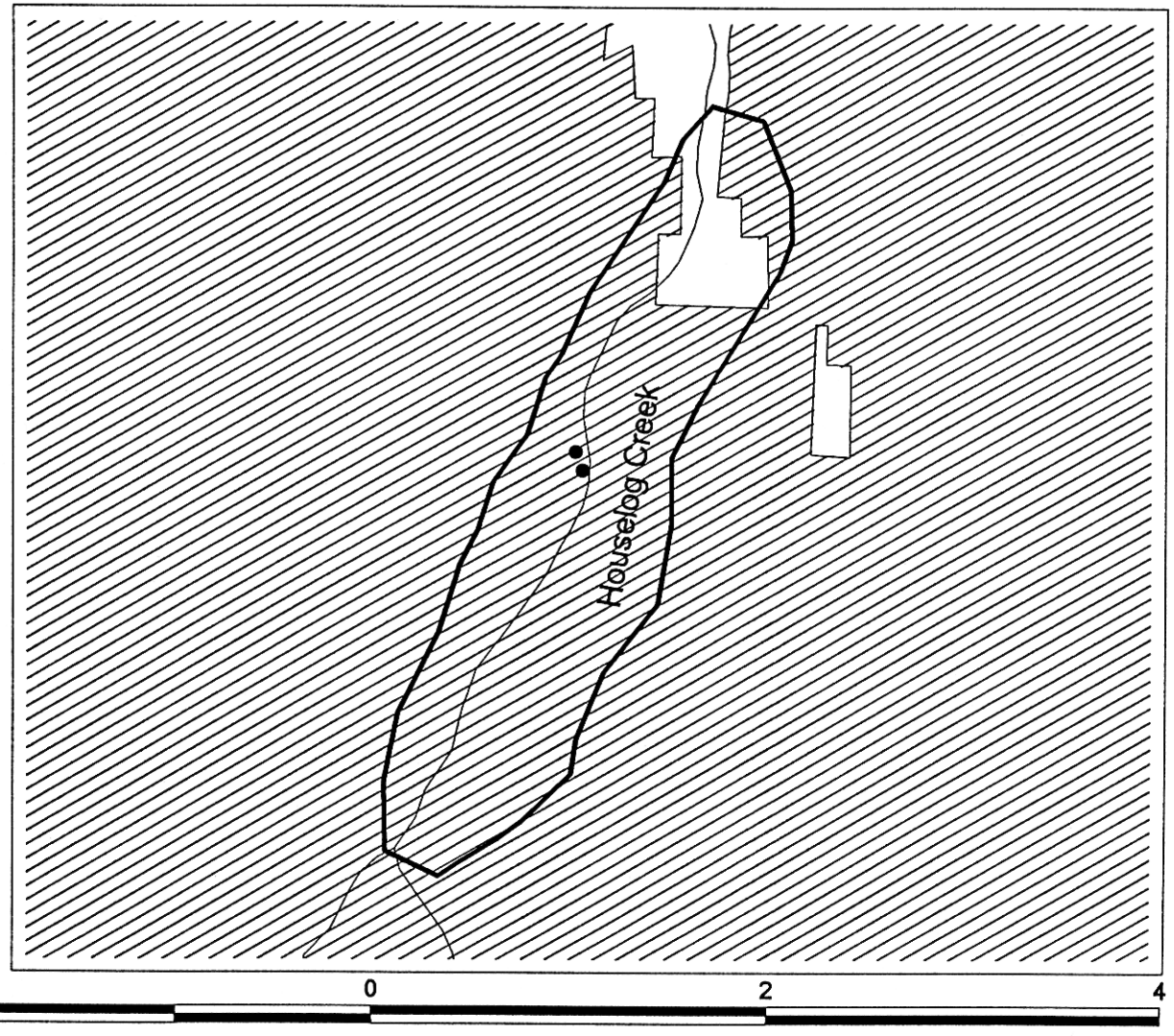
Table 47. Wetland functional evaluation for the Houselog Creek site.

Function	Ratings	Confidence in Rating	Comments
Hydrologic Functions			
Groundwater Recharge	medium	high	although floodplain aquifers are augmented during snowmelt, the stream is generally gaining flow through this site
Groundwater Discharge	very high	high	numerous springs and bed seepage
Floodflow Alteration	high	medium	dense riparian vegetation dissipates erosive power of overbank floods
Sediment Stabilization	high	high	well vegetated
Biogeochemical Functions			
Sediment/Toxicant Retention	medium	medium	vegetation filters transported sediment
Nutrient Removal/ Transformation	low	medium	nutrient removal from the stream is probably minor at baseflows
Biological Functions			
Production Export	very high	high	this site produces an abundance of carbon material (leaves, branches, etc.) which are transported downstream during floods
Habitat	very high	high	excellent habitat for riparian and aquatic fauna
Aquatic Diversity/ Abundance	medium	medium	not sampled, good habitat
Recreation	high	high	an excellent location for fishing or wildlife viewing
Uniqueness/ Heritage Value	medium	medium	montane riparian ecosystem with natural feature largely intact and two globally rare communities

Houselog Creek
(ownership status)







Public land element occurrences
- vertebrate
- invertebrate
- plant
- community

Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

N

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.

Luder Creek

Biodiversity Rank: B4 (moderate biological significance)
This site contains a good occurrence of a montane riparian shrubland and one of the largest occurrences of beaked sedge wet meadow known for Saguache County.

Protection Urgency Rank: P4
This site is owned and managed by Rio Grande National Forest. Protecting the natural hydrologic regime is important. Current threats appear minimal although any future changes in water use or road building could affect this site.

Management Urgency Rank: M3
Management changes may be necessary within five years to maintain the health of the willow community at this site. Livestock use of this site was heavy at the time of the field survey for this report. Many willows showed signs of browsing, and some 'mushroom' shaped adults were evident. There are also high densities of non-native meadow grasses in adjacent habitats which may invade the riparian corridor with excessive surface disturbance. Monitoring livestock impacts would help, as would occasionally resting the site to allow for adequate regeneration of willow species. The management responses of this plant association are likely to be similar to other tall-willow shrublands dominated by Geyer's willow or mountain willow. The wet and often saturated soils of this plant association are vulnerable to compaction by livestock and heavy equipment. Overgrazing by livestock can dry the site, increase non-native grass cover, and reduce the vigor of willow root structure. In order to maintain productivity and vigor of the plants and prevent damage to the soils, livestock grazing should be deferred until after soils dry, and be of short duration.

Location: This site is located 24 air miles west of the town of Saguache or 2 miles east of Cochetopa Pass.

U.S.G.S. 7.5 minute quadrangle: North Pass
Legal Description: T45N, R4E S 7,8,17,18,20,28.29

General Description: This site includes an extensive montane riparian shrubland on Luder Creek floodplain in the upper montane life zone approximately 2 air miles east of the continental divide. The site includes over 1500 acres of floodplain and toeslope habitats extending for 5 miles along Luder Creek from 8,800 to 10,150 feet (2,684-3096 meters) in elevation. The community is rich in plant species and willow age classes. Dominant willows include Geyer's willow (*Salix geyeriana*), mountain willow (*Salix monticola*), and planeleaf willow (*Salix planifolia*). The riparian soils are perennially wet and support an understory of wetland species, including beaked sedge (*Carex utriculata*), water sedge (*Carex aquatilis*), tufted hairgrass (*Deschampsia cespitosa*), and Canadian reedgrass (*Calamagrostis canadensis*). Drier margins of the floodplain support stands of shrubby cinquefoil (*Pentaphylloides floribunda*) with Thurber's fescue (*Festuca thurberi*) and occasional patches of the non-native Kentucky bluegrass (*Poa pratensis*). Adjoining upland vegetation is spruce-fir (*Picea engelmannii-Abies lasiocarpa*) and

aspen (*Populus tremuloides*) forest on northern aspects and bristlecone pine/ fescue (*Pinus aristata/Festuca* spp.) woodlands on southern exposures.

This site is heavily used as a car camping area, particularly at Luder Creek campground, with fishing and hunting in season. Livestock graze the site seasonally and tend to congregate in the floodplain wetlands along Luder Creek. Cochetopa Pass road borders the site on the north and bisects it just east of the entrance to Luder Creek campground.

Biodiversity Rank Justification: This site contains a good occurrence of Geyer's willow-mountain willow/ mesic graminoid (*Salix geyeriana-Salix monticola* / mesic graminoid) montane riparian shrubland, a CNHP community of special concern, and an excellent example of a beaked sedge montane wetland. In addition, the site harbors aspen forests and shrubby cinquefoil shrublands on terraces adjacent to the riparian zone, enhancing the habitat of the floodplain. As a whole, the site contains a structurally and floristically diverse assemblage of riparian and moist toeslope plant communities.

The Geyer willow-mountain willow /mesic forb) plant association and similar types occur in eastern Utah, Idaho (Padgett *et al*. 1989), Wyoming, and Colorado (Johnston 1987, Baker 1989, Bourgeron and Engelking 1994, Colorado Natural Heritage Program 1997). This community type is geographically widespread but occurs only in areas with suitable environmental conditions of medium to fine textured alluvial soils, perennial soil moisture, and abundant light. The low gradient meadows where this community occurs are favored as summer pasture for domestic livestock. Livestock herbivory of seedlings can lead to losses of stands by attrition, and many known stands in Colorado are severely impacted by livestock grazing (Kittel 1997, personal communication). This association is threatened by livestock grazing and invasive species throughout its range.

The beaked sedge wetland at this site is in excellent condition and quite large for this region, extending several miles along the valley of Luder Creek. The beaked sedge wetland type is relatively common at middle and upper elevation through the ranges of the Western U.S., occurring in riparian, lakeside, and fen wetlands. Large fen wetlands, which are formed by stable discharge of groundwater, are one of Colorado's rarer wetland types. They require wet, anaerobic soils, carbon accumulation from vigorous plant growth, low soil temperatures, and long periods of time to form their characteristic peat soils. Once formed, these peat soils are essentially irreplaceable in any management time frame.

Table 48. Natural Heritage element occurrences at the Luder Creek site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Carex utriculata	beaked sedge montane wetland	G5	S4		A 8/27/97
Salix geyeriana-Salix monticola/mesic graminoid	montane riparian willow carr	GU	S3		B 9/8/97

*EO=Element Occurrence; date indicates date of last observation

Boundary Justification: This boundary is drawn to 1) protect the riparian occurrences from direct impacts such as trampling, overuse, or other surface disturbances; and 2) to include the

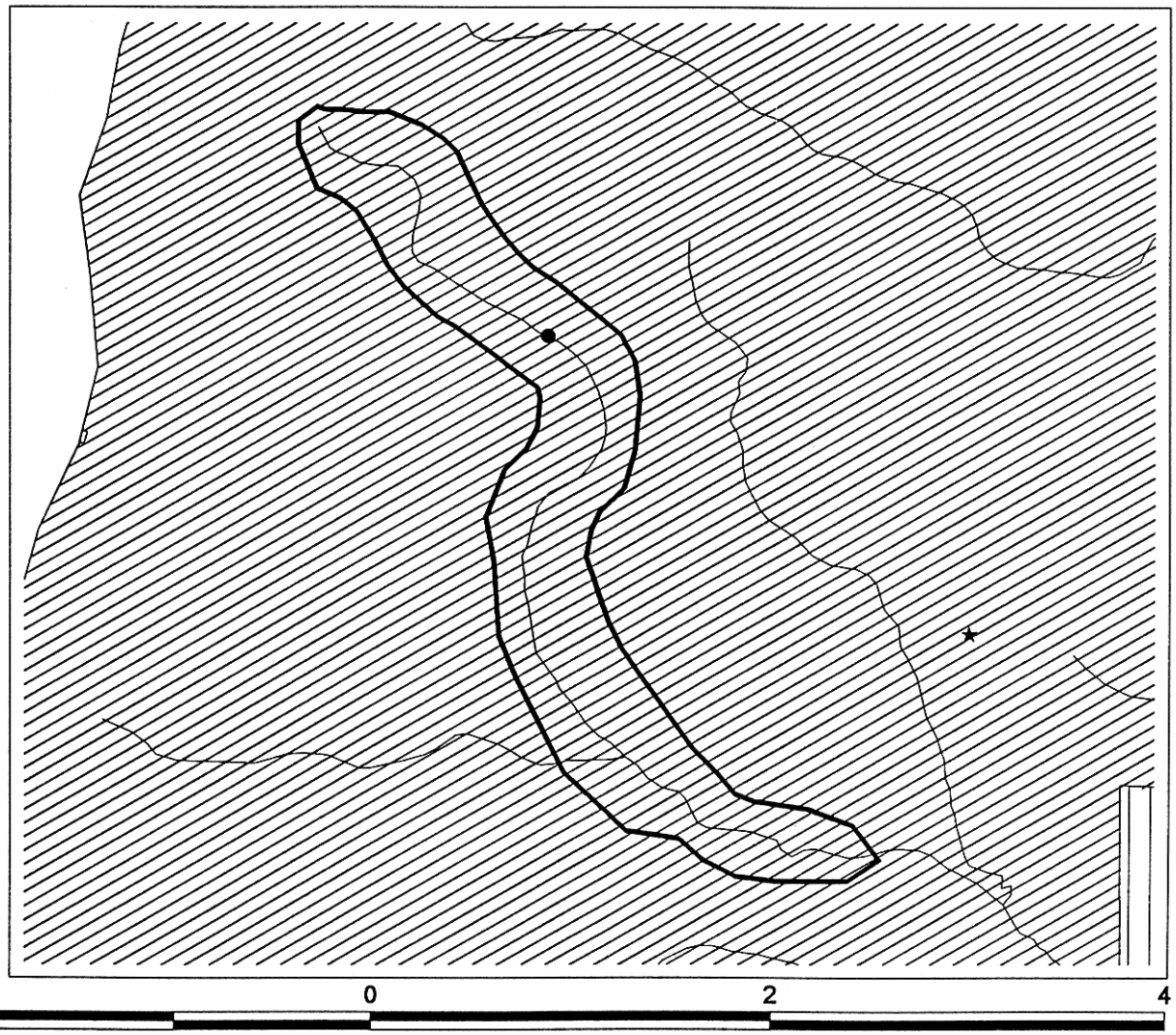
immediate slopes which contribute surface and groundwater flow to the wetlands. The site boundary was based on initial aerial photo analysis, a 1997 field visit by a CNHP wetland ecologist, and subsequent corroboration with satellite imagery.

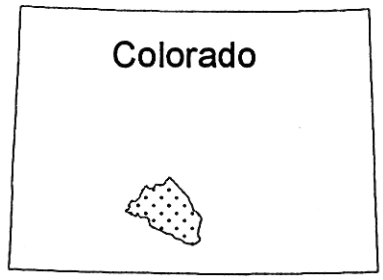
Wetland Functional Evaluation for the Luder Creek site:
Wetland Class: riverine

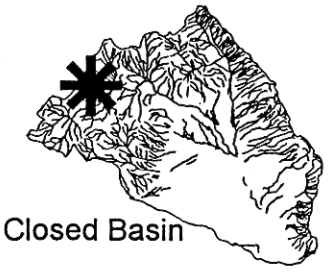
Table 49. Wetland functional evaluation for the Luder Creek site.

Function	Ratings	Confidence in Rating	Comments
Hydrologic Functions			
Groundwater Recharge	low	medium	this is a high gradient reach with few off channel ponds or other sites for groundwater recharge
Groundwater Discharge	high	high	this entire site occurs in an area of groundwater discharge
Floodflow Alteration	high	high	the floodplains is very well vegetated and slows overbank floods
Sediment Stabilization	high	high	dense streamside vegetation
Biogeochemical Functions			
Sediment/Toxicant Retention	high	high	dense vegetation
Nutrient Removal/ Transformation	medium	medium	vigorous growth of streamside vegetation and peaty soils
Biological Functions			
Production Export	high	high	the riparian shrubland at this site is very productive, and it provides copious organic material for downstream export
Habitat	high	high	this site contains excellent montane riparian habitat
Aquatic Diversity/ Abundance	medium	medium	unsurveyed, but appears high
Recreation	high	high	angling, wildlife viewing
Uniqueness/ Heritage Value	medium	high	two high quality occurrences of common communities

Luders Creek
(ownership status)







Public land element occurrences
- ■ vertebrate
- ★ invertebrate
- ▲ plant
- ● community

Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

N

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.

Slaughterhouse Creek

Biodiversity Rank: B4 (Moderate significance)
The Slaughterhouse Creek site supports a riparian area dominated by aspen and alder that is in excellent condition.

Protection Urgency Rank: P4
The site is managed and owned by Rio Grande National Forest and immediately upstream of private land and Bonanza Mine area(see following maps). Protection is adequate at this time.

Management Urgency Rank: M4
Management does not need to be changed at this time. Given the proximity of this site to the heavily impacted Bonanza Mine, it is recommended that this site be maintained in its present condition and regarded as a biotic refuge for natural recolonization of the downstream degraded area. Logging, heavy livestock grazing, or water diversion are discouraged. Management is especially important to this watershed because extreme pulses of water or sediment passing through the toxic mine sites have been implicated in fish kills as much as 20 miles downstream on Kerber and San Luis creeks. Land uses in the upper watershed, such as heavy logging and roads, which increase the potential for high runoff or sediments loads, should be avoided.

Location: This site is located 18 miles west of the town of Villa Grove, using the Bonanza Mine road (Saguache County road LL36).

U.S.G.S. 7.5 minute quadrangle: Bonanza
Legal Description: T47N, R7E S 26

General Description: This site delineates a small canyon which drains the southern slope of Antora Peak and is tributary to Kerber Creek. The Slaughterhouse Creek site supports a near-pristine riparian corridor with a dense and lush riparian canopy. Dominant species include thinleaf alder (*Alnus incana*) along the stream margins, with an overstory of aspen (*Populus tremuloides*) growing on the canyon bottom and moist toeslopes. The undergrowth is intact and dominated by horsetails (*Equisetum arvense*) and C*onioselinum scopulorum* with few non-native plants, and many downed aspen logs. Surrounding uplands slopes are covered with dense mixed conifer forests of Douglas-fir (*Pseudotsuga menziesii*), ponderosa pine (*Pinus ponderosa*), Engelmann spruce *(Picea engelmannii*), and lodgepole pine (*Pinus contorta* ssp. *latifolia*). Downstream of this site is the Bonanza Mine Superfund site. However, this site is a roadless canyon upstream of any mine impacts, recent or historic.

The site covers approximately 130 acres and ranges in elevation from 9,600 to 10,000 feet (2,925-3,050 meters).

Biodiversity Rank Justification: The Slaughterhouse Creek site supports an excellent quality riparian area dominated by aspen and alder. The quaking aspen/thinleaf alder (*Populus tremuloides/Alnus incana*) montane riparian forest community is located in narrow ravines and along first and second-order streams where upland aspen forests intermix with riparian shrub

vegetation. The presence of obligate riparian shrub species distinguish this association from upland aspen communities. This plant community has only been documented from Colorado, although it is probably more widespread.

Table 50. Natural Heritage elements at the Slaughterhouse Creek site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Populus tremuloides/Alnus incana	montane riparian forest	GU	S3		A 8/5/97

*EO=Element Occurrence

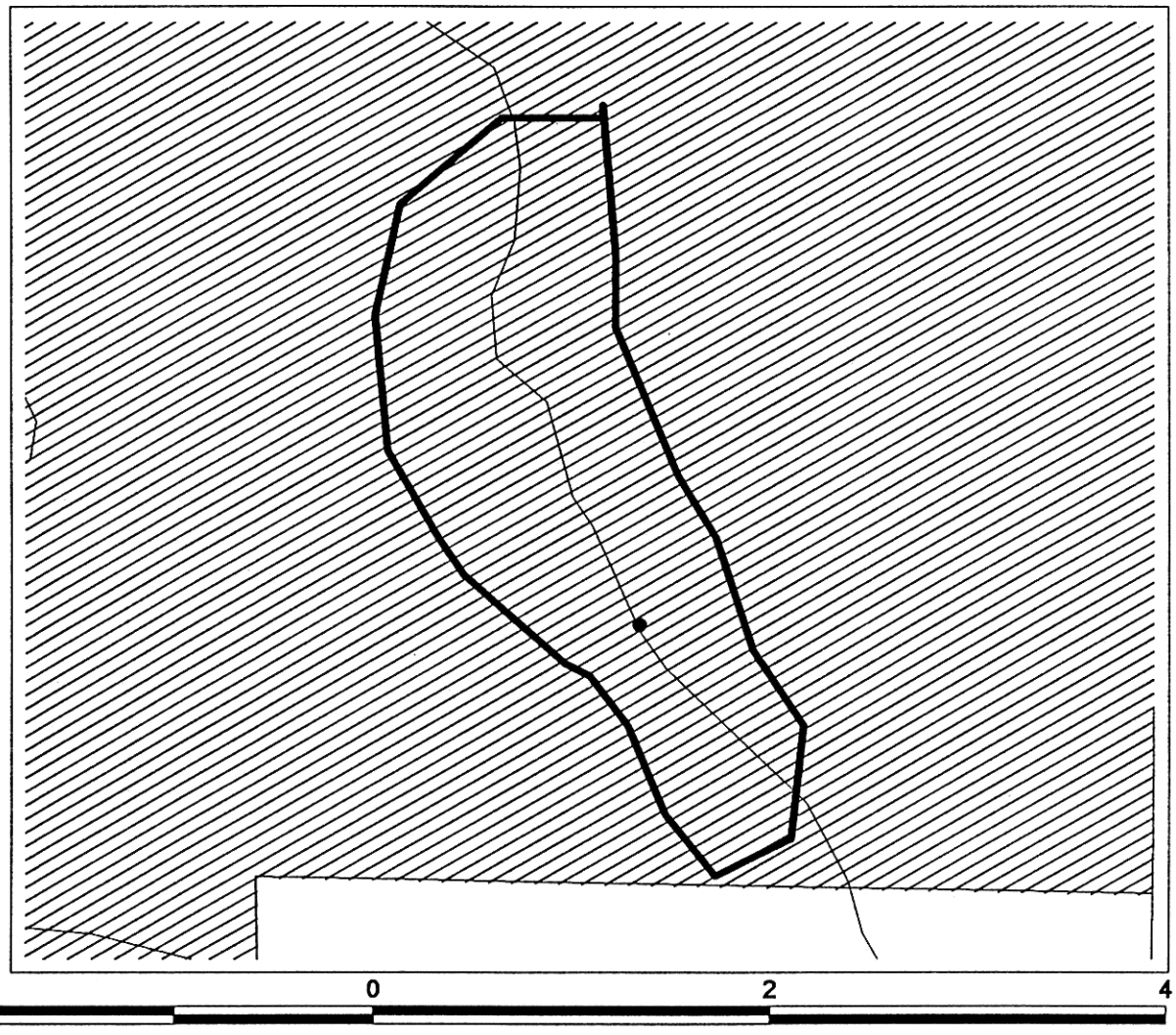
Boundary Justification: This boundary is drawn to include the canyon that support the element of biodiversity found at the site. It is designed to 1) protect the riparian occurrence from direct impacts such as trampling or other surface disturbances; and 2) to include the immediate slopes which contribute surface and groundwater flow to the riparian forest. The boundary was delineated using 1988 NAPP 1:40,000 aerial photographs and satellite imagery at a scale of approximately 1:100,000.

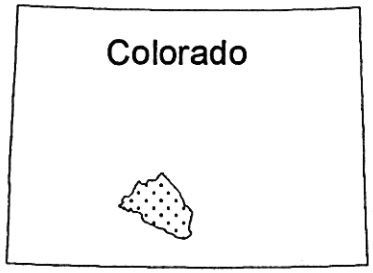
Wetland Functional Evaluation for the Slaughterhouse Creek site:

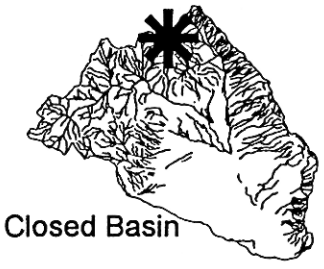
No wetland evaluation was conducted at this site.

Slaughterhouse Creek

(ownership status)







Public land element occurrences
- ■ vertebrate
- ★ invertebrate
- ▲ plant
- ● community

Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

N

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 29 December, 1997. Map created by Anne Ochs.

East Middle Creek

Biodiversity Rank: B5 (General interest)
An unranked occurrence of the state rare Rio Grande cutthroat trout is included within this site.

Protection Urgency Rank: P4
The entire site is within Rio Grande National Forest and there is no need for further protection. See following map.

Management Urgency Rank: M4
The Rio Grande cutthroat trout at this site were introduced in 1991, and were still present in 1995. Trout populations should be periodically monitored to ascertain any deleterious changes in populations.

Location: On East Middle Creek, approximately three miles south of Marshall Pass.

U.S.G.S. 7.5 minute quadrangle: Chester, Bonanza.
Legal Description: T47N, R6E S 1,2,11,12,13,14,22,23,24,26,27,28,33,34
T47N, R7E S 7,8,17,18,19

General Description: This site was not visited during the Colorado Natural Heritage Program's 1997 field inventories. It covers approximately 5,000 acres and ranges from 8,900 to 13,000 feet (2,700-3,950 meters) in elevation. It encompasses the immediate watershed of a high elevation stream in the eastern San Juan mountains. It is a high montane area with some subalpine influences.

Biodiversity Rank Justification: This site is of general significance in that it supports a transplanted population of Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis*).

Table 51. Natural Heritage element occurrence at the East Middle Creek site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Oncorhynchus clarki virginalis	Rio Grande cutthroat	G4T3	S3	(3C), SC, FS	I 1995

*EO=Element Occurrence; date indicates the date of last observation

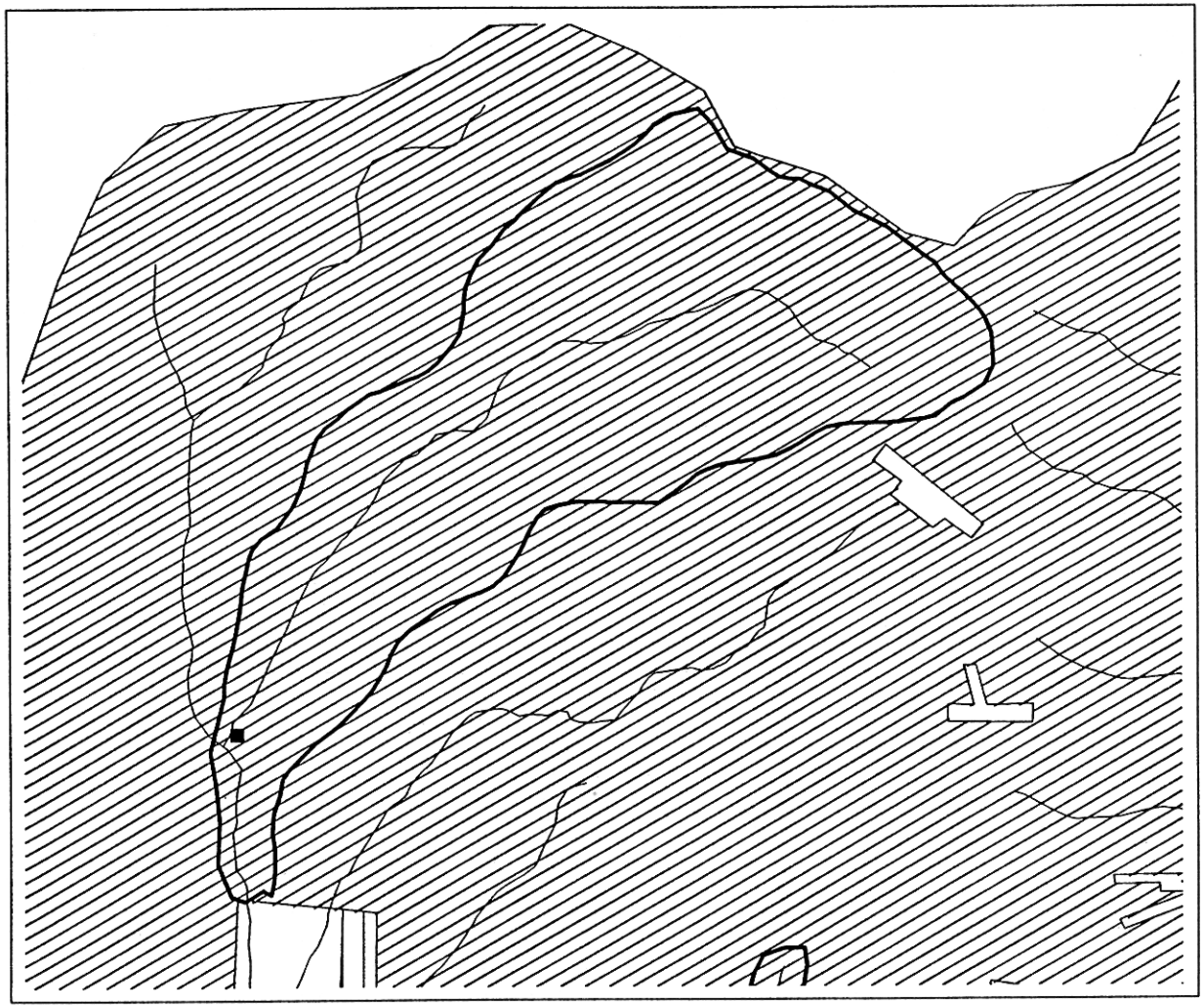
Boundary Justification: The boundary for this site was drawn in 1994 and includes the immediate watershed of East Middle Creek. This boundary is the area in which actions may have an effect on the trout at the site.

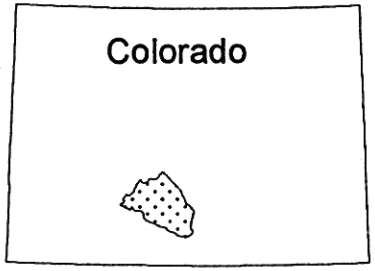
Wetland Functional Evaluation for the East Middle Creek site:

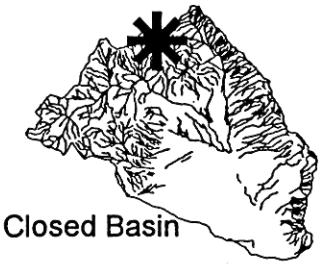
No wetland evaluation was conducted at this site.

East Middle Creek

(ownership status)







All element occurrences
- vertebrate
- invertebrate
- plant
- community

Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

2 0 2 4 Miles

N

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 29 December, 1997. Map created by Anne Ochs.

San Juan and Upper Saguache Creek Sub-Region

The San Juan and Upper Saguache Creek Sub-region lies in the southwest part of Saguache County and includes sites from the foothills to the subalpine zone of the San Juan Mountains (Figure 9). This sub-region contains eight proposed conservation sites, three of which are wetland sites. The following table summarizes the biodiversity, protection, and management ranks for the three proposed wetland conservation sites in the San Juan and Upper Saguache Creek sub-region.

Table 52. San Juan and Upper Saguache Creek Sub-region, Proposed Conservation Sites by Biodiversity Rank.

SITENAME	Biodiversity Rank	Protection Urgency Rank	Management Urgency Rank	Page number
Carnero Creek	B 3	P 4	M 2	
Saguache Creek	B 3	P 4	M 3	
Groundhog Park	B 5	P 4	M 3	

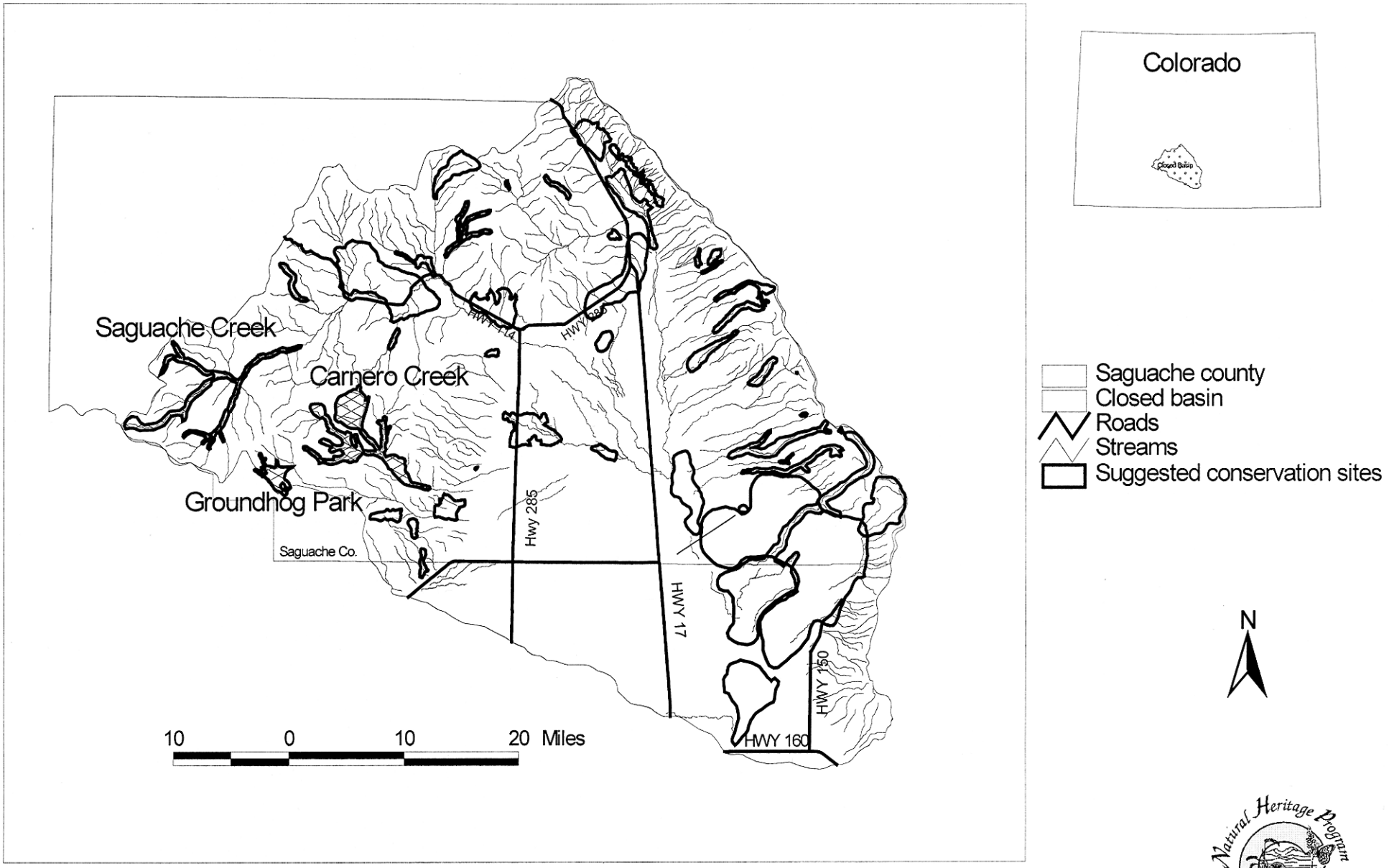


Figure 9. San Juans and Upper Saguache Creek sub-region wetland proposed conservation sites.

Carnero Creek

Biodiversity Rank: B3 (Moderate significance)
The Carnero Creek site supports a bristle cone pine woodland, a montane grassland, a Rio Grande cutthroat trout population, all of which are state rare.

Protection Urgency Rank: P4
The upper portions of the site is owned and managed by the Rio Grande National Forest, (see the following map) where the primary conservation issue is one of management, rather than direct protection. The lower portions of this site are privately owned and are subject to high residential development pressures.

Management Urgency Rank: M2
Current management of the hydrology at the lower elevations results in the loss of many cutthroat trout each spring; when water is diverted to flood adjacent hay meadows, many fish go with it, resulting in an artificially high mortality rate. The property owner on this portion of the site is aware of the problem and thoroughly concerned about it. Fish grates are expensive to maintain, but may be an appropriate alternative to cessation of flood irrigation.
In addition, the fish community at the lower elevations is degraded by the presence of white sucker (*Catostomus commersoni*), a species introduced from the eastern slope of Colorado as bait fish.

Along the lower portions of the riparian corridor, invasive exotic grasses have degraded the natural vegetation. Restoration of this area would improve the native vegetation.

Location: Approximately 1 mile northwest of La Garita on Carnero Creek, continuing into the La Garita Mountains.

U.S.G.S. 7.5 minute quadrangle:		Bowers Peak, Lookout Mountain, Lime Creek, Twin Mountains SE.
Legal description:	T42N, R4E	S 3,11,12
	T42N, R5E	S 3,11,12,13
	T42N, R6E	S 19,26,27,28,29,30
	T43N, R4E	S 8,9,10,11,14,15,16,17,20,21,23,24,25,39
	T43N, R5E	S 4,9,1`0,21,28,31,33,34

General Description: The Carnero Creek site covers approximately 13,000 acres and ranges in elevation from 8,300-11,300 feet (2,535-3,450 meters). "Carnero" means ram in english, which is appropriate for this site, since it is an important foraging and breeding ground for bighorn sheep. The lower portions of this site are primarily a mosaic of pinyon pine-juniper woodlands (*Pinus edulis-Juniperus monosperma*), mountain mahogany shrublands (*Cercocarpus montanus)* with some currant (*Ribes* sp.*),* Yucca (*Yucca glauca)*, and rabbitbrush (*Chrysothamnus nauseosus*). A blue grama (*Bouteloua gracilis*) shortgrass prairie and a montane grassland

comprised of mountain muhly and Arizona fescue (*Muhlenbergia montana-Festuca arizonica*) dominate the lower south-facing slopes.

The riparian area in the lower portion of the site has been managed for livestock production, and primarily used for hay meadows. This has resulted in a high number of non-native grasses and an eroding streambank. A narrow strip of native vegetation dominated by alder (*Alnus incana)* borders this portion.

The higher elevation areas to the northwest include U. S. Forest Service lands where bristle cone pine (*Pinus aristata*) communities occur. The native trout populations get healthier with elevation in this site. White sucker (*Catostomus commersoni*) do not occur at the higher elevations. The hydrology of this upper portion is kept intact by a local population of American beaver (*Castor canadensis*), but the riparian areas and roadsides host exotic annuals.

The surface and ground water of Carnero Creek is a major contributor to Russell and Mishak Lakes, both proposed conservation sites listed in this document. The Carnero Creek site is also an important hunting ground for American peregrine falcons (*Falco peregrinus anatum)*.

Biodiversity Rank Justification: The Carnero Creek site supports a healthy population of a subspecies of native trout. This population of Rio Grande cutthroat (*Oncorhynchus clarki virginalis*) progresses in quality as one continues up the stream. At the lower elevations, the fish community is degraded by the presence of white sucker (*Catostomus commersoni*), a species introduced from the eastern slope of Colorado as bait fish. Also present at this site are community occurrences of globally rare montane grasslands (*Festuca arizonica-Muhlenbergia montana*), shrublands (*Alnus incana/mesic graminoid*), and woodlands (*Pinus aristata/Festuca thurberi*).

Table 53. Natural Heritage element occurrences at the Carnero Creek site.
Multiple listings of elements represent suboccurrences. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Plant communities					
Alnus incana/mesic graminoid	montane riparian shrubland	G2G3	S3		C 9/5/97
Festuca arizonica-Muhlenbergia montana	**montane grassland**	**G3**	**S3**		**B 10/23/97**
Pinus aristata/Festuca arizonica	montane woodland	G4	S3		B 7/8/94
Pinus aristata/Festuca thurberi	lower montane woodland	G3	S2		C 7/9/94
*Salix monticola/*mesic graminoid	montane riparian willow carr	GU	S3		C 6/24/97
Fish					
Oncorhynchus clarki virginalis	**Rio Grande cutthroat**	**G4T3**	**S3**	**(3C), SC, FS**	**A 7/10/97**
Oncorhynchus clarki virginalis	Rio Grande cutthroat	G4T3	S3	(3C), SC, FS	B 8/9/97
Oncorhynchus clarki virginalis	Rio Grande cutthroat	G4T3	S3	(3C), SC, FS	unranked no date

*EO=Element Occurrence; date indicates the date of last observation

Boundary Justifications: This boundary is drawn to include the wetland complex and uplands that supports the elements of biodiversity found at the site. It is designed to 1) protect the element occurrences from direct impacts such as trampling or other surface disturbances; and 2) to include the immediate slopes which contribute surface and groundwater flow to the wetlands. When considering potential effects on this site, the watershed scale is the appropriate level for consideration. Activities anywhere within the entire watershed surrounding this site have the potential to benefit or injure the integrity of the elements present. The boundaries for this site were drawn using satellite imagery at scales ranging from 1:60,000 to 1:200,000.

Wetland Functional Evaluation for the site:

Table 54. Wetland functional evaluation for the Miner's Creek (Carnero Creek site).
Wetland Class: riverine

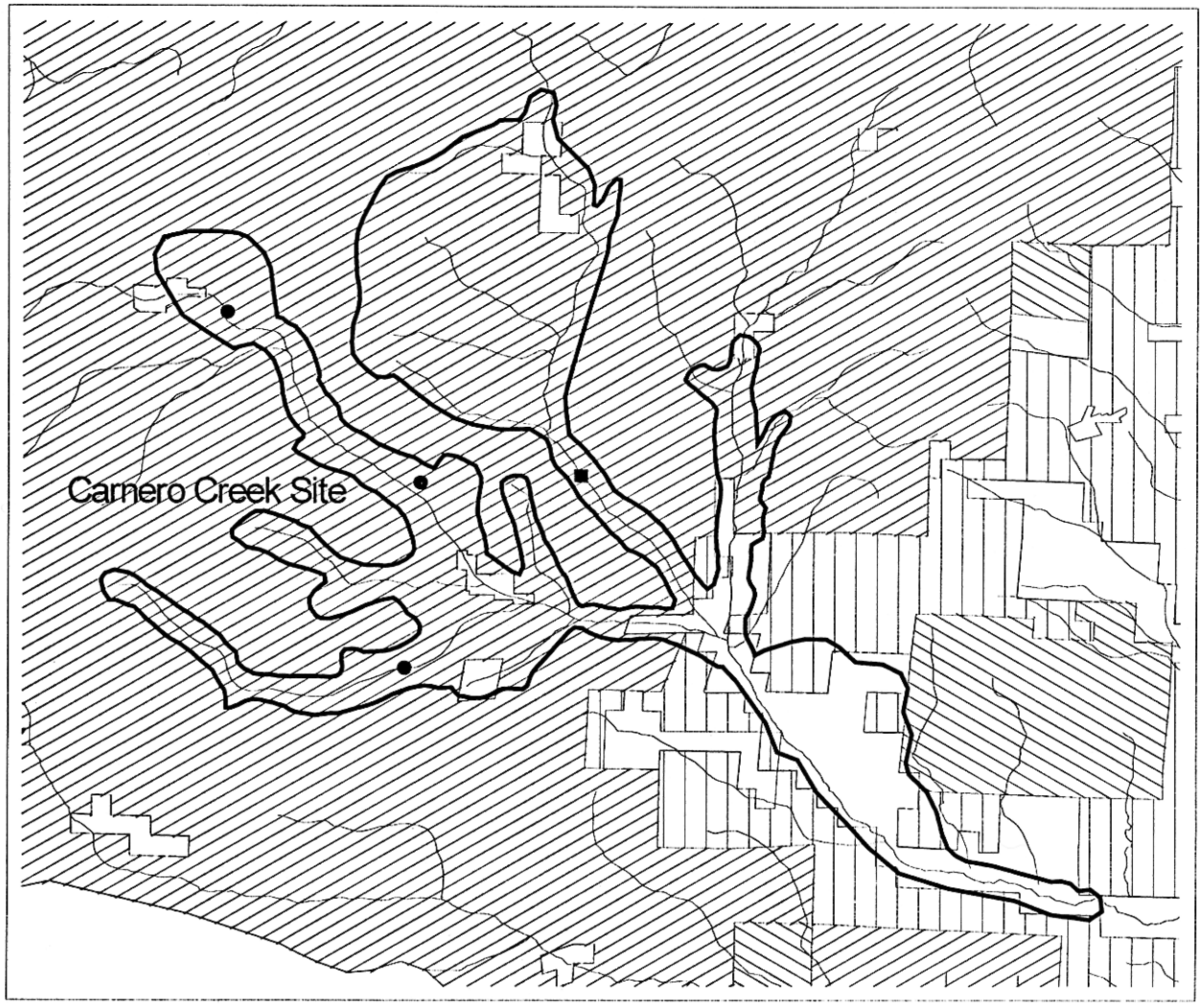
Function	Ratings	Confidence in Rating	Comments
Hydrologic Functions			
Groundwater Recharge	medium	medium	beaver dams are abundant and increase floodflow capture and infiltration
Groundwater Discharge	high	high	this reach is gaining flow from groundwater
Floodflow Alteration	high	high	beaver dams, dense vegetation
Sediment Stabilization	high	high	beaver dams, dense vegetation
Biogeochemical Functions			
Sediment/Toxicant Retention	high	high	dense productive vegetation
Nutrient Removal/ Transformation	medium	high	dense productive vegetation
Biological Functions			
Production Export	high	high	high gradient headwater reach with abundant willows
Habitat	high	high	diverse layers of vegetation
Aquatic Diversity/ Abundance	medium	medium	appears to be good habitat, aquatic biodiversity unsampled
Recreation	high	medium	very scenic with fishing, wildlife viewing, and hunting opportunities
Uniqueness/ Heritage Value	medium	medium	a subalpine stream with vigorous beaver activity

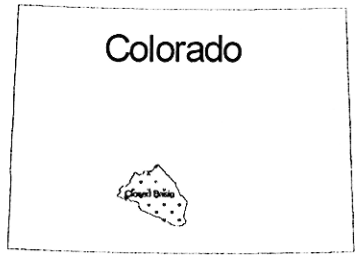
Table 55. Wetland functional evaluation for south fork Carnero Creek (Carnero Creek site).
Wetland Class: riverine

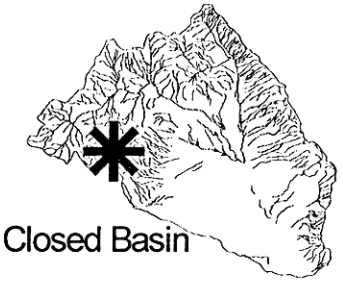
Function	Ratings	Confidence in Rating	Comments
Hydrologic Functions			
Groundwater Recharge	medium	medium	beaver dams are abundant and increase floodflow capture and infiltration
Groundwater Discharge	high	high	this reach is gaining flow from groundwater
Floodflow Alteration	high	high	beaver dams, dense vegetation
Sediment Stabilization	high	high	beaver dams, dense vegetation
Biogeochemical Functions			
Sediment/Toxicant Retention	high	high	dense productive vegetation
Nutrient Removal/ Transformation	medium	high	dense productive vegetation
Biological Functions			
Production Export	high	high	high gradient headwater reach with abundant willows and woody debris
Habitat	high	high	diverse layers of vegetation
Aquatic Diversity/ Abundance	medium	medium	appears to be good habitat, aquatic biodiversity unsampled
Recreation	high	medium	very scenic with fishing, wildlife viewing, and hunting opportunities
Uniqueness/ Heritage Value	medium	medium	a subalpine stream with vigorous beaver activity

Carnero Creek

(ownership status)







Public land element occurrences
- vertebrate
- invertebrate
- plant
- community

Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

N

Occurrence data and site boundaries are current as of 9 January, 1998. Map created by Anne Ochs.

Upper Saguache Creek

Biodiversity Rank: B3 (high significance)
This site contains eight elements of concern: five different montane and subalpine willow communities, one herbaceous wetland, and three vertebrate species, the Rio Grande cutthroat trout, northern harrier, and Gunnison's prairie dog.

Protection Urgency Rank: P4
Over 95% of this site is managed and owned by Rio Grande National Forest. The primary conservation issue is management, rather than further protection.

Management Urgency Rank: M3
Management changes may be required to maintain the current quality of the element occurrences. The site is heavily used for livestock grazing, camping, hunting, and off road vehicle recreation. Given the abundance of potentially damaging uses, the site is in good condition.

There is abundant upland forage, but the livestock appear to be using the wetland areas of the site preferentially. The soils supporting the wetland plant associations at this site are highly susceptible to compaction by livestock due to saturated conditions throughout the growing season. Management efforts should direct livestock away from the perennially wet stream and fen areas towards more resistant uplands. In particular, the administrative pasture immediately upstream of the Stone Cellar campground exhibits signs of overuse. Many of the adult Geyer's willows at that location show the 'mushroom' shape characteristic of overbrowsing and regeneration is poor. Rest is recommended at that location.

The upper watershed of Saguache creek supports a broad diversity of aquatic and terrestrial habitats and maintains a largely undisturbed hydrological regime. This site provides a valuable headwater refuge for species which have been impacted by land use in the lower watershed, such as the Rio Grande cutthroat trout, which occupies less than 1% of its former range in Colorado (Alves 1996). Free-flowing streams with good quality water, healthy banks, and streamside vegetation within the upper Rio Grande watershed are vital habitat for this subspecies of trout. Livestock can decrease riparian cover and induce geomorphologic alterations, which can cause local and cumulative increases water temperature and sediment load (Schulz and Leininger 1990; Skovlin 1984). Platts (1982) recognizes all of these adverse changes as detrimental to trout populations. Interactions of livestock grazing with habitat for Rio Grande cutthroat remain poorly described (Rinne 1995), and further research in this field is recommended. Monitoring and adaptive management to improve quality and quantity of critical aquatic habitat in the upper Saguache drainage are warranted, and would be a significant contribution to the conservation of Rio Grande cutthroat trout and other imperiled aquatic biota in the Closed Basin.

Location: This site is located on the upper reaches of the Saguache Creek watershed approximately 22 miles west of the town of Saguache.

U.S.G.S. 7.5 minute quadrangles:		Elk Park, Saguache Park, Grouse Creek, Half Moon Pass, Mesa Mountain, Bowers Peak
Legal Description:	T42N, R2E	S 1, 3
	T43N, R1E	S 25-27, 34-36,
	T43N, R2E	S 1, 11-12, 14-15, 20-22, 29-31
	T43N, R3E	S 4-8, 17, 19, 20, 29-31
	T44N, R2E	S 20, 21, 27-31,35, 36
	T44N, R3E	S 24-27, 33, 34
	T44N, R4E	S 16-18

General Description: This site encompasses approximately 12,053 acres of riparian, valley bottom, and slope communities along the upper reaches of Saguache Creek. Elevation extends from 8,991 feet on lower Saguache Creek to 12, 940 feet (2,742-3,947 meters) at the western margin near the Continental Divide. The creek floodplains are well vegetated with willows (*Salix* spp.) and a dense understory of native grasses, sedges, and forbs. At higher elevations herbaceous riparian communities become increasingly common, usually dominated by Canadian reedgrass (*Calamagrostis canadensis*), tufted hairgrass (*Deschampsia cespitosa*), and several species of sedges (*Carex* spp.). The upper reaches of the stream traverse the semi-arid Saguache Park region which contains extensive montane grasslands. The grasslands support populations of Gunnison's prairie dog (*Cynomys gunnisoni gunnisoni*). Adjacent uplands are vegetated with patchy spruce (*Picea engelmannii*) and aspen (*Populus tremuloides*) forests on north-facing slopes and bristlecone pine/fescue (*Pinus aristata*/ *Festuca* spp.) woodlands on southern exposures.

The site includes Saguache and its major tributaries, all free flowing streams, which harbor populations of Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis*). The headwater basins within the La Garita wilderness contain among the highest concentrations of alpine lakes and wetlands in the Closed Basin.

The Upper Saguache Creek site is heavily used by for a wide variety of extractive and recreational uses. The entire site is used as summer range for domestic livestock. Grazing by tethered packstock is common within the heavily used trail corridors of the La Garita Wilderness. This site is a popular destination for off-road vehicle campers and two-track roads are abundant. Hunting and fishing are common in season.

Biodiversity Rank Justification: This site contains nine elements of concern. In particular, the site supports five different montane and subalpine willow carr associations: Bebb's willow (*Salix bebbiana*), Geyer's willow/mesic forb (*Salix geyeriana*/mesic forb), Geyer's willow-Rocky Mountain willow/mesic graminoid (*Salix geyeriana-Salix monticola*/mesic graminoid), Rocky Mountain willow/Canadian reedgrass (*Salix monticola/Calamagrostis canadensis*), and planeleaf willow/Canadian reedgrass (*Salix planifolia/Calamagrostis canadensis*). A good stand of beaked sedge (*Carex utriculata*) wetland occurs along the middle fork of Saguache Creek and numerous smaller wetlands occur in the upper watershed. Occurrences of three imperiled vertebrate species or subspecies have been recorded at the site, an occurrence of a nesting northern harrier (*Circus cyaneus*), Rio Grande cutthroat trout, and Gunnison's prairie dog

subspecies. The upper watershed of Saguache Creek supports a broad diversity of aquatic and terrestrial habitats and maintains a largely undisturbed hydrological regime. This site is a valuable headwater refuge for species which have been impacted by land use in the lower watershed, such as the Rio Grande cutthroat trout.

Table 56. Natural Heritage element occurrences at the Saguache Creek site.
Elements responsible for the biodiversity rank are in bold type face.

Element	Common Name	Rank	State Rank	ederal and tate Statu	EO* Rank
Plant communities					
Carex utriculata		G5	S4		B 9/07/97
	montane willow carr	G3	SU		B 7/9/97
*Salix geyeriana-Salix monticola/*mesic graminoid	montane riparian willow carr	GU	S3		B 8/5/97
*Salix geyeriana/*mesic forb	montane willow carr	G3	SU		B 9/8/97
Salix monticola/ Calamagrostis canadensis	**montane willow carr**	**G3**	**S3**		**A 7/8/97**
Salix planifolia/ Calamagrostis canadensis	subalpine willow carr	G4	S4		B 9/6/97
Birds					
Circus cyaneus	northern harrier	G5	S3B, SZ		unranked 7/24/1988
Mammals					
Cynomys gunnisoni gunnisoni	Gunnison's prairie dog subsp.	G5T3	S3		B 8/25/97
Fish					
Oncorhynchus clarki virginalis	Rio Grande cutthroat		S3		unranked 1994

*EO=Element Occurrence; date indicates date of last observation

Boundary Justification: The site boundaries are drawn to envelope the floodplain of Saguache Creek, its major tributaries, and valley toeslopes within 1/8 mile of the stream which contribute surface runoff to the stream channel. In glaciated basins, such as those on the headwaters of the middle fork of Saguache Creek, all valley bottom wetlands were included. The boundary was extended to include occurrences of non-wetland elements (e.g., Gunnison's prairie dog) where such occurrences were contiguous to the wetland boundary. Although not contained in the present site boundary, contributory watersheds should be managed to avoid downstream impacts in the Saguache Creek site.

Further research on the grasslands of Saguache Park may warrant including these within this site boundary.

Wetland Functional evaluations for the Upper Saguache Creek site.

Table 57. Wetland functional evaluation for the Machin Basin (Upper Saguache Creek site).
Wetland Class: riverine

Function	Ratings	Confidence in Rating	Comments
Hydrologic Functions			
Groundwater Recharge	medium	medium	beaver ponds capture excess flood flows and aid in infiltration
Groundwater Discharge	high	high	this is primarily an area of groundwater discharge from the surrounding slopes
Floodflow Alteration	high	high	dense vegetation, beaver ponds
Sediment Stabilization	high	high	dense vegetation
Biogeochemical Functions			
Sediment/Toxicant Retention	high	high	dense vegetation, beaver ponds
Nutrient Removal/ Transformation	medium	high	vigorous vegetation, but no known sources of excess nutrients in the watershed
Biological Functions			
Production Export	high	high	dense vegetation and woody debris, which are exported downstream in floods
Habitat	high	high	excellent riparian habitat
Aquatic Diversity/ Abundance	medium	medium	good habitat, but aquatic biota not sampled
Recreation	very high	high	popular destination in wilderness area
Uniqueness/ Heritage Value	high	high	alpine wetlands in good condition

Table 58. Wetland functional evaluation for the south fork Saguache Creek (Upper Saguache Creek site).

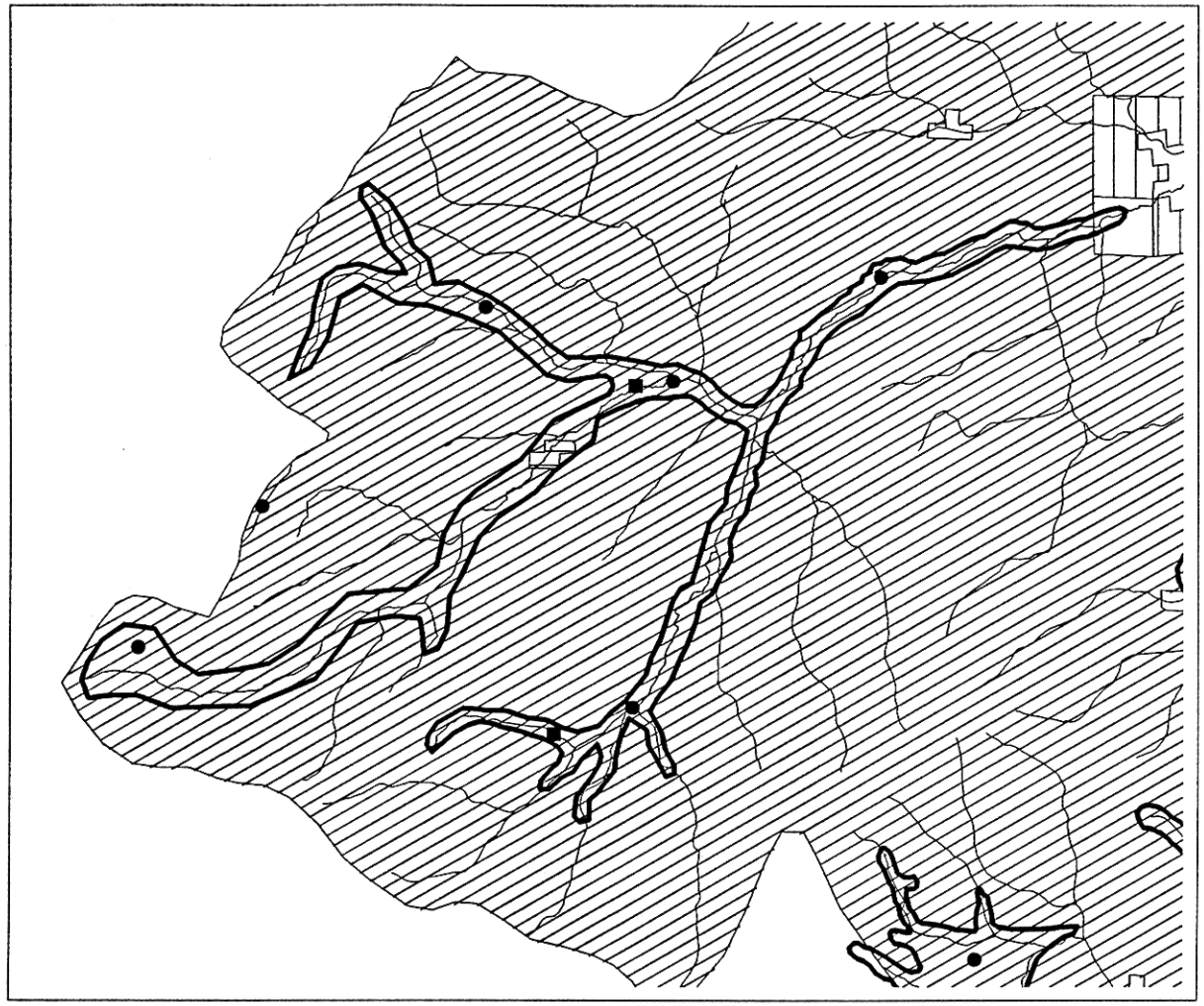
Wetland Class: riverine

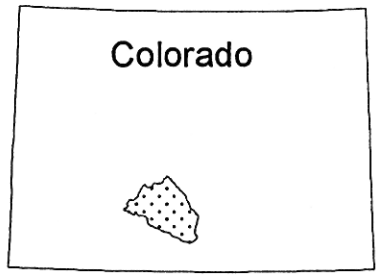
Function	Ratings	Confidence in Rating	Comments
Hydrological Functions			
Groundwater Recharge	medium	medium	numerous beaver ponds capture flood flows and aid in infiltration
Groundwater Discharge	high	high	most of this wetland receives groundwater flow during early summer
Floodflow Alteration	high	high	dense vegetation, beaver ponds, and a wide floodplain
Sediment Stabilization	high	high	dense vegetation
Biogeochemical Functions			
Sediment/Toxicant Retention	high	high	dense vegetation, broad floodplain
Nutrient Removal/ Transformation	medium	medium	no sources of excess nutrients in upper watershed
Biological Functions			
Production Export	high	high	this wetland produces abundant vegetation which is displaced downstream in overbank floods
Habitat	high	high	dense, structurally diverse vegetation
Aquatic Diversity/ Abundance	medium	medium	aquatic biota not sampled, habitat and condition appear excellent
Recreation	high	high	located near wilderness boundary and adjacent to a popular primitive campground
Uniqueness/ Heritage Value	medium	high	montane willow carr in good condition

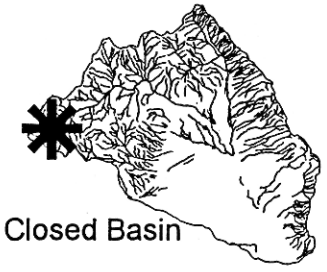
Table 59. Wetland functional evaluation for the Stone Cellar (Upper Saguache Creek site).
Wetland Type: riverine

Function	Ratings	Confidence in Rating	Comments
Hydrologic Functions			
Groundwater Recharge	medium	medium	there is a seasonal water table mound by the creek during high snowmelt flows
Groundwater Discharge	high	high	the are several perennial springs north of Saguache Creek which augment streamflows in late summer
Floodflow Alteration	high	high	this site is a broad, low gradient floodplain
Sediment Stabilization	high	high	dense, sod forming vegetation
Biogeochemical Functions			
Sediment/Toxicant Retention	high	high	dense vegetation filters sediment during floodflows
Nutrient Removal/ Transformation	medium	medium	no excess sources of nutrients in watershed
Biological Functions			
Production Export	high	high	this site exports carbon during overbank flows
Habitat	high	high	excellent habitat, forage for riparian dependent fauna
Aquatic Diversity/ Abundance	medium	medium	aquatic biota not sampled, but habitat and water quality are good
Recreation	high	high	wetland is adjacent to a popular primitive campground
Uniqueness/ Heritage Value	medium	high	nice montane wetland, but type is relatively common in Colorado

Saguache Creek
(ownership status)







Public land element occurrences
- ■ vertebrate
- ★ invertebrate
- ▲ plant
- ● community

Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

N

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.

Groundhog Park

Biodiversity Rank: B5 (General biodiversity interest)
The Groundhog Park site contains one of the best examples of subalpine fen wetlands in the Closed Basin watershed, including good stands of the planeleaf willow/tufted hairgrass and planeleaf willow/marsh marigold plant communities.

Protection Urgency Rank: P4
This site is publicly owned and managed by Rio Grande National Forest. The primary conservation issue is one of management, rather than direct protection.

Management Urgency Rank: M3
The entire site is used as seasonal pasture for domestic livestock. Although the site is generally in good condition, trampling impacts are evidenced by puncturing of wet peat soils and bank erosion along Groundhog Creek. There is abundant upland forage, but the livestock appear to be using the wetland areas of the site preferentially. The soils supporting these plant associations are highly susceptible to compaction by livestock due to saturated conditions throughout the growing season. Management efforts should direct livestock away from the perennially wet stream and fen areas towards more resistant uplands. This would be an excellent site for exclosure fencing.

Some two track roads extend into the park from the main road and encourage traffic on the moist meadow soils. These side roads should be closed.

Location: This site is located at the headwaters of La Garita Creek about 20 air miles northeast of Southfork, Colorado.

U.S.G.S. 7.5 minute quadrangle: Pine Cone Knob
Legal Description: T42N, R4E S 17, 18, 19, 29, 30, 31
` T42N, R3E S 13, 14, 23, 24

General Description: The Groundhog Park site delineates a gently undulating subalpine basin in the southwest portion of the Closed Basin. The site covers over 3500 acres ranging from 10,400 to 12,470 feet in elevation. The basin supports numerous riparian willow (*Salix* spp.) carrs, fen wetlands, and montane grasslands. The fen wetlands along Benino and Groundhog creeks are fed by perennial discharge of cold groundwater from the surrounding uplands and support extensive stands of beaked sedge (*Carex utriculata*), tufted hairgrass (*Deschampsia cespitosa*), planeleaf willow (*Salix planifolia*), and marsh marigold (*Caltha leptosepala*). Other notable wetland associates include rose crown (*Sedum rhodanthum*), elephantella (*Pedicularis groenlandica*), and hoary sedge (*Carex canescens*). The fen soils are peats with numerous hummocks overlaying gleyed sands. The montane grasslands are comprised of several species of fescue (*Festuca* spp.), junegrass (*Koeleria macrantha*), spiked trisetum (*Trisetum spicatum*), and oatgrass (*Danthonia intermedia*). This site is in a region of high precipitation and surrounding uplands support excellent stands of spruce-fir (*Picea engelmannii-Abies lasiocarpa*) and aspen (*Populus tremuloides*) forests.

This site is very scenic and heavily used as a car camping area, with fishing and hunting in season. A major forest road skirts the western and northern margins of this site with small two track roads branching off. Livestock graze the site seasonally and tend to congregate in the open wetland and grassland areas.

Biodiversity Rank Justification: The Groundhog Park site contains the best examples of subalpine fen wetlands in the Closed Basin watershed. Specifically, the site supports good stands of the planeleaf willow/tufted hairgrass (*Salix planifolia/Deschampsia cespitosa)* and planeleaf willow/hoary sedge (*Salix planifolia/Caltha leptosepala)* plant communities. These plant associations typically occur in wide, glaciated valleys adjacent to streams. They occur in swales, depressions, and on slopes where snow melt runoff saturates soils for much of the growing season. Both of these communities are relatively common in Colorado where the proper environmental conditions are met. This is the largest wetland complex of its type in the Closed Basin and is in good condition.

Table 60. Natural Heritage elements at the Groundhog Park site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Salix planifolia/Caltha leptosepala	subalpine willow carr	G4	S4		B 8/2/97
Salix planifolia/Deschampsia cespitosa	montane willow carr	G2G3			B 8/2/97

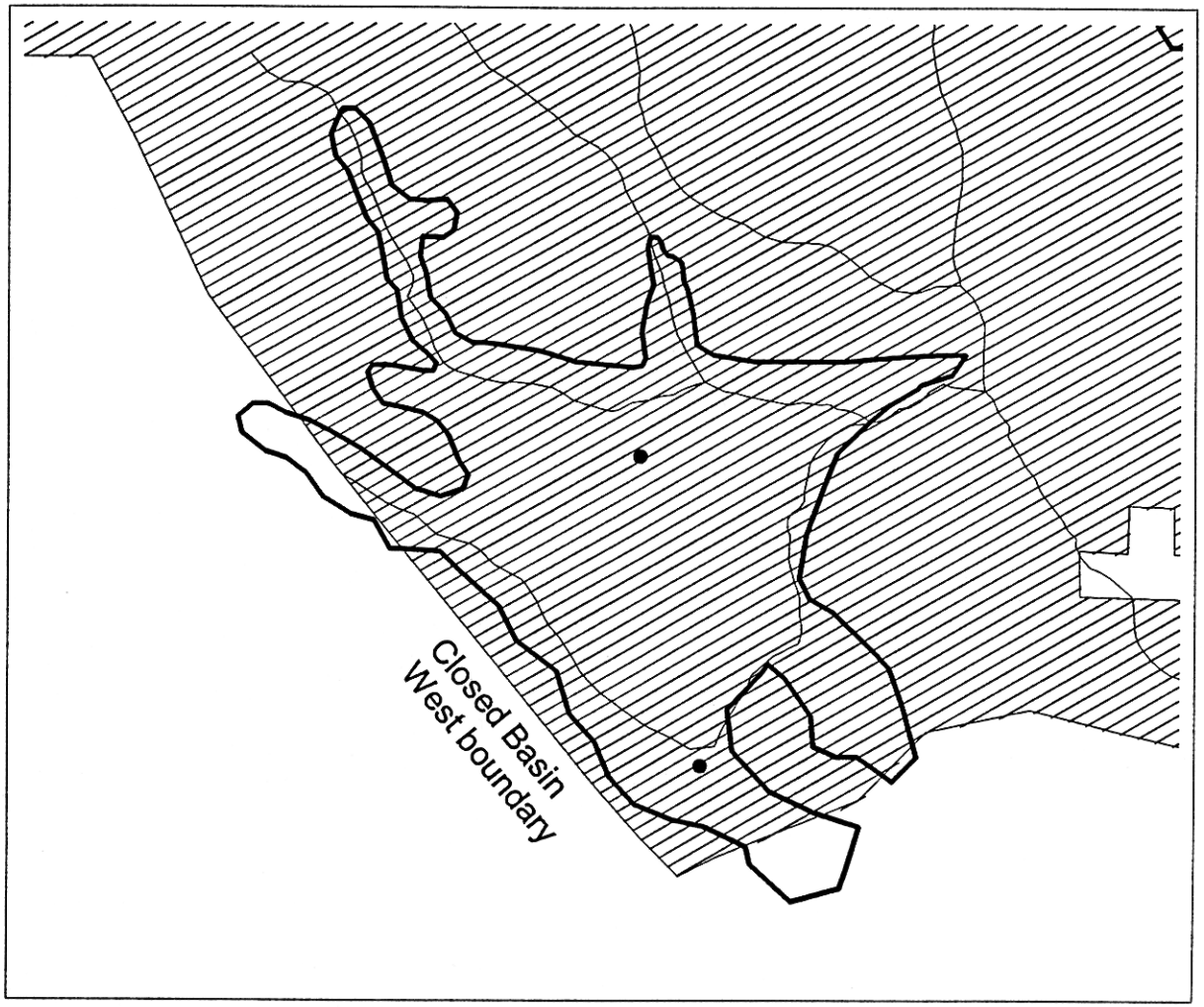
*EO=Element Occurrence; date indicates the date of last observation

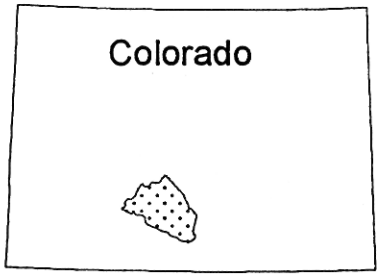
Boundary Justification: This boundary is drawn to include the wetland complex that supports the elements of biodiversity found at the site. It is designed to 1) protect the wetland occurrences from direct impacts such as trampling or other surface disturbances; and 2) to include the immediate slopes which contribute surface and groundwater flow to the wetlands. The boundary was delineated after 1997 field visits by a CNHP wetland ecologist, and corroboration with satellite imagery.

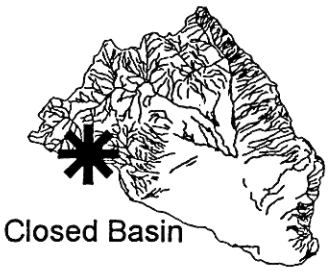
Wetland Functional Evaluation for the Groundhog Park site:
Wetland Class: slope
Table 61. Wetland functional evaluation for the Groundhog Park site.

Function	Ratings	Confidence in Rating	Comments
Hydrologic Functions			
Groundwater Recharge	low	medium	this is primarily a discharge site
Groundwater Discharge	very high	high	continuous groundwater upwelling
Floodflow Alteration	high	high	this site contains numerous depressions and dense surface vegetation
Sediment Stabilization	high	high	dense vegetation
Biogeochemical Functions			
Sediment/Toxicant Retention	high	high	the depressions at this site collect sediment from upland erosion; no toxicants known in area
Nutrient Removal/ Transformation	medium	high	vigorous vegetation growth
Biological Functions			
Production Export	very high	high	the site produces copious dissolved organic matter which is discharged into Groundhog and Benino creeks.
Habitat	high	high	site provides wood habitat for wetland plants, trout, small mammals, and invertebrates
Aquatic Diversity/ Abundance	low	medium	largely composed of shallow wetlands, but numerous small creeks are present
Recreation	high	high	the site is popular for fishing, hunting, and camping
Uniqueness/ Heritage Value	medium	high	this site contains the best examples of subalpine fen wetlands in the Closed Basin watershed

Groundhog Park
(ownership status)







Public land element occurrences
- vertebrate
- invertebrate
- plant
- community

Closed basin
Roads
Streams
Suggested conservation sites

Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private

N

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.

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